

Introduction

CSG Building Commissioning Group has contracted with Aberdeen School District to ensure that the schools in the district have adequate outside air based on American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Guideline 62.1. It has been shown that good indoor air quality improves the learning environment and health of the students and teachers. Although studies have shown the results of good indoor air quality for years, the pandemic has brought the issue to the forefront. Funding has also been made available through the Elementary and Secondary School Emergency Relief Fund (ESSER Fund).

This is a report of the findings of the first look at the Aberdeen schools and the issues found. Outside Air (OA) has been measured in all schools and where possible the correct setting was determined. If the correct air flows were achieved, the code damper position was noted and entered on a table that will be provided to the district. This will ensure that the correct damper position can be maintained over time. At this time, the systems in all buildings are set at the same location as found when CSG started, to ensure that maintenance staff have the same system they're used to for the time being.

Issues were found where clogged screens, rusted and binding dampers, or controls issues prevented an accurate reading. If adjustments were not possible, the issue was noted, and steps needed to correct the issue have been included along with the estimated cost.

CSG is aware of maintenance staffing. Some of this work will need to be performed by a mechanical contractor. A controls contractor will also need to be engaged for additional work to make the systems work correctly. CSG can oversee the corrections necessary and get the systems working as an addition scope of work to our contract. Pricing for all this scope of work will be presented to the district prior to the start of any work for approval.

Prioritization

- In some areas, OA is not available. These areas are prioritized as **URGENT**.
- Restricted OA due to controls or other issues have been prioritized as **HIGH**.
- Rooms receiving OA, but not at a controllable level have been prioritized as **MEDIUM**.

Breakdown of Individual Schools for **Urgent Issues (No outside air)**

Stevens Elementary School

Scope of work needed: Mechanical Contractor/Controls Contractor

1. *Issue:* Clogged screens blocking most or all the outside air in the classroom unit ventilators. Also, dirt at the bottoms of the unit ventilators blocking movement of the outside air louver.
Recommendation: Hire mechanical contractor to remove outside rain louvers, dispose of all the screens since they are too small in mesh (these are very fine mesh like window screens), clean the bottoms of unit ventilators that are restricting damper movement, install 1/8" hardware cloth (approximately the same size as at AJ West) behind the louvers. Once the screens are clean and the bottoms of the unit ventilators are clean, then the outside air & return dampers can move freely throughout their range, and CSG can set the correct outside air percentages. Estimated cost 21 classrooms / \$1500 = **\$31,500**.
2. *Issue:* Four portable classrooms with no outside air.
Recommendation: In the old portables 201 and 202 replace the outside air damper actuator or damper controller on the Bard heat pumps. In the new portables A and B enter the thermostat code and set the thermostat menu to "Continuous Fan Mode", otherwise those portables also have no outside air. This would be a lower cost option but not recommended for Clean Building compliance.

Best solution is to add Bard ERV units into existing HVAC units on portables. Change thermostats to programable units with CO2 monitoring and occupancy sensors that allow units to run based on occupancy. Estimated cost 6 classrooms /\$6,500 = **\$39,000**

3. *Issue:* No exhaust in health room restroom.

Recommendation: 1. Connect health room restroom to existing exhaust duct in adjacent restroom. 2. Undercut health restroom door. 3. Install one larger inline exhaust fan to serve both restrooms. Install larger exhaust fan to serve two restrooms, including ducting. **\$5,500**

Total Urgent issues estimated cost for Stevens Elementary **\$76,000**.

A J West Elementary

Scope of work needed: Mechanical Contractor/Controls Contractor

1. *Issue:* Clogged screens blocking most of the outside air in the unit ventilators in five classrooms. Also, dirt at the bottoms of the unit ventilators blocking movement of the outside air damper.

Recommendation: Hire contractor to clean the screens and the bottoms of the unit ventilators that are restricting damper movement (outside rain louvers not removeable). Once the screens are clean and the bottoms of the unit ventilators are clean, check to see that the outside air and return dampers can move freely throughout their range, and CSG can set the correct outside air percentage. 14 classrooms / \$1,250 = **\$17,500**.

2. *Issue:* Two portable classrooms with no outside air.

Recommendation: Replace outside air door actuator or controls in old portables 21 and 22. Also set the thermostats in portables 23 and 24 so that the fan runs continuously, otherwise those portables also have no outside air. This would be a lower cost option but not recommended for Clean Building compliance.

Best solution is to add Bard ERV units into existing HVAC units on portables. Change thermostats to programable units with CO2 monitoring and occupancy sensors that allow units to run based on occupancy. 4 classrooms /\$6,500 = **\$26,000**

3. *Issue:* Classrooms 19 and 4 have more serious issues non-functioning actuators (19) or frozen actuators (4).

