Environmental Safety Management Corporation
Air Quality, Mold Testing, Ergonomics, OSHA

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December 6, 2021

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

Dear Ms. Cleary,

This report outlines findings from ESMCorp's November 16, 17 and 22, 2021 Indoor Air Quality monitoring at each of the 8 Scotch Plains-Fanwood Schools. This assessment was conducted as part of the Scotch Plains – Fanwood Schools routine preventative indoor air quality program to ensure acceptable air quality for students, staff and visitors.

The purposes of this inspection were the following:

- Determine if air quality parameters including fresh air supply, volatile organic compounds, carbon monoxide, temperature and humidity were within expected ranges.
- Determine if the school is in general compliance with current guidelines by the State of New Jersey and the CDC with respect to ventilation in classrooms for reducing COVID-19 transmission risk.

The inspections, data analysis and report were conducted Mr. Richard A. Lynch, MBA, CIEC and Dr. Richard M. Lynch, Ph.D., CIH of Environmental Safety Management Corporation.

Executive Summary
Findings revealed that fresh air supply was within normal ranges in accordance with PEOSHA, CDC and NJ Department of Education guidelines for COVID-19 transmission risk reduction in each of the 8 schools inspected. There were no musty odors, no widespread visible water damage, and no visible mold contamination observed. There were no elevations in carbon monoxide or Volatile Organic Compounds. Temperature and relative humidity were with normal ranges given outdoor conditions at each of the schools. Teachers should be encouraged to open as many windows as is feasible given outdoor temperature and humidity conditions. Unit ventilators in particular classrooms as shown in schools-specific Tables at the end of this report should be inspected for airflow rates and/or fresh air damper position. Upgrades to HVAC systems in classroom trailers to increase outdoor air delivery rates should be prioritized. We are prepared to assist you with more detailed evaluation and specification development for these trailers.

I. Evaluation Criteria

According to the most recent CDC guidance (May 15, 2021), "regardless of the level of community transmission, **it is critical that schools use and layer prevention strategies**. Five key prevention

strategies are essential to safe delivery of in-person instruction and help to prevent COVID-19 transmission in schools:

1. Universal and correct use of masks
2. Physical distancing
3. Handwashing and respiratory etiquette
4. Cleaning and maintaining healthy facilities
5. Contact tracing in combination with isolation and quarantine

All prevention strategies provide some level of protection, and layered strategies implemented at the same time provide the greatest level of protection. Schools should adopt prevention strategies to the largest extent practical—a layered approach is essential." Source: CDC Operational Strategy for K-12 Schools through Phased Prevention

Heating Ventilation, Air Conditioning Systems

The CDC recommended that schools "Improve ventilation to the extent possible to increase circulation of outdoor air, increase the delivery of clean air, and dilute potential contaminants. This can be achieved through several actions.

- Bring in as much outdoor air as possible.
- Ensure Heating, Ventilation, and Air Conditioning (HVAC) settings are maximizing ventilation.
- Filter and/or clean the air in the school by improving the level of filtration as much as possible.
- Use exhaust fans in restrooms and kitchens.

For mechanically ventilated schools, 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^{o}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^{o}F during the heating season, 74-78^{o}F during the cooling season and 68-79^{o}F during the transition seasons; all ideally at 30-60% relative humidity.

In non-mechanically ventilated buildings the PEOSHA standard requires that the employer "Assure that buildings without mechanical ventilation are maintained so that windows, doors, vents, stacks, and other portals designed or used for natural ventilation are in operable condition (NJAC 12: 100-13.3-6). In naturally ventilated classrooms (rooms with no mechanical ventilation systems such as unit ventilators, or rooftop air handlers), it is recommended that windows be opened to the maximum extent possible given temperature and security concerns. (Villers et al "SARS-CoV-2 Aerosol Transmission in Schools: The Effectiveness of Different Interventions", and Lynch "Review 2 SARS-CoVo2 Aerosol Transmission in Schools: The effectiveness of Different Interventions" Rapid Reviews COVID-19 MIT Press September 19, 2021.

