Due Diligence Study

of

Frost Bank Tower and Parking Garage

100 W. Houston St.

San Antonio, TX 78205

For the

City of San Antonio

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Prepared by:

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1.0 EXECUTIVE SUMMARY

This report documents the condition of the Frost Bank Tower and Parking Garage in San Antonio, Texas. The property is comprised of a twenty-two (22) story, 380,525 square foot office building and an adjacent eight (8) story, 344,245 square foot parking garage. The office building serves as headquarters for Frost Bank and also provides office space to multiple tenants.

Long term upgrade is considered as the building is reoccupied and conditions change. These modifications would include finish out, upgrades of restrooms and cosmetic upgrades. In general these items are not included in this report. Included is primarily the infrastructure issues and equipment requiring replacement.

The more immediate replacement issues recommended for consideration are:

A. FIRE PROTECTION

- The existing floors that are not currently sprinklered will require sprinkling as they are renovated. Refer to Fire Code Analysis in Appendix 2.1.
- The fire pump will require replacement due to the pump not providing sufficient pressure at the penthouse level. Refer to Fire Code Analysis in Appendix 2.1.
- Diesel tanks should be constructed on the roof of the parking garage to remove the quantities of fuels presently from inside the building.

B. HEATING, VENTILATION AND AIR CONDITIONING

- Air handlers that are original construction are recommended to be replaced.
- Pneumatic HVAC controls are recommended to be upgraded to Direct Digital Controls, DDC. The existing DDC system that is 20 years old should also be replaced. On the Tower, this should be considered as part of the Tenant Finish Out pricing.
- Split DX and window units are recommended to be replaced.

C. ELECTRICAL

- Switchboards/Motor Control Centers
  Consideration should be given for complete replacement and/or relocations as the basement floor is renovated to allow space for a new electrical room.

D. ENERGY

The building, as a whole, is not an energy efficient building. The building and its functional components are, for the most part, based on technology that this approximately 40 years old. These forms of technology were just not designed with energy efficiency in mind, and hence are not capable of competing with current energy efficient building technology.

This building does present numerous opportunities to implement energy saving features:

- The constant volume chilled water system with chillers operating on a 6 deg. temperature differential is an inefficient cooling system. Variable flow pumping and control should be incorporated.

- The lack of cooling tower isolation and optimization also negatively effects the energy consumption of the cooling system.

- The predominate use of pneumatic controls precludes the use of energy saving control strategies such as night setback/setup, optimal start-stop, supply temperature reset, local zone occupancy scheduling, demand control ventilation control and economizer operation.

- The lighting on most floors is still controlled by local switching instead of utilizing occupancy sensors or automatic lighting controls.

E. OPERATIONS

The day-to-day operation of this building requires an on-site facilities staff with intimate knowledge of the building equipment, operational characteristics, and operating systems. This building is in operational condition, but only because of the constant attention and knowledge of the existing staff. The very nature of pneumatic HVAC controls requires an on-site presence to monitor and maintain the air compressor system, adjust controls in the occupied zones, and monitor the central plant equipment. A building with 40 year old components requires a staff to attend to small, minor system failures immediately before they escalate into critical, expensive failures. Additionally, the expectations of tenants demand that on-site facilities personnel react, address, and resolve any building related issue immediately.

In the current condition, this building requires a staff of four (4) building facilities operators. This staff can be either in-house personnel or a contracted service staff, but either way, it is essential that these personnel are trained and knowledgeable facilities operators. It is equally essential that these personnel have intimate knowledge of this particular building. Without trained facilities personnel with knowledge of this building's specific operational characteristics, this building will begin to degrade in operational stability.

2.0 BUILDING & SYSTEMS DESCRIPTION

2.1 GENERAL

The Frost Bank Tower and Parking Garage is located at 100 W. Houston St. in San Antonio, Texas. The complex is comprised of a 22 story, 380,525 square foot office building and a connected eight (8) story, 344,245 square foot parking garage. The Parking Garage was the first of the two structures to be constructed in 1962, with the Tower construction completed and opened in 1973. The complex currently serves as headquarters for Frost Bank in addition to providing office lease space to other tenants. The top occupied floor houses the Plaza Club which includes a kitchen and dining facilities.

2.2 FIRE PROTECTION & LIFE SAFETY

Refer to Appendix 1.1 – Fire Protection and Life Safety Equipment for photographs and equipment documentation of the systems described in this section. Also, refer to Appendix 2.1 for a more detailed analysis of specific fire related issues.

The building fire protection system consists of the combination of a wet pipe automatic sprinkler system and standpipe system. The automatic sprinkler system does cover the occupied areas of the parking garage (basement and street level), but only a portion of the tower. Fire protection standpipes are located in both the east and west stairwells of the tower. The tower is in process of being upgraded to install automatic sprinklers on each floor with the upgrade occurring on a floor-by-floor basis as floors are undergoing renovation. Currently three (3) floors have been upgraded.

The fire riser assemblies and fire pump are located in the basement mechanical room. The fire riser assemblies are supplied by a 6" tap off the existing 8" incoming domestic water main upstream of the building domestic water backflow preventer. The fire pump is also supplied off the existing 8" incoming domestic water main, but downstream of the building domestic water backflow preventer. The fire pump is a 50 HP pump rated at 500 gpm. The fire jockey pump is a vertical 1-1/2 HP pump.

The tower is not equipped with a comprehensive smoke evacuation system or stairwell pressurization system. The west stairwell is fitted with a smoke evacuation system in which an exhaust fan draws air out of the top of the stairwell and air in drawn in at the street level. This stairwell also has a smoke vestibule. The east stairwell and elevator lobbies are not fitted with any type of smoke exhaust or pressurization systems.

The fire-proofing material that is installed on the underside of each floor in the tower has been tested and documented to contain asbestos. Floors that have currently been renovated and upgraded with a wet pipe sprinkler system have also had this fire-proofing material removed and abated.

Special fire protection systems are located throughout the building for protection of special areas. A pre-action system is located on the occupied areas of the first floor of the parking garage. This system serves the UPS room and main printing room.

The two vaults located in the bank area (basement of the parking garage) are both protected with a gas based fire extinguishing system.

2.3 PLUMBING SYSTEMS

Refer to Appendix 1.2 – Plumbing Systems for photographs and equipment documentation of the systems described in this section.

Domestic water enters the building in the basement mechanical room through an 8" service and is fitted with a backflow prevention system. Fire protection water supply for the wet pipe sprinkler system taps off the incoming domestic water upstream of the backflow preventer and the fire protection water for the fire pump taps off the domestic water supply downstream of the backflow preventer. A domestic water booster pump system serves the building and is located in the basement mechanical room. The booster pump system is a multi-stage, VFD pumping system and maintains a constant 155 psi discharge pressure. A Pressure Reducing Valve (PRV) is located on each floor from the basement to the 12th floor of the tower to reduce the pressure to 60 psi supplied at each floor. The domestic water piping in the basement mechanical room is steel piping while distribution piping on individual floors is copper piping. A water softening system is located in the basement mechanical room. Softened water is only provided to the steam boilers and hot water systems and equipment.

Domestic hot water for the tower and the majority of the parking garage is generated in the basement mechanical room through a steam heat exchanger. Domestic hot water circulation pumps in the basement circulate domestic hot water throughout the tower. Domestic hot water for the Staff Development Area (old motor bank area) in the parking garage is separate from the remainder of the domestic hot water system and is generated by individual, electric domestic water heaters located near point-of-use locations.

The sanitary and vent piping system is comprised of a combination of cast iron and PVC piping. Cast iron is the primary sanitary and vent material with limited amount of PVC piping installed on individual floors. An 8" sanitary sewer stack collects waste from the tower and discharges to the city sewer main located in Main Street. A sewage ejection system is located in the basement mechanical room to collect and discharge all waste originating in the basement. The sewage ejector pump system discharges the waste into the 6" gravity drain sanitary sewer that serves the parking garage. This sanitary line exits the basement mechanical room and discharges to the city sewer main located in Main Street.

Plumbing fixtures are primarily low-flow fixtures with sensor controls. All plumbing fixtures throughout the building have been replaced with low-flow fixtures through the SAWS retrofit program. Plumbing fixtures on newly renovated floors have been upgraded to ultra-low flow fixtures with sensor controls.

Natural gas enters the building in the basement mechanical room through a 3" diameter gas main. Two regulators are located in the basement mechanical room to reduce the incoming pressure down to 11/10 oz. The regulator vents are piped to the exterior. The building has two (2) 10,000 CFH meters, also installed in the basement mechanical room. Natural gas currently just serves the steam boilers; however, at one time natural gas did serve the kitchen in the basement of the parking garage. The kitchen and cooking functions have been abandoned and while the gas piping to the kitchen still remains, it has been valved off and is currently abandoned in-place.

2.4 HVAC Systems

A. Cooling System:

Refer to Appendix 1.3 – HVAC Systems: Cooling System for photographs and equipment documentation of the systems described in this section.

The building utilizes a chilled water system for cooling. The chilled water system is comprised of three (3) centrifugal chillers located in the basement mechanical room. Heat is rejected from the chillers through three (3) open cell cooling towers located on the roof of the parking garage. The condenser water pumps, which circulate water between the chillers and cooling towers and the chilled water pumps, which circulate chilled water throughout the building, are located in the basement mechanical room. The chilled water plant also provides chilled water for the Rand Building, which is the adjacent building located across Main Street. An unmetered chilled water supply and return lines are routed under Main Street to supply the Rand Building with chilled water. This chilled water service to the Rand Building will be disconnected in the near future, according to Frost personnel, thereby providing additional surplus or redundant cooling capacity in the central plant. If the chilled water for the Rand Building is kept on the chiller plant, the City should either charge for the service or discontinue the service.

The three chillers are York water-cooled centrifugal chillers. All three utilize R-134a refrigerant and all three are equipped with VFDs. The west chiller (CH-1) is a 530 ton machine and was installed in 2001. The east chiller (CH-2) and south chiller (CH-3) are both 550 ton machines and were both installed in 2014. The chillers operate on a 6 deg. temperature differential between the entering and leaving chilled water temperature. (This is considered low and inefficient in comparison to industry standards)

A refrigerant monitoring system is mounted between the east and south chillers. Since the chillers are mounted in the same room with the steam boilers, in order to comply with code, the refrigerant monitoring system automatically interlocks the boilers upon detection of refrigerant in the basement mechanical room.

Three (3) single cell cooling towers are located on the roof of the parking garage. Each cooling tower is a 550 ton open cell tower. The cooling tower fans are VFD controlled. The towers are approximately 20 years old, but the fill on the north tower was replaced in May of 2014 and the fill on the Center and South towers were replaced in 2004. All three towers operate together with equalizing lines on a common basin header. The towers are not equipped with controls to isolate individual towers automatically. The tower basins are not equipped with basin heaters.

The chilled water loop is a constant volume primary loop with 3-way control valves at each air handler cooling coil. The condenser water loop is a constant volume loop with a tower bypass. Chillers 1 and 2 have two (2) headered chilled water pumps (CHP-1, CHP-2) while Chiller 3 has a dedicated chilled water pump (CHP-6). Likewise, chillers 1 and 2 have two (2) headered condenser water pumps (CWP-4, CWP-5) and Chiller 3 has a dedicated condenser water pump (CWP-7). The headered chilled water pumps (CHP-1,CHP-2) and headered condenser water

pumps (CWP-4, CWP-5) are all fitted with VFDs, however, the VFD is only utilized for soft start procedures, both the chilled water and condenser water flow is based on constant volume flow conditions. A swing pump (SWP-1) is provided in the headered systems such that it can be operate as an emergency chilled water pump or an emergency condenser water pump depending on the valving arrangement.

The chilled water system is fitted with a chemical shot feeder around chilled water pump #3 (CHP-6) for chemical treatment of the chilled water system. The cooling tower water treatment system is located on the roof of the parking garage. The cooling tower water treatment control system is a new, web-based control system installed in June of 2014. The system monitors and controls the condenser water pH, biocides, and inhibitors. The system is tied into the Building Management System.

B. Heating System:

Refer to Appendix 1.4 – HVAC Systems: Heating System for photographs and equipment documentation of the systems described in this section.

Building heat is generated by a low-pressure steam system. Two (2) natural gas fired steam boilers are located in the basement mechanical room. The steam condensate receiver and two (2) steam condensate pumps are also located in the basement mechanical room to support the steam system. Steam is supplied directly to steam coils in some air handlers and two steam heat exchangers also generate heating hot water for heating hot water coils for other air handling units.

The two steam boilers are original to the building. The east boiler, B-1, is a 300 HP boiler which produces 15 psi steam. The west boiler, B-2, is a 100 HP boiler, also producing 15 psi steam. Both boilers draw combustion air in from the basement mechanical room. Flues from both boilers combine into a common flue stack which terminates at the roof of the parking garage.

The condensate receiver and condensate return pumps are original to the building. The condensate return pumps are 3 HP pumps with a 41 lb./hr. capacity. The capacity of each of the hot water heat exchangers is 1,630 MBH. The two hot water circulating pumps are 3 HP pumps capable of producing 180 gpm at 60 ft. of head.

C. Air Handling Systems:

Refer to Appendix 1.5 – HVAC Systems: Air Handling Systems for photographs and equipment documentation of the systems described in this section.

Tower:

Tower floors 2 thru 20 are served by four (4) built up air handling units located in the penthouse. Each unit is comprised of a 100,000 CFM vane axial fan powered by a 200 HP motor. The supply fans have been upgraded to have VFD drives. Each air handling unit supplies a hot deck and a cold deck supply duct. The cold deck supply duct utilizes a nominal 275 ton chilled water coil to produce 55 F supply air. The cold deck supply is ducted down chases in each corner of the tower. At each level, a constant pressure regulator controls the cold deck supply air entering each floor. Constant volume induction VAV boxes regulate the amount of cooling provided to

individual interior zones of each floor. The hot deck supply duct passes through a steam heating coil to produce 105 F air to supply the perimeter zones of the tower during the heating season. During cooling season, the steam coil is bypassed and air from the cold deck is routed through the hot deck duct system to provide perimeter cooling during the cooling season.

The perimeter air distribution system is not controlled on a zone or floor-by-floor basis, the perimeter air distribution system is controlled as one zone based on the return air temperature from the building. The air handlers draw return air up the corner chases into common plenums on the east and west side of the building. Each penthouse air handling unit is provided with outside air through a single 3 foot wide by 10 foot tall outside air louver. The outside air louver does not modulate based on occupancy and the system is not capable of economizer operation.

The street level and basement level of the tower is served by a packaged, multi-zone air unit located in the east basement mechanical room. This unit, denoted as AHU-8, is a constant volume air handler with chilled water cooling and hot water heating. This unit produces 24,750 CFM of supply air and is capable of approximately 68 tons of cooling and 800 MBH of heating. At the entry vestibules on the street level, electric reheat boxes air provided with this air distribution system to offset infiltration associated around the doors.

The Plaza Club Kitchen on the 21st floor is served by a dedicated air handling unit located in the penthouse. This unit, designated as AHU-11, is a single zone, constant volume unit with chilled water cooling and hot water heating. Airflow, cooling capacity and heating capacity is unknown.

The northwest corner of the basement level of the tower is served by a packaged, single zone air unit located in a mechanical closet on the west side of the basement. This unit, denoted as AHU-12, is a constant volume air handler with chilled water cooling and hot water heating. This unit produces 4,000 CFM of supply air and is capable of approximately 8 tons of cooling and 55 MBH of heating.

Parking Garage:
The occupied areas of the parking garage are served by 13 air handling units, grouped loosely by the areas that they serve.

The Basement Bank Lobby which is beneath the parking garage/old motor bank is served by a packaged, multi-zone air unit located in the basement mechanical room adjacent to the chilled water/condenser water pumps. This unit, designated as AHU-1, is a constant volume air handler with chilled water cooling and hot water heating. This unit is a two-zone unit and produces 15,100 CFM of supply air and is capable of approximately 44 tons of cooling and 230 MBH of heating.

The Safe Deposit Vault and Commercial Vault, both located in the basement beneath the parking garage/old motor bank on the west side of the building is served by a packaged, single zone air unit suspended above the ceiling of the safe deposit area. This unit, designated as AHU-3, is a constant volume air handler with chilled water cooling and hot water heating. This unit is a single zone unit and produces 4,000

CFM of supply air and is capable of approximately 8 tons of cooling and 55 MBH of heating.
The Old Kitchen, Dining Room and Founders Room are located in the basement on the south west side of the parking garage. The kitchen has been decommissioned and serves as storage and a base of operations for Housekeeping. The dining room has been converted to a break room and the Founders Room remains a conference/meeting room. These rooms are served by two packaged air units located in a mechanical room between the kitchen and dining room. The unit which serves the kitchen and north portion of the dining room is a single zone, constant volume air handler with chilled water cooling and hot water heating. This unit is designated as AHU-5. The second unit, designated AHU-6, is a multi-zone, constant volume air handler with chilled water cooling and hot water heating. This unit serves the south portion of the Dining Room and the Founders Room. The outside air to these units is treated with a steam pre-heat coil. AHU-5 produces 11,400 CFM of supply air and is capable of approximately 40 tons of cooling and 210 MBH of heating. AHU-6 produces 15,050 CFM of supply air and is capable of approximately 44 tons of cooling and 230 MBH of heating.

The office area on the southeast side of the basement in the parking garage is served by a built-up unit located in the east side of the basement adjacent to the building facility offices. This unit is a VAV unit, equipped with a VFD on the supply fan. This unit is designated at AHU-7 and produces 64,000 CFM of supply air and is capable of approximately 175tons of cooling. The unit has three (3) reheat coils in the system with a combined heating capacity of 207 MBH.

The records vault, located in the basement beneath the parking garage/old motor bank on the east side of the building, is served by a packaged, single zone air unit mounted on the mezzanine of the vault. This unit, designated as AHU-10, is a constant volume air handler with chilled water cooling and electric duct heating. This unit is a single zone unit and produces 3,800 CFM of supply air and is capable of approximately 6 tons of cooling. The heating capacity of the electric duct heater is unknown.

The office area on the southwest street level in the parking garage is served by a served by a packaged, multi-zone air unit located in the mechanical room adjacent to the armored car dock. This unit also serves a portion of the basement office space surrounding the commercial teller area. This unit, designated as AHU-'OLD7', is a constant volume air handler with chilled water cooling and hot water heating. This multi-zone unit produces 15,500 CFM of supply air and is capable of approximately 45 tons of cooling and 245 MBH of heating.

The Commander's Room is a theater style conference room on the street level of the Parking Garage. This unit is served by a packaged, single zone air unit located in an adjacent mechanical room. This unit, designated as AHU-9, is dedicated to this room and only operates when this room is occupied. The unit is a constant volume air handler with chilled water cooling and hot water heating. This unit produces 10,300 CFM of supply air and is capable of approximately 40 tons of cooling and 365 MBH of heating.

The Capital Markets Area is office space located on the street level in the southeast corner of the parking garage. This area was renovated in 2000. This area is served by two packaged air units which are located on the 3rd floor of the parking garage. These units, designated AHU-14 and AHU-15, are VAV air handlers which supply air to VAV boxes with electric reheat. The units are the same units which were originally installed with the parking garage construction in 1964. During the renovation in 2000, these units were fitted with VFDs. The units still function with their chilled water coils and hot water pre-heat coils. AHU-14 produces approximately 5,000 CFM of supply air and is capable of approximately 10 tons of cooling and 80 MBH of preheat. AHU-15 produces approximately 5,000 CFM of supply air and is capable of approximately 10 tons of cooling and 80 MBH of preheat.

The old motor bank area on the street level of the parking garage was converted to occupied space in 1993. This area now provides Staff Development and Postal functions. During the conversion of this space from the motor bank to occupied space, three (3) air handlers were installed to condition the space. These air handlers, designated AHU-16, AHU-17, and AHU-18 are located in mechanical rooms adjacent to the occupied space. These units are constant volume, multi-zone air handlers with chilled water cooling and electric duct heating for individual zones. AHU-16 produces 4,630 CFM of supply air and is capable of approximately 11 tons of cooling and a combined 29.5 kW of electric zone duct heating. AHU-17 produces 4,890 CFM of supply air and is capable of approximately 11 tons of cooling and a combined 34 kW of electric zone duct heating. AHU-18 produces 47,750 CFM of supply air and is capable of approximately 11 tons of cooling and a combined 44 kW of electric zone duct heating.

D. Exhaust Systems:

Refer to Appendix 1.6 – HVAC Systems: Exhaust Systems for photographs and equipment documentation of the systems described in this section.

Tower:

The tower is equipped with several exhaust fans in the penthouse to provide required exhaust of the building. Tower exhaust fan #1 (EF-1) provides general exhaust of the building. The main exhaust duct travels from 2nd floor to the penthouse in the northwest chase, tapping off at every floor. The fan is an 11,300 CFM utility vent set with a 5 HP motor. The fan is suspended in the penthouse and discharges to the roof. Tower exhaust fan #2 (EF-2) provides exhaust for the tower restrooms (floors 2 through 21). The fan is a 12,400 CFM utility vent set with a 7.5 HP motor. The fan is floor mounted in the penthouse and discharges to the roof. Tower exhaust fan #3 (EF-3) provides exhaust for the low-rise elevator machine room. The fan is a 6,200 CFM utility vent set with a 2 HP motor. The fan is floor mounted in the penthouse and discharges to the roof. Tower exhaust fan #4 (EF-4) provides smoke exhaust of the west stairwell. The fan is a 16,850 CFM utility vent set with a 5 HP motor. The fan is mounted in the penthouse on top of the west stairwell shaft. The fan discharges to the roof. Tower exhaust fan #5 (EF-5) provides exhaust of the old penthouse chiller room. The fan is a 2,050 CFM utility vent set with a 1 HP motor. This fan has been abandoned in-place and is not used since there no longer exists chiller equipment in the penthouse chiller room. The Plaza Club Kitchen exhaust fan is located on the roof and discharges over the roof through a

goose-neck discharge. This fan, designated "Kitchen Exhaust Fan" provides kitchen exhaust for the Plaza Club Kitchen on the 21st floor.

