



March 23, 2018

To: Waverly Elementary School

From: Christopher Madden, CIH
Indoor Environmental Quality Manager

Re: Indoor Air Quality Testing During Renovations - February

As Waverly Elementary School is currently undergoing renovations, the Howard County Public School System's Office of the Environment is conducting weekly Indoor Air Quality Testing to determine if renovation activities are adversely impacting the IAQ in areas located in close proximity to the renovation. The Office of the Environment visited Waverly Elementary on February 23 and 28, 2018. The Office of the Environment observed the engineering controls in place to limit construction related constituents from migrating into occupied areas of the school and collected measurements of temperature, relative humidity, carbon dioxide, carbon monoxide, volatile organic compounds, and particulate matter.

General Observations

February 23, 2018

Construction activities varied during the assessment. Most notably, demolition of a block wall was occurring. Other various trades were also performing various tasks. The Office of the Environment observed that the construction containment (from floor to drop-ceiling) was in place with seams duct taped. The poly-sheeting (on the construction side) used to create a secondary barrier had been torn down. The construction superintendent was contacted to re-install the poly-sheeting and install a negative air machine in close proximity to the construction barrier.

Visible emissions were not observed in the school in the vicinity of the construction containment.

February 28, 2018

Limited construction activities were being conducted. Most notable, a welding or torch cutting odor was observed in the construction area. The odor was not observed within the school. The damaged poly-sheeting noted on February 23 has been repaired and a negative air machine was in place.

Visible emissions were not observed in the school in the vicinity of the construction containment.

General Indoor Air Quality Measurements

Temperature, Relative Humidity, Carbon Dioxide (CO₂), Carbon Monoxide (CO), and Volatile Organic Compound (VOC) readings were collected as part of the IAQ assessment.

The American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) recommends a temperature range of 68.5 to 75 degrees Fahrenheit (F) in the winter and 75 to 80.5 degrees F in the summer (assuming 50% relative humidity) (Indoor Environmental Quality 2015). The recommended temperature ranges vary slightly depending on relative humidity.

To prevent mold growth, The Environmental Protection Agency (EPA) recommends relative humidity should be maintained below 60%, ideally between 30-50%. Humidity readings below 30% are often encountered in buildings where humidity is not introduced through the Heating Ventilation and Air Conditioning (HVAC) system.

Carbon Dioxide measurements can provide a general sense of the adequacy of the ventilation system. It is recommended that CO₂ readings be less than 700 parts per million (ppm) plus the outside concentration of CO₂.

Carbon Monoxide can be introduced through incomplete combustion (car exhaust, improperly ventilated boilers, etc.) and should not exceed 9 ppm.

“Low levels of VOCs are ubiquitous in indoor and outdoor air from both natural and man-made sources (The IAQ 2016). VOCs can be introduced by a variety of indoor (paints, perfumes, art products, building materials, carpet, furnisher, etc.) and outdoor sources (vehicles, manufacturing emissions, etc.). A “spike” is identified when indoor readings are significantly higher than the outdoor readings.

Temperature, Relative Humidity, CO₂, and CO data was collected using a TSI IAQ Calc (Model #7545). VOC data was collected using a Rae ToxiRae Pro Photoionization Detector (PID) (Model #PGM-1800).

Below are the results of the temperature, relative humidity, CO₂, and CO measurements collected.

Table I - General IAQ Measurements – February 23, 2018

Location	Temperature (F)	Relative Humidity (%)	CO ₂ (ppm)	CO (ppm)	Total VOCs (ppm)
Outside	51.0	54.6	396	0.2	0.1
Lobby	61.3	53.6	681	0.0	0.2
Hallway Outside of Health Suite	69.1	53.6	626	0.1	0.0
A123	69.7	43.0	977	0.1	0.0
Gymnasium Hallway	71.7	39.2	786	0.0	0.0
1 st Floor Addition	70.4	32.9	521	0.0	0.0
Construction Containment	52.6	68.4	485	0.0	0.0
Outside	45.8	63.0	384	0.0	0.0

Note: Bolded values were not within recommended limits.

