Loudoun County Public Schools
Continuity of Operations Plan (COOP)
Facilities Assessment Study
Related to Critical Systems

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By:

Office of Support Services
Division of Construction Services
Division of Facilities Services
Architecture, Inc.
Ascent Engineering
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Summary

The objective of this study was to evaluate Loudoun County Public Schools (LCPS) school facilities focusing on the condition and functionality of the existing building systems as it relates to continuity of operations. A discontinuation of operations can be caused by the failure or breakdown in critical operational building systems or components that would prevent, interrupt, or disrupt academic instruction for an extended period.

Based on historical Capital Asset Preservation Plan (CAPP) and Division of Construction Services renovations, the assessment of the risk of an interruption to academic instruction operations due to deferred maintenance of critical system caused failures provides a perspective to the probability of a long-term impact on the academic instruction process. The priority order identified in this report is the Staff recommendation of the school renovation priority order to minimize the risk of interrupting instructional operations for an extended period. The renovation priority was defined by the Continuity of Operations Plan assessment of High, Medium and Low risk of catastrophic system failure within five (5) years. Within those three categories, the facilities are prioritized based on the Facility Condition Assessments completed in 2015 and 2016.

It is highly likely that continued deferred maintenance of a building systems’ equipment will eventually result in additional, otherwise avoidable, downtime for the facility. While the continuous operation of education facilities may not be required by any current codes, the facilities in the school system are necessary for the successful operation and function of the instructional goals of LCPS.

Regular replacement and other recommended upkeep of equipment will minimize the risk of extended downtime, and are well managed through the CAPP process. While the CAPP maintains and replaces many components of a system; as the system renovations increase in scope and complexity, they must be address in the CIP.

Addressing maintenance upkeep and replacement of critical systems within a facility allows that costs can be controlled, minimized and planned for. When maintenance is deferred in a habitual fashion, equipment failures can be more costly and inconvenient for the system. When maintenance is deferred across several facilities over an extended period, the results can be compounded, eventually being very disruptive to normal operations. Preventative maintenance and scheduled system upgrades takes funding, effort, time, and attention, but the positive results far outweigh the numerous negative consequences of deferred maintenance.

Appendix 1: LCPS Recommended Renovation Priority Order List
Appendix 2: Additional information on first 10 schools
History

Loudoun County Public Schools (LCPS) has commissioned three school evaluations studies in the past. The first study was completed in 2003, and the second in 2015 and 2016.

In 2003, Loudoun County Public Schools commissioned a Facility Assessment Study of all school facilities. The schools at that time were assessed and graded using six (6) major categories: Site, Structure, Mechanical Plant, Safety, Educational Adequacy, and Educational Environment. All of the schools built before 1980 received the lowest rankings.

During the summer of 2015, LCPS conducted a Facility Assessment Study evaluating twenty-two (22) of the school facilities built before 1980. During the summer of 2016, LCPS conducted a second Facility Assessment Study evaluating twenty-nine (29) other school facilities.

These two studies are known as the ‘Facility Condition Assessments, Phase 1 and 2’ and were published in 2016. The studies evaluated the 51 schools that received the lowest ranking in the 2003 study. Outside the 51 schools, the renovation priority order of the more recent schools is based solely on age. Both of these prior studies ranked the schools on the condition and age of the facility.

In 2017, it became apparent to the Department of Support Services that the prior evaluation methodologies did not effectively capture risks of extended interruption of instructional operations at the LCPS schools. Therefore, LCPS commissioned a supplemental facility evaluation study in 2017. With the assistance of consultants, Architecture, Inc. and Ascent Engineering, the Office of Support Services and the Divisions of Facilities and Construction collaborated to evaluate the facilities for the specific purpose of assessing potential for facility-related interruptions to instructional operations. The systems and risks evaluated are only those within LCPS control. For example, the potential for failure of the off-site Dominion Virginia Power electrical distribution system was not considered as part of this effort. However, the on-site electrical switchgear, maintained by LCPS, was considered, as these components would be part of a school renovation project.