The tower loading dock is equipped with an exhaust fan which is ducted to draw exhaust air from under the loading dock. This fan is a utility vent set and is mounted in the southwest corner of the loading dock. The fan has been abandoned in place and is no longer utilized. The exhaust air intakes have been blocked.

The basement mechanical room is equipped with tower exhaust fan #6 (EF-6). This fan provides exhaust and ventilation of the basement mechanical room. The fan is a 16,750 CFM utility vent set with a 3 HP motor. The fan is located adjacent to the basement mechanical room and draws filtered ventilation air from the south side of the basement mechanical room, through the electrical entry, to be discharged over the east parking garage entry ramp. The fan is on a VFD. The fan provides continuous ventilation of the basement mechanical room, but also functions as a purge fan in conjunction with the refrigerant monitoring system.

Parking Garage:
The parking garage is equipped with an exhaust system for the armored car loading dock. The fan is located on the roof of the parking garage, adjacent to the generator. This fan is a downblast roof exhaust fan, but specific information regarding the fan is unavailable.

The parking garage is served by multiple, fractional horsepower restroom exhaust fans. Specific information regarding these fans is unknown.

The Staff Development Area is equipped with both an outside air fan and a relief air fan. Both fans are in-line fans. The outside air fan is a 1 HP fan supplying 2,345 CFM to AHU-16, AHU-17, and AHU-18. The relief air fan is a ½ HP fan providing 1,275 CFM of building relief.

E. HVAC Controls:

Refer to Appendix 1.7 – HVAC Systems: Controls for photographs of the systems described in this section.

The building HVAC controls are comprised of three (3) separate types of control systems. The majority of the building utilizes pneumatic controls, while a Johnson Controls (JCI) Legacy N2 Control system and a Johnson Controls Metasys Control system are interlaced into the building also.

The pneumatic control system was the original control system in the building. Pneumatics control all the tower floors except the three (3) most recently renovated floors. All the zone dampers, chilled water, hot water and steam control valves are pneumatically controlled. The building pneumatic air compressor is located in the basement mechanical room and is original to the building (1972). The air compressor is a dual compressor with two (2) 1-1/2 HP compressor motors. As required for pneumatic controls, the air compressor is fitted with an air dryer and oil/water separator.

The JCI Legacy N2 system was installed in the early 1990s and controls a portion of the central plant equipment such as the boiler, chilled water and condenser water pumps. Several of the air handling units that were installed in the early 1990's are also controlled with the Legacy N2 system through pneumatic actuators.

The JCI Metasys Control system is a BACnet based control system. The Metasys system provides front-end controls for the building. Key building monitoring systems are reported through the Metasys system, but much of the control of these systems is still through the JCI Legacy N2 system or pneumatically controlled. The JCI Metasys Control System does provide control and sequencing of the chillers and penthouse built-up air handling units.

F. Specialty HVAC Systems:

Refer to Appendix 1.8 – HVAC Systems: Specialty HVAC Systems for photographs of the systems described in this section.

The high rise elevator machine room located in the penthouse of the Tower is equipped with two (2) new 5-ton DX, packaged units to provide cooling for the elevator machine room. Installation of the units was completed in 2014 in conjunction with elevator upgrades.

The UPS room is located in the Staff Development Area of the Parking Garage (old motor bank location). The UPS serves the telephone switch room located on the 12th floor of the tower. The UPS room is provided with a Leibert chilled water CRAC unit. The UPS Room is also fitted with a thermostatically controlled exhaust fan for redundancy.

The elevator machine rooms in the Parking Garage are equipped with through-the-wall or window-unit air conditioning systems. These units have replaced the original ventilation fans in order to provide better cooling and temperature control in the elevator machine rooms.

The elevator lobbies in the Parking Garage are equipped with through-the-wall or window-unit air conditioning systems.

2.5 Electrical Systems

A. Power:

Refer to Appendix 1.8 – Electrical Systems for photographs and equipment documentation of the systems described in this section.

Utility Power:
The building is fed from a 1500kVA 13.8kV/480-277V CPS Energy transformer vault located in the basement mechanical room. The primary service conductors enter in to the basement level from CPSE underground distribution network. The conductors are protected from damage by a welded steel cage assembly until they penetrate the wall of the CPSE transformer vault. The vault is secured to prevent access by unauthorized personnel.

Normal Power:
The secondary side of the utility transformer feeds electrical located in the basement mechanical room, utilizing a service voltage of 480Y/277V. The electrical service equipment consists of two switchboards: 'MSA' and 'MSB'. Both switchboards are rated 5000A.

'MSA' feeds the building fire pump, Chillers 1 and 2, switchboard 'MSD' (4000A). Most notably, switchboard 'MSD' subsequently feeds motor control centers 'MCCLA' (600A), 'MCCRA' (1200A), and the West bus duct riser of the Tower (1600A).

'MSB' feeds switchboards 'MSC' (4000A) and 'MSE' (4000A). Most notably, switchboard 'MSC' subsequently feeds motor control centers 'MCCLB' (600A), 'MCCRB' (1200A), and the East bus duct riser of the Tower (1600A). Most notably, switchboard 'MSE' subsequently feeds motor control centers 'EHVAC' (800A/Emer), 'MCC1' (800A), Switchboard '1D' (800A), '1E' (800A/Emer), and Chiller 3.

The central location for most is the large electrical gear is the basement mechanical room. This consists of the switchboards and motor control centers as described above, as well as the Automatic Transfer Switches (ATS) for the emergency power distribution. There are incidental pockets of electrical distribution feeding various areas of the building, as would typically be expected in a commercial building. This includes panelboards (480V and 208V) and associated transformers. Additionally there are two bus duct risers (East and West) which serve the tower. Each leasable floor of the tower has a corresponding East and West electrical room. Each tower electrical room includes panelboards (480V and 208V) and associated transformers dedicated to the tenant space.

Emergency Power:
Emergency power is provided by (2) diesel generators, both located on the roof of the parking garage. One generator, rated 285 kW, is located inside the cooling tower building. The other, generator, rated 1400 kW, is located on the roof of the cooling tower building. These generators provide emergency back-up to building functions including essential mechanical and plumbing systems, building elevators and stairwell lighting. Additionally, there is a third generator, rated 250 kW, located adjacent to the 285 kW unit. This unit is maintained and, through a series of manual transfer switches, acts as a back-up to the 285 kW unit.

UPS System:
The framework for a UPS system is present on the occupied areas of the first floor of the parking garage. This UPS room currently houses two (2) 500 kVA UPS units and associated peripheral electrical gear. The batteries in the UPS units were removed when the room was decommissioned several years ago.

B. Lighting:

Refer to Appendix 1.8 – Electrical Systems for photographs and equipment documentation of the systems described in this section.

The lighting fixtures utilized in the building are typical for a commercial building of this age. Linear fluorescent light fixtures are used for the majority of the lighting in

the building. The linear fluorescent fixtures used are most typically2x4 acrylic, parabolic, and volumetric types, as well as 4' strip fixtures. These fixture fixtures occupy offices, mechanical/electrical rooms, and corridors. Downlights are used throughout the building for accent and general lighting, in the more decorative areas.

There is no lighting control scheme currently in place, such as a lighting control panel. All lighting control is provided at the local level, either through lighting switches or occupancy sensors.

C. Special Systems:

Fire Alarm:
The Fire Alarm system provides monitoring and annunciation typical for a high rise office building. The Fire Alarm system is an IFC 3030 by Johnson Controls, replaced in 2012.

Elevators:
The elevator controllers are currently undergoing a renovation to replace original relay style control cabinets with current technology panels. This renovation is expected to be completed in 2015. Additionally, an improvement project was completed in 2014 to place all elevators on the 1400 kW generator.

Grounding:
A separately derived grounding system was added to the building in 2012. This grounding system originates in the basement and branches throughout the building, including extending a riser up through the East and West tower electrical rooms.

2.6 COMMUNICATIONS SYSTEMS

The building is served by AT&T for telecomm and internet. It is also additionally served by Time Warner Cable for television and internet. Both services originate in the basement and are routed throughout the building. Each leasable floor of the tower has a corresponding East and West telecomm room.

3.0 CONDITION STATEMENT

3.1 GENERAL

The following table documents recent upgrade projects implemented in the building.

FROST TOWER RECENT CAPITAL UPGRADES			
PROJECT	DESCRIPTION	COMPLETION DATE	PROJECT COST
TOWER FAN RETROFIT	FITTED BUILT-UP AHU FANS WITH VFDS	JUNE 2008	$730,764
TOWER WATERPROOFING	REPLACED CAULKING BETWEEN PRECAST PANELS	AUGUST 2010	$182,217
TOWER ROOF REPLACEMENT	REPLACED ROOF WITH NEW MODIFIED BITUMEN ROOF AND FLASHING. 20 YR. TRANSFERABLE WARRANTY FROM INSTALLATION DATE.	MAY 2011	$301,476
BAS CONTROL – FRONT END	INSTALLED JCI METASYS FRONT-END BUILDING CONTROLS.	MARCH 2012	$228,144
TOWER LIGHTING RETROFIT	UPGRADED TO T8 FIXTURES	JUNE 2012	$195,678
GARAGE LIGHTING RETROFIT	UPGRADED TO T8 FIXTURES	JUNE 2012	$78,036
TOWER LEVEL 10 REMODEL	ASBESTOS ABATEMENT, SPRINKLER SYSTEM, HVAC, FLOORING, CEILING, LIGHTING, RESTROOMS, DDC CONTROLS.	JUNE 2012	$1,286,471
REPLACED REVOLVING DOORS	REPLACED ROTATING MECHANISMS FOR REVOLVING ENTRY DOORS	OCTOBER 2012	$65,000
REPLACE TOILETS AND URINALS IN TOWER AND GARAGE	SAWS PROJECT TO REPLACE ALL TOILET AND URINAL FIXTURES WITH LOW FLOW FIXTURES	OCTOBER 2012	SAWS FUNDED
GARAGE ELEVATOR UPGRADE	NEW ELEVATOR CONTROL EQUIPMENT	OCTOBER 2013	$125,609
RE-TUBED MAIN BOILER	REPLACED BOILER TUBES IN MAIN BOILER	NOVEMBER 2013	$28,000
TOWER PLAZA CLUB REMODEL	REPLACED DRAINAGE PIPING, ETC. IN CONJUNCTION WITH LEVEL 20 REMODEL	NOVEMBER 2013	$458,671
TOWER LEVEL 20 REMODEL	ASBESTOS ABATEMENT, SPRINKLER SYSTEM, HVAC, FLOORING, CEILING, LIGHTING, RESTROOMS, DDC CONTROLS.	JANUARY 2014	$1,693,340
DOMESTIC BOOSTER PUMP	REPLACED 2 DOMESTIC WATER PUMPS WITH 3 PUMP VFD SYSTEM.	AUGUST 2014	$146,640
TOWER CHILLER REPLACEMENT	REPLACED 2 OF 3 CHILLERS IN CENTRAL PLANT	AUGUST 2014	$821,073
TOWER ELEVATOR POWER REDUNDANCY	PLACE ALL GARAGE AND TOWER ELEVATORS ON EMERGENCY GENERATOR POWER	AUGUST 2014	$204,685
TOWER ELEVATOR UPGRADES	NEW ELEVATOR CONTROL EQUIPMENT	IN PROGRESS	$1,832,571
REPLACE BOILER BURNERS	REPLACED AND UPGRADED BURNERS IN BOTH BOILERS	IN PROGRESS	IN PROGRESS

Even with the many capital upgrades completed over the past several years, it is evident that the building was constructed using codes and technology from the early 1970s. This is reflected in the systems and equipment still in operation in the building.

3.2 FIRE PROTECTION & LIFE SAFETY

A. Automatic Sprinkler System:

The majority of the existing floors that are not currently sprinklered will require sprinkling as they are renovated. Refer to Fire Code Analysis in Appendix 2.1.

B. Fire Pump System:

The fire pump will require replacement due to the pump not providing sufficient pressure at the penthouse level. Refer to Fire Code Analysis in Appendix 2.1.

C. Stairwell Smoke Control:

For the existing stairwells to comply with current codes, modification of the exhaust fan in the west stairwell with the vestibule will be required. Only one stairwell shall require retro-fit to comply with current codes.

D. Fireproofing System:

The abatement of the existing fire-proofing material on non-renovation floors is recommended to be continued as floors are renovated.

E. Special Fire Protection Systems:

The existing pre-action system that serves the UPS Room and Printer Room on the 1st level of the parking garage is in good condition. The pre-action controller was installed in 1998 and is not anticipated to need replacement within the next 10 years.

The fire extinguishing systems located in the vaults are original equipment to the building that was constructed with the parking garage structure in 1964. The system is in good condition and has been well maintained. While it is not anticipated that the system need replacement, maintenance must be continued to keep the system in operation. If the vault spaces are utilized for a different function and a system is not required, it is highly recommended that the system be removed.

F. Gas:

The diesel fuel tanks should be removed and replaced with a tank sized for the generators on the parking garage roof. Refer to Fire Code Analysis in Appendix 2.1.

3.3 PLUMBING SYSTEMS

A. Domestic Water Piping:

The majority of the domestic water piping system is original to the building. The steel supply piping for both the cold and hot domestic water systems appears to be in good, operational condition. The system is 42 years old and with a typical steel piping system having a service life of approximately 50 to 60 years, it is anticipated that that the entire piping system would not require replacement within the next 10 years. However, the system is approaching its service life limit and portions of the system may be required to be replaced as maintenance items. The copper distribution pipe on each floor is not available for inspection; however, with copper piping having a service life of 50 to 60 years, the copper piping system is anticipated not to require replacement within the next 10 years. However, as floors are being remodeled, it is recommended that the copper water service piping be replaced as the piping system is approaching its service life limit.

B. Domestic Water Booster Pump:

The multiple stage, VFD domestic water booster pump system is a new piece of equipment, having been installed within the last year. This equipment is in excellent condition and is not expected to require replacement.

C. Domestic Water Softener System:

The domestic water softener system is approximately 20 years old but appears to be in good condition. With basic manufacturer recommended maintenance, this equipment is not expected to require replacement within the next 10 years.

D. Domestic Water Heating:

The steam heat exchanger providing domestic hot water for the tower appears to be in good operational condition. The steam heat exchanger is not expected to require replacement within the next 10 years.

The electric storage hot water heaters serving the parking garage areas all appear to be in good operational condition. The water heaters have been well maintained and have been replaced as needed. The current electric storage water heaters are not expected to require replacement within the next 10 years.

E. Sanitary and Vent Piping:

The majority of the sanitary and vent piping system is original to the building. As each floor is undergoing renovation, the sanitary and vent piping on the floor has been replaced. The cast iron sanitary piping that comprises the majority of the building's sanitary system appears to be in good condition as no leaks or obvious signs of damage are evident. The sanitary system, however, is 42 years old and with a typical cast iron sanitary system having a service life of approximately 50 to 70 years, it would be expected that although system replacement would not be required within the next 10 years, portions of the system will require maintenance.

F. Plumbing Fixtures:

All plumbing fixtures have been replaced since the construction of both the tower and the parking garage to comply with the low-flow water consumption requirements of 1992 EPAC. Plumbing fixtures in general are in good condition and do not requiring replacement within the next 10 years.

G. Natural Gas Piping System:

The natural gas piping system is original to the building. The piping and gas equipment is in good condition. The life expectancy of steel piping in a natural gas application is 50 to 70 years. Although the piping system is nearing the end of useful operation, it is not anticipated to need to be replaced in the next 10 years.

3.4 HVAC Systems

A. Cooling System:

Two of the water cooled chillers are new units (installed in 2014) and in excellent condition. The third unit is 10 years old, but also in good condition. Other than regular maintenance, the chillers should be in good, operable condition for an extended period of time. It is anticipated that the chillers will not need to be replaced in the next 10 years. The chillers are currently operating at a 6 deg. temperature differential. Modern chillers, as these are, have the capability to operate much more efficiently at a higher temperature differential, 12 to 14 degrees. There is an opportunity to greatly improve the efficiency of the chillers and lower

the operating cost by modifying the chilled water system to operate on a higher temperature differential.

The cooling towers are approximately 20 years old. Ongoing maintenance, such as cleaning and fill replacement will be required. The cooling towers are currently operating on an equalized, common basin system without an automatic means to isolate a tower or provide cooling tower optimization sequences. There is an opportunity to improve the efficiency of the cooling system by modifying the cooling tower/condenser water system to enable tower optimization control sequences to be implemented.

The chilled water and condenser water pumps are original to the building. The pumps have been well maintained and are in good condition. Pump seals and motors have obviously been replaced throughout the life of the building. The pumps should be programmed to be replaced in the next 5 years. Two chilled water pumps and two condenser water pumps have been retrofitted with VFDs for soft-start features, however, the VFDs do not vary the flow of the chilled water or condenser water. There is great opportunity to improve the efficiency and drastically reduce the operating cost of the cooling system by modifying the chilled and condenser water system to be variable flow systems.

The new condenser water treatment system installed in of 2014 provides for excellent monitoring and control of the condenser water system. Much of the monitoring and control is automatic which provides for a cleaner system, which in turn, provides for efficient operation of the cooling tower and reduced maintenance.

The chilled water and condenser water piping systems are original to the building. These steel piping systems have been in operation for 42 years and while they do appear to be in generally good condition, leaks have developed in several locations. This has required maintenance and replacement of several portions of the piping system.

B. Heating System:

The steam boilers are original to the building. The boilers have been retrofitted and maintained. The burners in both boilers are currently being replaced. Steam boilers, by nature, require significant maintenance in order to keep them in good operational condition. They will require significant maintenance resources and chemical treatment to keep them operational. When the boiler reaches its end of life where it is not economical to repair, it should be replaced with a hot water boiler.

The condensate receiver and condensate return pumps are in good operational condition and are not expected to require replacement in the next ten years.

The hot water heat exchanger is also in good condition and is not expected to require replacement in the near future. The hot water circulation pumps, while in good operating condition, are demonstrating signs of age. It appears that one pump has been replaced during the life of the building and the second pump is original to the building. The original pump should be replaced.

C. Air Handling System:

Tower:

The penthouse built-up air handling units are original to the tower. The original vane axial fans with inlet vanes have been modified. The inlet vanes have been removed and the fans have been fitted with VFDs. The fans are in good condition and have been well maintained. A spare 200 HP motor and a spare VFD are on-site in preparation for change-out when an operating fan/VFD fails. It is essential that when one failure occurs and the spare equipment is utilized, that the spare equipment is replaced as soon as possible in anticipation of the next failure. The steam heating coils in all four built-up air units were replaced in 2014. It is not anticipated that the steam coils will need to be replaced in the next 10 years. The cooling coils are still original to the building. While they are in good condition, it is anticipated that significant cooling coil maintenance will be required in the next 10 years. The existing outside air louver does not allow enough outside air flow to meet current ASHRAE 62.1 ventilation code requirements. There exists no outside air measurement capability or damper controls to control the amount of ventilation air delivered to the occupied spaces through the penthouse built-up air handling units.

The air unit serving the street and lower level of the tower (AHU-8) is original to the building (1972). The unit is a constant volume unit and is equipped with pneumatic zone controls, chilled water controls and hot water controls. This unit is operational, but is beyond its service life expectancy. It is anticipated that this unit will require replacement within the next 5 years.

The air unit serving the Plaza Club Kitchen (AHU-11) is approximately 25 years old. This unit is operational and specifically serves the Plaza Club Kitchen. The Plaza Club, as a building tenant is responsible for any service and replacement of this unit since it is dedicated specifically for special purpose tenant operation. In the event that the kitchen function is removed from the 21st floor, this unit should be removed as well.

The air unit serving the northwest corner of the tower basement (AHU-12) is original to the building (1972). The unit is a constant volume unit and is equipped with pneumatic chilled water and hot water controls. This unit is operational, but is beyond its service life expectancy. It is recommended to be replaced.

Parking Garage:

The air unit serving the basement bank lobby (AHU-1) is original to the building (1964). The unit is a constant volume unit and equipped with pneumatic chilled water and hot water controls. This unit is operational, but is beyond its service life expectancy. It is anticipated that this unit will require replacement within the next 5 years.

The air unit serving the Safe Deposit/Commercial Vault (AHU-3) is original to the parking garage structure (1964). The unit is a constant volume unit and equipped with pneumatic chilled water and hot water controls. This unit is operational, but is beyond its service life expectancy. It is anticipated that this unit will require replacement within the next 5 years.

The air units serving the Old Kitchen, Dining Room, and Founders Room (AHU-5 and AHU-6) are original to the parking garage structure (1964). These units are constant volume units and equipped with pneumatic chilled water and hot water controls. These units are in fair condition and are operational, but the units are well beyond their service life expectancy. It is anticipated that these units will require replacement within the next 5 years.

The basement built-up air handling unit was installed in 1972 with the tower addition. The original vane axial fan with inlet vanes has recently been modified such that the inlet vanes have been removed and the fan has been fitted with a VFD. In conjunction with the VFD installation, the fan controls are being upgraded from pneumatic controls to DDC controls. This upgrade occurred in October of 2014. The fan is in in good condition and has been well maintained.

