HVAC SYSTEMS

A. EXISTING CONDITIONS DESCRIPTION:

BOILER ROOM:

The boiler room is provided with two (2) dual fuel Weil McLain cast iron sectional boilers which appears to have been installed in 1992. Natural gas is piped to each burner through an overhead schedule 40 black steel piping system however, not used due to low system capacity issues. Fuel oil is piped to each burner through an overhead uninsulated schedule 40 black steel piping system which originates at a duplex fuel oil transfer system located on the floor adjacent to the boilers. Fuel oil is stored outside of the boiler room in two (2) below ground double wall 10,000 gallon fuel oil storage tanks. Although we were not able to confirm, it appears that supply and return fuel oil is piped from the tank to the boiler room through the double wall piping. It does appear that the entire fuel oil storage and distribution system was installed in approximately 1992. Each boiler is provided with a single low water cut off and all operating and safety controls. The boilers are generating 200º supply water which distributes to the individual buildings by primary base mounted end suction pumps, through a schedule 40 black steel insulated piping which appears to be insulated with fiberglass with an all service jacket. Common piping, which is buried between buildings, feeds secondary distribution piping in each house each of which is provided with a primary and standby in-line circulator with overhead black steel piping covered with fiberglass insulation. Combustion air in the boiler room is through a high and low duct from inlet louvers each provided with motorized dampers all of which is code compliant. Breeching is vented from each boiler through a welded black steel insulated breeching system with a barometric damper which connects to a common overhead breeching which ties into a masonry chimney extending above the roof. Although the chimney does appear structurally sound it was not possible to determine if this chimney is provided with a flue liner. Compressed air is generated at approximately 20 PSI of control pressure which distributes out to various control devices throughout each of the buildings. At one time a refrigerated air dryer was installed in the system however it appears that this unit was removed from service and is presently sitting on the floor out of service. Adjacent to the compressed air storage tank is an automatic temperature control panel which contains switches and gages for the individual systems. The entire automatic temperature control system appears to have been upgraded during the 1992 renovation and does appear to operate in a satisfactory manor however, it has been brought to our attention that many devices within the building are not controlling adequately due to a problem with the control pressure being generated and without the proper reducing valves installed to control a consistent pressure.

BUILDING A:

Building A is generally child care areas, art rooms, auditorium, and boiler room all of which are located at the first floor level and the second floor level is generally classroom space. Located at the first floor ceiling is a new schedule 40 black steel recirculating heating hot water piping distribution system which is feed from two individual in-line circulators feeding the entire

building. The first floor area has a limited amount of unit ventilators in the child care area as well as the art room each of which appear to tie into existing wall intake louvers. By the general positioning of these unit ventilators very poor distribution is maintained in the actual occupied areas of the space. Also located throughout the areas is varying lengths of fin tube radiation located along the exterior walls. The fin tube radiation as well as the unit ventilators are all controlled by a single wall mounted pneumatic thermostat in each occupied area. The child care area is provided with two wall mounted axial exhaust fans which are designed to remove the minimum amount of ventilation air required by code. The installation is extremely crude, soiled, and noisy when they do operate. The art room is provided with a wall mounted cabinet exhaust fan adjacent to the unit ventilator to remove its space code required ventilation air. As we understand it this fan does operate and is in average condition. Located throughout the center of the space communicating with general storage rooms, toilet spaces etc. is a central exhaust system of the galvanized sheet metal design. Many branches located on this system have been capped and the system is presently operating at a much reduced volume. It appears that a very old exhaust fan is tied into this system and has been rebalanced to the new volume however, it would appear to operate extremely unstable due to the dramatically reduced load.
The second floor areas are all provided with individual classroom unit ventilators in each classroom each provided with a heating hot water coil, supply fan, filters, and appear to be tied into louvers installed during a previous renovation. Exhaust air is provided from each classroom which communicates to a roof mounted exhaust fan through a central galvanized sheet metal exhaust system. Exhaust quantities appear to be adequate to meet current building code requirements and all systems do appear to operate in a satisfactory manor.

The auditorium is provided with a single air handling unit located in a mechanical space under the stage. This air handling unit is original condition to the building however in 1992 was rebuilt to provide a new heating hot water coil. The unit is also provided with a supply fan and a source of outside air for ventilation. The air handling unit feeds galvanized sheet metal distribution ductwork which is original condition to the building and feeds to various overhead diffusers. It does appear that the volume of air provided to this auditorium based on population does appear to be deficient based on current building code requirements. Return air for this air handling unit is through a series of return air registers located under the stage which communicate directly back to the mechanical space under the stage. It does not appear that there are any secondary exhaust systems designed into the air handling unit to account for the minimum code required amount of ventilation air which should be provided.

