April 2, 2021

Joe Crelier, Director–Risk Management
Portland Public Schools
501 N Dixon Street
Portland, Oregon

Via email: jcrelier@pps.net

Regarding: COVID Response Indoor Air Quality Testing Report
Markham Elementary School
10531 SW Capitol Highway
Portland, Oregon
PBS Project 25000.138

Dear Mr. Crelier:

On March 18, 2021, PBS Engineering and Environmental Inc. (PBS) performed indoor air quality testing in Markham Elementary School located at the address above. These services were provided to Portland Public Schools (District) to measure air quality parameters before schools and district-owned buildings are opened again for reoccupancy.

As part of these indoor air quality testing services, PBS measured carbon monoxide (CO), carbon dioxide (CO_2), temperature in degrees Fahrenheit (°F), relative humidity (%RH), and airborne particulate (PM2.5 and PM10). Additionally, PBS reviewed and inventoried accessible components of the test rooms' heating, ventilation, and air conditioning (HVAC) systems

Based on PBS' findings, six rooms tested below the recommended range for indoor temperatures. At the time of the investigation, school was not in session and HVAC systems may not have been in full operation. These rooms should be monitored for temperature complaints. The results of the testing and assessment indicates that indoor air quality in the building is good and that the building is acceptable for occupancy.

While PBS observed no measurable indoor air quality concerns in any of the rooms that were tested, PBS did not test every occupiable room in each building. This investigation has been performed in concert with a concerted effort on the part of the District to perform regular inspections and repair of all HVAC mechanical systems throughout the District. Additionally, it is the District's policy that rooms without adequate ventilation will not be utilized moving forward.

VENTILATION PARAMETERS AND AIRBORNE PARTICULATE MONITORING

PBS took spot measurements of ventilation parameters in approximately 20% of the classrooms, offices, and common areas in the building (or each building). The readings were compared to recommendations in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality.

PBS used a TSI VelociCalc 9565 ventilation meter to measure temperature, %RH, CO, and CO_2. A TSI Aerotrak 9306-V2 optical particle counter was used to measure airborne particulate. The table below summarizes the results of the testing. Readings above or below the ASHRAE recommendations are shown in bold.

IAQ Testing Results

Room	CO	CO_2	Temp. (°F)	%RH	PM2.5	PM10	HVAC
Outdoor Air (Pre)	1.1	437	54.1	57.7	0.018	0.005	N/A
Room 100	0.0	485	**66.5**	45.3	0.005	0.003	Operable Windows, Unit Ventilator
Room 105	0.0	453	**67.2**	40.8	0.004	0.002	Supply Air
Room 115	0.0	460	**67.3**	40.5	0.000	0.000	Supply and Return Air, Operable Windows, Radiant Heat
Auditorium	0.0	450	68.9	39.2	0.000	0.000	Supply and Return Air
Office 120	0.0	458	68.2	37.3	0.007	0.004	Supply Air
Room 132	0.0	452	69.0	38.0	0.003	0.001	Supply Air
Staff Kitchen 120	0.0	466	69.3	37.5	0.008	0.005	Supply and Return Air
Staff Lounge 138	0.0	448	69.8	38.0	0.004	0.002	Supply and Return Air, Air Purifier
Main Office	0.0	449	69.9	36.4	0.003	0.002	Supply and Return Air
Gym	0.0	450	70.8	37.4	0.023	0.010	Supply and Return Air, Radiant Heat
Physical Education	0.0	497	**67.5**	38.9	0.001	0.000	Supply and Return Air
Industrial Arts	0.0	456	**65.6**	41.8	0.010	0.008	Supply and Return Air
Room 164	0.0	452	**65.6**	45.7	0.006	0.003	Supply and Return Air
Room 170	0.0	445	66.2	41.5	0.003	0.001	Supply and Return Air, Operable Windows
Cafeteria	0.0	451	71.3	39.0	0.004	0.002	Supply and Return Air, Operable Windows
Outdoor Air (Post)	1.5	433	59.7	45.5	0.013	0.002	N/A

CO and CO_2 are presented in parts per million (ppm)
°F: degrees Fahrenheit
%RH: relative humidity
PM: particulate matter
HVAC: visible heating, ventilation, and air conditioning components

CARBON MONOXIDE

CO is produced from the incomplete combustion of carbon-containing fuels, including gasoline, heating oil, and natural gas. CO encountered in a classroom or office environment would likely be the result of proximity to motor vehicles or a malfunctioning heating system exhaust. While ASHRAE recommends that CO levels indoors should not exceed 9 parts per million (ppm), any sustained measurable amount of CO should be investigated.

CARBON DIOXIDE

CO_2 is a normal constituent of exhaled breath and indoor concentrations depend on the number of occupants, duration of occupancy, and air exchanges in a given space. ASHRAE recommends maintaining indoor CO_2 concentrations at less than approximately 1,200 ppm. Given that the building had only limited occupancy during the testing, the reported concentrations are not reflective of conditions during full occupancy.

TEMPERATURE

ASHRAE recommends maintaining indoor temperatures between 68 and 76°F.

RELATIVE HUMIDITY

ASHRAE recommends maintaining relative humidity indoors below 60%. Relative humidity indoors is difficult to regulate and is largely reflective of outdoor conditions.

AIRBORNE PARTICULATE

PM2.5

Airborne particulate matter was measured to assess the effectiveness of the buildings ventilation filtration system. ASHRAE recommends that ambient airborne particulate matter concentrations, measured as PM2.5, should meet National Ambient Air Quality Standards (NAAQS) which for PM2.5 which is 0.035 milligrams per cubic meter of air (mg/m^3) as measured and averaged over a period of 24 hours.

PM10

Airborne particulate matter was measured to assess the effectiveness of the buildings ventilation filtration system. ASHRAE recommends that airborne particulate matter concentrations, measured as PM10, should meet NAAQS which for PM10 which is 0.150 mg/m^3 as measured and averaged over a period of 24 hours.

HVAC

Gymnasium and cafeteria are served by a fan unit. Classrooms are served by fan units. The addition has fan unit and unit ventilators.

RECOMMENDATIONS

PBS did not observe any rooms that had neither operable windows nor an obvious mechanical or gravity ventilation system. PBS has no recommendations concerning ambient air quality at this time.

LIMITATIONS OF SCOPE

This study was limited to the tests and locations as indicated above. The site as a whole may have other environmental concerns that will not be characterized by this study. The findings and conclusions of this work are not scientific certainties but probabilities based on professional judgment concerning the significance of the data gathered during the course of this investigation. PBS is not able to represent conditions on the site or adjoining sites beyond those detected or observed by PBS.

PBS respectfully submits these results of our indoor air quality investigation. Please feel free to contact me at 503.313.9061 or wayne.sehman@pbsusa.com with any questions or comments.

Sincerely,

Digitally signed by
Wayne Sehman
Date: 2021.04.02
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Wayne Sehman
Project Manager

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