The air unit serving the records vault (AHU-10) was installed in 1972. The unit is a constant volume unit and equipped with pneumatic chilled water controls and an electric duct heater. This unit is operational, but is beyond its service life expectancy. It is anticipated that this unit will require replacement within the next 5 years and should be replaced with change of function of the space.

The air unit serving the street level, southwest offices and basement commercial teller area (AHU-'OLD7') is original to the building (1964). The unit is a constant volume unit and equipped with pneumatic chilled water and hot water controls. This unit is operational, but in poor condition and beyond its service life expectancy. It is anticipated that this unit will require replacement within the next year. Piping insulation is known to contain asbestos, so asbestos remediation and abatement will be required at time of unit replacement.

The air unit serving the Commander's Room (AHU-9) was installed in 1972. This unit is a constant volume unit and equipped with pneumatic chilled water and hot water controls. This unit is operational, but is beyond its service life expectancy. It sis recommended the unit be replaced.

The air units serving the Capital Markets Offices on the southeast street level (AHU-14 and AHU-15) were installed in 1964. When the space was renovated in 2000, the air units remained in service, but were fitted with VFDs in order for the system to be a VAV system. The downstream VAV boxes and unit VFDs are on DDC controls, but the chilled water and hot water control valves are pneumatically controlled. The units are located in the 3rd level of the open air parking garage, but the duct and pipe insulation is for interior applications and therefore is significantly weathered and damaged. The duct and pipe insulation is in poor condition and the units are in fair condition. It is anticipated that these units will require replacement in the next 5 years.

The air handlers serving the Staff Development Area and Postal Area (AHU-16, AHU-17, and AHU-18) were installed in 1993. These units are constant volume, multi-zone units equipped with pneumatic chilled water and zone controls. Electric duct heaters provide individual heating for each zone of the systems. These units are in very good condition and are not expected to require replacement within the next 10 years.

D. Exhaust System:

Tower:

The tower exhaust fans which provide general building exhaust (EF-1), restroom exhaust (EF-2), and low-rise elevator machine room exhaust (EF-3) are all in good condition and have been well maintained. These fans are original to the construction of the tower (1972).

The exhaust fan providing ventilation of the west stairwell does not meet current life safety codes pertaining to stairwell pressurization. Reference condition statement under Fire and Life Safety section. This fan will need to be modified.

The Plaza Club Kitchen Exhaust Fan is reported by Frost to be a tenant owned piece of equipment. Any maintenance or replacement of the fan, therefore, should be the responsibility of the Plaza Club. This should be re-reviewed on lease re-assignments.

The basement mechanical room exhaust fan (EF-6) is in good condition and has been well maintained. The fan is original to the construction of the tower (1972).

Parking Garage:

The roof mounted exhaust fan serving the armored car dock in the parking garage is in fair condition. The fan is estimated to be approximately 40 years old. It is anticipated that the fan will need to be replaced within the next 5 years.

The multiple in-line exhaust fans serving restroom functions throughout the parking garage are original to the building and hence approximately 50 years old. It is estimated that these fans will need to be replaced in the next 5 years.

The outside air and relief air fans serving the Staff Development Area are approximately 20 years old. It is not anticipated that these fans will require replacement in the next 10 years.

E. HVAC Controls:

The pneumatic HVAC control system is original to the building. The pneumatic controls are operable and serviceable as they currently exist in the building. Pneumatic controls are limited on the ability to implement energy saving strategies and functions and do not allow for central building management and control. The pneumatic system does require monitoring and maintenance, particularly the air compressor. It is essential that the air compressor, filter dryer and oil/water separator are well maintained and monitored. Failure of the system, such as water or oil entering the pneumatic lines, will cripple the entire building HVAC system. Due to energy considerations and standard of care for similar buildings, it is recommended that the system be upgraded to Direct Digital Control (DDC)

The JCI Legacy N2 system is a control system that is approximately 20 years old. Control technology has advanced significantly since this system was installed. Replacement components of this system, while still currently available, are not being manufactured and this system will eventually reach an end-of-life point. The end-of-life point is anticipated to occur within the next 5 years.

The JCI Metasys Control system is a BACnet based control system. BACnet based systems are currently the state-of-the-art, industry standard. This is an open protocol system with multiple manufacturers and control components available and interchangeable. BACnet based control systems are anticipated to remain the industry standard well into the future.

The presence of three separate control systems in the building presents an operational and maintenance issue. Each control system requires a special set of skills and knowledge to efficiently operate, troubleshoot, and maintain the systems. To keep the building operational, it is essential that personnel fully versed in these systems be present in the building on a daily basis. Industry-wide, personnel knowledgeable in pneumatic systems is limited, and personnel knowledgeable in all three types of systems are even more limited.

F. Specialty HVAC Systems:

The DX split systems serving the high-rise elevator machine room are new units. These units are stand-alone units to maintain operational environmental conditions for the newly upgraded elevators. Package DX units have an operational life of 15 to 20 years. Since these units have been installed within the past year, it is not anticipated that these units will require replacement within the next 5 years.

The Leibert CRAC unit serving the UPS Room is in good condition. It is not anticipated that this unit will need to be replaced within the next 10 years. The redundant, thermostatically controlled exhaust system was installed new in 2001. It is not anticipated that the fan or controls will need to be replaced within the next 10 years.

The through-the-wall air conditioning units serving the Parking Garage elevator machine rooms are in good condition. The age of the units is unknown; however, the service life expectancy of these units is approximately 10 to 15 years. It is anticipated that these units which have not been recently replaced, will need to be replaced within the next 5 years.

The through-the-wall air conditioning units serving the Parking Garage elevator lobbies are in good condition. The age of the units is unknown; however, the service life expectancy of these units is approximately 10 to 15 years. These units are also located in areas exposed to the public which increases the chances of damage to the units. It is anticipated that these units will need to be replaced.

3.5 Electrical Systems

A. Electrical Gear:

General Working Clearances:

There are several areas within the building where proper National Electric Code (NEC) working clearances are not present. This condition occurs at several locations in the basement mechanical room and also in most of the East and West tower electrical rooms. This includes several switchboards and motor control centers located in the basement. Tower floors 9, 10 and 20 have been renovated within the last 5 years, at which point the electrical rooms were reconfigured. It is

recommended that procedures be put in place to ensure safe working conditions should the electrical gear require servicing while energized.

Switchboards:
Most of the switchboards are part of the original building construction, dating back to 1972. Many of the output switches have been replaced or repaired as part of various renovation projects. The switchboards undergo regular thermal scans, cleaning and torqueing as part of the facility scheduled maintenance. Overall, the switchboards are in good condition. Consideration should be given for relocation in conjunction with Bank level renovation to correct the lack of adequate working clearance around the equipment.

Motor Control Centers:
Most of the motor control centers are part of the original building construction, dating back to 1972. Some of the output buckets have been replaced or repaired as part of various renovation projects, however most are original. The MCCs undergo regular thermal scans, cleaning and torqueing as part of the facility scheduled maintenance. Overall, the MCCs are in good condition.

Panelboards:
Most of the panelboards, including distribution panelboards, have been renovated; however there are some that are part of the original building construction. The older panelboards are located throughout the building. They are typically maintained through a stockpile of scavenged circuit breakers. The panelboards undergo regular thermal scans, cleaning and torqueing as part of the facility scheduled maintenance. Overall, the panel boards are in good condition; however the extended life cycle of older panels will be limited by the stock of spare circuit breakers. The original panels should be replaced, rather than using scavenged parts.

Transformers:
Most of the transformers are part of the original building construction, dating back to 1972. The service life expectancy of these units is approximately 20 to 30 years. Due to the age of the older units, it is anticipated that they will need to be replaced within the next 10 years. With proper maintenance, however, their utilization could be extended.

UPS:
The UPS units were properly decommissioned when the IT division was relocated and the UPS power was no longer needed. Both 500 kVA unit could be re-commissioned and provided with new batteries.

Generators and Transfer Switches:
All generators are regularly maintained through maintenance contracts and are in good working order. With proper maintenance, these generators should expect additional operational life of 15 to 20 years.

All transfer switches have undergone planned maintenance in 2014.

B. Lighting:

The lighting system underwent a complete retrofit process in 2012. The retrofit consisted of a complete replacement of all T12 fluorescent lamps and associated magnetic ballasts with T8 fluorescent lamp technology and equivalent electronic ballasts. Additionally, all incandescent lamps were replaced with fluorescent screw-type lamps.

Overall, the lighting system is well maintained and in good working order. There are some areas that would benefit from an Architectural refresh. This refresh would be intended to replace damaged/dingy lenses on fixtures in any back-of-house areas and to replace any outdated fixture styles in the public spaces.

Under new construction standards, a building of this nature would typically have an overall lighting control system. A lighting control system brings the benefit of more expanded control and more efficient energy consumption.

C. Special Systems:

Fire Alarm:
Overall, the Fire Alarm system is well maintained and in good working order. No renovations are expected on this system, other than as required due to space remodeling.

Elevators:
Upon completion of the current control panel renovation, and with subsequent required maintenance, the elevators should not require any major replacements.

3.6 Communications Systems

Overall, the communications systems provided by both AT&T and Time Warner are well maintained and in good working order. No renovations are expected on this system, other than as required due to space remodeling.

3.7 Energy Consumption

The building, as a whole, is not an energy efficient building. The building and its functional components are, for the most part, based on technology that this approximately 40 years old. These forms of technology were just not designed with energy efficiency in mind, and hence are not capable of competing with current energy efficient building technology.

Several upgrades have been implemented into the building to improve efficiency. Examples include complete lighting retro-fits to utilize T-8 fluorescent lighting technology, retro-fitting all incandescent light fixtures with compact fluorescent lamps, addition of VFDs on the penthouse air handlers, restroom upgrades to utilize low-flow fixtures and automatic sensors for plumbing fixture controls. Additionally, the three newly renovated floors have implemented energy efficient technology such as the conversion to full DDC HVAC controls and addition of occupancy controls for light fixtures.

This building does present numerous opportunities to implement energy saving features. The constant volume chilled water system with chillers operating on a 6 deg. temperature differential is an inefficient cooling system. The lack of cooling tower isolation and optimization also negatively effects the energy consumption of the cooling system. The predominate use of pneumatic controls precludes the use of energy saving control

strategies such as night setback/setup, optimal start-stop, supply temperature reset, local zone occupancy scheduling, demand control ventilation control and economizer operation. The lighting on most floors is still controlled by local switching instead of utilizing occupancy sensors or automatic lighting controls.

3.8 Structural Systems

Both the Tower and Parking Garage structure is steel reinforced concrete columns and beams. Upon visual inspection, the structure appears to be in good condition. There appears to be no obvious signs of damage or structural issues. There were several areas in the parking garage where reinforcing steel has become exposed. It is recommended that a structural analysis and remediation be performed.

4.0 Building Analysis & Recommendations

4.1. General

Life safety codes, building codes, mechanical codes, electrical codes and energy codes have all undergone numerous revisions throughout the life of the building and hence the building does not meet all current codes. Certain items, such as fire sprinkler system upgrades, will eventually need to be brought up to current life safety codes and other items, such as energy efficiency measures, would be beneficial to bring up to current codes and practice for economic reasons.

4.2 On-Site Building Facilities Staff

The day-to-day operation of this building requires an on-site facilities staff with intimate knowledge of the building equipment, operational characteristics, and operating systems. This building is in good operational condition, but only because of the constant attention and knowledge of the existing staff. The very nature of pneumatic HVAC controls requires an on-site presence to monitor and maintain the air compressor system, adjust controls in the occupied zones, and monitor the central plant equipment. A building with 40 year old components requires a staff to attend to small, minor system failures immediately before they escalate into critical, expensive failures. Additionally, the expectations of tenants demand that on-site facilities personnel react, address, and resolve any building related issue immediately.

In the current condition, this building requires a staff of four (4) building facilities operators. This staff can be either in-house personnel or a contracted service staff, but either way, it is essential that these personnel are trained and knowledgeable facilities operators. It is equally essential that these personnel have intimate knowledge of this particular building. Without trained facilities personnel with knowledge of this building's specific operational characteristics, this building will begin to degrade operations in a matter of weeks.

4.3 Maintenance Budget

Maintenance is essential to the ongoing operation of this building. It is essential that an annual maintenance budget be allocated to not only address day-to-day maintenance items such as lamp replacement, plumbing repair, pneumatic controls air compressor maintenance, and fan belt replacement, but also building systems infrastructure as well. Many of the building systems are original to the building and hence beginning to approach the end of their service life expectancy. While the majority of these system will still be operational for another 20 years and hence not require capital expenditures for replacement, a portion of the individual systems will possibly require maintenance to keep the system, as a whole, operational for that time period. A prime example is the current condenser water piping system. While the piping system as a whole is expected to be operational for another 25 to 30 years, leaks have developed in two areas of the system. Repair and replacement of a specific section of the piping system as a maintenance item will keep the system as a whole operational without requiring capital expenditures for replacement.

4.4 PROJECTS RECOMMENDED FOR IMPLEMENTATION IMMEDIATELY

The aggressive maintenance schedule and recent facility upgrades performed over the past several years have positioned the building to be in good operational condition. Items listed below are projects identified to replace equipment/systems that are likely to fail or require significant maintenance within the next one to two years, and hence should be implemented to maintain the operational status of the building.

Note all costs are current costs. Escalation of 3% to 4% shall be necessary to plan for future systems.

A. Replacement of AHU-'OLD 7':

AHU-'OLD7', located in the mechanical room next to the armored car dock, is in poor condition and should be considered for replacement within one year. The unit should be replaced with a packaged, multi-zone unit with chilled water cooling and hot water heating. The unit, zone dampers, chilled water control valve, hot water control valve, and all related sensors should be DDC controlled.

Estimated Cost: $125,000 to $150,000

B. Replacement of JCI Legacy N2 Control System/Front-end Upgrade:

The JCI Legacy N2 control system will eventually be reaching end-of-life status. Current technology is replacing this system and replacement parts will cease being available. Although support and parts will not cease being available within the next 5 years, it is in the best interest to replace the system prior to the point where parts and service are not available. Additionally, it is in the best interest of the facility to move to unifying the HVAC control system into a single controls system based on the most current technology. Under the same project, it is recommended that the Front-end and existing JCI Metasys DDC control system be upgraded to the most current BACnet Building Automation System technology.

Estimated Cost: $125,000 to $175,000

C. Replacement of Heating Hot Water Pump, HWP-1:

Heating Hot Water Pump, HWP-1, is exhibiting signs of corrosion. This pump appears to be original to the building and the matching pump has already been replaced. This pump is estimated to be at the end of its useful service life.

Estimated Cost: $10,000 to $12,500

D. Replacement of Packaged Air Handlers Original to Building:

The majority of the packaged air handling equipment is original to the building, either installed in 1964 with the parking garage or in 1972 with the tower. All of these units are nearing the end of their service life expectancy and should be anticipated to be replaced. The units should be replaced with similar packaged, multi-zone or single zone units with chilled water cooling and hot water heating. The unit, zone dampers, chilled water control valve, hot water control valve, and all related sensors should be DDC controlled.

AHU to be Replaced	Estimated Cost
Tower: AHU-8	$200,000 to $230,000
Tower: AHU-12	$30,000 to $50,000
Parking Garage: AHU-1	$125,000 to $150,000
Parking Garage: AHU-3	$30,000 to $50,000
Parking Garage: AHU-5	$100,000 to $125,000
Parking Garage: AHU-6	$125,000 to $150,000
Parking Garage: AHU-9	$75,000 to $100,000
Parking Garage: AHU-10	$30,000 to $50,000
Parking Garage: AHU-14	$50,000 to $75,000
Parking Garage: AHU-15	$50,000 to $75,000
Total:	$815,000 to $1,065,000

E. Stairwell Modification:

The existing stairwells do not comply with current high-rise smoke control codes. The stairwell with the vestibule will need to be modified by removing the exhaust fan.

Estimated Cost: $15,000

F. Pneumatic Controls Upgrade to DDC Controls:

Pneumatic controls require constant maintenance and servicing of the system in order to keep the system operational. Pneumatic controls are also extremely limited in their ability to allow energy conservation strategies to be implemented into the building HVAC system. As building floors are being renovated, the control system is being changed out to a DDC control system. This will significantly improve energy consumption of the building, drastically reduce maintenance by eliminating the pneumatic control function, provide better building thermal control, and improve system troubleshooting and preventative maintenance activities.

Estimated Cost: $750,000 to $850,000

G. Parking Garage Elevator Machine Room A/C Replacement:

The air conditioning units in the Parking Garage Elevator Machine Rooms are packaged, thru-the-wall units. Current age of these systems is unknown. This type of system typically has a service life of 10 to 15 years. It is likely that these units will require replacement within the next 10 years.

Estimated Cost: $5,000 to $7,500

H. Parking Garage Elevator Lobby A/C Replacement:

The air conditioning units in the Parking Garage Elevator Lobbies are packaged, thru-the-wall units. Current age of these systems is unknown. This type of system typically has a service life of 10 to 15 years. These units are also located in a public area which is likely prone to damage.

Estimated Cost: $15,000 to $25,000

I. Renovate Outdated 208V Electrical Gear:

Some of the existing 208Y/120V electrical distribution gear (transformers and panelboards) within the facility are outdated and are being maintained with stockpile parts that have salvaged from previous renovations. In advance of a catastrophic failure or simply running out of stockpile material, it is recommended that this equipment be replaced in a controlled manner.

Estimated Cost: $250,000 to $275,000

J. Addition of Sprinkler System to Individual Tower Floors:

The basement and three floors are currently sprinklered. There remains 18 floors (including the mechanical penthouse) to be upgraded to be fully sprinklered. While it is not likely that all 18 floors will be required to be completed in the next 5 years, it is anticipated that progress will need to be made towards the goal. Whether the upgrade occurs only during renovation of a floor, or if the upgrade will need to occur as floors are still occupied, will need to be negotiated with the Fire Marshal's Office.

Estimated Cost:

- $3 per square foot if constructed in conjunction with full remodel
- $5 per square foot if constructed while floor is occupied

K. Renovate Lighting Control:

The existing building does not comply with current energy codes for lighting control. Currently, the building is grandfathered, but it is anticipated and recommended that this requirement will need to be met as the building is renovated. While much of the requirement can be met with occupancy sensors, however a completely integrated lighting control panel would be recommended.

Estimated Cost: $225,000 to $300,000

4.5 Projects Recommended for Implementation within 5 Years

The age of the building is such that some of the buildings systems are nearing the end of their service life expectancy. Items listed below are projects identified to replace equipment/systems that are likely to fail or need upgrading within the next 5 years.

A. Replacement of Exhaust Fans in Parking Garage:

The parking garage general exhaust fans and armored car dock exhaust fan are reaching the end of their service life.

Estimated Cost: $10,000 to $15,000

B. Replace and Upgrade Chilled Water Loop and Cooling Tower Piping:

The existing chilled water piping and condenser/cooling tower piping arrangement is original to the building. Portions of the piping systems have to be replaced as maintenance items and the pumps will be nearing the end of their service life expectancy. Additionally, the existing chilled water system and cooling tower piping arrangement is an inefficient system. It is recommended that the chilled water

system, including pumps and chilled water control valves be converted to a variable primary pumping system. In addition, the condenser water/cooling tower piping system shall be upgraded to allow for control valve isolation of the individual cooling towers. These pumping/piping system upgrades, in conjunction with DDC control strategies for cooling tower optimization and chiller optimization will significantly reduce energy consumption of the cooling system.

Estimated Cost: $250,000 to $300,000

C. Fire Pump: The fire pump is not capable of pressurizing the penthouse level to the correct pressure. It is recommended that the pump be replaced with a higher pressure discharge pump. In addition, the electrical feed is recommended to be modified to provide power directly off the main electrical bus with intervening means of disconnects.

Estimated Cost: $ 240,000 to $ 280,000

D. Fuel Tanks: To remove the fuel tanks from within the building, it is recommended to install a new double wall contained fuel tank on the roof of the parking garage. A fuel pump would be required to install in the basement to lift the fuel to the roof.