BUILDING E:

Building E is a single story structure which houses the main campus cafeteria, teachers dining, and kitchen. The main cafeteria is provided with six (6) individual wall mounted classroom unit ventilators which are located along the perimeter wall of the space. Each unit ventilator is provided with a heating hot water coil, supply fan, filters, and a direct source of outside ventilation air. It appears that the unit ventilators were connected into existing building louvers which at one time occupied steam fired unit ventilators. Located between the unit ventilators are varying lengths of fin tube radiation which is pedestal mounted. All heating apparatus which

include unit ventilators and fin tube radiation communicate to an above ceiling heating hot water supply and return distribution piping system. The piping system is insulated with what appears to be fiberglass insulation with an all service jacket and all systems appear to have been installed in approximately 1992. Various pneumatic thermostats located throughout the space control the fin tube radiation and classroom unit ventilators and these pneumatic thermostats receive control air from the compressed air system located within the boiler room in building A. Located throughout the cafeteria area are various exhaust systems which appear to be original condition to the building and appear to have been rebalanced during the 1992 renovation. Today, many of these exhaust fans are extremely antiquated and are questionable as to there performance and in fact whether or not they are even operating at this time. Located between the cafeteria and the kitchen are various transfer grilles which allow for make-up air from the cafeteria to the kitchen exhaust hood.

The kitchen area is provided with a double wall canopy type with exhaust hood located above the entire cooking area. The size and mounting height of this hood appears code compliant and was noted to be provided with vapor tight incandescent lighting. A roof mounted air handling unit provides heated ventilation air directly as a source of make up to this double wall hood and the exhaust air is removed by two individual roof mounted up blast exhaust fans. Also located within the kitchen is a general space roof mounted heating and ventilation unit. This unit is provided with galvanized sheet metal supply ductwork located above the kitchen ceiling and provides heated and ventilation air through a series of ceiling mounted supply diffusers. Also located in the ceiling is a return air register which communicates directly back to the rooftop unit. Considering that both the supply and return are located at the ceiling along with all of the exhaust systems a large percentage of the supply air is ineffective due to the close proximity of the supply and return registers. Located throughout the kitchen area are various exhaust systems generally feeding toilets, and storage spaces. These exhaust systems are made up of galvanized sheet metal exhaust ductwork all located above the ceiling of the individual spaces and communicates to various roof mounted exhaust fans. Much of this exhaust air from the individual spaces is not provided with any means of either mechanical make-up air or door louvers for make-up air.

The teachers dining area located adjacent to the cafeteria and kitchen is provided with individual wall mounted vertical discharge classroom unit ventilators. Each unit ventilators is provided with a hot water heating coil, supply fans, filters, and a direct source of outside ventilation air. Located between the unit ventilators are varying lengths of wall mounted fin tube radiation all of which communicate to the heating hot water piping system located above the ceiling. The fin tube radiation and the unit ventilators are all controlled by a single wall mounted pneumatic thermostat and all systems were noted to be operating in a satisfactory manor. All systems were noted to be dirty and somewhat antiquated in their design. Located high on the wall were “through the wall” air conditioning units. These units are provided with self contained thermostatic control and freeblow into the space at approximately 7 ft above the floor. These air conditioning units were noted to be slightly dirty and also noisy however they were maintaining reasonable space temperature control.

BUILDINGS B, C, D, AND G:

Buildings B, C, D, and G are all considered academic classroom areas. Typically, each classroom space is provided with a wall mounted classroom unit ventilator which is provided with a heating hot water coil, supply fans, filters, and a direct source of outside ventilation air. In many of the classrooms is was noted that the general proximity of the unit ventilator to the occupied space does not provide adequate air circulation throughout the space due to short cycling between the supply an exhaust system. The unit ventilators are served by the recirculating heating hot water piping system which is located above the ceiling. Heating hot water piping is feed from an interior petition to the unit ventilator which is covered with fin tube cover however, no radiation is provided. Located in each classroom space is a ceiling mounted exhaust register which communicates to a central galvanized sheet metal exhaust system to a roof mounted exhaust fan. It does appear that the volume of the exhaust air being provided by the various exhaust registers appears undersized for current building code requirements. It was also noted that many of the exhaust registers were slightly dirty. The unit ventilators also located within each space were also noted to be slightly dirty and slightly damaged however, as we understand it all systems do operate and maintain reasonable space temperature control. The unit ventilators in each classroom are provided with a wall mounted pneumatic thermostat which connects into the central pneumatic distribution system which originates in the Building A boiler room. The pneumatic temperature control system does appear to be antiquated at this time.