Recommendation: Replace damper actuators in two units. 2 classrooms / \$2,500 = **\$5,000**

4. *Issue:* The five classrooms with mini splits have no outside air.

Recommendation: Install 5 heat recovery ventilators (HRVs) through the outside classroom walls (such as the kind in the Miller modulars), or possibly install one large central HRV in the relief ductwork. The individual classroom through wall units would not need an engineer as they could be chosen from a catalog and installed with a connection to the DDC controls so they would run during occupied hours. A larger central HRV would need an engineer to design the size, specify additional ductwork to the classrooms for a return path to the HRV, and dampers for balancing the flow. Install 5 heat recovery ventilators in classrooms with mini-split systems for outside air. (These are like the modular units at Miller Jr. High School.) 5 classrooms / \$7,500 = **\$37,500**.

Total Urgent issues estimated cost for A J West Elementary **\$86,000**.

Miller Junior High School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. *Issue:* Four modular classrooms have no outside air.

Recommendation: Install the same or similar HRVs as in the other classrooms. These individual classroom through wall units would not need an engineer as they could be chosen from a catalog and installed with a connection to the DDC controls so they would run during occupied hours.

Install 4 heat recovery ventilators in classrooms with no outside air. (These are like the existing modular units in the rest of the modular at Miller Jr. High School.) 4 classrooms / \$7,500 = **\$30,000.**

2. *Issue:* Health room doesn't have large enough exhaust fan to make the health room negative.
Recommendation: Install larger fan at existing health room restroom exhaust duct.
Install larger fan at existing health room restroom. **\$5,500**

Total Urgent issue cost for Miller Junior High **\$35,500.**

Robert Gray Elementary School

1. *Issue:* Portable P2 has no outside air since its outside air damper actuator is broken.
Recommendation: Replace outside air damper actuator. Estimated cost \$2,000
Also needed: best solution is to add Bard ERV units into existing HVAC units on portables.
Change thermostats to programable units with CO2 monitoring and occupancy sensors that allow units to run based on occupancy. 2 classrooms /\$6,500 = **\$13,000.**

Total Urgent issue cost for Robert Gray Elementary = **\$15,000**

Central Park Elementary School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. *Issue:* Health room doesn't have large enough exhaust fan to make the health room negative.
Recommendation: Install larger exhaust fan at existing health room restroom exhaust duct (and connect to the DDC system so it stays on during occupied hours (rather than switch off at the bathroom switch)). Install larger fan at existing health room restroom. **\$5,500**

Total Urgent Issues estimated cost for Central Park Elementary School = **\$5,500**

Total estimated cost for Urgent Issue Corrects at all schools = \$217,50

Breakdown of Individual Schools for **High Issues (Restricted outside air)**

Stevens Elementary School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. *Issue:* Pneumatic actuators have reached the end of their life in the library, and outside air can no longer be controlled by the DDC system.
Recommendation: If possible, make one functioning unit for the library out of the two library units. Or buy a pneumatic actuator for the one functioning unit. Estimated cost is **\$3,500.**
2. *Issue:* Cafeteria and gym dampers have issues with control signals being backwards, and the dampers possibly being open at night, and CSG made changes to the controls settings to revise signal.
Recommendation: CSG will verify that changes made to the controls are working. At this time there is no cost associated with this repair. For budget purposes add **\$2,500** for Controls work.

Total estimated cost for High priority issues at Steven Elementary School = **\$6,000**

A J West Elementary School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. *Issue:* The Johnson Controls DDC system for this school is programmed for 0V to 10V dampers actuators, yet the school was built with 2V to 10V actuators. So, when the DDC system tells the dampers to open, they don't open enough, and the school doesn't get sufficient outside air. An attempt was made to correct the damper positions to compensate, however now the dampers stay open at night. This school will need to have the damper control reprogrammed with a Johnson Controls programmer, or the DDC controls will need to be replaced in their entirety.

Recommendation: Either obtain advice from a Johnson Controls programmer on how to set up the controls to match or come up with a proper way to ratio the damper actuators so they open properly and don't stay open at night. Best option is to replace with new Alerton controls. 49,678 square feet elementary school @ \$5.65 = **\$280,681**

Total estimated cost for High priority issues at A J West Elementary School = **\$280,681**

Miller Junior High School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. *Issue:* Some of the 40+ year old outside air and return air damper pivots are rusted and dampers do not stroke to their full 0% or 100% positions, making it impossible to set the correct outside air percentage. It's estimated that 30% of the damper pivots are rusted somewhat, however they all need to be lubricated to prevent future corrosion.