Estimated Cost $ 30,000 to $40,000

SUMMARY TABLE OF RECOMMENDATIONS FROST TOWER

DESCRIPTION	COST
A: ON-SITE FACILITIES STAFF	
B: MAINTENANCE BUDGET EQUAL TO FROST EXISTING MAINTENANCE BUDGET	
C: PROJECTS RECOMMENDED FOR IMPLEMENTATION IMMEDIATELY	
1: REPLACE AHU-'OLD7'	$137,500
2: REPLACE JCI LEGACY N2 CONTROL SYSTEM/FRONT-END UPGRADE	$150,000
3: REPLACE HEATING HOT WATER CIRCULATION PUMP	$11,250
4: REPLACE PACKAGED AIR HANDLERS ORIGINAL TO BUILDING	
A: TOWER: AHU-8	$215,000
B: TOWER: AHU-12	$40,000
C: PARKING GARAGE: AHU-1	$137,500
D: PARKING GARAGE: AHU-3	$40,000
E: PARKING GARAGE: AHU-5	$112,500
F: PARKING GARAGE: AHU-6	$137,500
G: PARKING GARAGE: AHU-9	$87,500
H: PARKING GARAGE: AHU-10	$40,000
I: PARKING GARAGE: AHU-14	$62,500
J: PARKING GARAGE: AHU-15	$62,500
TOTAL AIR HANDLERS	$935,000
5: STAIRWELL MODIFICATIONS	$9,000
6: PNEUMATIC CONTROLS UPGRADE TO DDC CONTROLS	$800,000
7: PARKING GARAGE ELEVATOR MACHINE ROOM A/C REPLACEMENT	$6,250
8: PARKING GARAGE ELEVATOR LOBBY A/C REPLACEMENT	$20,000
9: RENOVATE OUTDATED 208V ELECTRICAL GEAR	$262,500
1: FIRE SPRINKLER UPGRADES	
A: UPGRADE COMPLETED DURING FLOOR REMODEL; PER FLOOR	
TOTAL FOR 18 FLOORS	$1,143,000

SUMMARY TABLE OF RECOMMENDATIONS FROST TOWER

2: RENOVATE LIGHTING CONTROL	$262,500
3. ASBESTOS REMOVAL, ESTIMATE FROM COSA	$1,643,684
TOTAL FOR IMMEDIATE CONSIDERATION	$5,380,684
ESCALATION 5% PER YEAR, 3 YEARS	$807,103
TOTAL	$6,187,787
D: PROJECTS RECOMMENDED FOR IMPLEMENTATION WITHIN 5 YEARS	
4. REPLACE/UPGRADE COOLING TOWER PIPING AND CONVERT CHILLED WATER TO VARIABLE PUMPING WITH 2 WAY VALVES	$275,000
5: FIRE PUMP REPLACEMENT	$262,500
5. FUEL TANK REPLACEMENT	$35,000
6: REPLACEMENT OF EXHAUST FANS IN PARKING GARAGE	$12,500
TOTAL 5 YEAR PROJECTS TO BE CONSIDERED	$585,000
TOTAL OF ALL PROJECTS	$5,965,684

5.0 GLOSSARY

AHU – Air Handler Unit

BTU – British Thermal Units

CFH – Cubic Feet Per Hour

CFM – Cubic Feet Per Minute

CHP – Chilled Water Pump

CRAC – Computer Room Air Conditioner

CWP – Condenser Water Pump

DDC – Direct Digital Controls

DX – Direct Expansion

EF – Exhaust Fan

EPAC – Energy Policy Act

HP – Horse Power

HVAC – Heating, Ventilating, Air Conditioning

GPM – Gallons Per Minute

kVA – Kilovolt Amps

kW – Kilowatt

MBH – Million BTU Hours

MCC – Motor Control Center

NEC – National Electric Code

PRV – Pressure Reducing Valve

PSI – Pounds Per Square Inch

PVC – Polyvinyl Chloride

SAWS – San Antonio Water System

UPS – Uninterruptable Power Supply

V - Volt

VAV – Variable Air Volume

VFD – Variable Frequency Drive

APPENDIX 1.1 FIRE PROTECTION & LIFE SAFETY EQUIPMENT

PHOTOGRAPHIC DOCUMENTATION

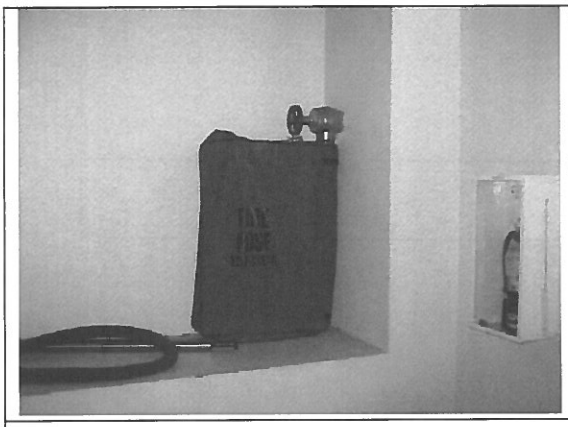

Photo 1.1.01: Typical Fire Protection Standpipe and Hose in Stairwell

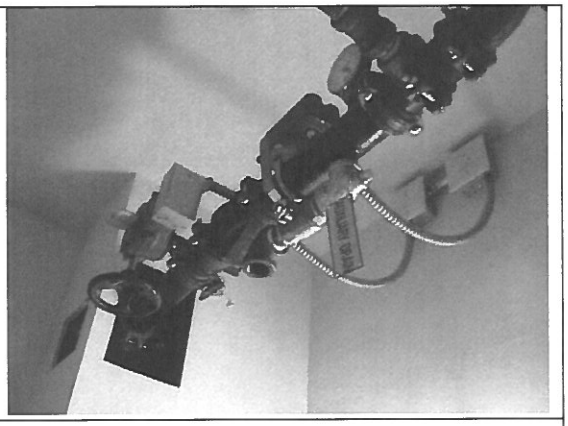

Photo 1.1.02: Wet Pipe Sprinkler System Upgrade – Valve to Individual Floor

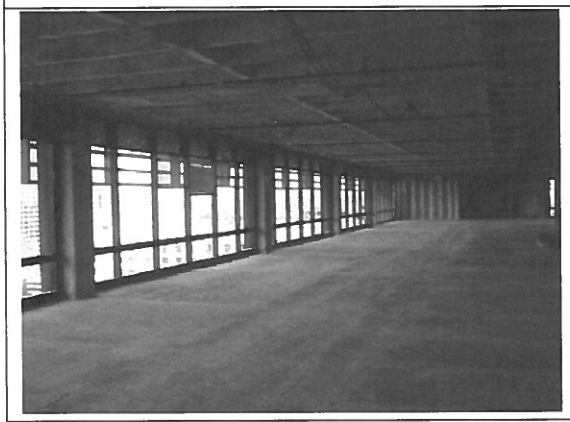

Photo 1.1.03: Wet Pipe Sprinkler System Upgrade Added on Floor Under Renovation

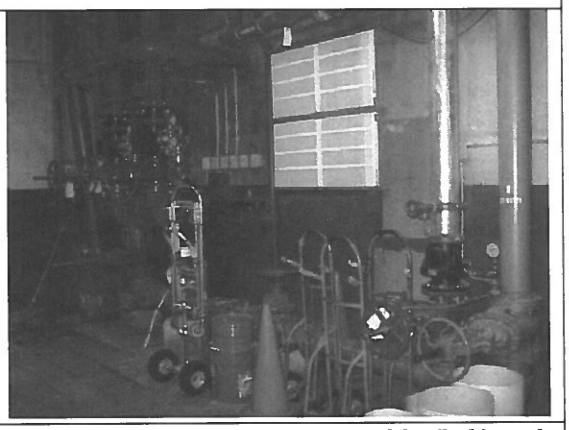

Photo 1.1.04: Fire Riser Assembly (left) and Fire Pump Supply Tap (right)

Photo 1.1.05: Fire Pump (center) and Fire Jockey Pump (right)

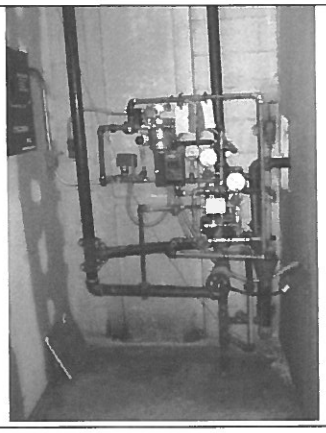

Photo 1.1.06: Pre-action System Assembly Serving UPS Room and Main Printing Room

Photo 1.1.07: Typical Halon Extinguishing Agent System

EQUIPMENT CONDITION SUMMARY

FIRE PROTECTION PUMPS									
MARK	DESCRIPTION	TYPE	MANUFACTURER	MOTOR SIZE (HP)	FLOW (GPM)	HEAD (FT)	VFD	MANUF DATE	CONDITION/NOTES
FP-1	FIRE PUMP	HORIZ. SPLIT CASE	AURORA	50	500	220	NO	ESTIMATED 1972	• GOOD CONDITION • WELL MAINTAINED • CURRENT FIRE MARSHAL CERTIFICATIONS
JP-1	JOCKEY PUMP	VERTICAL INLINE	AURORA	1-1/2	--	--	NO	UNKNOWN	• GOOD CONDITION • WELL MAINTAINED

APPENDIX 1.2 PLUMBING SYSTEMS

PHOTOGRAPHIC DOCUMENTATION

Photo 1.2.01: Domestic Water Entry into Basement Mechanical Room (Green Pipe)

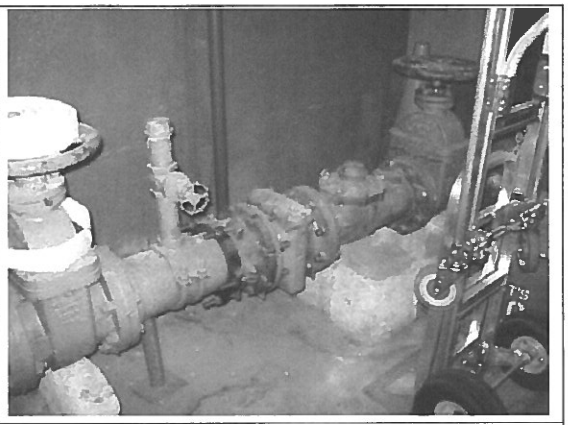

Photo 1.2.02: Domestic Water Backflow Preventer

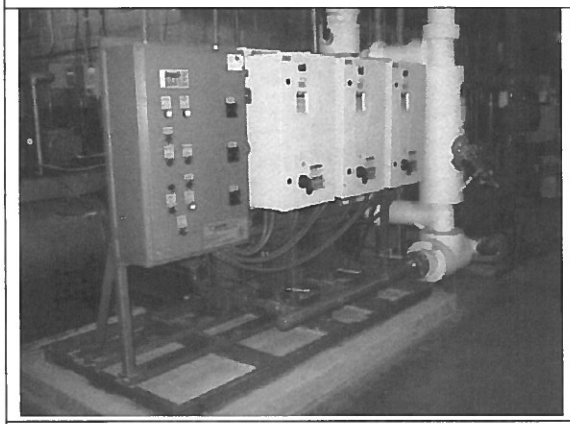

Photo 1.2.03: Domestic Water Booster Pump System

Photo 1.2.04: Water Softener System

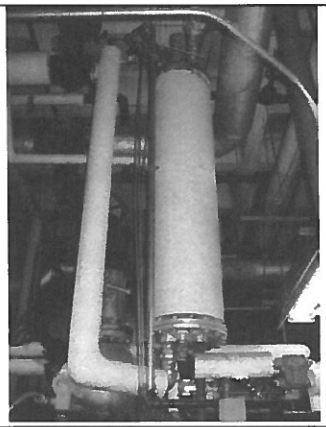

Photo 1.2.05: Domestic Hot Water Steam Heat Exchanger

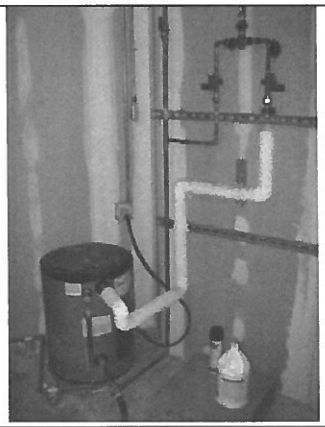

Photo 1.2.06: Electric Storage Water Heater Serving Occupied Spaces in Parking Garage

Photo 1.2.07: Cast Iron Sanitary Sewer Exiting Building (Grey Pipe)

Photo 1.2.08: Basement Sewage Ejection System

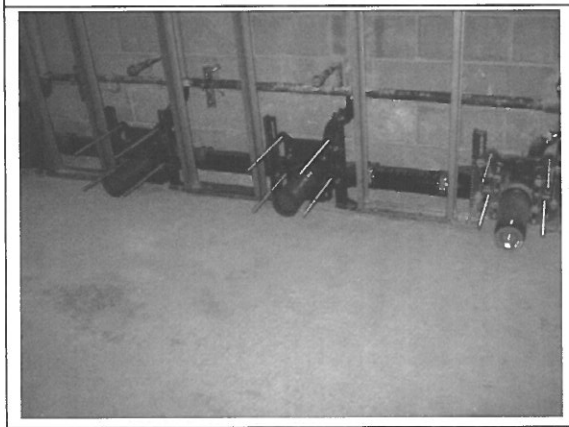

Photo 1.2.09: New Sanitary and Domestic Water Piping for Renovated Restroom

Photo 1.2.10: Existing PVC Sanitary Piping System on 17th Floor

Photo 1.2.11: Typical Water Closet Serving Public Restrooms

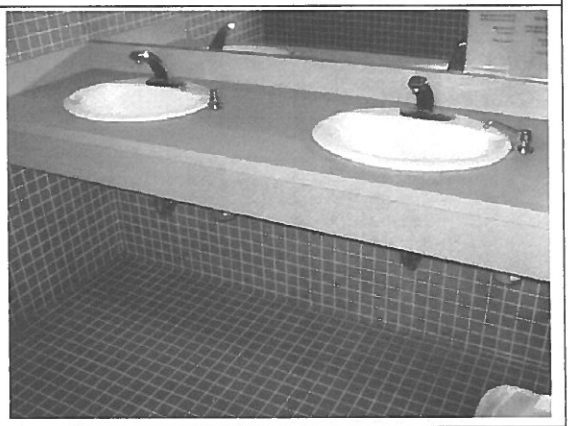

Photo 1.2.12: Typical Lavatories Serving Public Restrooms

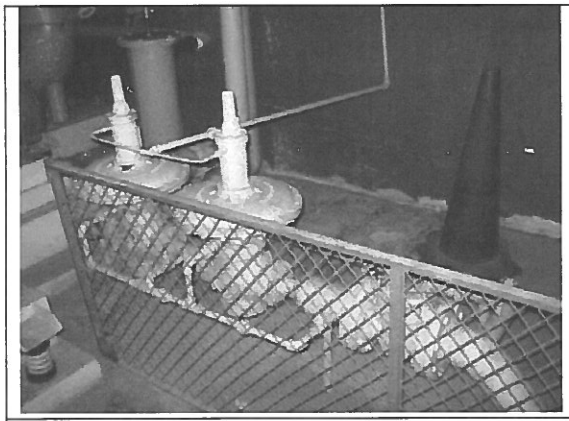

Photo 1.2.13: Natural Gas Regulators

Photo 1.2.14: Natural Gas Meters

DOMESTIC WATER PUMPS									
MARK	DESCRIPTION	TYPE	MANUFACTURER	MOTOR SIZE (HP)	FLOW (GPM)	HEAD (FT)	VFD	MANUF DATE	CONDITION/NOTES
BP-1	DOMESTIC WATER BOOSTER PUMP SYSTEM	VERTICAL, MULTI-STAGE, VFD	CANARIS	(3) @ 10	--	358 (155 PSI)	YES	2013	• EXCELLENT CONDITION • CONSIDERED NEW EQUIPMENT • EXCELLENT EFFICIENCY AND CONTROL

WATER SOFTENER EQUIPMENT								
MARK	DESCRIPTION	TYPE	MANUFACTURER	CONT. FLOW (GPM)	PEAK FLOW (GPM)	DRAIN FLOW (GPM)	MANUF DATE	CONDITION/NOTES
WS-1	DOMESTIC WATER SOFTENER SYSTEM	COMMERCIAL, DUAL TANK, ION EXCHANGE	WENDLAND	UNKNOWN	UNKNOWN	UNKNOWN	1993	• GOOD CONDITION • WELL MAINTAINED

APPENDIX 1.3 HVAC SYSTEMS: COOLING SYSTEM

PHOTOGRAPHIC DOCUMENTATION

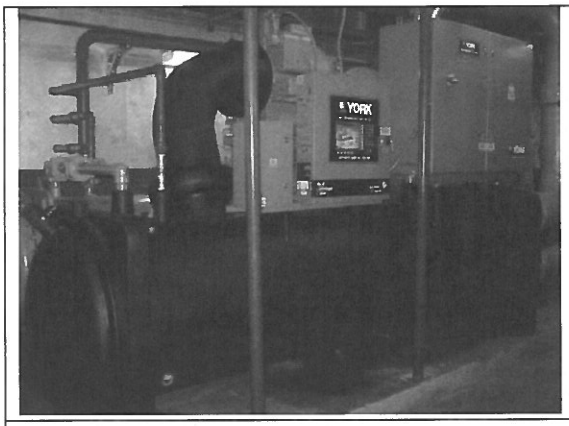

Photo 1.3.01: Typical Water Cooled Chiller

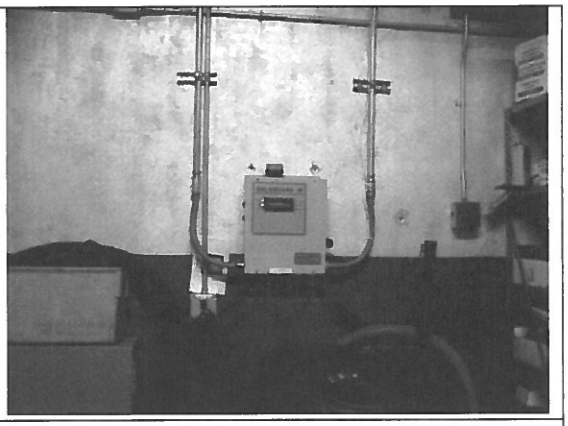

Photo 1.3.02: Refrigerant Monitoring System in Basement Mechanical Room

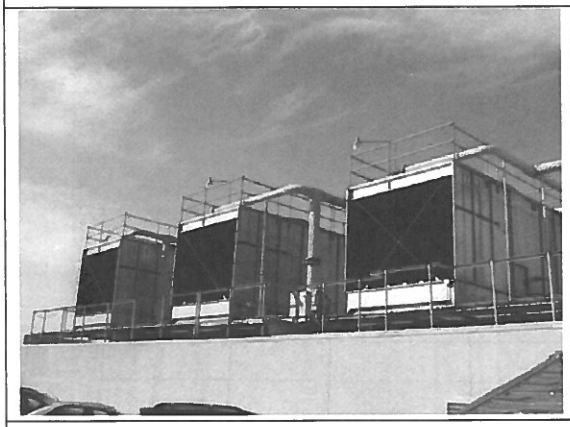

Photo 1.3.03: Cooling Towers Located on Roof of Parking Garage

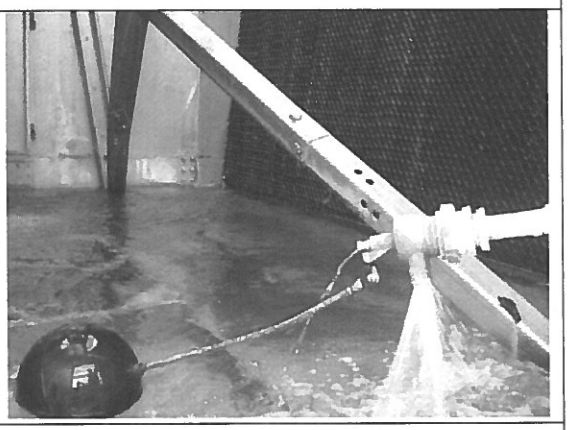

Photo 1.3.04: Interior of Cooling Tower

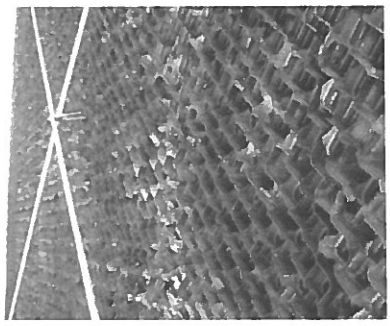

Photo 1.3.05: Cooling Tower Basin Fill

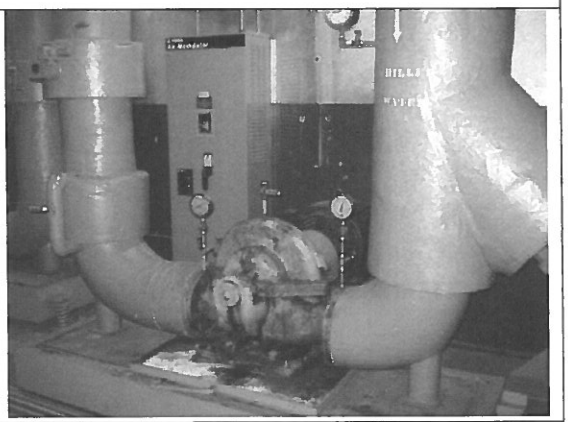

Photo 1.3.06: Typical Chilled Water Pump with VFD (beyond)

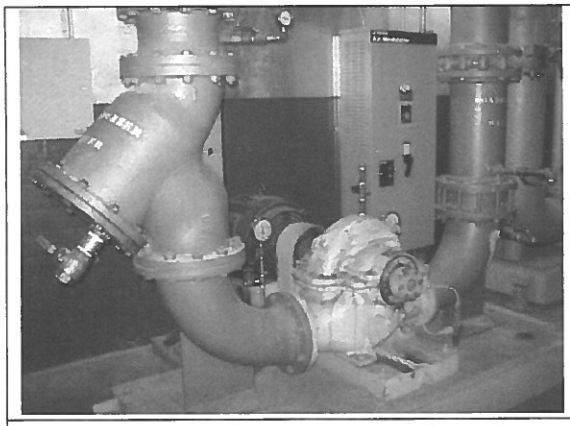

Photo 1.3.07: Typical Condenser Water Pump with VFD (beyond)