It is important to note the distinction between this Continuity of Operations Assessment and the Facility Condition Assessment studies. The Facility Condition Assessment Studies evaluated the school facility systems and components to identify areas in need of improvement. They focused on site and exterior envelope, interior environment, safety, ADA compliance, space plan and program adequacy, and mechanical and electrical systems. This COOP study, on the other hand, scrutinized only major and critical facility systems. Potential system failures make a facility vulnerable to restricted use of occupied space. Repair and replacement of these systems would be part of a planned Capital Improvement Plan (CIP) facility renovation project.
Defining Emergency Conditions

The following are the different levels of emergency related to building infrastructure that would elevate the risk of interrupting instructional operations at a school:

**LEVEL 1** - A Level 1 emergency includes a major emergency that affects all or a sizable portion of the school campus for an extended or indeterminate amount of time. Level 1 emergencies may be single or multi-hazard situations and often require considerable coordination both within and outside LCPS. Level 1 emergencies also include imminent events on campus or in the general community that may develop into a major crisis or a full disaster. Examples include: heating plant failures, air handling failures, extended power outages, weather emergencies, major fires, or domestic water contamination. In these situations, LCPS Emergency Response Team plans must be implemented and the LCPS Emergency Management Team must be notified and involved.

- Examples of Level 1 emergencies include the failure of Hydronic Piping Systems, Air Handling/HVAC equipment, Electrical Wiring, Switchgear, or Packaged Cooling Equipment.
- Potential interruptions are typically measured in **weeks to months** where major portions or all of a school could be unusable for instructional purposes.

**LEVEL 2** - Emergencies at these levels usually are spontaneous and unfold rapidly, not lending to a formal declaration of emergency. For the most part, these emergencies are facilities related matters that can readily be resolved between the LCPS Facilities Division and other LCPS Division, such as Telecommunications, Public Safety and Health and Safety. Events at these levels may required assistance from outside LCPS.

- Examples of Building System Level 2 failures include the failure of Electrical Panels, Building Automation Systems, Plumbing piping systems, or Gas and Electric services.
- Potential interruptions are measured in **days to weeks** where major portions or all of a school could be unusable for instructional purposes.

**LEVEL 3** - A Level 3 emergency includes a department or building incident that can be resolved with existing LCPS resources or limited outside help. A Level 3 incident is usually a one-dimensional event that has a limited duration and little impact on the campus community beyond those using the space/building in which it occurred. Typically, these emergencies can be resolved in 1 to 3 days. Many of these components may be supplemented or replaced temporarily with rented equipment until the permanent equipment is installed. Notification may be made to LCPS administration.

- Examples of building system Level 3 failures include the failure of individual components for Fire Alarms, Boilers, Pumps, Domestic Boilers, Water Heaters, Generators, VAV Boxes, or Chillers.
- Potential interruptions are measured in **days** where affected portions of a school could be unusable for instructional purposes.

**LEVEL 4** - A level 4 emergency includes a minor department or building incident that can be resolved by the responding service unit. This may result in calling in personnel and notifying the department where
the problem occurred. An example is the Facilities Division response to broken water pipe. There is no need to notify or involve anyone outside of the affected area.

- Examples of building system Level 4 failures include the failure of electrical outlets, filters, minor piping repairs, etc.
- Potential interruptions are measured in hours up to a day where affected portions of a school could be unusable for instructional purposes.

**Components of the Renovation Priority Order**

**Heat and Air-Conditioning**

Hydronic piping is a term used to describe a heating or cooling system that transfers heat by circulating a fluid (usually water, or a water/glycol mix) through a closed loop system of piping. Thus, a hydronic heating system transfers heat using liquid rather than air through a piping system rather than a ductwork system. The majority of LCPS schools are hydronic piping systems filled with a water/glycol mix. These systems are subject to corrosion and deterioration over time.

These hydronic piping systems have a 30-35 year life expectancy according to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Several LCPS schools at the top of the attached LCPS COOP priority list are approaching 40 years without replacement. Given this and the failure vulnerability of the hydronic piping systems, especially in the older systems, a small leak repair can easily become a substantial piping replacement project, costing significantly more, taking more time to complete than planned, and causing increased interruption to instructional operations due to the inability to plan for the event.

Another concern regarding the older of these types of systems is the level of corrosion in the system and the uncertainty of the long-term condition, composition, pH testing and concentration testing of the fluid. Water/glycol hydronic piping systems use ethylene glycol or propylene glycol in the mixture. Both systems exist at LCPS schools, and the older ethylene glycol systems would pose a larger impact to operations if a significant failure occurs since it is currently listed as a reportable glycol ether under SARA, Title III, Section 313, due to its acute oral toxicity. Newer building designs and all replacements use either propylene glycol or water only as a heat transfer fluid. Propylene glycol is “generally recognized as safe” (GRAS) by the FDA, although not intended for human consumption.