The corridors throughout each of the buildings are provided with a limited amount of exhaust ventilation which is also connected to the central exhaust ventilation system within the buildings. There was no mechanical supply ventilation provided to any corridors and it does appear that the amount of exhaust provided is undersized based on current building code requirements. Many of the corridors were not provided with any source of heating even though the corridors do maintain a heat loss due to the roof exposure in winter months.

The toilet spaces and storage rooms throughout each building are all provided with ceiling mounted exhaust registers which communicate to individual roof mounted exhaust fans through a galvanized sheet metal exhaust system. Many of these spaces were not provided with any means of make-up air either mechanical ventilation or undercut or louver doors. Each of the buildings are provided with a secondary distribution pumping system which connects into the primary systems which terminates in each building. The secondary pumping system is made up of two individual inline circulators one primary and one standby which provides a recirculating heating and hot water flow throughout each individual building. It was noted that all piping, pumping, and valving within each individual secondary system was in very good condition and appears to operate satisfactorily. Because each of the individual secondary pumping systems are stand alone it would appear that expansion tanks would be required to accept expanded water during heating applications however, there were no expansion tanks noted in any of the secondary piping systems. This condition should be further investigated.

In building D, in addition to the academic classroom areas, this building is provided with lecture hall located between building C and D. this lecture hall is provided with an air handling unit in an adjacent storage room which appears to have been installed during the original building construction. It appears that this air handling unit was retrofitted with a new heating hot water coil and new supply ductwork to provide heating and ventilation air to the entire space. No air conditioning is provided for this lecture hall. Heated and ventilation air is provided to the entire space through individual side wall grilles along one wall discharging ventilation air approximately 10 ft above the floor. Also located on the same wall is a return air opening which draws return air from the lecture hall back to the air handling unit. The close proximity of the supply and the returns are creating a "short circuiting" effect rendering a large portion of the supply heating and ventilated air to the space as ineffective. On an adjacent wall is an exhaust register also located high within the space which is further contributing to the very poor air circulation patterns throughout the entire space. Located along two of the exterior walls were varying lengths of fin tube radiation which are provided to offset conductive losses of the exterior wall. It was noted that this fin tube radiation was slightly dirty and slightly damaged however it does seem to operate and maintain reasonable space temperature control. The air handling unit and the fin tube radiation are all controlled by a single wall mounted thermostat which ties into the central pneumatic system all of which was noted to be antiquated.

BUILDING H:

Building H is a two story structure which houses on the first floor the administration, guidance, and health areas and the second floor is the media center. The administrative areas of the first floor are served by three individual single zone roof mounted heating ventilating and air condition units. Each of the rooftop units was installed during the 1992 renovation and are each provided with direct expansion cooling. Located above the ceiling throughout the entire first floor is a galvanized sheet metal duct distribution system which connects to various slot supply diffusers located around the occupied spaces. Also located within the ceiling adjacent to the supplies are various return air register slots which communicate return air from the space directly to a return air ceiling plenum. It was noted that many of the supply diffusers were dirty as was evidence by staining around the ceiling. Each of the rooftop units are controlled by a wall mounted electric thermostat which does not communicate with the central pneumatic automatic temperature control system. Many of the exterior perimeter spaces are provided with hot water fin tube radiation much of which is residential quality and noted to be dirty and severely damaged. The entire first floor is considered two zones and all spaces are controlled by two individual thermostats. As we understand it wide spread temperature control problems do appear to exist. The toilet and storage spaces throughout the first floor are all provided with exhaust registers which communicate to a central galvanized sheet metal exhaust system to roof mounted exhaust fans. All exhaust systems were noted to be slightly dirty and it is questionable as to whether they operate and if they do are providing the code required amounts of exhaust ventilation. Make-up air for these toilet spaces is generally through louvers within the doors.

The entire second floor area is the media center and general support spaces. The entire media

center is served by three individual roof mounted single zone heating and ventilating and air conditioning units each of which are provided with direct expansion cooling. The entire distribution system is through a series of slot diffusers which are intergraded into a ceiling system which also contain return registers as slots which communicate directly to an above ceiling return air plenum. All of the duct work located above the ceiling appears to be original condition to the building and only the roof mounted equipment was installed in the 1992 renovation. The rooftop equipment is controlled by individual wall mounted electric thermostats which do not communicate with the central pneumatic automatic temperature control system. It was noted that the supply diffusers were dirty as noted by staining on the ceiling and it does not appear that the systems are maintaining the code required amounts of ventilation air based on the current building code requirements. There were no central exhaust systems to maintain the minimum code required amounts of ventilation air and it appears that all ventilation is removed from the space through pressurization. Considering the limited three zones of temperature control for the entire space very poor automatic temperature control is maintained. Also located throughout the perimeter of the entire media center are varying lengths of fin tube radiation all of which was noted to be soiled. It does appear that this fin tube radiation is controlled through the pneumatic automatic temperature control system.