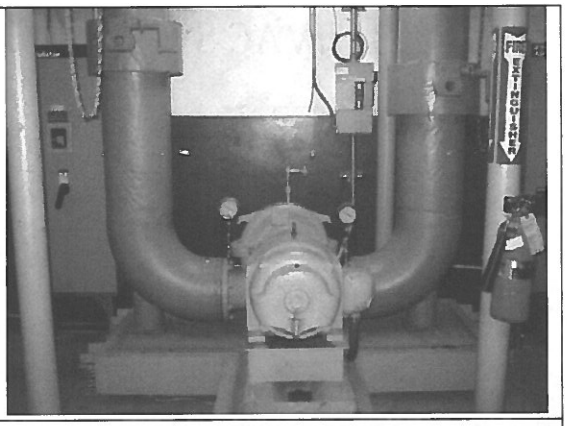

Photo 1.3.08: Chilled Water/Condenser Water Swing Pump

Photo 1.3.09: Chilled Water Chemical Shot Feeder

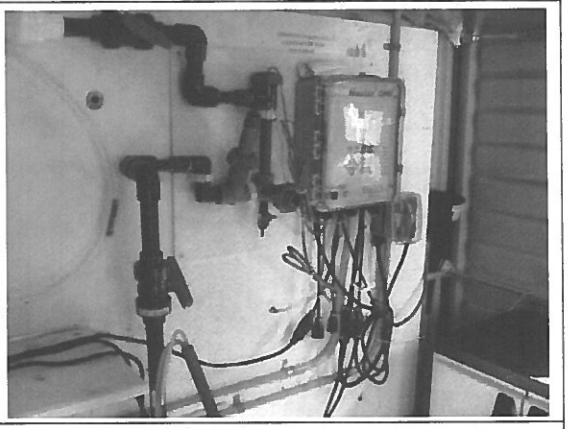

Photo 1.3.10: Condenser Water Treatment System

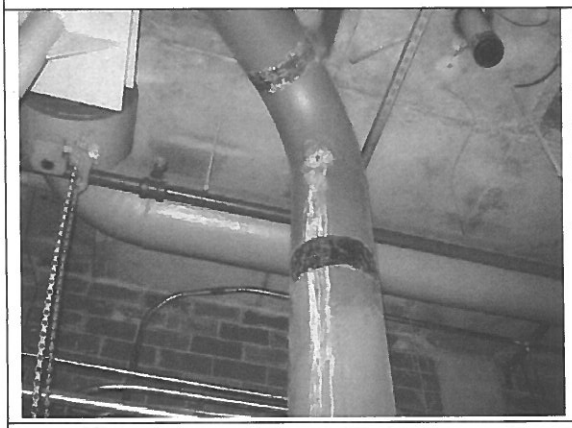

Photo 1.3.11: Condenser Water Piping System Leak at Elbow

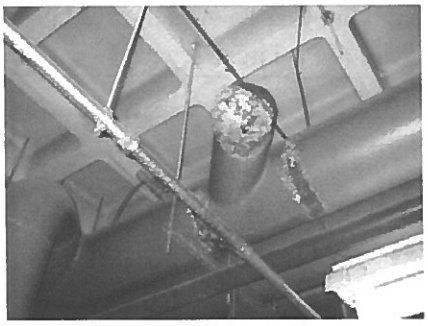

Photo 1.3.12: Condenser Water Piping System Leak at Capped Line

EQUIPMENT CONDITION SUMMARY

WATER COOLED CENTRIFUGAL CHILLERS									
MARK	DESCRIPTION	TYPE	MANUFACTURER	NOM. CAPACITY (TONS)	EVAP/COND FLOW (GPM)	EVAP/COND. DELTA T (F)	VFD	MANUF DATE	CONDITION/NOTES
CH-1	WEST CHILLER	WATER COOLED CENTRIFUGAL	YORK/JCI	530	1,120 / 1,750	6 / 10	YES	2001	• EXCELLENT CONDITION • WELL MAINTAINED
CH-2	EAST CHILLER	WATER COOLED CENTRIFUGAL	YORK/JCI	550	1,120 / 1,750	6 / 10	YES	2014	• EXCELLENT CONDITION • CONSIDERED NEW EQUIPMENT
CH-3	SOUTH CHILLER	WATER COOLED CENTRIFUGAL	YORK/JCI	550	1,120 / 1,750	6 / 10	YES	2014	• EXCELLENT CONDITION • CONSIDERED NEW EQUIPMENT

COOLING TOWERS									
MARK	DESCRIPTION	TYPE	MANUFACTURER	NOM. CAPACITY (TONS)	FLOW (GPM)	FAN MOTOR (HP)	VFD	MANUF DATE	CONDITION/NOTES
CT-1	NORTH COOLING TOWER	OPEN CELL CROSSFLOW	MARLEY	550	1,750	40	YES	ESTIMATE 1992	• GOOD CONDITION • WELL MAINTAINED
CT-2	CENTER COOLING TOWER	OPEN CELL CROSSFLOW	MARLEY	550	1,750	40	YES	ESTIMATE 1992	• GOOD CONDITION • WELL MAINTAINED
CT-3	SOUTH COOLING TOWER	OPEN CELL CROSSFLOW	MARLEY	550	1,750	40	YES	ESTIMATE 1992	• GOOD CONDITION • WELL MAINTAINED

CHILLED WATER/CONDENSER WATER PUMPS

MARK	DESCRIPTION	TYPE	MANUFACTURER	MOTOR SIZE (HP)	FLOW (GPM)	HEAD (FT)	VFD	MANUF DATE	CONDITION/NOTES
CHP-1	CHILLED WATER PUMP	HORIZONTAL SPLIT CASE	AURORA	50	1,120	122	YES	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
CHP-2	CHILLED WATER PUMP	HORIZONTAL SPLIT CASE	AURORA	50	1,120	122	YES	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
CHP-6	CHILLED WATER PUMP	HORIZONTAL SPLIT CASE	AURORA	50	1,120	122	NO	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
CWP-4	CONDENSER WATER PUMP	HORIZONTAL SPLIT CASE	ALLIS-CHALMERS	50	1,750	75	YES	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
CWP-5	CONDENSER WATER PUMP	HORIZONTAL SPLIT CASE	ALLIS-CHALMERS	50	1,750	75	YES	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
CWP-7	CONDENSER WATER PUMP	HORIZONTAL SPLIT CASE	ALLIS-CHALMERS	50	1,750	75	NO	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
SWP-1	CHILLED/CONDENSER SWING PUMP	HORIZONTAL SPLIT CASE	ALLIS-CHALMERS	40	1,200	115	NO	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED

APPENDIX 1.4 HVAC SYSTEMS: HEATING SYSTEM

PHOTOGRAPHIC DOCUMENTATION

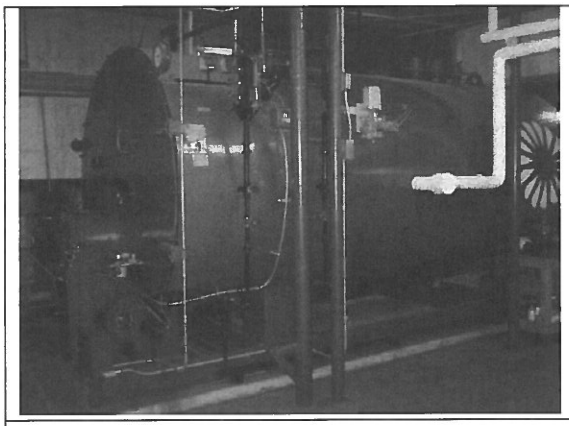

Photo 1.4.01: B-1 - 300 hp Steam Boiler

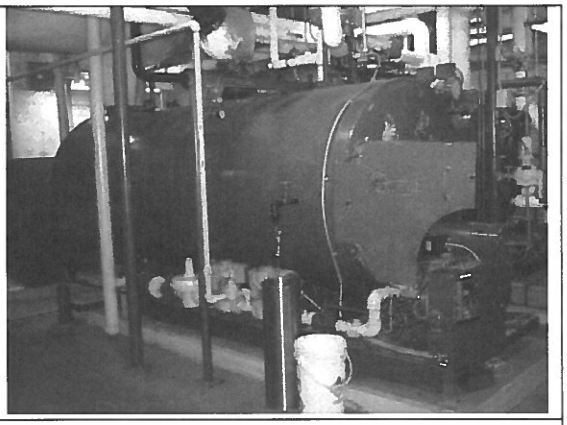

Photo 1.4.02: B-2 – 100 hp Steam Boiler

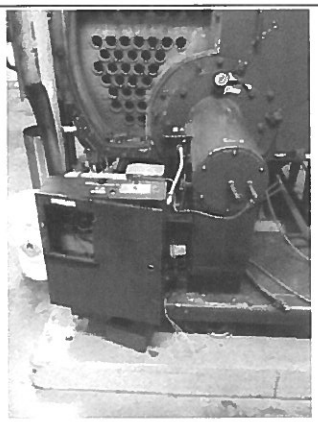

Photo 1.4.03: Burner Replacement on 100 hp Steam Boiler

Photo 1.4.04: Boiler Flue Termination at Roof of Parking Garage

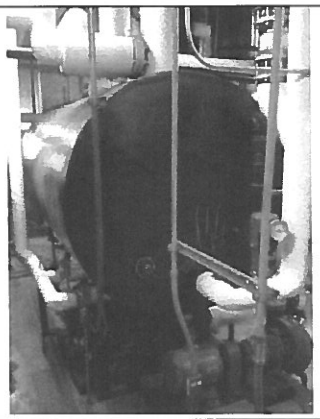

Photo 1.4.05: Steam Condensate Receiver

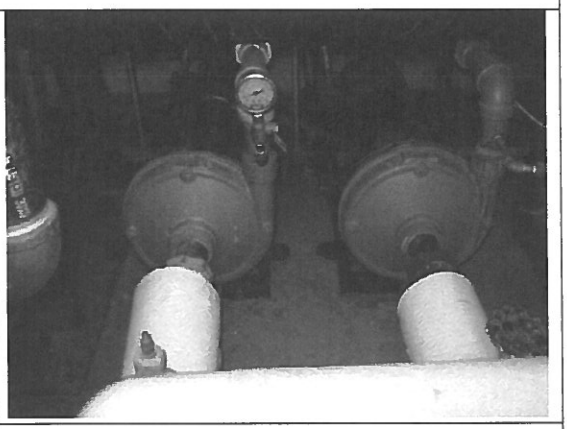

Photo 1.4.06: Steam Condensate Return Pumps

Photo 1.4.07: Heating Hot Water Heat Exchangers

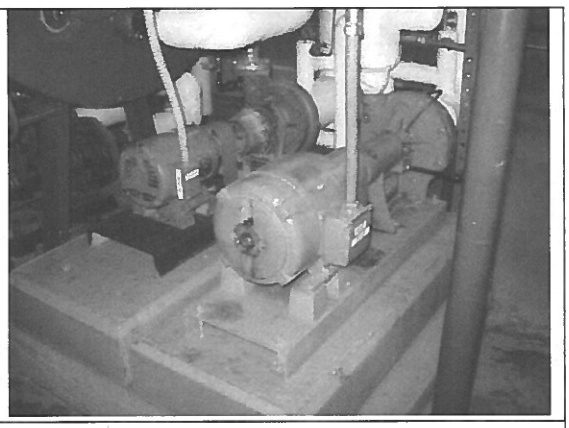

Photo 1.4.08: Heating Hot Water Circulation Pumps

EQUIPMENT CONDITION SUMMARY

STEAM BOILERS									
MARK	DESCRIPTION	TYPE	MANUFACTURER	NOM. CAPACITY (HP)	STEAM PRESS. (PSI)	WATER PRESS. (PSI)	GAS PRESS. (IN. WC)	MANUF DATE	CONDITION/NOTES
B-1	WEST STEAM BOILER	FIRE TUBE	KEWANEE	300	15	30	16	ESTIMATED 1972	• GOOD CONDITION • WELL MAINTAINED
B-2	EAST STEAM BOILER	FIRE TUBE	KEWANEE	100	15	30	16	ESTIMATED 1964	• GOOD CONDITION • WELL MAINTAINED

HOT WATER HEAT EXCHANGER									
MARK	DESCRIPTION	TYPE	MANUFACTURER	NOM. CAPACITY (MBH)	STEAM RATE (#/HR)	WATER FLOW (GPM)	LVG WATER TEMP (F)	MANUF DATE	CONDITION/NOTES
HX-1	HOT WATER HEAT EXCHANGER	SHELL & TUBE	UNKNOWN	1,630	1,680	90	180	ESTIMATED 1964	• GOOD CONDITION • WELL MAINTAINED
HX-2	HOT WATER HEAT EXCHANGER	SHELL & TUBE	UNKNOWN	1,630	1,680	90	180	ESTIMATED 1964	• GOOD CONDITION • WELL MAINTAINED

HEATING SYSTEM PUMPS

MARK	DESCRIPTION	TYPE	MANUFACTURER	MOTOR SIZE (HP)	FLOW (GPM)	HEAD (FT)	VFD	MANUF DATE	CONDITION/NOTES
CP-1	STEAM CONDENSATE PUMP	END SUCTION	UNKNOWN	3	--	--	NO	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
CP-2	STEAM CONDENSATE PUMP	END SUCTION	UNKNOWN	3	--	--	NO	ESTIMATE 1972	• GOOD CONDITION • WELL MAINTAINED
HWP-1	DOMESTIC HOT WATER CIRULATION PUMP	END SUCTION	UNKNOWN	3	180	60	NO	ESTIMATE 1964	• FAIR CONDITION • NO OBVIOUS LEAKS BUT PUMP HOUSING EXHIBITS SIGNS OF CORROSION
HWP-2	DOMESTIC HOT WATER CIRULATION PUMP	END SUCTION	CHICAGO PUMP	3	180	60	NO	UNKNOWN	• GOOD CONDITION • WELL MAINTAINED

APPENDIX 1.5 HVAC SYSTEMS: AIR HANDLING SYSTEMS

PHOTOGRAPHIC DOCUMENTATION

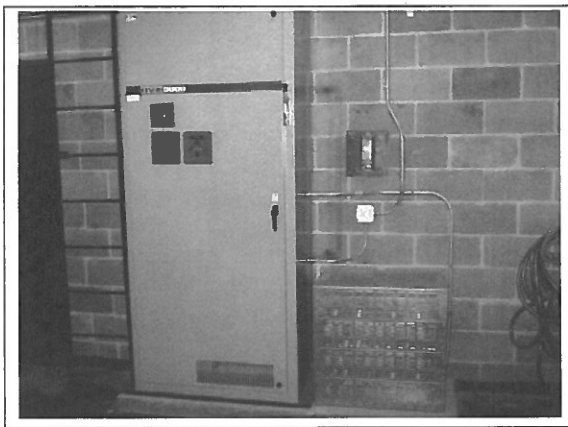

Photo 1.5.01: VFD Serving Penthouse Built-up Air Handling Unit

Photo 1.5.02: B-2 – Cooling Coil of Penthouse Built-up Air Handling Unit

Photo 1.5.03: Hot Deck Supply Duct with Steam Coil of Penthouse Air Unit

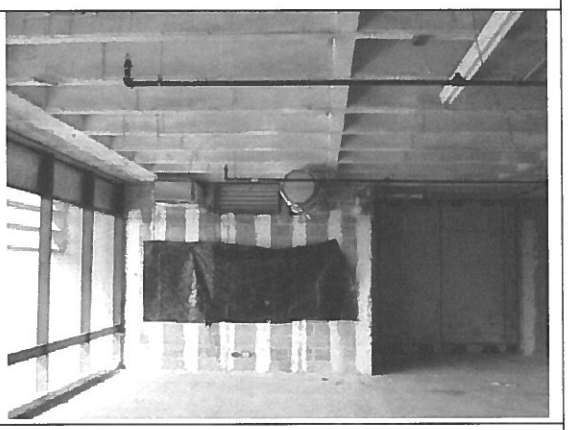

Photo 1.5.04: Hot Deck (left) and Cold Deck (right) Ducts Exiting Chase at Typical Floor

Photo 1.5.05: Outside Air Louver/Damper (left) and Return Air Damper in Penthouse

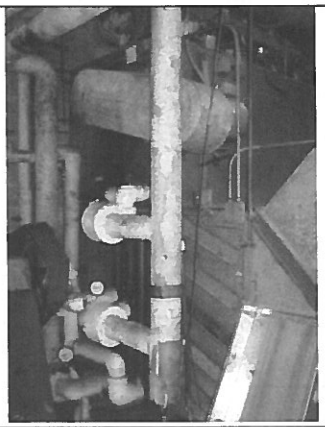

Photo 1.5.06: Tower Air Handler #8 – Serves Tower Basement and Street Level

Photo 1.5.07: Plaza Club Kitchen Air Handling Unit

Photo 1.5.08: Tower Air Handler #12 – Serves Northwest Tower Basement

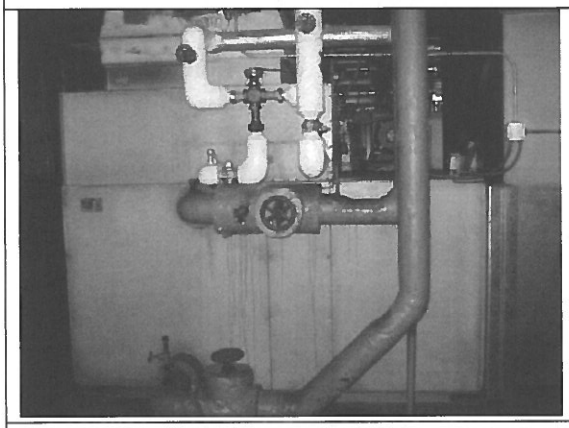

Photo 1.5.09: Parking Garage Air Handler #1 – Serves Basement Bank Lobby

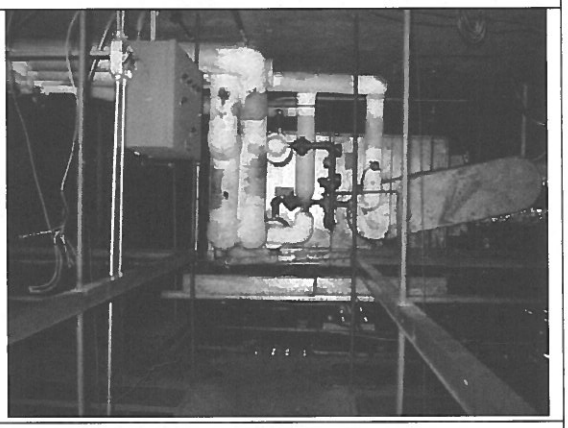

Photo 1.5.10: Parking Garage Air Handler #3 – Serves Safe Deposit/Commercial Vault

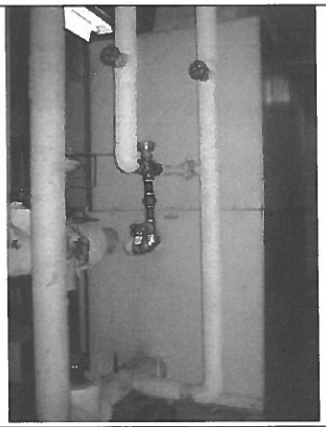

Photo 1.5.11: Parking Garage Air Handler #5 – Serves Old Kitchen and Portion of Dining

Photo 1.5.12: Parking Garage Air Handler #6 – Serves Portion of Dining Room and Founders Room

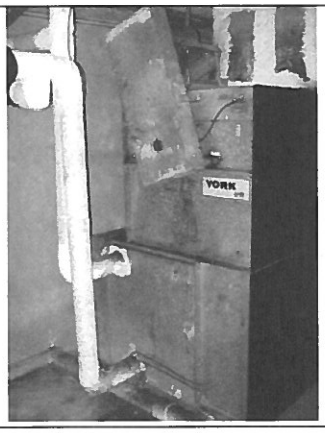

Photo 1.5.13: Parking Garage Air Handler #10 – Serves Record Vault

Photo 1.5.14: Electric Duct Heater Serving Records Vault – Parking Garage AHU-10

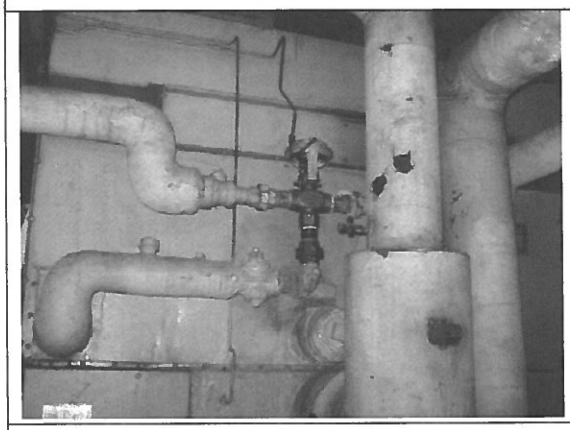

Photo 1.5.15: Parking Garage Air Handler OLD #7 – Serves Southwest Street Level Offices and Basement Commercial Tellers

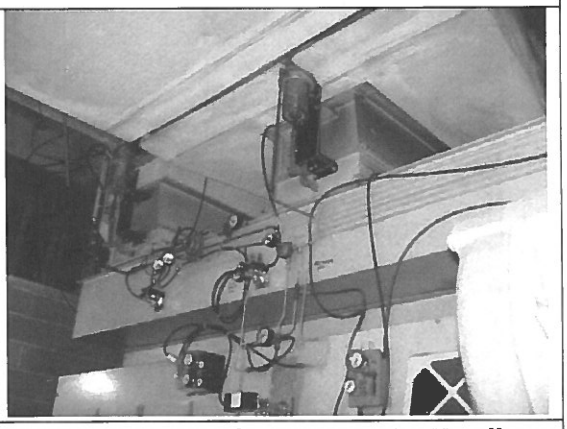

Photo 1.5.16: Parking Garage Air Handler OLD #7 – Serves Southwest Street Level Offices and Basement Commercial Tellers

