

June 4, 2021

Ms. Jeanne Cleary
Director of Operations and Special Projects
Scotch Plains - Fanwood Public Schools
512 Cedar Street
Scotch Plains, NJ 07076

Re: Scotch Plains Fanwood Schools Re-Opening May 2021 Indoor Air Quality Report

Dear Ms. Cleary,

This report outlines findings from [ESMCorp's](#) May 13-14, 2021 **Indoor Air Quality** Inspections of the Scotch Plains Schools. These inspections are a follow-up to our November 2020 HVAC inspection report which summarized steps that Scotch Plains Schools may consider to reduce risk for COVID-19 transmission at the schools for students and staff. The purposes of the May 13-14, 2021 inspections were the following:

- Determine if Indoor Air Quality measurements in representative classrooms throughout the buildings were “well ventilated” at the current occupancy levels during Hybrid Instruction, in accordance with the guidance provided by the and New Jersey Department of Education “Road Back” as well as the February 12, 2021 recently revised CDC guidance for reduction of COVID-19 transmission risk.
- Determine if temperature and humidity within classrooms were within normal ranges
- Determine if unit ventilator fan speed settings require and additional adjustment (from lower occupancy and winter settings) to increase ventilation rates as higher numbers of students are projected to return to in-person learning as the Springtime warmer weather returns.
- Project recommended occupancy of students and staff using the current HVAC settings when the district reduces social distancing and begins to bring more students back to in-person instruction, while maintaining the CDC and ASHRAE guidance of 15 cubic feet per minute outdoor air per person introduction rates for reduction of COVID-19 transmission risk
- Assist the district in determining scheduling any additional adjustments, equipment, or HVAC upgrades in preparation for return to in-person teaching and learning for all students.

The inspections, data analysis and report were conducted by Dr. Richard M. Lynch, Ph.D., CIH, Mr. Richard A. Lynch, MBA, CIEC and Ms. Langston Lynch of Environmental Safety Management Corporation with the assistance of yourself, Anthony, Pat and Steve from the Scotch Plains/Fanwood schools Facilities Department.

Executive Summary of Findings

Each of the Scotch Plains/Fanwood Schools as currently occupied (1-22 persons/classroom) and at the current HVAC settings is considered adequately ventilated in accordance with CDC, ASHRAE and PEOSHA guidance for the reduced occupancy rates present at the time of inspection. Unit ventilators were equipped with MERV8 filters and functioning in accordance with expected airflows and outdoor air introduction given installed equipment vintage and capabilities. Fresh air dampers were observed to be open a minimum of 25-35% outdoor air in all buildings inspected (>40% at Brunner). Window position was highly varied across the district with some buildings having up to 91% of windows open, while other buildings had as few as 23% of windows open at the time of inspection.

To increase projected occupancy rates beyond those described in this report, teachers should be reminded to keep windows open (ideally 2 or more) to maximize dilution ventilation as outdoor temperatures increase into the spring and as additional students return to in-person instruction. Facilities staff should continue to conduct regular inspections to ensure continued effective operation of overhead air handlers and unit ventilators as increased numbers of students return to in-person learning. Fresh air dampers should be kept open to the maximum extent possible for dilution of respiratory aerosols. Continue use of portable air purifiers where mechanical ventilation is not present, or where higher occupant densities are planned.

I. Evaluation Criteria

The [NJ PEOSHA Indoor Air Quality Standard](#) requires that HVAC systems be inspected and maintained in accordance with manufacturer specifications and that damaged components be repaired. According to the standard, when indoor air levels of carbon dioxide exceed 1,000 parts per million the employer inspect the system to ensure that it is operating as it should NJAC 12:100-13.3. The standard also requires that when indoor air temperatures cannot be maintained between 68-79°F during the heating season, that the HVAC system be inspected. This is based upon the ASHRAE 55 standard which recommends that air temperatures be maintained between 68-72°F during the heating season, 74-78°F during the cooling season and 68-79°F during the transition seasons; all ideally at 30-60% relative humidity.

To reduce the potential for COVID-19 infection risk, the CDC, NJDOE, and ASHRAE **recommend that outdoor air introduction be maximized to the greatest extent feasible**, meeting or exceeding the minimum ASHRAE 62 guidance of 13-17 cubic feet per minute of outdoor air person (depending on age group and classroom type). For this analysis, our recommendations target the middle of this range of 15 cfm outdoor air per person.

II. Methods

The following methods were observed during this assessment:

- Indoor air quality monitoring was conducted outdoors and within representative classrooms within each building per the following:
 - McGinn Elementary School – 16 classrooms inspected.
 - Evergreen Elementary School – 15 classrooms inspected.
 - Coles Elementary School – 22 classrooms inspected.
 - School One Elementary School – 18 classrooms inspected.
 - Brunner Elementary School – 17 classrooms inspected.
 - Terrill Middle School – 20 classrooms inspected.