Table II - General IAQ Measurements – February 28, 2018

Location	Temperature (F)	Relative Humidity (%)	CO ₂ (ppm)	CO (ppm)	Total VOCs (ppm)
Outside	65.8	27.0	402	0.0	0.0
Lobby	71.6	25.3	668	0.0	0.0
Hallway Outside of Health Suite	71.5	25.3	668	0.0	0.0

Table II (Continued) - General IAQ Measurements – February 28, 2018

Location	Temperature (F)	Relative Humidity (%)	CO ₂ (ppm)	CO (ppm)	Total VOCs (ppm)
A123	70.7	28.7	704	0.0	0.0
A125	70.3	29.2	745	0.0	0.0
Health Suite	71.2	27.9	754	0.0	0.0
1 st Floor Addition	70.3	29.2	800	0.2	0.0
Outside	68.6	27.6	395	0.0	0.0

Particulate Matter Measurements

Particulate matter “is a complex mixture of extremely small particles and liquid droplets that get into the air (Particulate 2017). The data collected does not distinguish between types of particles in the air which can include pollen, skin cells, soil, human/animal hairs, etc. Particles designated as “respirable” are less than 10 micrometers (µm) in diameter and typically fall into two categories, coarse and fine particles. Coarse particles are those that are less than 10 µm (PM₁₀) and fine particles are those less than 2.5 µm (PM_{2.5}). ANSI/ASHRAE standard 62.1-2016 suggests target indoor concentration for PM_{2.5} and PM₁₀ of 12 and 50 µg/m³ respectively.

Particulate matter data was collected with a TSI AeroTrak Particle Counter (Model #9306-V2). Note that the particle counter is not capable of collecting PM_{2.5} data. Due to this limitation, PM_{3.0} data is used. This would provide a more conservative, overestimate of PM_{2.5}.

Table III - Particulate Matter Measurements – February 23, 2018

Location	PM _{0.5}	PM _{1.0}	PM _{3.0}	PM _{5.0}	PM _{10.0}
Outside	3	5	8	13	29
Lobby	5	13	56	158	488
Hallway Outside of Health Suite	4	9	29	73	237
A123	3	8	34	103	370
Gymnasium Hallway	3	7	25	73	242
1 st Floor Addition	1	1	1	2	3
Containment	5	179	184	760	3,254
Outside	3	4	6	8	11

Table IV - Particulate Matter Measurements – February 28, 2018

Location	PM _{0.5}	PM _{1.0}	PM _{3.0}	PM _{5.0}	PM _{10.0}
Outside	0	0	3	7	17
Lobby	0	0	1	5	22
Hallway Outside of Health Suite	0	0	1	4	17
A123	0	0	1	3	9
A125	0	0	1	3	14
Health	0	0	3	9	30
1 st Floor Addition	0	0	1	7	32
Outside	0	1	3	8	24

Discussion

February 23, 2018

Temperatures were slightly lower than recommended levels in the lobby. This was likely due to individuals moving in and out of the building during the sampling period. The temperature in the lobby does not appear to be a concern as the other temperatures measured within the school are within the ASHRAE recommended levels.

The temperature and relative humidity levels within the construction containment do not represent a concern as the construction area is open to the outside and the ventilation system is not currently operating.

February 28, 2018

No concerns were identified in association with the data collected on February 28, 2018.

Conclusion

Based on the assessment conducted on February 23, 2018 dust control measures needed improvement. The Office of Construction was contacted and the poly-ethylene sheeting within the construction area was re-attached and a negative air machine was placed in the containment. The assessment that occurred on February 28, 2018 indicated that measures are being taken to reduce dust and odors from migrating to occupied areas of the school. Regarding dust, it should be noted that elevated concentrations are expected and would not necessarily be associated with construction activities. Dust levels are expected to vary overtime based on student and staff activities.

It should be noted that the sampling is not being conducted for Occupational Safety and Health Administration (OSHA) compliance, in association with the renovation/construction contractors.

References

Indoor Environmental Quality, the National Institute for Occupational Safety and Health/Centers for Disease Control and Prevention, September 1, 2015. Retrieved from: <https://www.cdc.gov/niosh/topics/indoorenv/temperature.html>

The IAQ Investigator's Guide, 3rd Edition, American Industrial Hygiene Association, Edited by Ellen C. Gunderson, CIH, CSP, 2016.

Particulate Matter (PM) Pollution, Environmental Protection Agency, Last Updated on August 21, 2017. Retrieved from: <https://www.epa.gov/pm-pollution>

Volatile Organic Compounds (VOC) Criteria for New Construction White Paper, American Industrial Hygiene Association, March 15, 2017.