Due to the nature of these hydronic piping system designs, the fluids alone cannot be replaced. To replace a hydronic piping system, it is necessary to remove all of the ceiling tiles and grid, all of the lights, substantial amounts of ductwork and electrical work depending on the facility, and numerous other items. The value in replacing the hydronic piping as part of a planned CIP renovation project is that the scheduled replacements of the ceiling, lights, ductwork, electrical, plumbing, and mechanical systems above the ceiling may be planned, designed and contracted efficiently, along with the replacement of the hydronic piping.

Some LCPS facilities (such as Park View High School) have custom-made rooftop units, which to replace, would require very long lead-times to obtain for replacement. Such units cannot simply be rented, and they would require cranes to lift and install. Therefore, staff carefully monitors the age
and condition of these components. Other items that are not feasible to rent include air-handling units. In addition to these concerns, the availability of parts for the older equipment and rooftop units puts them at further risk.

In general, buildings are heated using hot water boilers, electric heating coils, gas-fired heat exchangers (furnaces), or a combination of these. The boilers are either natural gas or fuel oil fired, with natural gas being the most prevalent. Boiler systems in a central mechanical room generate hydronic heating water. Pumps distribute the water throughout the building through associated hydronic piping. Electric coils and gas-fired heat exchangers are typically located within individual air handling equipment.

Any failure of the boiler system will result in the loss of heating for the majority of the building. A failure of any of the electric heating coils or gas-fired heat exchangers could result in an inability to heat individual classrooms, classroom wings or areas such as multipurpose rooms, cafeterias, etc.

**Indoor Air Quality**

The design and construction of heating, ventilation, and air-conditioning (HVAC) systems and equipment provide appropriate levels of indoor air quality as required by Virginia Uniform Statewide Building Code (USBC). The HVAC systems also provide the necessary volumes of air replacement (air exchanges) in all areas at schedules rates based on occupancy and activity. Section 402 of the 2012 International Mechanical Code references:

> “402.2 Outdoor air required. The minimum outdoor airflow rate shall be determined in accordance with Section 402.2. Ventilation supply systems shall be designed to deliver the required rate of outdoor airflow to the breathing zone within each occupiable space.”

A failure of air-handling components could result in the loss of required outside air provisions to the entire building or to localized areas of the building. During times of power company outages, an emergency life safety generator may provide power requirements limited to life safety systems and select equipment. Life safety generators do not have the capacity to support air-handling equipment in the event of a failure of systems internal to the building.

While interruption of air conditioning may not be a code compliance issue, and understanding spaces without air conditioning are not always comfortable, the disruption of the required air exchange provisions and indoor air quality will make the space unable to be occupied and will cause an interruption to instructional operations.

In addition, the lack of indoor air quality has been a documented comfort issue, and historically speaking, school staff and students do not function well without proper air conditioning and ventilation, and as related to occupancy, air conditioning can be more important than heating from the standpoint of space comfort.

Cooling systems for LCPS schools generally include: (a) air handling equipment with chilled water piping systems, (b) packaged direct expansion (DX) refrigerant air handling systems, or (c) a combination of both (a) and (b). A chilled water air conditioning system includes a central water- or air-cooled chiller to generate chilled water, pumps to circulate chilled water throughout the building using a hydronic piping loop, and chilled water coils located within air handling equipment to cool and condition the air supplied by the equipment to temperatures suitable for comfort cooling. Direct
expansion systems utilize localized compressor/condenser systems and refrigerant to provide comfort cooling at individual air handling equipment.

Any failure of the chilled water system (e.g., chiller, pumps, and piping) will result in an inability to cool spaces, and in turn, provide required air exchanges (see Section 402 of the 2012 International Mechanical Code above) for the majority of the building. A failure of any of the DX cooling and air-handling systems will result in an inability to cool and provide required air exchanges for the individual classrooms, classroom wings or areas such as multipurpose rooms, cafeterias, etc. served by the respective equipment.