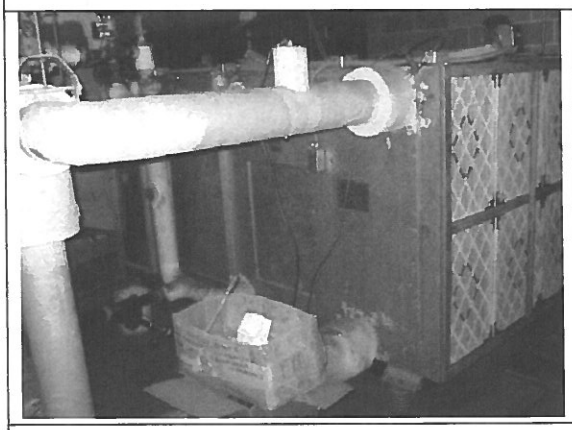

Photo 1.5.17: Parking Garage Air Handler #9 – Serves Commander's Room

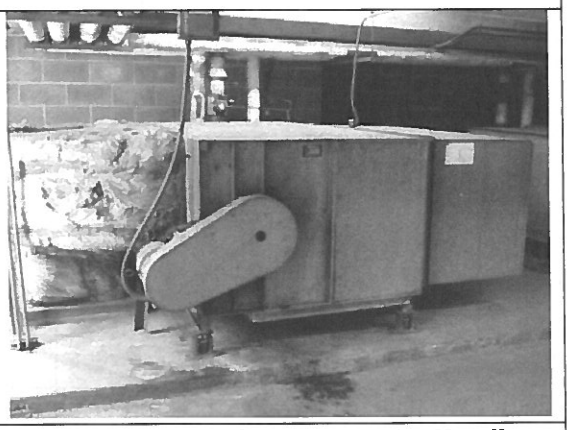

Photo 1.5.18: Parking Garage Air Handler #14 – Serves Capital Markets Offices

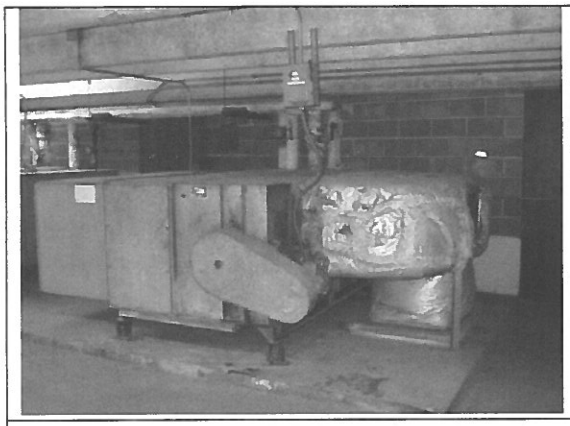

Photo 1.5.19: Parking Garage Air Handler #15 – Serves Capital Markets Offices

Photo 1.5.20: VFD Controls for Parking Garage Air Handlers #14 and #15

Photo 1.5.21: Parking Garage Air Handler #16 – Serves Staff Development Area

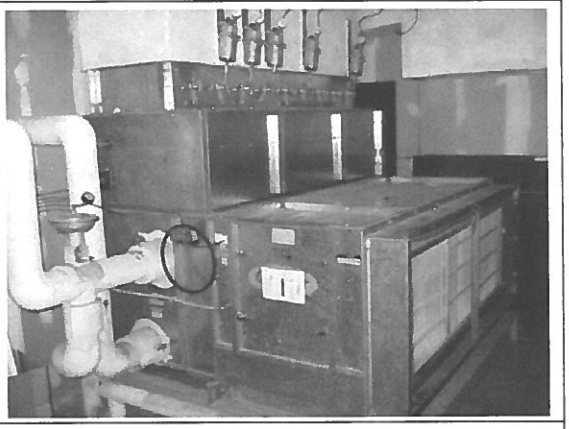

Photo 1.5.22: Parking Garage Air Handler #17 – Serves Postal Area

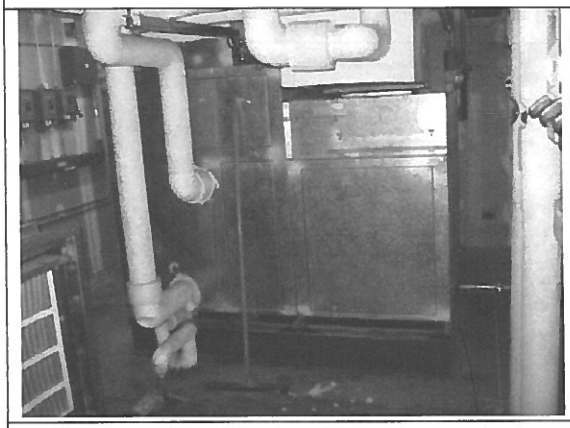

Photo 1.5.23: Parking Garage Air Handler #18 – Serves Staff Development Area

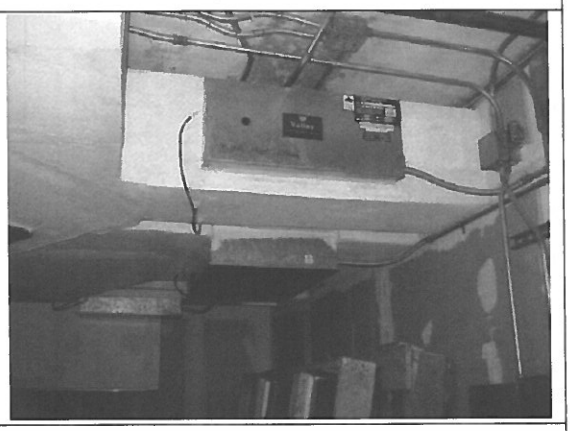

Photo 1.5.24: Typical Electric Duct Heater Installation Serving Units 16, 17, and 18

EQUIPMENT CONDITION SUMMARY

TOWER AIR HANDLING UNITS									
MARK	DESCRIPTION	TYPE	MANUFACTURER	AIRFLOW (CFM)	CLG CAPACITY (TONS)	HTG CAPACITY (MBH)	VFD	MANUF DATE	CONDITION/NOTES
AHU-1 TOWER	PENTHOUSE BUILT-UP AHU	BUILT-UP; CHW/STEAM	JOY (FAN)	100,000	275	420	YES	1972	• GOOD CONDITION • WELL MAINTAINED • NEW STEAM COIL
AHU-2 TOWER	PENTHOUSE BUILT-UP AHU	BUILT-UP; CHW/STEAM	JOY (FAN)	100,000	275	2,100	YES	1972	• GOOD CONDITION • WELL MAINTAINED • NEW STEAM COIL
AHU-3 TOWER	PENTHOUSE BUILT-UP AHU	BUILT-UP; CHW/STEAM	JOY (FAN)	100,000	275	2,100	YES	1972	• GOOD CONDITION • WELL MAINTAINED • NEW STEAM COIL
AHU-4 TOWER	PENTHOUSE BUILT-UP AHU	BUILT-UP; CHW/STEAM	JOY (FAN)	100,000	275	420	YES	1972	• GOOD CONDITION • WELL MAINTAINED • NEW STEAM COIL
AHU-8 TOWER	TOWER BASEMENT AND STREET	PACKAGED; CHW/HW	TRANE	24,750	40	800	NO	1972	• FAIR CONDITION • ANTICIPATE REPLACMENT
AHU-11 TOWER	PLAZA CLUB KITCHEN AHU	PACKAGED; CHW/STEAM	UNKNOWN	UNKNOWN	--	--	NO	ESTIMATED 1989	• FAIR CONDITION • TENANT RESPONSIBLE FOR REPLACEMENT
AHU-12 TOWER	TOWER BASEMENT - NW CORNER	PACKAGED; CHW/HW	UNKNOWN	4,000	8	55	NO	1972	• FAIR CONDITION • ANTICIPATE REPLACMENT

PARKING GARAGE AIR HANDLING UNITS

MARK	DESCRIPTION	TYPE	MANUFACTURER	AIRFLOW (CFM)	CLG CAPACITY (TONS)	HTG CAPACITY (MBH)	VFD	MANUF DATE	CONDITION/NOTES
AHU-1 PK GRG	BASEMENT BANK LOBBY AHU	PACKAGED; CHW/HW	YORK	15,100	44	230	NO	1964	•GOOD CONDITION •WELL MAINTAINED •CLEANED COILS 2014
AHU-3 PK GRG	SAFE DEPOSIT/ COMMERCIAL VAULT AHU	PACKADED; CHW/HW	--	4,000	8	55	NO	1964	•FAIR CONDITION •ANTICIPATE REPLACMENT
AHU-5 PK GRG	OLD KITCHEN / DINING RM AHU	PAKCAGED; CHW/HW	YORK	11,400	40	210	NO	1964	•FAIR CONDITION •ANTICIPATE REPLACMENT
AHU-6 PK GRG	DINING RM / FOUNDERS RM AHU	PAKCAGED; CHW/HW	YORK	15,050	44	230	NO	1964	•FAIR CONDITION •ANTICIPATE REPLACMENT
AHU-7 PK GRG	BASEMENT OFFICE AREA AHU	BUILT-UP; CHW/HW	--	64,000	175	N/A	YES	1972	•GOOD CONDITION •WELL MAINTAINED •VFD ADDED 2014
AHU-10 PK GRG	RECORDS VAULT AHU	PAKCAGED; CHW/ELEC	YORK	3,800	6	UNKNOWN	NO	1972	•FAIR CONDITION •ANTICIPATE REPLACMENT
AHU- 'OLD7' PK GRG	SW STREET LVL OFFICES AHU	PACKAGED; CHW/HW	YORK	15,500	45	245	NO	1964	•POOR CONDITION •ASBESTOS ON PIPING •REPLACEMENT REQUIRED
AHU-9 PK GRG	COMMANDERS ROOM AHU	PACKAGED; CHW/HW	YORK	10,300	40	365	NO	1972	•FAIR CONDITION •ANTICIPATE REPLACMENT
AHU-14 PK GRG	CAPITAL MARKETS AHU	PACKAGED VAV; CHW/HW	--	5,000	10	80	YES	1964	•FAIR CONDITION •ANTICIPATE REPLACMENT
AHU-15 PK GRG	CAPITAL MARKETS AHU	PACKAGED VAV; CHW/HW	--	5,000	10	80	YES	1964	•FAIR CONDITION •ANTICIPATE REPLACMENT
AHU-16 PK GRG	STAFF DVLPMNT AHU	PACKAGED; CHW/ELEC	CARRIER	4,630	11	29.5 KW	NO	1993	•VERY GOOD CONDITION •WELL MAINTAINED
AHU-17 PK GRG	STAFF DVLPMNT AHU	PACKAGED; CHW/ELEC	CARRIER	4,890	11	34 KW	NO	1993	•VERY GOOD CONDITION •WELL MAINTAINED
AHU-18 PK GRG	STAFF DVLPMNT AHU	PACKAGED; CHW/ELEC	LA SALLE	4,748	11	44 kw	NO	1993	•VERY GOOD CONDITION •WELL MAINTAINED

APPENDIX 1.6 HVAC SYSTEMS: EXHAUST SYSTEMS

PHOTOGRAPHIC DOCUMENTATION

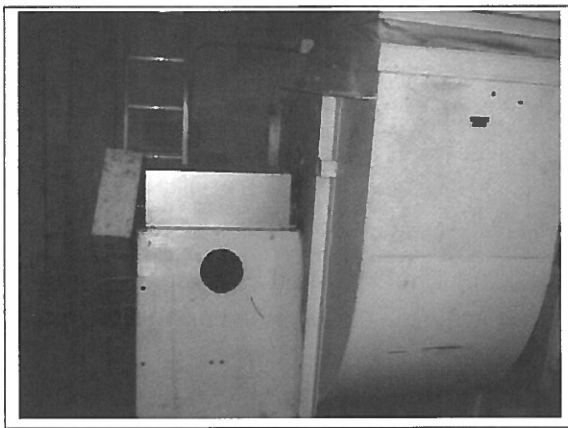

Photo 1.6.01: Tower Restroom Exhaust fan – TEF-2

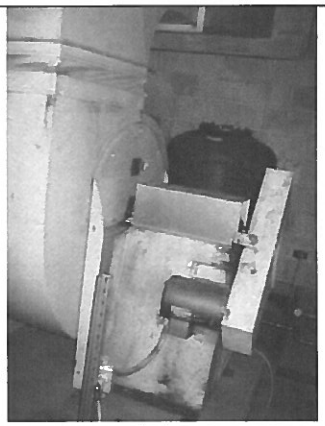

Photo 1.6.02: Low-Rise Elevator Machine Room Exhaust Fan – TEF-3

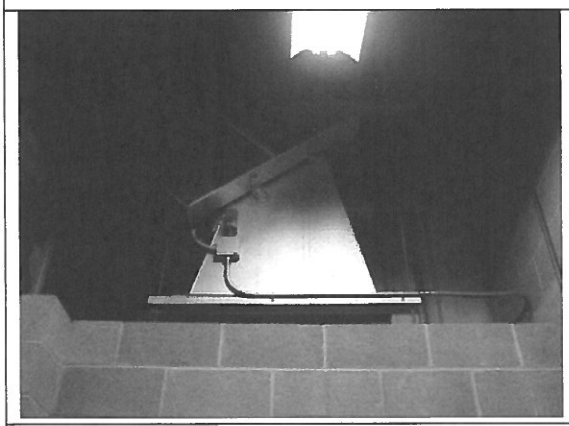

Photo 1.6.03: West Stairwell Ventilation Fan – TEF-4

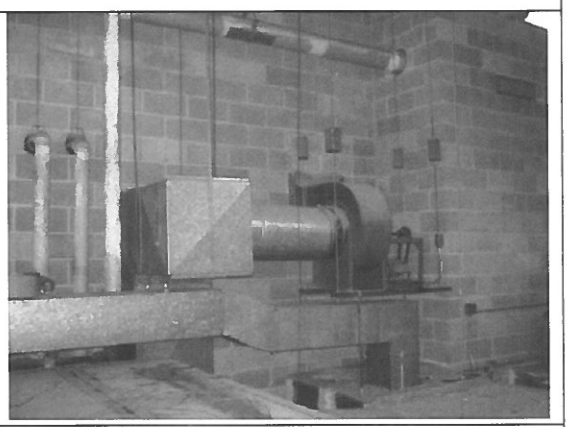

Photo 1.6.04: Abandoned Penthouse Chiller Room Exhaust Fan – TEF-5

Photo 1.6.05: Plaza Club Kitchen Exhaust Fan

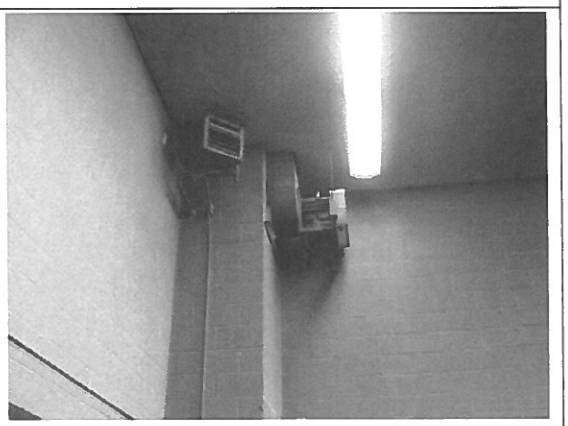

Photo 1.6.06: Abandoned Loading Dock Exhaust Fan (right).

	
Photo 1.6.07: Basement Mechanical Room Exhaust Fan – TEF-6	Photo 1.6.08: Roof Mounted Exhaust Fan Serving Armored Car Dock in Parking Garage

EQUIPMENT CONDITION SUMMARY

TOWER EXHAUST FANS									
MARK	DESCRIPTION	TYPE	MANUFACTURER	AIRFLOW (CFM)	STATIC PRESS. (IN. WC)	MOTOR (HP)	VFD	MANUF DATE	CONDITION/NOTES
EF-1 TOWER	GENERAL EXHAUST FAN	UTILITY VENT SET	PORTER	11,300	1.25	5	NO	1972	• GOOD CONDITION • WELL MAINTAINED
EF-2 TOWER	RESTROOM EXHAUST FAN	UTILITY VENT SET	PORTER	12,400	1.75	8	NO	1972	• GOOD CONDITION • WELL MAINTAINED
EF-3 TOWER	LOW-RISE ELEVATOR MACHINE ROOM EXHAUST FAN	UTILITY VENT SET	PORTER	6,200	1.00	2	NO	1972	• GOOD CONDITION • WELL MAINTAINED
EF-4 TOWER	WEST STAIRWELL VENTILATION FAN	UTILITY VENT SET	PORTER	16,850	0.63	5	NO	1972	• VENTILATION CONCEPT DOES NOT COMPLY WITH CODE • SYSTEM REPLACEMENT REQUIRED
EF-5 TOWER	PENTHOUSE CHILLER ROOM EXHAUST FAN	UTILITY VENT SET	PORTER	2,050	0.38	1	NO	1972	• ABANDONED IN-PLACE
EF-6 TOWER	BASEMENT MECHANCIAL ROOM EXHAUST FAN	UTILITY VENT SET	PORTER	16,750	0.50	3	YES	1972	• GOOD CONDITION • WELL MAINTAINED
LOADING DOCK FAN	LOADING DOCK EXHAUST FAN	UTILITY VENT SET	PORTER	1,890	0.75	1	NO	1972	• ABANDONED IN-PLACE
KITCH EXH FAN	PLAZA CLUB KITCHEN EXHAUST FAN	UTILITY VENT SET	UNKNOWN	--	--	--	NO	UNKNOWN	• OPERATIONAL • TENANT RESPONSIBILITY

PARKING GARAGE EXHAUST FANS

MARK	DESCRIPTION	TYPE	MANUFACTURER	AIRFLOW (CFM)	STATIC PRESS. (IN. WC)	MOTOR (HP)	VFD	MANUF DATE	CONDITION/NOTES
EF-1 PK GRG	ARMORED CAR LOADING DOCK EXHAUST	ROOF DOWN-BLAST	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	NO	UNKNOWN	• FAIR CONDITION • ANTICIPATE REPLACMENT
MISC EF PK GRG	MISC RESTROOM EXHAUST	IN-LINE	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	NO	UNKNOWN	• FAIR CONDITION • ANTICIPATE REPLACMENT
OAF-1 PK GRG	STAFF DEVEL OA FAN	IN-LINE	UNKNOWN	2,345	0.25	1	NO	1993	• GOOD CONDITION
RF-1 PK GRG	STAFF DEVEL RELIEF FAN	IN-LINE	UNKNOWN	1,275	0.38	1/2	NO	1993	• GOOD CONDITION

APPENDIX 1.7 HVAC SYSTEMS: CONTROLS

PHOTOGRAPHIC DOCUMENTATION

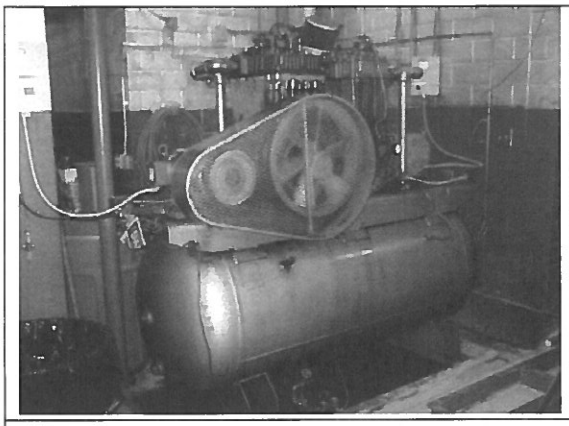

Photo 1.7.01: Air Compressor Providing Air for Pneumatic Control System

Photo 1.7.02: Oil/Water Separator and Air Dryer (left) for Pneumatic Control System

Photo 1.7.03: Typical JCI Legacy N2 Control Cabinet

Photo 1.7.04: Typical JCI Metasys BACnet Controllers

APPENDIX 1.8 HVAC SYSTEMS: SPECIALTY HVAC

PHOTOGRAPHIC DOCUMENTATION

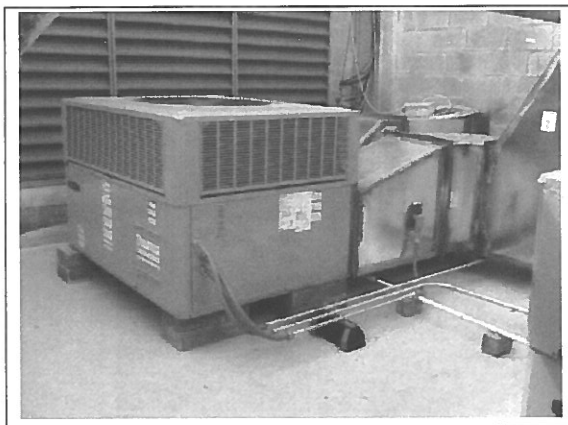

Photo 1.8.01: Packaged DX Unit Serving High-Rise Elevator Machine Room (1 of 2)