The heating hot water distribution in the administration building originates in a stand alone boiler room which serves only the administration building. The heating plant consists of a single cast iron sectional boiler located at the first floor level. This boiler appears to be approximately 25 years old and distributes to the various fin tube radiation and convectors located throughout the entire building through a combination of copper and schedule 40 black steel all of which appears insulated which fiberglass insulation with an all service jacket. Combustion air for this boiler room is through two individual opening one located high within the space and one low, neither of which is provided with motor operated dampers. Control of this boiler room appears to be through the central pneumatic automatic temperature control system and it was noted to that all components appear to be in average and below average condition and generally in need of replacement.

BUILDING F:

The boiler room is provided with two (2) dual fuel Weil McLain cast iron sectional boilers which appears to be in excess of 25 years old. Natural gas is piped to each burner through an overhead schedule 40 black steel piping system. Fuel oil is piped to each burner through an overhead uninsulated schedule 40 black steel piping system which originates at a duplex fuel oil transfer system located in the front of the boilers approximately two feet above the floor. Fuel oil is stored outside of the boiler room in a below ground 10,000 gallon fuel oil storage tank which appears to be double wall. Although we were not able to confirm, it appears that supply and return fuel oil piped from the tank to the boiler room is single wall piping. It does appear that the entire fuel oil storage and distribution system was installed when the building was built. Each boiler is provided with a single low water cut off and all operating and safety controls. The boilers are generating 200º supply water which distributes thru a compensated water mixing valve to individual heating apparatus located throughout the building through a schedule 40

black steel insulated piping which appears to be insulated with fiberglass with an all service jacket and covered with an additional aluminum covering. Combustion air for the boiler room is through a two louvers mounted in the exterior wall each provided with motorized dampers. Breeching is vented from each boiler through a welded black steel insulated breeching system, neither boiler is provided with a barometric damper. The combined breeching from each boiler connects to a common overhead steel chimney extending above the roof and terminates with a rain cap.

Compressed air is generated at approximately 20 PSI of control pressure which distributes out to various control devices throughout each of the buildings. Adjacent to the compressed air storage tank is an automatic temperature control panel which contains switches and gages for the individual systems. The entire automatic temperature control system appears to have been upgraded, and does appear to operate in a satisfactory manor.

The field house area is provided with four individual heating and ventilating air handling units which are located at the ceiling and freeblow into the space. It appears that each of these air handling units were installed in a recent renovation and all equipment was noted to be in very good condition. Each air handling unit is provided with a hot water heating coil, supply fan, filters, a direct source of outside air through a roof hood , and return air, drawn directly at the air handling unit. With the close relationship of both the supply and return opening very poor air distribution patterns are being maintained throughout rendering a large percentage of the total supply air ineffective to the space. It was noted that there was not pressure relief hoods located at any point throughout the space to allow for a relief of the minimum ventilation requirement introduced at each air handling unit. It was also noted that there were no supplementary exhaust systems to assure minimum ventilation code requirements.

The circulation corridor around the perimeter of the field house is provided with a limited amount of recessed wall convectors which are controlled through various wall mounted pneumatic thermostats. The overall condition of the convectors was noted to be average as they were slightly dirty. This communicating corridor around the field house is not provided with any means of either exhaust or supply ventilation air.

The locker areas are served by individual heating a ventilating units located above the locker rooms adjacent to the field house. The heating and ventilating units distribute to a series of what appears to be galvanized sheet metal ductwork to various ceiling and side wall supply registers throughout the locker area. It does not appear that there are any exhaust systems located throughout the locker areas and all air supplied to the space appears to return to the air handling unit through a central return air system. It was noted that all registers, diffusers, and grilles were dirty many of which were damaged as well. Individual wall mounted pneumatic thermostats control all heating and ventilation functions in the air handling equipment and generally speaking the systems were noted to be in very poor condition.

B. ITEMS OF CONCERN:

BOILER ROOM:

- Surface contamination on the face of each boiler could be due to leaking cast iron sections however, further investigation is required.
- Surface contamination on the air separator.
- Complaints that the safety valves have been releasing which could indicate incorrect operating pressures in the system or improperly sized safety valves. This condition should be investigated further.
- Refrigerated air dryer in automatic temperature control system is not in service.
- Pneumatic automatic temperature control system is antiquated.