**Energy Management System**

The energy management system (EMS) monitors and controls the building space temperatures by modulating the amount and temperature of supply air necessary to satisfy space comfort conditions. Along with the chilled water and boiler systems, the EMS control also involves the use of hydronic control valves to modulate the flow of chilled or hot water to each cooling or heating coil. Failure of the EMS could result in the inability to control HVAC systems properly and present potential losses of heating or cooling. Failure of hydronic control valves could result in the loss of water flow, and heating or cooling to major portions of the building. Based on ASHRAE data for life expectancy, these components deteriorate with age, and as such, would be part of a replacement strategy in a planned CIP renovation project.
Summary

The result of this report is a current hierarchical priority order list of all 92 LCPS schools identified to have the most critical needs as related to continuity of instructional operations and the Facilities Condition Assessments. Each school was assessed individually based upon the knowledge of the specific systems located within. The assessment priority order was based on a number of factors; including age, condition, expected overall remaining useful service life, and critical impact of failure of the critical operational system components. However, the study also tried to incorporate some of the intangible elements that might extend beyond system observations. For example, there are issues with condensate drain pans within the air-handling units at Algonkian Elementary School. This bears a potential for standing water retainage within the supply airstream, posing a potential indoor air quality issue.

The attached Renovation Priority List (RPL) shows the ranking of existing LCPS school facilities based on the level of risk; denoting each facility with a High, Medium or Low risk level based on the current state in 2017.

- A High Risk means that based on the current condition and type of infrastructure, a Level 1 or 2 Facility Emergency, is likely within the next 5 years.
- A Medium Risk means that based on the current condition and type of infrastructure, a Level 1 or 2 Facility Emergency, could happen within the next 5 years.
- A Low Risk means that based on the current condition and type of infrastructure, a Level 1 or 2 Facility Emergency, is unlikely to happen within the next 5 years.
- These rankings are based on the professional opinion of the LCPS Facilities Services Supervisory Staff.

It is the Level 1 and Level 2 emergencies previously defined that guide the priority order listed in this document. The majority of the older schools have already had the hydronic piping system, electrical systems, or HVAC systems replaced and are at significantly lower risk of a catastrophic system failure that would affect instructional operations.

Older critical systems tend to be much less energy efficient, and replacing the oldest systems, not necessarily located within the oldest constructed schools, will provide the mitigation of the risk of interrupting the instructional operations of a school for an extended period of time. In addition, there are a number of schools with critical systems where replacement parts are no longer available. Many older facilities have much more simply operated systems, that have been [easier] to maintain and replace.

Unlike previous facility assessments, this study did not account for the absence of systems that are incorporated in newly constructed LCPS buildings in compliance of current codes or standards (such as, a sprinkler system or a preferred efficient HVAC system). While current codes and standards require the noted systems, which are incorporated in new schools and current renovations, the codes and standards in force at the time of an older building construction directs the respective code requirements. Therefore, those factors did not constitute a rationale for prioritized risk ranking. A
school structure designed and constructed under a previous building code and still operational in the original configuration is not out of compliance with the current building code.

Even though there would likely be benefits to upgrading non-critical building systems or components, these systems did not receive the highest weight factor since they have little to no impact on continued instructional operations of the education process.

Preventative maintenance and scheduled system upgrades via full renovations takes planning, funding, effort, time, and attention, but the positive results far outweigh the numerous negative consequences of deferred maintenance and replacement.
# APPENDIX 1

## LCPS RECOMMENDED SCHOOL RENOVATION PRIORITY ORDER

<table>
<thead>
<tr>
<th>CURRENT Priority Order Number</th>
<th>C.O.O.P. 5 Year Risk Level</th>
<th>2015-2016 Facility Condition Assessment Priority</th>
<th>School Name</th>
<th>Type</th>
<th>Year Opened</th>
<th>Year Last Major Renovation Complete</th>
<th>Year Next Projected Renovation Complete</th>
<th>Number of Years Between Renovations</th>
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1. **Algonkian E.S. – HIGH RISK**

   Opening Date: 1989  
   Date of Last Major Renovation: N/A

   Academic areas are served by VAV air handling units in conjunction with VAV terminal units. Ventilation is provided through the air handling units. The large assembly spaces are served by single zone air handling units located either indoors within the mezzanines or on the roof. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat.

   Equipment/Components recently replaced or scheduled to be replaced:
   - Chiller
   - Boilers
   - Hot water heater
   - Packaged equipment serving administration area
   - Partial EMS
   - Fire Alarm

   There are major components and systems within the building that are original to the building and are approaching 30 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching or have exceeded their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as high.