- Park Middle School – 33 classrooms inspected.
- Scotch Plains Fanwood High School – 38 classrooms inspected.
- Airflow rates, carbon dioxide, and supply air temperature were measured from supply registers in monitored classrooms equipped with unit ventilators. No airflows were measured from ceiling supply registers during this inspection, as this would have been disruptive to teaching and learning occurring in occupied classrooms.

III. Findings and Results

Findings revealed the following:

HVAC/Unit Ventilator Air Flow Measurements

- Unit ventilators and overhead air handlers were operating in 94-100% of classrooms inspected at each of the 8 operating Scotch Plains Schools. Filter efficiency ratings in unit ventilators were observed to be MERV8 filters, reportedly the maximum filter rating compatible with installed unit ventilators. MERV ratings for rooftop air handlers was reported to range between MERV10-13.
- Classroom window position (open versus closed) varied substantially across the district, as follows:
 - McGinn Elementary School – 19% of classrooms had windows closed.
 - Evergreen Elementary School– 33% of classrooms had windows closed.
 - Coles Elementary School– 9% of classrooms had windows closed.
 - School One Elementary School– 72% of classrooms had windows closed.
 - Brunner Elementary School– 65% of classrooms had windows closed.
 - Terrill Middle School– 50% of classrooms had windows closed.
 - Park Middle School– 39% of classrooms had windows closed.
 - Scotch Plains Fanwood High School– 53% of classrooms had windows closed.
- Estimated total airflows from classroom unit ventilators were within expected ranges, given vintage of the equipment installed as follows:
 - McGinn Elementary School – Average 729 cubic feet per minute.
 - Evergreen Elementary School – Average 675 cubic feet per minute.
 - Coles Elementary School – Average 899 cubic feet per minute.
 - School One Elementary School – Average 606 cubic feet per minute.
 - Brunner Elementary School – Average 385 cubic feet per minute (smaller UV's).
 - Terrill Middle School – Average 728 cubic feet per minute.
 - Park Middle School – Average 561 cubic feet per minute.
 - Scotch Plains Fanwood High School - – Average 709 cubic feet per minute.
- Inspection of unit ventilator fresh air dampers revealed that dampers were open to allow 25% of more outdoor air introduction in each of the buildings inspected.
- Average classroom temperature and humidity were within normal ranges at each of the schools inspected given outdoor conditions (average 68-73°F@27-32% relative humidity).

		
<p>Classroom Windows Open, Measurement of airflow and fresh air introduction from unit ventilators.</p>	<p>Unit ventilator damper @25-35% outdoor air introduction position. MERV8 Filter.</p>	<p>Unit ventilator damper@ 100% outdoor air position. MERV8 Filter last inspected and cleaned March 2021.</p>

Indoor Air Quality Measurement Findings

- Outdoor air was measured to contain approximately 415 to 420 parts per million carbon dioxide. Temperature was approximately 70-76°F at 15-20% relative humidity on the days of the inspections.
- No elevations in carbon monoxide or volatile organic compounds were detected in any classrooms inspected.
- Occupant levels for the classrooms at the 8 schools ranged from 1 to a maximum of 22 persons at the time of monitoring.
- Average classroom carbon dioxide levels within classrooms were as follows:
 - McGinn Elementary School – 671 parts per million
 - Evergreen Elementary School – 675 parts per million
 - Coles Elementary School - 626 parts per million
 - School One Elementary School– 546 parts per million
 - Brunner Elementary School – 686 parts per million
 - Terrill Middle School – 807 parts per million
 - Park Middle School – 629 parts per million
 - Scotch Plains Fanwood High School – 565 parts per million
- Based upon the above, all airborne carbon dioxide levels measured were below the ASHRAE 62.1 guideline of 700 ppm about outdoor levels, and the PEOSHA IAQ standard requirement to inspect HVAC equipment above of 1000 ppm. This indicates that outdoor air introduction (via HVAC units and open windows combined) exceeded the CDC and ASHRAE recommended 15 cubic feet per minute per person for the reduced number of occupants present at the time of inspection. Classrooms with the highest occupancy levels (12-22) occupants) also had CO₂ levels at 1,080 ppm and lower, indicating that outdoor air introduction exceeded ASHRAE 62 guidance for on the day of inspection.

- Carbon dioxide measurements exiting unit ventilator supply registers confirmed that outdoor air was being introduced to classrooms via operating unit ventilators at each school consistent with the observations described previously within this report.