CDC encourages facilities to consider some or all of the following tools to improve ventilation:

- Open outdoor air dampers beyond minimum settings to reduce or eliminate HVAC air recirculation. In mild weather, this will not affect thermal comfort or humidity. However, this may be difficult to do in cold, hot, or humid weather, and may require consultation with an experienced HVAC professional.

- Open windows and doors, when weather conditions allow, to increase outdoor air flow. Do not open windows and doors if doing so poses a safety or health risk (e.g., risk of falling, triggering asthma symptoms) to occupants in the building. Even a slightly open window can introduce beneficial outdoor air.
- Use fans to increase the effectiveness of open windows. To safely achieve this, fan placement is important and will vary based on room configuration. Avoid placing fans in a way that could potentially cause contaminated air to flow directly from one person to another (see FAQ below on indoor use of fans). One helpful strategy is to use a window fan, placed safely and securely in a window, to exhaust room air to the outdoors. This will help draw outdoor air into the room via other open windows and doors without generating strong room air currents. Similar results can be established in larger facilities using other fan systems, such as gable fans and roof ventilators.
- Ensure ventilation systems operate properly and provide acceptable indoor air quality for the current occupancy level for each space.
- Rebalance or adjust HVAC systems to increase total airflow to occupied spaces when possible.
- Turn off any demand-controlled ventilation (DCV) controls that reduce air supply based on occupancy or temperature during occupied hours. In homes and buildings where the HVAC fan operation can be controlled at the thermostat, set the fan to the "on" position instead of "auto," which will operate the fan continuously, even when heating or air-conditioning is not required.
- Improve central air filtration:
    - Increase air filtration to as high as possible without significantly reducing design airflow. Increased filtration efficiency is especially helpful when enhanced outdoor air delivery options are limited.
    - Make sure air filters are properly sized and within their recommended service life.
    - Inspect filter housing and racks to ensure appropriate filter fit and minimize air that flows around, instead of through, the filter.
- Ensure restroom exhaust fans are functional and operating at full capacity when the building is occupied.
- Inspect and maintain exhaust ventilation systems in areas such as kitchens, cooking areas, etc. Operate these systems any time these spaces are occupied. Consider operating them even when the specific space is not occupied, to increase overall ventilation within the occupied building.
- Consider portable high-efficiency particulate air (HEPA) fan/filtration systems to enhance air cleaning (especially in higher risk areas such as a nurse's office or areas frequently inhabited by people with a higher likelihood of having COVID-19 and/or an increased risk of getting COVID-19). See the FAQ below on HEPA filters and portable HEPA air cleaners. (Note: Portable air cleaners that use filters less efficient that HEPA filters also exist and can contribute to room air cleaning. However, they should be clearly labeled as non-HEPA units.)
- Generate clean-to-less-clean air movement by evaluating and repositioning as necessary, the supply louvers, exhaust air grilles, and/or damper settings. See the FAQ below on Directional Airflow. This recommendation is easier to accomplish when the supply and exhaust points are located in a ceiling grid system.
- Consider using ultraviolet germicidal irradiation (UVGI) as a supplemental treatment to inactivate SARS-CoV-2, especially if options for increasing room ventilation and filtration are limited. Upper-room UVGI systems can be used to provide air cleaning within occupied spaces, and in-duct UVGI systems can help enhance air cleaning inside central ventilation systems.
- In non-residential settings, consider running the HVAC system at maximum outside airflow for 2 hours before and after the building is occupied.

II. Methods

Based upon the above, the following methods were observed:

1. A visual inspection of a 270 representative sample of classrooms throughout the district was conducted for indications of air quality concerns including water damage, musty odors, air flow and general cleanliness.
2. Carbon Dioxide (CO_2) was measured as an indicator of fresh air supply in each of the representative areas evaluated at the center of the room, and where accessible, at the discharge of unit ventilators, using a TSI Q-Trak 7575 IAQ Monitor. Carbon monoxide, temperature and relative Humidity were also measured.
3. Volatile Organic Compounds (VOCs) were measured, using a Mini-Rae 2000 Photoionizer.