   Systems or Components posing the greatest potential for operational failures:
   - Control Valves
   - Piping
   - Pumps
   - VAV boxes
   - Air handling units
   - EMS controls (those that have not been replaced)
   - Lack of availability of replacement parts
   - Failing condensate drain pans creating potential air quality concerns
2. **Cool Spring E.S. – HIGH RISK**

Opening Date: 1989  
Date of Last Major Renovation: N/A

Academic areas are served by VAV air handling units in conjunction with VAV terminal units. Ventilation is provided through the air handling units. The large assembly spaces are served by single zone air handling units located either indoors within the mezzanines or on the roof. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat.

Equipment/Components recently replaced or scheduled to be replaced:
- Chiller
- Boilers
- Hot water heater
- Partial EMS
- Packaged equipment serving administration area
- Fire Alarm

There are major components and systems within the building that are original to the building and are 30 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching or have exceeded their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as high.

Systems or Components posing the greatest potential for operational failures:
- Control Valves
- Piping
- Pumps
- VAV boxes
- Air handling units
- EMS controls (those that have not been replaced)
- Lack of availability of replacement parts
- Failing condensate drain pans creating potential air quality concerns
3. **Ashburn E.S. – HIGH RISK**

Opening Date: 1992  
Date of Last Major Renovation: N/A  

Classrooms are served by four-pipe unit ventilators. Ventilation air is provided through wall louvers at each unit ventilator. The administration area is served by a split system air conditioning unit. The music room, multipurpose room, and cafeteria are served by indoor and rooftop air handling units. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat. EMS is a hybrid of Andover Siemens and Trane and incorporates both electronic and pneumatic controls.

Equipment/Components recently replaced or scheduled to be replaced:
- Chiller
- Boilers
- Packaged equipment serving administration area
- Partial EMS

There are major components and systems within the building that are original to the building and are 25 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching or have exceeded their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as high.

Systems or Components posing the greatest potential for operational failures:
- Control Valves
- Piping
- Pumps
- Unit Ventilators
- Air handling units
- Boilers
- EMS controls (those that have not been replaced)
- Lack of availability of replacement parts
- Humidity/air quality concerns
4. **Farmwell Station M.S. – HIGH RISK**

Opening Date: 1995  
Date of Major Renovation: N/A

Academic areas are served by VAV air handling units in conjunction with VAV terminal units. Ventilation is provided through the air handling units. The large assembly spaces are served by single zone air handling units located either indoors within the mezzanines or on the roof. Cooling is provided by a water cooled chiller. Gas-fired boilers provide building heat.

Equipment/Components recently replaced or scheduled to be replaced:  
- Fire Alarm  
- Packaged equipment serving administration area and computer lab  
- Chiller

There are major components and systems within the building that are original to the building and are 22 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching or have exceeded their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as high.

Systems or Components posing the greatest potential for operational failures:  
- Control Valves  
- Piping  
- Pumps  
- VAV boxes  
- Air handling units  
- Boilers  
- Chiller  
- Cooling Tower  
- EMS controls  
- Lack of availability of replacement parts
5. **Potowmack E.S. – MEDIUM RISK**

Opening Date: 1995  
Date of Last Major Renovation: N/A

Classrooms are served by four-pipe unit ventilators. Ventilation air is provided through wall louvers at each unit ventilator. The administration area is served by a split system air conditioning unit. The music room, multipurpose room, and cafeteria are served by indoor and rooftop air handling units. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat. EMS is Andover.

Equipment/Components recently replaced or scheduled to be replaced:
- Fire Alarm
- Water heater
- Packaged equipment serving administration area and computer lab
- Chiller

There are major components and systems within the building that are original to the building and are 22 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching or have exceeded their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. However, the decentralized nature of these systems helps reduce the impact on the entire building in the event of a failure in a single air handling system. For these reasons, the five year risk level has been assessed as medium.

Systems or Components posing the greatest potential for operational failures:
- Control Valves
- Piping
- Pumps
- Unit Ventilators
- Air handling units
- Boilers
- EMS controls
- Lack of availability of replacement parts
- Humidity/air quality concerns
6. **Lowes Island E.S. – MEDIUM RISK**

Opening Date: 1997  
Date of Last Major Renovation: N/A

Classrooms are served by four-pipe fan coil systems. Ventilation air is provided through rooftop dedicated outdoor air systems incorporating energy recovery. The administration area is served by a split system air conditioning unit. The music room, multipurpose room, and cafeteria are served by indoor and rooftop air handling units. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat. EMS is Andover Controls.