Findings are summarized in Table #1 below”

**Table #1 – Summary of Indoor Air Quality Measurement Findings
Scotch Plains/Fanwood Schools May 13-14, 2021**

School	Average Occupant # (range)	Average Airborne Carbon Dioxide (ppm)	Key Findings	Recommendations to Increase Occupancy @ 15 cfm outdoor air /person
McGinn Elementary School	Average=15 Range= 21	671	Windows closed in 19% classrooms inspected.	Recommend Teachers Open Windows. Maintain minimum 25% outdoor air introduction.
Evergreen Elementary School	Average=13 Range=21	675	Windows closed in 33% of classrooms inspected	Recommend Teachers Open Windows. Maintain minimum 25% outdoor air introduction.
Coles Elementary School	Average=8 Range=22	626	Windows closed in 9% of classrooms inspected.	Recommend Teachers Open Windows. Maintain minimum 25% outdoor air introduction.
School One Elementary	Average=6 Range=16	546	Windows closed in 72% of classrooms inspected.	Recommend Teachers Open Windows. Maintain minimum 25% outdoor air introduction.
Brunner Elementary School	Average=10 Range=21	686	Windows closed in 65% of classrooms inspected.	Recommend Teachers Open Windows. Maintain dampers to 40%-100% outdoor air in smaller unit ventilators
Terrill Middle School	Average=11 Range=21	626	Windows closed in 50% of classrooms inspected.	Recommend Teachers Open Windows.

				Maintain minimum 25% outdoor air introduction.
Park Middle School	Average=8 Range=22	629	Windows closed in 39% of classrooms inspected.	Recommend Teachers Open Windows. Maintain minimum 25% outdoor air introduction.
Scotch Plains/Fanwood High School	Average=8 Range=22	565	Windows closed in 53% of classrooms inspected.	Recommend Teachers Open Windows. Maintain minimum 25% outdoor air introduction.

IV. Conclusions and Recommendations

Based upon the above, it is our professional opinion that each of the Scotch Plains/Fanwood Schools as currently occupied (1-22 persons/classroom) and at the current HVAC settings is considered adequately ventilated in accordance with CDC, ASHRAE and PEOSHA guidance for the reduced occupancy rates present at the time of inspection. Unit ventilators were equipped with MERV8 filters and functioning in accordance with expected airflows and outdoor air introduction given installed equipment vintage and capabilities. Fresh air dampers were observed to be open a minimum of 25% outdoor air in all buildings inspected (40% at Brunner).

Window position was highly varied across the district with some buildings having up to 91% of windows open, while other buildings had as few as 28% of windows open at the time of inspection. Teachers should be reminded to keep windows open (ideally 2 or more) to maximize dilution ventilation as outdoor temperatures increase into the spring and as additional students return to in-person instruction.

Recommendations

Based upon all of the above, we recommend that district conduct the following leading to increasing in-person teaching and learning beyond the current occupancy levels:

1. Ensure that unit ventilator and overhead HVAC fans are **operating at maximum fan speed** and that air filters are changed in accordance with your routine preventative maintenance schedule.
2. Ensure that **fresh air dampers are set to a minimum of 25-35% outdoor air introduction rate** now that outdoor temperatures are increasing and occupancy is expected to increase. Continue to maximize outdoor air introduction rates at Brunner (>40%) to compensate for smaller unit ventilator size.
3. **Remind teachers at all schools that unit ventilators must be kept in the “on” position** whenever teachers and students are present for the mechanical introduction of outdoor air to reduce the potential for COVID-19 transmission. This is especially important as classroom occupancy increases beyond the current rates.
4. **Teachers should be reminded to open windows** whenever possible (weather permitting) to further increase dilution ventilation. If there are circumstances where teachers believe that

windows cannot be opened, or if unit ventilators are not functioning properly, this should be reported to Facilities staff.

5. **Clean unit ventilators over the summer break** to remove higher dust and debris loading associated with increased outdoor air introduction. Compressed air clean any unit ventilator evaporator coils where airflows may be lower than expected.
6. **Continue with installation of supplemental air filters where mechanical ventilation is not present** (e.g. offices), in Nurse offices or COVID isolation rooms, or where higher occupancy density is anticipated.
7. Continue to adhere to social distancing, enhanced cleaning and disinfection and use of masks in accordance with NJ Department of Education and CDC Guidelines.

Thank you for the opportunity to assist the Scotch Plains/Fanwood School District with your 2020-21 COVID Reopening Planning. Please contact me with any questions.

Sincerely,

Richard M. Lynch

Richard M. Lynch, Ph.D., CIH, CMC, CMRS, CHFM

President - Environmental Safety Management Corporation - www.esmcorp.com

AIHA Fellow

Certified Industrial Hygienist

Certified Microbial Consultant

Certified Microbial Remediation Supervisor

Certified Healthcare Facility Manager

NJ Licensed Indoor Environmental Consultant