Photo 1.8.02: Liebert Chilled Water CRAC Unit Serving UPS Room

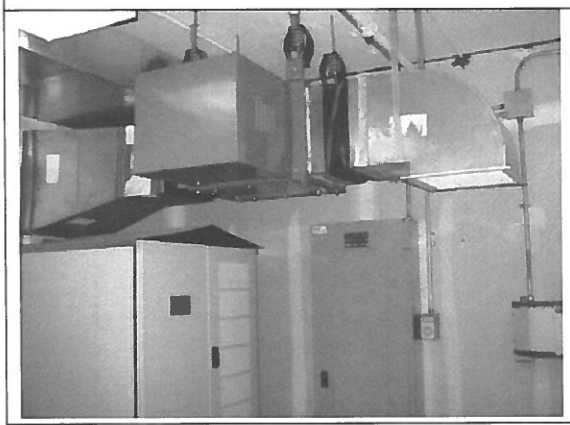

Photo 1.8.03: Redundant Thermostatically Controlled Exhaust Fan Serving UPS Room

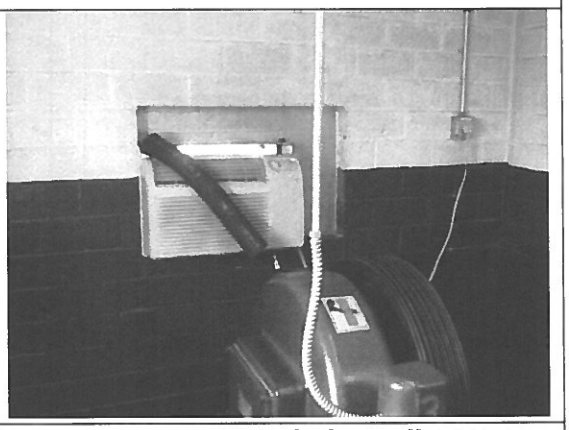

Photo 1.8.04: Through-the-Wall AC Unit Serving Single Elevator Machine Room

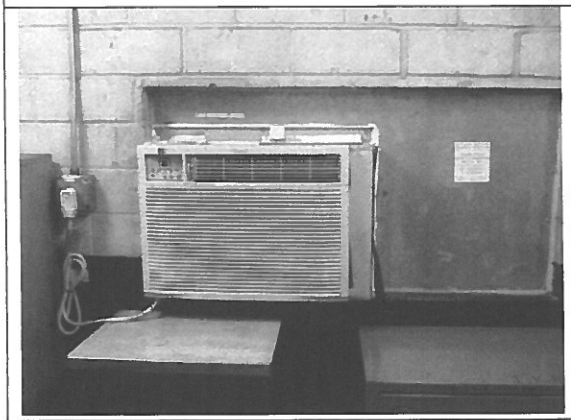

Photo 1.8.05: Through-the-Wall AC Unit Serving Double Elevator Machine Room

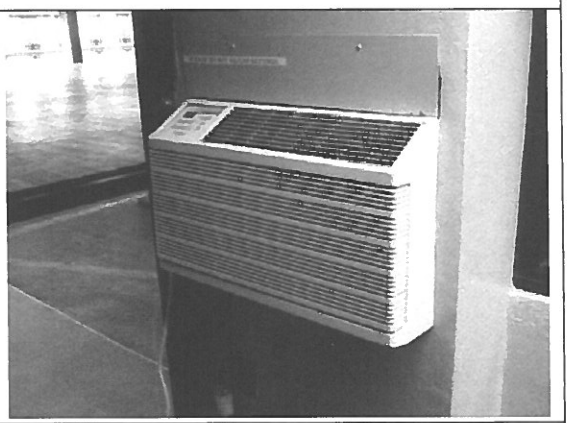

Photo 1.8.06: Typical Through-the-Wall AC Unit Serving Garage Elevator Lobbies

APPENDIX 1.9 ELECTRICAL SYSTEMS

PHOTOGRAPHIC DOCUMENTATION

Photo 1.9.01: Service Aisle Between Switchboards in Basement

Photo 1.9.02: Switchboard 'MSC'

Photo 1.9.03: 208Y/120V Electrical Distribution

Photo 1.9.04: Motor Control Centers '1D' and '1E'

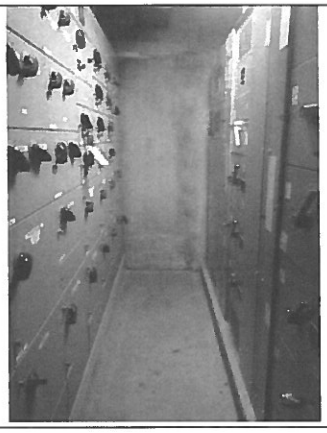

Photo 1.9.05: Service Aisle Between Switchboard & MCC in Basement

Photo 1.9.06: Motor Control Centers 'MCCLA' and 'MCCLB'

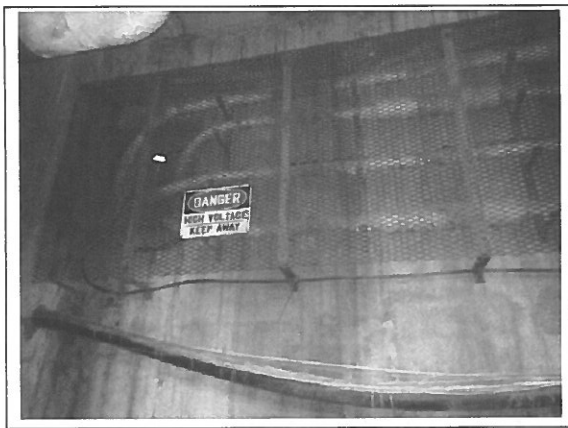		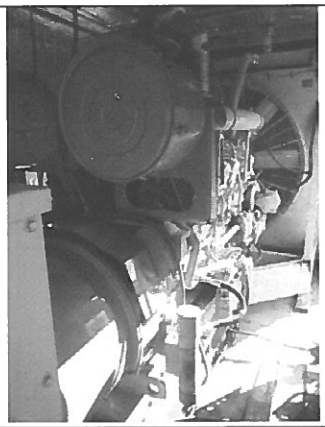
Photo 1.9.07: HV Electric Utility Entrance in Basement		Photo 1.9.08: 1,400kW Generator
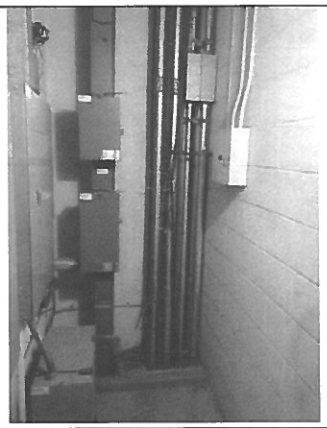		
Photo 1.9.09: Renovated Tower Electrical Room		Photo 1.9.10: Decommissioned UPS units

APPENDIX 2.1 FIRE SYSTEM REPORT

339 Sandalwood Lane
San Antonio, Texas 78216

FPCG
Fire Protection Consulting Group, LLC

www.FIREpcg.com
Main Office +1 210.858.2389

April 26, 2015

Mr. Dean Alderson, P.E.
Alderson & Associates, Inc.
7700 Torino, Suite 101
San Antonio, Texas 78229

Via e-mail to: Dean@alderson-inc.com

RE: **Due Diligence Survey Report**
Frost Bank Building
100 West Houston Street
San Antonio, Texas

Dear Mr. Alderson:

Thank you for contacting Fire Protection Consulting Group, LLC (FPCG) regarding this project. In response to your request, I have conducted a field observation and am providing this report of findings and recommendations for each of the specified items listed below. This report pertains to the tower portion of the building only.

Purpose and Scope

The purpose of this report is to summarize my observations and recommendations regarding the following existing building equipment, systems, or features:

1. **Automatic Sprinkler Protection and Standpipes** – Is the building required to be protected throughout by an automatic sprinkler system?
2. **Stairwells as Smokeproof Enclosures** – Do the two office tower stairs are required to be provided with stair pressurization systems?
3. **Fire Pump** – Is the existing fire pump and jockey pump adequately sized to support the installation of an automatic sprinkler system throughout the building?
4. **Diesel Fuel Storage** – Is the existing method and quantity of fuel storage acceptable?

The scope of this report is limited to these items and only evaluates them based upon the information provided and the visible construction features observed at the time of the site survey.

Executive Summary of Recommendations

The following is a summary of the recommendations provided by the full report. References to the detailed sections of this report that provide supporting information for the subject recommendation are provided after each item.

1. **Automatic Sprinkler Protection and Standpipes**
    a. Option 1 – Provide an automatic sprinkler system throughout the building, or
    b. Option 2 – Conduct an engineering evaluation resulting in the design of an engineered life safety system in lieu of full sprinkler protection.
    c. If Option 2, Address the findings of the engineering evaluation to the State Fire Marshal and work with their assigned representative to determine an appropriate time-frame by which either option should be completed.
    d. Move existing standpipe hose connections to within 48 inches of the landing on which they are installed.
    e. Where future plans include renovation of a floor, the budget for each floor renovation should include the cost of providing full sprinkler protection to said floor.

f. Approximate costs:

i. Option 1 – $3 per square foot or approximately $1MM (Based upon 18,000ft^2 per floor where 18 floors still remain unprotected).

ii. Option 2 – $20,000 for engineered evaluation. System cost is to-be-determined.

iii. Re-locate Standpipe Hose Connections – $8,400 (Based upon 42 hose connections @ $200 each. Re-use of existing angle hose valve and exposed 2-1/2" piping to desired height.).

iv. Provide 2-1/2" by 1-1/2" standpipe hose connection reducing caps - $4,200 (Based upon 42 hose connection caps @ $100 each.).

v. Remove Hose Reels with the approval of the San Antonio Fire Department. – No cost.

vi. Budget for per-floor sprinkler renovations - $60,000 per floor.

2. **Stairwells as Smokeproof Enclosures**

a. Re-commission the West Stair vestibule ventilation fan to determine existing system performance. Establish a testing frequency and to be conducted semiannually, at a minimum, by persons knowledgeable in the operation, testing, and maintenance of the systems. Testing should include measurement and balancing of air flows across each vestibule opening and documenting the sequence of operations for the fan.

b. If building renovations include changes to higher-hazard occupancies such as additional restaurant or other assembly or if additional stories are added to the building, existing stairs will be required to be renovated to completely comply with the requirements for new smokeproof enclosures.

c. Approximate costs:

i. Re-commission fan for West Stair Vestibule – $10,000

ii. Semi-annual fan testing – $4,000 per trip ($8,000 per year)

3. **Fire Pump**

a. The fire pump is expected to be acceptable for sprinkler protection for all levels except the Level 21 mechanical penthouse. This is primarily due to large elevation pressure losses and is little affected by expected system flows or existing pipe sizes. Detailed sprinkler system calculations must be performed to confirm.

b. Eventual replacement of the fire pump is required to comply with the retroactive provisions of the IFC due to the requirement to provide 65psi at the top of the most remote standpipe. When the fire pump is replaced, this will trigger a reconfiguration of the existing electrical service to the fire pump as it does not currently meet the requirements of the National Electric Code, NFPA 70.

c. Approximate costs:

i. Replacement fire pump and electrical service reconfiguration – $350,000.

ii. Engineering for fire pump and electrical service replacement – $25,000.

4. **Diesel Fuel Storage**

a. The quantity limit for fuel-oil storage in the existing fuel storage tanks is 660 gallons where approximately 3,900 gallons is currently present. Storage quantities should be

limited or a new protected above-ground fuel storage tank should be provided to store a maximum of 3,000 gallons.

Applicable Codes and Standards

The following codes and standards have been referenced and utilized during this analysis and form the basis for this report:

- 2012 edition of the International Building Code (IBC), as adopted by the City of San Antonio (http://www.sanantonio.gov/dsd/codes.asp).
- 2012 edition of the International Fire Code (IBC), as adopted by the City of San Antonio (http://www.sanantonio.gov/dsd/codes.asp).
- 2012 edition of the International Existing Building Code (IEBC), as adopted by the City of San Antonio (http://www.sanantonio.gov/dsd/codes.asp).
- 2012 edition of NFPA 101, Life Safety Code (LSC), as adopted by the Texas Department of Insurance, State Fire Marshal's Office for inspection of existing buildings (http://www.tdi.texas.gov/fire/fmfsinotices.html).

This study anticipates use when determining requirements for new renovated areas of the existing building, therefore currently adopted codes have been utilized. Furthermore, FPCG has used experience and engineering judgment as well as comparison to the applicable sections of these codes and standards to provide the findings and recommendations contained in this report.

1. Automatic Sprinkler Protection and Standpipes

The tower portion of the building is partially equipped with automatic sprinklers. Based upon discussions with Frost Bank building maintenance staff, FPCG understands that portions of the Sub-Level and all of Level 1 and Level 20 are protected with automatic sprinklers.

1.1. LSC Requirements

Compliance with the LSC for existing construction is not considered mandatory for this building as it is within in the City of San Antonio jurisdiction. However, a summary of the requirements from the LSC have been provided in this report as it is a common and nationally recognized standard.

Chapters 13 and 39 of the LSC outlines all the occupancy specific requirements for Existing Assembly (restaurant) and Business Occupancies, respectively. Though these chapters contain many requirements for these occupancies, only requirements associated with automatic sprinklers are included in this Section.

1.1.1. Chapter 13 – Existing Assembly Occupancies

Sections 13.3.5.1 and 13.3.5.2 address the need for automatic sprinkler systems in Existing Assembly Occupancies. Section 13.3.5.1 applies to dance halls, discotheques, nightclubs, and occupancies with festival seating and FPCG understands is not applicable to the restaurant in this building. Section 13.3.5.2 requires that assembly occupancies being used or capable of being used for exhibition o display purposes shall be provided with a sprinkler system when the exhibition or display area exceeds 15,000ft^2. Though it is unclear if the restaurant is ever utilized for exhibition or display, FPCG understands that the existing restaurant is currently fully protected with an automatic sprinkler system.

1.1.2. Chapter 39 – Existing Business Occupancies

Because this building is classified as a high-rise, Section 39.4.2 for existing high-rise business occupancies applies. Section 39.4.2 states that all high-rise business occupancy buildings shall be provide with a reasonable degree of safety from fire, and such degree of safety shall be accomplished by one of the following means:

1. Installation of a complete, approved, supervised automatic sprinkler system, or

2. Installation of an engineered life safety system complying with all of the following:
   a. The engineered life safety system shall be developed by a registered professional engineer experienced in fire and life safety systems design.
   b. The life safety system shall be approved by the authority having jurisdiction and shall be permitted to include any or all of the following systems:
      i. Partial automatic sprinkler protection
      ii. Smoke detection alarms
      iii. Smoke control
      iv. Compartmentation
      v. Other approved systems

Furthermore, Section 39.4.2.2 states that a limited, but reasonable, time shall be permitted for compliance with any part of Section 39.4.2.1 commensurate with the magnitude of the expenditure and disruption of services.

1.2. IFC Requirements

Compliance with the IFC for new construction is not required for this building, and are therefore not included here. Chapter 11 of the IFC provides retro-active requirements applicable to all buildings within the jurisdiction of the City of San Antonio.

1.2.1. IFC Section 1103.5 – Sprinkler Systems

Section 1103.5 requires that existing buildings containing Group I-2 (hospital) occupancies or where nitrate film or other pyroxylin plastics or used or stored are to be provided with automatic sprinklers. Because FPCG understands that neither of these uses are present within this building, this section does not apply.

1.2.2. IFC Section 1103.6 – Standpipes

Section 1103.6.1 for existing multiple-story buildings requires that buildings with occupied floors over 50 feet above the highest level of fire department vehicle access be provided with standpipes. Both building exit stairs are provided with 6-inch standpipe risers and 2-1/2" Class I hose connections with hose reels, meeting the requirement of this section.

Based upon field observations the hose connections on the existing standpipes are provided with hose reels and are located at approximately 72 inches above the floor landings. Current installation standards for standpipes in the City of San Antonio require that no hose be provided, hose connection caps be provided with an integral 1-1/2" reducing fitting, and that hose connections be installed at no higher than 48 inches above the walking surface. Because standpipes are an operational feature of fire protection for use by SAFD first responders, FPCG recommends modifying the existing hose connections to comply with these requirements.

1.3. IEBC Requirements

Compliance with the IEBC must be provided for any new work, but provisions of the IEBC are not retroactive for existing buildings not undergoing work. The IEBC is broken into several major sections where applicability depends upon the level of work being proposed by a renovation project. This section assumes the renovation of a single entire floor and is included to provide the user with an understanding of the level of work that could be required given such a level of work.

A single floor full gut and renovation would fall under the category of a Level 2 Alternation and therefore, Chapter 8 of the IEBC.

The requirements for automatic sprinklers are provided by Section 804.2 below:

"804.2 Automatic sprinkler systems.
Automatic sprinkler systems shall be provided in accordance with the requirements of Sections 804.2.1 through 804.2.5. Installation requirements shall be in accordance with the *International Building Code.*

804.2.1 High-rise buildings.
In high-rise buildings, work areas that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection in the entire *work area* where the *work area* is located on a floor that has a sufficient sprinkler water supply system from an existing standpipe or a sprinkler riser serving that floor.

804.2.1.1 Supplemental automatic sprinkler system requirements.
Where the *work area* on any floor exceeds 50 percent of that floor area, Section 804.2.1 shall apply to the entire floor on which the *work area* is located.

Exception: Tenant spaces that are entirely outside the *work area.*

804.2.2 Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2.
In buildings with occupancies in Groups A, B, E, F-1, H, I, M, R-1, R-2, R-4, S-1 and S-2, work areas that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection where all of the following conditions occur:

1. The *work area* is required to be provided with automatic sprinkler protection in accordance with the *International Building Code* as applicable to new construction; and
2. The *work area* exceeds 50 percent of the floor area."

In summary of these IEBC sections above, where an entire floor is renovated and the floor is provided with a standpipe and adequately sized fire pump to provide a water supply to the floor for the sprinkler system, a new automatic sprinkler system must be provided as part of the renovation project. It is therefore FPCG's recommendation that future renovation work include funding within the budget for the installation of a new automatic sprinkler system on the renovation floor.

The requirements for standpipes are provided by Section 804.3 below:

"804.3 Standpipes.
Where the *work area* includes exits or corridors shared by more than one tenant and is located more than 50 feet (15 240 mm) above or below the lowest level of fire department access, a standpipe system shall be provided. Standpipes shall have an approved fire department connection with hose connections at each floor level above or below the lowest level of fire department access. Standpipe systems shall be installed in accordance with the *International Building Code.*

Exceptions:

1. No pump shall be required provided that the standpipes are capable of accepting delivery by fire department apparatus of a minimum of 250 gallons per minute (gpm) at 65 pounds per square inch (psi) (946 L/m at 448KPa) to the topmost floor in buildings equipped throughout with an automatic sprinkler system or a minimum of 500 gpm at 65 psi (1892 L/m at 448KPa) to the topmost floor in all other buildings. Where the standpipe terminates below the topmost floor, the standpipe shall be designed to meet (gpm/psi) (L/m/KPa) requirements of this exception for possible future extension of the standpipe.
2. The interconnection of multiple standpipe risers shall not be required."

Because the existing Frost Bank building is equipped with standpipes in both stairwells and generally complies with the intent of Section 804.3, no additional recommendations resulted from the review of IEBC requirements. Please refer to Section 3 of this report for the evaluation of the fire pump and additional details regarding the existing standpipe system design and capabilities.

1.4. IBC Requirements

Compliance with the provisions of the IBC is not required for this building as the IBC does not contain retroactive requirements and is only applicable to new construction work. Therefore the IBC is considered not applicable to this section of the report.

2. Stairwells as Smokeproof Enclosures

The tower portion of the building is equipped with two vertical exit enclosures. These stairs are labeled in the building as the West Stair and East Stair. Both stairs are accessed via a small vestibule measuring approximately four feet wide by five feet long (direction of travel). Both vestibules have louvered ventilation openings on one wall. The louvers are approximately three feet wide by four feet tall for a gross ventilation area of approximately $12ft^2$. The West Stair ventilation openings are connected to an exhaust fan located in the mechanical penthouse that is rated to exhaust 16,850cfm of air at $0.625"H_2O$. The East Stair ventilation openings are connected via a vertical shaft that is open to the exterior on the roof of the building.

2.1. LSC Requirements

Compliance with the LSC for existing construction is not considered mandatory for this building as it is within in the City of San Antonio jurisdiction. However, a summary of the requirements from the LSC have been provided in this report as it is a common and nationally recognized standard.

Chapters 13 and 39 of the LSC outlines all the occupancy specific requirements for Existing Assembly (restaurant) and Business Occupancies, respectively. Though these chapters contain many requirements for the means of egress, only requirements associated with smokeproof enclosures are included in this Section.

The result of FPCG's review concludes that the LSC permits, but does not require, smokeproof enclosures to be provided for stairwells serving existing assembly or business occupancies, regardless of the building being a high-rise (§13.2.2.4, §39.2.2.4). It must be noted, however, that the results of a future evaluation and development of an Engineered Life Safety System could include the provision of smokeproof enclosures in lieu of complete automatic sprinkler protection. See Section 1.1.2 of this report for additional discussion on this matter.

2.2. IFC Requirements

Compliance with the IFC for new construction is not required for this building. IFC Chapter 11 for existing buildings contains no requirements for smokeproof enclosures. Therefore the IFC is considered not applicable to this section of the report.

2.3. IEBC Requirements

Compliance with the IEBC must be provided for any new work, but provisions of the IEBC are not retroactive for existing buildings not undergoing work. The IEBC is broken into several major sections where applicability depends upon the level of work being proposed by a renovation project. This section assumes the renovation of a single entire floor and is included to provide the user with an understanding of the level of work that could be required given such a level of work.

A single floor full gut and renovation would fall under the category of a Level 2 Alternation and therefore, Chapter 8 of the IEBC. IEBC Chapter 8 contains no requirements for smokeproof enclosures. Therefore the IEBC is considered not applicable to this section of the report.

2.4. IBC Requirements

Compliance with the provisions of the IBC is not required for this building as the IBC does not contain retroactive requirements and is only applicable to new construction work. This section is provided for comparison and reference to assist in understanding the recommendations provided herein.

For high-rise buildings, stair enclosures are required to comply with Section 909.20 of the IBC as smokeproof enclosures. This section provides three options for compliance:

a) Naturally ventilated vestibule,
b) Mechanically ventilated vestibule, or
c) Stair pressurization alternative.

Based upon field observations, the building and systems most closely resemble Options "a" and "b". Option "c" has not be utilized.