Recommendation: Mechanical contractor will lubricate all pivots where the damper pivots are rusting inside the damper arms, exercise the dampers until they are free, and lubricate again. Once the outside air and return dampers move freely throughout their range, CSG can set the correct outside air percentage. 50 units / \$ 800 = **\$40,000**

Note that damaged or broken dampers may need to be replaced and this would be additional cost. CSG recommends having a mechanical contractor check 3-5 dampers if the worst dampers and see if they can get them into working order before establishing a final budget. This would be from the MRSC roster and with a "not to exceed amount of **\$5,000". This would give the district a better idea for budgeting the work.*

Total estimated cost for High priority issues at Miller Jr. High School = **\$45,000**

McDermoth Elementary School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. *Issue:* The air handler outside air and return air damper pivots are rusted and dampers do not stroke to their full 0% or 100% positions, making it impossible to set the correct outside air percentage.

Recommendation: Hire contractor to lubricate locations where the damper pivots are rusting inside damper arms, exercise the dampers until they are free, and lubricate again. Once the outside air and return dampers move freely throughout their range, CSG can set the correct outside air percentage. 4 units / \$1,250 = **\$5,000**

2. *Issue:* Because the return fan to supply fan offset ratios for the air handlers have been lost, the whole school is negative and outside air is inadequate and can't be measured.

Recommendation: Rebalance the three (3) air handler supply ducts and three (3) return ducts for AHU1 and AHU2, and the single (1) supply and return ducts for AHU3 and 4, to determine offset ratios for the return fans. CSG can perform this TAB work but is added scope of **\$12,000**.

3. *Issue:* VAV boxes are not set in the controls to the correct size, design flow or are not calibrated

to flow the correct air to each room.

Recommendation: Ensure that the VAV box sizes and flow numbers are entered into the control system. Then calibrate all the VAV boxes. The DDC controls vendor will need to ensure the calibration blank is visible on the control's graphics, and CSG can then calibrate the boxes. During our visit the calibration blank was not visible on the controls. With access to the control field blank, CSG can perform the necessary TAB work with the control's contractor for estimated cost of **\$23,000**.

4. **Issue:** It appears that various sensors and control strategies were never re-installed or implemented when a controls upgrade was performed. An example of this is missing supply duct pressure sensors.

Recommendation: The usual and normal sensors and controls programming that are necessary for a functioning air handler and VAV system will need to be installed by the DDC controls vendor before this school will be comfortable, have the proper amounts of outside air, and operate with low energy costs. Estimated cost **\$22,500**.

Total estimated cost for High priority issues at McDermoth Elementary School = **\$62,500**

Robert Gray Elementary School

Scope of work needed: Mechanical Contractor/Controls Contractor

1. **Issue:** The air handler damper shafts are rusted and causing the Belimo actuators to hit their maximum torque and stop before the outside air and return dampers are fully open or fully closed.

Recommendation: Hire mechanical contractor to lubricate locations where the damper pivots are rusting inside damper arms, exercise the dampers until they are free, and lubricate again. Once the outside air and return dampers move freely throughout their range, CSG can set the correct outside air percentage. 4 Units / \$1,250 = **\$5,000**

2. **Issue:** VAV boxes are not set in the controls to the correct size, design flow or are not calibrated to flow the correct air to each room.

Recommendation: Ensure that the VAV box sizes and flow numbers are entered into the control system. Then calibrate all the VAV boxes. The DDC controls vendor will need to ensure the calibration blank is visible on the control's graphics, and CSG can then calibrate the boxes. During our visit the calibration blank was not visible on the controls. With access to the control field blank, CSG can perform the necessary TAB work with the control's contractor for **\$23,000**.

Total cost estimate for High priority issues at Robert Gray elementary school = **\$28,000**

Central Park Elementary School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. **Issue:** The air handlers for the administration and gym do not function properly in the controls. The damper settings do not move for the admin, or can't be manipulated for the gym, via the controls.

Recommendation: The DDC vendor will need to reprogram the sequences/graphic for the outside air dampers. Then CSG can then set the outside air. Estimated cost **\$6,500**.

2. **Issue:** The CO2 sensor for the administration air handler no longer works. This either over ventilates and wastes energy, or under ventilates.

Recommendation: The CO2 sensor can be replaced by the District, the DDC vendor or a mechanical contractor. CSG can then set a small per-square-foot damper setting for both the admin and the gym to save energy, and the damper can then open further if there are occupants in the spaces. Estimated cost **\$3,500**.