III. Findings and Results

General Observations

- Classrooms were occupied by an average 6 to 16 students at the time of assessment.
- Windows position varied substantially between classrooms and between buildings. On average 1 of 4-6 windows were open in each classroom.
- There were no indications of unusual accumulations of dust or debris in any areas.
- There were no mold-like or musty odors present, and no evidence of unusual mold growth in the areas inspected.
- Unit ventilators in 99% of classrooms throughout the district were operating at the time of inspection.

Air Monitoring Findings

- Outdoor air was measured to contain approximately 425 to 450 parts per million carbon dioxide with temperature at 51 to 62^{o}F. Relative humidity ranged between 35 to 62% over the inspection period.
- The average carbon dioxide level in all classrooms monitored was 742 parts per million; lower than to the PEOSHA guideline of 1000 ppm and the ASHRAE guideline of 700 ppm above outdoor levels.
- There were no elevations in carbon monoxide or volatile organic compounds detected in any of the classrooms monitored.
- Temperature and relative humidity were within the PEOSH recommended range in most areas tested, averaging 72@ 33% RH, and considered normal.
- A few rooms in particular schools contained slightly elevated carbon dioxide levels exceeding 1,000 parts per million, suggesting a need to inspect unit ventilator fan speed and/or outdoor air damper position as described in the PEOSHA indoor air quality standard.
- Carbon dioxide levels in classroom trailers at Terrill and Park Middle School were generally higher than CO_2 levels in regular classrooms indicating a need to upgrade HVAC airflow capacity in these areas. A recommendation for more detailed evaluation of trailer HVAC systems is contained at the end of this report. We are prepared to assist with this at your earliest opportunity.

A summary of inspection findings and air quality results is displayed in Table #1 below.

TABLE #1 - Summary –Findings by Building – Scotch Plains – Fanwood Schools
November 2021 IAQ Assessment

	Total Rooms inspected	Rooms with CO_2 levels greater than 1000ppm	Water damaged ceiling tiles rooms	Average CO_2 levels (center of room)	Average CO_2 levels (Unit ventilator supply)	Average Temperature (°F)	Average Relative Humidity (%)	Average number of windows open	Average number of windows	Average number of students present	Estimated visual student capacity
Scotch Plains - Fanwood High School	71	1	0	631	539	72	27	0	2	6	23
Evergreen Elementary	24	1	0	596	546	72	26	1	4	10	19
Coles Elementary	35	2	0	722	636	71	28	1	3	13	20
Terrill Middle School	31	10	4	900	662	72	32	1	5	16	24
McGinn Elementary	14	2	0	746	654	70	35	1	4	10	25
Malcolm E. Nettingham Middle School	46	10	1	827	666	72	40	1	4	11	22
School One Elementary	23	0	0	697	533	72	41	1	2	8	20
Brunner Elementary	26	8	0	815	725	73	38	1	4	13	20
Total	270	34	5	-	-	-	-	-	-	-	-
Average (All Buildings)	34	4	1	742	620	72	33	1	4	11	22

Detailed classroom findings and recommendations are contained in the Appendix at the end of this report.

IV. Conclusions and Recommendations

The November 2021 routine Indoor Air Quality Assessment of the Scotch Plains – Fanwood schools revealed that fresh air supply was within normal ranges in accordance with PEOSHA, CDC and NJ Department of Education guidelines for COVID-19 transmission risk reduction in each of the 8 schools inspected. There were no musty odors, no widespread visible water damage, and no visible mold contamination observed. There were no elevations in carbon monoxide or Volatile Organic Compounds. Temperature and relative humidity were with normal ranges given outdoor conditions at each of the schools. Based upon these findings the following recommendations should be considered:

Recommendations

1. Unit ventilators in particular classrooms as shown in schools-specific Tables at the end of this report should be inspected for airflow rates and/or fresh air damper position.
2. Upgrades to HVAC systems in classroom trailers to increase outdoor air delivery rates should be prioritized. We are prepared to assist you with more detailed evaluation and specification development for these trailers.
3. Teachers should be encouraged to open as many windows as is feasible given outdoor temperature and humidity conditions.
4. Replace water-damaged ceiling tiles where indicated.

Thank you for the opportunity to assist you with the evaluation. Our next round of routine air quality monitoring will be scheduled for January 2021. Please contact me with any questions at (856)764-3557.

Sincerely,

Richard M. Lynch

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