



August 4, 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
Lincoln High School
1600 SW Salmon Street
Portland, Oregon
PBS Project 25000.138

Dear Mr. Crelier:

On June 16, 2021, PBS Engineering and Environmental Inc. (PBS) performed indoor air quality testing in Lincoln High 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 (CO₂), 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, three rooms tested above the recommended ambient airborne particulate concentrations; however, when compared to the ambient outdoor concentrations these results do not present an actionable condition. 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 CO₂. 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
Outdoors (Pre)	0.0	484	66.7	52.8	0.049	0.021	N/A
Student Services	0.0	525	67.1	58.6	0.087	0.044	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Main Office	0.0	502	69.3	54.0	0.044	0.018	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Counseling Office	0.0	482	69.6	55.7	0.022	0.009	Supply and Return, Air Purifier
Auditorium	0.0	502	70.3	50.7	0.015	0.003	Supply and Return, Air Purifier
Classroom 137	0.0	488	70.2	50.2	0.011	0.006	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Classroom 145	0.0	484	69.8	51.0	0.005	0.002	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Main Gymnasium	0.0	509	70.7	51.3	0.016	0.009	Supply and Return
Nurse/Athletics	0.0	488	70.2	49.2	0.007	0.004	Supply and Return
Room 120	0.0	482	70.1	49.7	0.007	0.002	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 123	0.0	486	69.6	50.7	0.016	0.006	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 214	0.0	506	69.4	50.5	0.008	0.003	Supply and Return, Operable Windows, Air Purifier, Radiant Heat

Room	CO	CO ₂	Temp. (°F)	%RH	PM2.5	PM10	HVAC
Room 216	0.0	482	70.0	50.4	0.007	0.002	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 218	0.0	502	69.9	49.8	0.031	0.015	Supply and Return, Operable Windows, Air Purifier, Radiant Heat, Hood
Room 237	0.0	478	70.1	49.4	0.008	0.003	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 224	0.0	497	71.3	50.3	0.035	0.021	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 230	0.0	489	71.3	48.3	0.012	0.003	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 232	0.0	492	71.0	48.8	0.014	0.008	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 109	0.0	466	69.9	50.1	0.041	0.019	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Room 106	0.0	475	70.8	49.4	0.005	0.001	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Library	0.0	471	70.7	47.0	0.021	0.005	Supply and Return, Operable Windows, Air Purifier, Radiant Heat
Cafeteria	0.0	489	71.3	50.2	0.023	0.013	Supply and Return, Air Purifier
Room 9	0.0	495	71.5	50.8	0.004	0.004	Supply and Return, Air Purifier
Room 6	0.0	493	71.3	53.7	0.000	0.000	Supply and Return, Air Purifier

Room	CO	CO ₂	Temp. (°F)	%RH	PM2.5	PM10	HVAC
Room 11	0.0	491	71.5	49.8	0.061	0.028	Supply and Return, Air Purifier
Room 5	0.0	471	71.2	46.7	0.006	0.002	Supply and Return, Air Purifier, Air Conditioner
Room 71B	0.0	494	71.7	48.9	0.004	0.000	Supply and Return, Air Purifier
Room 13	0.0	472	72.5	44.2	0.014	0.005	Supply and Return, Operable Windows, Air Purifier, Radiant Heat, Air Conditioner
Outdoors (Post/Pre)	0.0	464	68.3	45.5	0.058	0.030	N/A
Portable 2B	0.0	480	74.0	46.8	0.007	0.001	Supply and Return, Operable Windows, Air Purifier
Portable 2A	0.0	474	72.5	48.8	0.005	0.002	Supply and Return, Operable Windows, Air Purifier
Portable 1A	0.0	496	71.4	49.7	0.060	0.031	Supply and Return, Operable Windows, Air Purifier
Portable 1B	0.0	515	71.4	48.0	0.011	0.003	Supply and Return, Operable Windows, Air Purifier
Outdoors (Post)	0.0	473	71.6	44.2	0.041	0.018	N/A

CO and CO₂ 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

CO₂ 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 CO₂ 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 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 is $0.150 \text{ mg}/\text{m}^3$ as measured and averaged over a period of 24 hours.

HVAC

Classrooms are served by penthouse fans. In addition, classrooms are served by two large fans. The main office is served by a separate fan unit. Health services, the gymnasium, auditorium, media center, and kitchen all have their own separate fan units. In addition, the cafeteria is served by small variable air volume units.

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: 2021.08.04
11:57:49 -07'00'

Wayne Sehman
Project Manager

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