Total cost for high priority issues for Central Park Elementary School = \$10,000

Aberdeen High School

Scope of work needed: Mechanical Contractor /Controls Contractor

1. **Issue:** Many of the outside air, return air, and relief air damper pivots are rusted, and dampers do not stroke to their full 0% or 100% positions, making it impossible to set the correct outside air percentage. This is particularly problematic in the smaller blower coil (BC) units.
Recommendation: Hire mechanical contractor to lubricate locations where the damper pivots are rusting inside damper arms, exercise the dampers until they are free, and lubricate again. Once the outside air, return air and relief air dampers move freely throughout their range, CSG can set the correct outside air percentage. 55 Units / \$750 = \$41,250

Total cost for high priority issues for Aberdeen High School = \$41,250

Total estimated cost of High Priority corrections at all schools = \$473,431

All items in green below will be evaluated and completed by ASD maintenance staff, unless otherwise noted.

Breakdown of Individual Schools for Medium Issues (Receiving outside air/not controlled)

AJ West Elementary School

1. **Issue:** AHU-118 (gym east) doesn't turn on in the DDC system. Unit will run if set to hand. Filters are perfectly clean meaning the unit is not being used.
Recommendation: Either obtain advice from a Johnson Controls programmer to get unit to run or best recommendation is to wait until controls are upgraded to Alerton (See High Priority).
2. **Issue:** UV-23 through 27 (classrooms 15-19) outside air damper doesn't close off the return. As a result, the amount of outside air won't correspond with the outside air damper position since more than the normal amount of return air is being provided to the classroom.
Recommendation: Hire mechanical contractor to adjust linkages on the dampers. 5 units /\$750 = \$3,750.
3. **Issue:** Portable classroom 25 the outside air damper stalls at 50% open because it touches the side of the outside air box.
Recommendation: Hire mechanical contractor to straighten out the outside air box. \$1,600

Total Medium priority issues estimated cost at AJ West Elementary = \$5,350

Miller Junior High

1. **Issue:** Duct is torn at various places, allowing air into the attic rather than classrooms.
Recommendation: Hire mechanical contractor to repair or tape the ducts. \$5,000
2. **Issue:** HV-10 (classrooms 116, 117, 119, hall 100B) - OSA damper at 80% when commanded to 20%.
Recommendation: Have ATS correct the control programming. \$2,500
3. **Issue:** HV-16 (room 138 (shop B)) - not working at all due to mechanical failure (probable motor).
Recommendation: Hire mechanical contractor to repair equipment. \$6,500

Total Medium priority issues estimated cost at Miller Jr. High = \$14,000

McDermoth Elementary School

1. *Issue:* Outside air duct for AHU-2 (library, admin) is open to the mezzanine and drawing in attic air, resulting in warm or cold library.
Recommendation: Hire mechanical contractor to close duct. \$4,750
2. *Issue:* AHU-4 (gym) - Unable to set outside air damper position in the DDC controls.
Recommendation: Have DDC control programmer correct controls. \$6,800

Total Medium priority issues estimated cost at McDermoth Elementary = \$11,550

Central Park Elementary School

1. *Issue:* Room 13 (UV-18) return damper gets stuck, resulting in low outside air delivered to the classroom.
Recommendation: Hire mechanical contractor to bend damper box. \$2,000

Total Medium priority issues estimated cost at Central Park Elementary = \$2,000

Aberdeen High School

1. *Issue:* A few dampers are programmed for 0V to 10V in the Alerton DDC system, yet the school was built with 2V to 10V actuators. So, when the DDC system tells the dampers to open, they don't open enough, and the school doesn't get sufficient outside air. A few dampers are also programmed backwards in the Alerton DDC system, so they close when they should open.
Recommendation: Once the dampers are freed up and lubricated and more throughout their range, the incorrectly programmed dampers can be identified by CSG and programmed correctly by an Alerton programmer. DDC programmer cost \$7,500

Total Medium priority issues estimated cost at Aberdeen High School = \$7,500

Total estimated cost for Medium Issues corrections at all schools= \$40,400

School	Urgent	High	Medium	CSG Manage	Total	Contingency	Grand Total
Stevens Elementary	\$76,000	\$6,000	\$0	\$12,300	\$94,300	\$16,974	\$111,274
AJ West Elementary	\$86,000	\$280,681	\$5,350	\$55,805	\$427,836	\$77,010	\$504,846
Miller Jr. High	\$35,000	\$45,000	\$14,000	\$13,350	\$102,350	\$18,423	\$120,773
Central Park Elementary	\$5,500	\$10,000	\$2,000	\$2,625	\$20,125	\$3,623	\$23,748
McDermoth Elementary		\$62,500	\$11,550	\$11,108	\$85,158	\$15,328	\$100,486
Robert Gray Elementary	\$15,000	\$28,000	\$0	\$6,450	\$49,450	\$8,901	\$58,351
Aberdeen High School		\$41,250	\$7,500	\$7,313	\$56,063	\$10,091	\$66,154
	\$217,500	\$473,431	\$40,400	\$108,950	\$835,281	\$150,351	\$985,631