BUILDING A:

- Many of the unit ventilators throughout the first and second floor are soiled and some are slightly damaged.
- The existing central exhaust system of the second floor is oversized along with the exhaust fan for the quantity of air being moved.
- Many sections of the fin tube radiation along the first floor are damaged.
- Many of the secondary exhaust systems throughout the first and second floor are soiled.
- No secondary exhaust system in the auditorium to assure minimum ventilation requirements.
- No economizer control relief in auditorium to allow for 100% ventilation.
- No air conditioning provided in the auditorium.
- Wall mounted exhaust fans in the child care area are dirty and noisy.
- The heating hot water distribution piping throughout the first floor ceiling is very low and does not appear sloped correctly.

BUILDING E:

- The classroom unit ventilators throughout the cafeteria were soiled and damaged.
- The fin tube radiation throughout the cafeteria between the unit ventilators was extremely damaged and very dirty.
- The transfer grilles between the cafeteria and the kitchen appeared undersized and were also dirty.
- The total amount of ventilation provided to the cafeteria appears undersized based on the population and the present code requirements.
- The pneumatic thermostats are antiquated.
- The kitchen hood appeared soiled and as we understand it may not be providing the code required amount of exhaust air.
- The make-up air systems in the kitchen were slightly dirty.
- The toilet and storage spaces which presently are provided with exhaust systems are not provided with any means of make-up air.
- The unit ventilators and fin tube radiation in the teachers dining room were noted to be slightly dirty and slightly damaged.
- The air conditioning units in the teachers dining room were slightly dirty and noisy when they operate.

BUILDINGS B, C, D, AND G:

- The fin cover between the classroom petitions and the unit ventilators in each classroom are noted to be slightly dirty and slightly damaged in many instances.
- The unit ventilators are noted to be slightly dirty and in some instances damaged,
- The pneumatic thermostats controlling the heating apparatus was noted to be antiquated.
- Exhaust registers located throughout the corridors and toilet and storage spaces were noted to e slightly dirty.
- There was no mechanical make-up air provided for the corridors, toilet spaces, or storage rooms.

- There were no secondary expansion tanks installed in the secondary piping loops of each building.
- The exhaust quantities indicated for each classroom appear undersized based on current building code requirements.
- It does not appear that the exhaust systems are balanced correctly or operating according to the current building code requirements.
- All supply and exhaust registers within space were noted to be slightly dirty.
- Pneumatic control system is antiquated.
- Fin tube radiation is slightly dirty and slightly damaged.
- Very poor air circulation throughout the space due to close proximity of supply and exhaust registers.

BUILDING H:

- Much of the fin tube radiation located throughout the first and second floor is soiled and severely damaged.
- Extremely limited automatic temperature control during air conditioning applications.
- Pneumatic control system controlling fin tube radiation is antiquated.
- The supply diffusers on both the first and second floor are soiled.
- With the supply and return system both located at the ceiling very poor air distribution patterns are maintained rendering a large percentage of the ventilation air ineffective.
- No central exhaust systems to maintain minimum ventilation control.
- Use of return air ceiling plenums does promote a compromised to good air quality.
- It does not appear that the code required amounts of ventilation air and total air throughout the media center is being provided.
- Exhaust systems for central toilet areas appears deficient in total exhaust air and make-up air.

- Slight surface contamination on the in-line circulators.
- Surface contamination on the cast iron sectional boiler.
- Cast iron sectional boiler appears to be in access of 25 years old and in need of replacement.
- No motor operated dampers in either combustion air duct.
- Sections of insulation on the piping systems are damaged and some sections removed.
- Centrifugal exhaust fan in room is slightly damaged and in very poor condition.

BUILDING F:

- Outside air ductwork feeding each air handling unit was not insulated.
- The very poor discharge of each air handling unit in the field house generates very drafty conditions throughout.
- The close proximity of the supply and return of each air handling unit promotes very poor air distribution patterns rendering a large percentage of the total ventilation air to the space ineffective.
- Air handling equipment located in the field house is very low to the floor and is susceptible to damage.
- Diffusers, registers, and grilles located throughout locker areas are dirty and in many instances severely damaged.
- Extremely limited exhaust systems located throughout locker spaces.
- No economizer relief in field house to allow 100% ventilation air to be provided for each air handling system.
- No central exhaust systems in field house to maintain minimum code required ventilation air quantities.
- Pneumatic temperature control systems serving all equipments is antiquated.
- No ventilation provided for main communicating corridor around field house