Equipment/Components recently replaced or scheduled to be replaced:
- Fire Alarm
- Packaged equipment serving the administration area
- Boilers
- Water heater
- Chiller

There are major components and systems within the building that are original to the building and are 20 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching or have exceeded their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as medium.

Systems or Components posing the greatest potential for operational failures:
- Control Valves
- Piping
- Pumps
- Boilers
- Fan coil units
- Air handling units
- EMS controls
- Lack of availability of replacement parts
7. **Horizon E.S. – MEDIUM RISK**

Opening Date: 1999  
Date of Last Major Renovation: N/A

Classrooms are served by four-pipe fan coil systems. Ventilation air is provided through rooftop dedicated outdoor air systems incorporating energy recovery. The administration area is served by a split system air conditioning unit. The music room, multipurpose room, and cafeteria are served by indoor and rooftop air handling units. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat. EMS is Siebe.

Equipment/Components recently replaced or scheduled to be replaced:  
- No significant upgrades

There are major components and systems within the building that are original to the building and are 18 years of age at the time of this report. Components and significant systems infrastructure are fast approaching the end of their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as medium.

Systems or Components posing the greatest potential for operational failures:
- Control Valves  
- Piping  
- Pumps  
- Boilers  
- Fan coil units  
- Air handling units  
- Chiller  
- EMS controls  
- Lack of availability of replacement parts
8. **Dominion Trail E.S. – MEDIUM RISK**

Opening Date: 1997  
Date of Last Major Renovation: N/A

Classrooms are served by four-pipe fan coil systems. Ventilation air is provided through rooftop dedicated outdoor air systems incorporating energy recovery. The administration area is served by a split system air conditioning unit. The music room, multipurpose room, and cafeteria are served by indoor and rooftop air handling units. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat. EMS is Andover Siemens.

Equipment/Components recently replaced or scheduled to be replaced:  
- Fire Alarm  
- Packaged equipment serving the administration area  
- Boilers  
- Water heater  
- Chiller

There are major components and systems within the building that are original to the building and are 18 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching the end of their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as medium.

Systems or Components posing the greatest potential for operational failures:  
- Control Valves  
- Piping  
- Pumps  
- Fan coil units  
- Air handling units  
- EMS controls  
- Lack of availability of replacement parts
9. **Seldens Landing E.S. – MEDIUM RISK**

Opening Date: 2001  
Date of Last Major Renovation: N/A

Classrooms are served by four-pipe fan coil systems. Ventilation air is provided through rooftop dedicated outdoor air systems incorporating energy recovery. The administration area is served by a split system air conditioning unit. The music room, multipurpose room, and cafeteria are served by indoor and rooftop air handling units. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat. EMS is Andover Siemens.

Equipment/Components recently replaced or scheduled to be replaced:
- No significant upgrades

There are major components and systems within the building that are original to the building and are 16 years of age at the time of this report. Components and significant systems infrastructure are fast approaching the end of their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. For these reasons, the five year risk level has been assessed as medium.

Systems or Components posing the greatest potential for operational failures:
- Control Valves
- Piping
- Pumps
- Boilers
- Fan coil units
- Air handling units
- Chiller
- EMS controls
- Lack of availability of replacement parts
10. Sanders Corner E.S. – MEDIUM RISK

Opening Date: 1995
Date of Last Major Renovation: N/A

Classrooms are served by four-pipe unit ventilators. Ventilation air is provided through wall louvers at each unit ventilator. The administration area is served by a split system air conditioning unit. The music room, multipurpose room, and cafeteria are served by indoor and rooftop air handling units. Cooling is provided by an air cooled chiller. Gas-fired boilers provide building heat. EMS is Andover Siemens.

Equipment/Components recently replaced or scheduled to be replaced:
• Packaged equipment serving administration area and computer lab
• Chiller
• Water heater
• Fire Alarm

There are major components and systems within the building that are original to the building and are 22 years of age at the time of this report. While several major pieces of equipment have been replaced, there are still a number of components and significant systems infrastructure that are fast approaching or have exceeded their useful service life. Additionally, spare parts for these systems are problematic creating potential for common maintenance functions to result in a crisis. However, the decentralized nature of these systems helps reduce the impact on the entire building in the event of a failure in a single air handling system. For these reasons, the five year risk level has been assessed as medium.

Systems or Components posing the greatest potential for operational failures:
• Control Valves
• Piping
• Pumps
• Unit Ventilators
• Air handling units
• Boilers
• EMS controls
• Lack of availability of replacement parts
• Humidity/air quality concerns