2.4.1. Naturally Ventilated Vestibule

Specific considerations required to comply as a naturally ventilated vestibule are as follows:

"**909.20.1 Access.**
Access to the *stair* shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall not be less than the required width of the *corridor* leading to the vestibule but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.
909.20.2 Construction.
The smokeproof enclosure shall be separated from the remainder of the building by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. Openings are not permitted other than the required *means of egress* doors. The vestibule shall be separated from the *stairway* by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The open exterior balcony shall be constructed in accordance with the *fire-resistance rating* requirements for floor assemblies.
909.20.2.1 Door closers.
Doors in a smokeproof enclosure shall be self- or automatic closing by actuation of a smoke detector in accordance with Section 716.5.9.3 and shall be installed at the floor-side entrance to the smokeproof enclosure. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smokeproof enclosure at all levels. Smoke detectors shall be installed in accordance with Section 907.3.
909.20.3 Natural ventilation alternative.
The provisions of Sections 909.20.3.1 through 909.20.3.3 shall apply to ventilation of smokeproof enclosures by natural means.
909.20.3.1 Balcony doors.
Where access to the *stairway* is by way of an open exterior balcony, the door assembly into the enclosure shall be a *fire door assembly* in accordance with Section 716.5.
909.20.3.2 Vestibule doors.
Where access to the *stairway* is by way of a vestibule, the door assembly into the vestibule shall be a *fire door assembly* complying with Section 715.4. The door assembly from the vestibule to the *stairway* shall have not less than a 20-minute *fire protection rating* complying with Section 716.5.
909.20.3.3 Vestibule ventilation.
Each vestibule shall have a minimum net area of 16 square feet (1.5 m^2) of opening in a wall facing an outer *court*, *yard* or *public way* that is at least 20 feet (6096 mm) in width.
909.20.4.3 Smoke trap.
The vestibule ceiling shall be at least 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward-moving air column. The height shall not be decreased unless *approved* and justified by design and test."

For many reasons, such as the length of the vestibule and size of the natural ventilation opening, the existing vestibules for the East Stair do not entirely comply with requirements above. However, it is clear that, when constructed, the East Stair was intended to be provided with a similar system as is

prescribed by the IBC and was potentially in compliance with a legacy standard used at the time of construction. FPCG has no further recommendations with regard to the East Stair vestibule.

2.4.2. Mechanically Ventilated Vestibule

In addition to the requirements for a naturally ventilated vestibule, the following must be provided to be considered a mechanically ventilated vestibule:

> **"909.20.4 Mechanical ventilation alternative.**
> The provisions of Sections 909.20.4.1 through 909.20.4.4 shall apply to ventilation of smokeproof enclosures by mechanical means.
> **909.20.4.1 Vestibule doors.**
> The door assembly from the building into the vestibule shall be a *fire door assembly* complying with Section 716.5.3. The door assembly from the vestibule to the *stairway* shall not have less than a 20-minute *fire protection rating* and meet the requirements for a smoke door assembly in accordance with Section 716.5.3. The door shall be installed in accordance with NFPA 105.
> **909.20.4.2 Vestibule ventilation.**
> The vestibule shall be supplied with not less than one air change per minute and the exhaust shall not be less than 150 percent of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within 6 inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than 6 inches (152 mm) down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling *dampers* are permitted where necessary to meet the design requirements, but *dampers* are not otherwise required."

Based upon field observation of the existing vestibule exhaust fan, and assuming a balanced distribution of exhaust air over each of the 21 building stories, the West Stair vestibules are provided with approximately 800cfm per floor resulting in approximately three air changes per hour for each vestibule. This assessment indicates that the existing exhaust fan appears to be sizes properly to provide protection as required by the IBC for a mechanically ventilated vestibule. FPCG recommends there be an established testing frequency for this system staring with a re-commissioning of the fan to ensure proper exhaust balance between floors and fan activation is provided upon a fire event.

For many reasons, such as the length of the vestibule and no provision for ducted supply air, the existing vestibules for the West Stair do not entirely comply with requirements above. However, it is clear that, when constructed, the West Stair was intended to be provided with a similar system as is prescribed by the IBC and was potentially in compliance with a legacy standard used at the time of construction. FPCG has no further recommendations with regard to the West Stair vestibule.

3. Fire Pump

The existing fire pump is rated to provide 500gpm at 95psi. Please see Appendix A to this report for the most current annual test of the fire pump available at the time, upon which this evaluation is based.

3.1. Supply for Automatic Sprinkler Systems

FPCG conducted preliminary hydraulic calculations to determine if the existing fire pump is capable of supporting automatic sprinkler protection throughout the building. The results are provided in Appendix A to this report and summarized here:

- The mechanical penthouse ceiling is approximately 269 feet above grade. The fire pump is approximately 16.75 feet below grade for a total elevation difference of 285.75 feet between the water supply source and the would-be connection point for the Level 21 sprinkler system.
- The mechanical penthouse is classified as an Ordinary Group I Hazard per NFPA 13 and must provide 0.15gpm/ft^2 of water spray over the most remote 1,500ft^2. This yields a total expected

water demand of approximately 275gpm when accounting for roughly 20% "overspray" of the sprinkler system.

- The existing 6-inch standpipe is assumed to be used as the supply riser, which is believed to be Schedule 40, black steel pipe based upon field observation.
- The available pressure at the point of connection to the supply riser at 275gpm is approximately 58psi.
- FPCG does not anticipate that this pressure is adequate to supply the Level 21 sprinkler system with 10% safety margin, as is required by the City of San Antonio. Detailed sprinkler system design calculations are necessary to confirm this finding.
- FPCG does anticipate that it would be capable of supplying a sprinkler system on any other level within the building.

3.2. Supply for Standpipe System

FPCG conducted preliminary hydraulic calculations to determine if the existing fire pump is capable of supporting the existing standpipe system. The results are provided in Appendix A to this report and summarized here:

- The topmost outlet of the standpipe system is approximately 247 feet above grade. The fire pump is approximately 16.75 feet below grade for a total elevation difference of 263.75 feet between the water supply source and the highest standpipe outlet on Level 21.
- As determined by the code evaluation of the standpipe system provided herein, the existing standpipe system must be capable of providing 500gpm at the most remote standpipe at a residual pressure of no less than 65psi.
- The available pressure at the topmost outlet of the existing standpipe system is approximately 54psi, which is 9psi less than the minimum required pressure.

Based upon this evaluation, it is evident that the existing fire pump is not adequate to support minimum requirements for this building. FPCG recommends steps be taken to replace the fire pump with a larger pressure rating in order to deliver the minimum required 65psi.

4. Diesel Fuel Storage

The existing emergency generator system fuel storage system consists of three storage tanks. Tank 1 is an existing welding steel storage tank of 800 gallons capacity located on the Sub-level of the building. Tank 1 is full, but no longer in use. Tank 2 is the primary fuel storage tank for the facility, has a capacity of 2,600 gallons, and is located on the Sub-level of the building in close proximity to Tank 1. Tank 2 is located in a CMU enclosure along with a fuel pump system for filling into, and pumping from the tank. Tank 2 is used to hold larger quantities of fuel that is pumped intermittently, when needed to a staging tank, or day-tank, for the emergency generator, Tank 3. Based upon interviews with Frost Bank building maintenance staff, FPCG understands that Tank 3 is located on Level 8 of the building though it was not physically observed by FPCG.

4.1. LSC Requirements

Compliance with the LSC for existing construction is not considered mandatory for this building as it is within in the City of San Antonio jurisdiction. However, a summary of the requirements from the LSC have been provided in this report as it is a common and nationally recognized standard.

Section 8.7 of the LSC outlines requirements for protection of special hazards. Section 8.7.1.1 states that protection from any area having a degree of hazard greater than that normal to the general occupancy of the building or structure shall be provided by one of the following means:

1. Enclosing the area with a fire barrier without windows that has a 1-hour fire resistance rating, or
2. Protecting the area with automatic extinguishing systems.

Based upon field observations and discussions with facilities staff, the fuel storage rooms are each protected by a properly maintained dry-chemical suppression system, thereby meeting the requirements of the LSC.

4.2. IFC Requirements

Compliance with the IFC for the operations and maintenance of fuel burning equipment and fuel systems is required for all buildings within the City of San Antonio limits. Section 603 of the IFC for Fuel-fire Appliances outlines the requirements for these systems. The applicable provisions of Section 603 are provided here:

"**603.3 Fuel oil storage systems.**
Fuel oil storage systems shall be installed in accordance with this code. Fuel-oil piping systems shall be installed in accordance with the *International Mechanical Code*.
603.3.1 Fuel oil storage in outside, above-ground tanks.
Where connected to a fuel-oil piping system, the maximum amount of fuel oil storage allowed outside above ground without additional protection shall be 660 gallons (2498 L). The storage of fuel oil above ground in quantities exceeding 660 gallons (2498 L) shall comply with NFPA 31.
603.3.2 Fuel oil storage inside buildings.
Fuel oil storage inside buildings shall comply with Sections
603.3.2.1 through 603.3.2.5 or Chapter 57.
603.3.2.1 Quantity limits.
One or more fuel oil storage tanks containing Class II or III *combustible liquid* shall be permitted in a building. The aggregate capacity of all such tanks shall not exceed 660 gallons (2498 L).
Exception: The aggregate capacity limit shall be permitted to be increased to 3,000 gallons (11 356 L) of Class II or III liquid for storage in protected above-ground tanks complying with Section 5704.2.9.7, when all of the following conditions are met:
1. The entire 3,000-gallon (11 356 L) quantity shall be stored in protected above-ground tanks;
2. The 3,000-gallon (11 356 L) capacity shall be permitted to be stored in a single tank or multiple smaller tanks; and
3. The tanks shall be located in a room protected by an *automatic sprinkler system* complying with Section 903.3.1.1.
603.3.2.2 Restricted use and connection.
Tanks installed in accordance with Section 603.3.2 shall be used only to supply fuel oil to fuel-burning or generator equipment installed in accordance with Section 603.3.2.4. Connections between tanks and equipment supplied by such tanks shall be made using closed piping systems.
603.3.2.3 Applicability of maximum allowable quantity and control area requirements.
The quantity of *combustible liquid* stored in tanks complying with Section 603.3.2 shall not be counted towards the maximum allowable quantity set forth in Table 5003.1.1(1), and such tanks shall not be required to be located in a *control area*.
603.3.2.4 Installation.
Tanks and piping systems shall be installed and separated from other uses in accordance with Section 915 and Chapter 13, both of the *International Mechanical Code*, as applicable.
Exception: Protected above-ground tanks complying with Section 5704.2.9.6 shall not be required to be separated from surrounding areas.
603.3.2.5 Tanks in basements.
Tanks in *basements* shall be located not more than two stories below grade plane."

Based upon these requirements, the storage of diesel fuel (Class II Combustible Liquid) is limited to 660 gallons maximum when not contained within a listed protected above-ground fuel storage tank. None of the tanks in the subject fuel system comply with the requirements to be classified as a protected above-ground tank. For these reasons, FPCG recommends removing or otherwise limiting the quantity of diesel fuel stored on-site or providing a new protected above-ground tank for such storage.

4.3. IEBC Requirements

The IEBC contains no provisions applicable to the storage and use of fuel oil. Therefore the IEBC is considered not applicable to this section of the report.

4.4. IBC Requirements

Compliance with the provisions of the IBC is not required for this building as the IBC does not contain retroactive requirements and is only applicable to new construction work. Therefore the IBC is considered not applicable to this section of the report.

This concludes the Due Diligence Survey Report. If you have any questions, please contact me by phone at (210) 858-2389 or by e-mail at gilead@firepcg.com.

Sincerely yours,

Gilead R. Ziemba

STATE OF TEXAS
GILEAD R. ZIEMBA
104873
LICENSED
PROFESSIONAL ENGINEER
April 26, 2015

Gilead R. Ziemba, P.E., M.Sc.
Partner & Sr. Fire Protection Engineer

Attachments: *Appendix A – Fire Pump Test Report and Report Calculations*

Appendix A

Fire Pump Test Report and Report Calculations

Date: 8/23/14
Time: 9:30 AM
Job Number: PI4504
Technician: MIKE JARRELL

Western States Fire Protection Co.

Protecting Lives and Property

a subsidiary of ***API Group, Inc.***

Signature of the inspector _____ 08/25/2014 10:12:47 am SigPlus1

Annual

FIRE SPRINKLER INSPECTION

Job Site Information

FROST BANK
100 W HOUSTON
SAN ANTONIO TX 78205
JERRY DANDENEAU 210-422-0841

Billing Information

FROST BANK
PO BOX 1600
SAN ANTONIO TX 78296-1600
JAY JUAREZ 210-220-5122

Western States Fire Protection Co.
13122 Lookout Way, Suite #2
San Antonio,TX 78233
Phone Number (210) 967-4731 Fax Number (210) 967-4766

Western States Fire Protection Co.
Protecting Lives and Property
a subsidiary of ARI Group, Inc.

8/23/2014

PI4504

FROST BANK
100 W HOUSTON

PUMP Manufacturer: AURORA | Serial No.: 72-80750 | Location Of Pump: BASEMENT | Shaft - Horizontal: YES | Vertical:
FM Approved: YES | Model/Type: 3-481-10 | Impellor Size: | Tank Size:
Rated GPM: 500 | 150% GPM: 750 | RPM: 3560 | Suction From: CITY | Discharge Size: 3 | Tank Height:
Rated Pressure (psi): 95 | 150% Rated Pressure (psi): 62 | MAX rated (psi): | Suction Size: 4

Last year pump results Churn Psi: 108 | 100% Psi: 100 | 150% Psi: 91 | Flow Gpm at Churn: 0 | 100%: 513 | 150%: 755

IF VERTICAL TYPE Vertical Distance Discharge Gauge to Water Level (ft.): | Static (ft.): | Pumping (ft.): | FM Approved: | Manufacturer: | Shop/Serial No.: | Model/Type: | Performance - Smooth: | Rough:

DRIVER Manufacturer: PACEMAKER | Serial No.: FRAME 324TS | Rated H.P.: 50 | Phase: 3
FM Approved: YES | Model/Type: 1947N-5 | Rated RPM: 3550 | Cycles: 60
Electric/Diesel: ELECTRIC | Rated Voltage: 230/460 | Operating Voltage: 480 | Service Factor: 1.15
Other: | Rated Full Load Amps: 122/61 | Amps @ 150%: | Hours on engine:

DIESEL ENGINE STARTS Battery #1 | Battery #2 | water level of batteries | Frame No.

CONTROLLER Manufacturer: CLARK SMITH | Serial No.: 263832-1-1 | Starting Pressure (psi): 155 | Stop Pressure (psi):
FM Approved: YES | Model/Type: 10-294100 | Manual: | Manual: YES
Horse Power.: 50 | Auto: YES | Auto:
Jockey Pump Manufacturer AURORA | Start Pressure (psi): 165 | Pressure Drop: YES
Stop Pressure (psi): 195 | Water Flow:

1.75 insert hose monster Coeff = 975 | Play pipe (UI Listed) Coeff = 97 | 2.5" hose monster Coeff = 906

Transfer Switch Manufacturer: | Model: | S/N:

Targeted flow	Number of Hose Streams	Coeff.	Size of Hose Streams	Pitot Readings								Flow	Suction	Discharge	Velocity head corr.	Net PSI	RPM	Corrected to rated speed		Aver of Volts	Aver of Amps
																		Net PSI	Flow		
Churn	0	0	0	0	0	0	0	0	0	0	0	0	79	189	0	110	3585	108	0	476.7	31
100%	2	0.970	1 3/4	8	8							514	75	173	3	101	3566	100	513	475.7	49
150%	3	0.970	1 3/4	8	8	7						754	71	156	5	90	3557	91	755	474.7	54

Actual Voltage across the lines @ Churn	AB	475	AC	479	BC	476	Actual Amps @ Churn	A	31	B	31	C	31
Actual Voltage across the lines @ 100%	AB	475	AC	476	BC	476	Actual Amps @ 100%	A	48	B	50	C	49
Actual Voltage across the lines @ 150%	AB	474	AC	476	BC	474	Actual Amps @ 150%	A	53	B	55	C	54

Recommendations

Notes/Comments:

FPCG
Fire Protection Consulting Group, LLC

HYDRAULIC CALCULATIONS - Sprinkler Source at Lvl 21 Cei

FPCG Proj. No. 14-131
Date 11/17/2014

Flow Test Data

Date	Static	Residual	Pitot 1	Pitot 2	C-Factor	Diameter	Total Flow	Flow at 2
8/23/2014	189	156	5	5	0.9	2.5	750	178

Domestic Flow Data

NA

Initial Pressure Correction

Req. Fire Flow	Pff (psi)	Elev. FT	Elev. SRC	ΔE	ΔPe	Pi (psi)
275	183.86	-16.75	-16.75	0	0	183.86

Fixed Loss Elements

Element	Loss (psi)	Name
NA	0	-

Node Elevations and Pipe Definitions

Node	Elevation (ft)	Pipe ID	Node 1	Node 2	Length	Material	Size	Fittin
SRC	-16.75	P1	SRC	BOR	30	Sch 40	6.065	-
BOR	0	P2	BOR	L20	327	Sch 40	6.065	-
L20	232	P3	HC1	L21	37	Sch 40	6.065	-
L21	269							

Calculations

Pipe ID	Q (gpm)	D (in)	C	L (fittings)	ΔP / ft.	ΔP total	ΔPe	Pf (ps
P1	275	6.065	120	100	0.00323	0.42	-7.253	176.1
P2	275	6.065	120	0	0.00323	1.06	-100.456	74.6
P3	275	6.065	120	0	0.00323	0.12	-16.021	58.5

FPCG

Fire Protection Consulting Group, LLC

HYDRAULIC CALCULATIONS - Standpipe

FPCG Proj. No. 14-131

Date 11/17/2014

Flow Test Data

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8/23/2014	189	156	5	5	0.9	2.5	750	178

Domestic Flow Data

NA

Initial Pressure Correction

Req. Fire Flow	Pff (psi)	Elev. FT	Elev. SRC	ΔE	ΔPe	Pi (psi)
500	173.44	-16.75	-16.75	0	0	173.44

Fixed Loss Elements

Element	Loss (psi)	Name
NA	0	-

Node Elevations and Pipe Definitions

Node	Elevation (ft)	Pipe ID	Node 1	Node 2	Length	Material	Size	Fittin
SRC	-16.75	P1	SRC	BOR	30	Sch 40	6.065	-
BOR	0	P2	BOR	HC1	327	Sch 40	6.065	-
HC1	232	P3	HC1	HC2	15	Sch 40	6.065	-
HC2	247							

Calculations

Pipe ID	Q (gpm)	D (in)	C	L (fittings)	ΔP / ft.	ΔP total	ΔPe	Pf (ps
P1	500	6.065	120	100	0.00976	1.27	-7.253	164.9
P2	500	6.065	120	0	0.00976	3.19	-100.456	61.2
P3	250	6.065	120	0	0.00271	0.04	-6.495	54.7

Date: 8/23/14
Time: 9:30 AM
Job Number: PI4504
Technician: MIKE JARRELL

Western States Fire Protection Co.

Protecting Lives and Property

a subsidiary of **API Group, Inc.**

Signature of the inspector _____ 08/25/2014 10:32:47 am SigPlus1

Annual

FIRE SPRINKLER INSPECTION

Job Site Information

FROST BANK
100 W HOUSTON
SAN ANTONIO TX 78205
JERRY DANDENEAU 210-422-0841

Billing Information

FROST BANK
PO BOX 1600
SAN ANTONIO TX 78296-1600
JAY JUAREZ 210-220-5122

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13122 Lookout Way, Suite #2
San Antonio,TX 78233
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8/23/2014

PI4504

FROST BANK
100 W HOUSTON

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Rated Pressure (psi): 95 | 150% Rated Pressure (psi): 62 | MAX rated (psi): | Suction Size: 4 | Discharge Size: 3 | Tank Height:

Last year pump results Churn Psi: 108 | 100% Psi: 100 | 150% Psi: 91 | Flow Gpm at Churn: 0 | 100%: 513 | 150%: 755

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FM Approved: YES | Model/Type: 1947N-5 | Rated RPM: 3550 | Cycles: 60
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Horse Power.: 50 | Auto: YES | Auto:
Jockey Pump Manufacturer AURORA | Start Pressure (psi): 165 | Pressure Drop: YES
Stop Pressure (psi): 195 | Water Flow:

1 75 insert hose monster Coeff = 975 | Play pipe (UI Listed) Coeff = 97 | 2 5" hose monster Coeff = 906

Transfer Switch Manufacturer: | Model: | S/N:

Targeted flow	Number of Hose Streams	Coeff.	Size of Hose Streams	Pitot Readings								Flow	Suction	Discharge	Velocity head corr.	Net PSI	RPM	Corrected to rated speed Net PSI	Corrected to rated speed Flow	Aver of Volts	Aver of Amps
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Actual Voltage across the lines @ 150%	AB 474	AC 476	BC 474	Actual Amps @ 150%	A 53	B 55	C 54

Recommendations

Notes/Comments:

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Fire Protection Consulting Group, LLC

HYDRAULIC CALCULATIONS - Sprinkler Source at Lvl 21 Cei

FPCG Proj. No. 14-131
Date 11/17/2014

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FPCG

Fire Protection Consulting Group, LLC

HYDRAULIC CALCULATIONS - Standpipe

FPCG Proj. No. 14-131

Date 11/17/2014

Flow Test Data

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Domestic Flow Data

NA

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Req. Fire Flow	Pff (psi)	Elev. FT	Elev. SRC	ΔE	ΔPe	Pi (psi)
500	173.44	-16.75	-16.75	0	0	173.44

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Element	Loss (psi)	Name
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