Aria Environmental, Inc.
INDUSTRIAL HYGIENE & SAFETY CONSULTANTS

February 24, 2017

Mr. Jeff Klenk
Howard County Public School System (HCPSS)
10910 Route 108
Ellicott City, MD 21043

RE: Indoor Air Quality Assessments during Renovations at Patuxent Valley Middle School
Project #J15-877

Dear Mr. Klenk,

Aria Environmental, Inc. (AE) is pleased to present this report of findings for indoor air quality assessments conducted at Patuxent Valley Middle School (PVMS). In response to a complaint about dust in Room 107, AE visited to PVMS on January 11, 2017 in order to monitor indoor air quality that may be affected by the current major renovation of the school. The visit included work site observations, and real time measurements for particles, volatile organic compounds (VOCs) and indoor air quality parameters (temperature, humidity, carbon monoxide (CO) and carbon dioxide (CO_2)). This assessment was performed by Brian Sciorilli and Tony Schwegmann of AE. The observations and recommendations made during this visit to PVMS and presented below are based upon conditions readily observed on the reported date.

Particles

Particulate matter or PM is the term for a mixture of solid particles and liquid droplets found in the air. It does not distinguish between the types of particles in the air (e.g., pollen, skin cells, soil, etc.). Particulate matter includes "inhalable coarse particles," with diameters larger than 2.5 micrometers and smaller than 10 micrometers (PM 10) and "fine particles," with diameters that are 2.5 micrometers and smaller (PM 2.5). A micrometer is also called a micron and is one millionth of a meter. To put these particle diameters in perspective, the average human hair is about 70 micrometers in diameter – making it 30 times larger than the largest fine particle. Particle loads expected to be a part of the school environment include carpet and clothing fiber, soil tracked from outside, paper dust and dust and fibers from building materials.

ASHRAE Standard 62.1–2010 suggests target indoor concentrations for PM 2.5 and PM 10 of 15 µg/m^3 and 50 µg/m^3, respectively. These concentrations are taken from the EPA's National Ambient Air Quality Standards (NAAQS) based on annual arithmetic means deemed acceptable for outdoor air quality. Occupational standards and guidelines for particles are nearly an order of magnitude higher than concentrations typically found in non-occupational settings and are not appropriate for comparison. Particle measurements were taken with an Aerocet 531 particulate monitor. The particle monitor takes a two minute averaged sample of particle concentrations in 5 size fractions (PM 1, PM 2.5, PM 7, PM 10 and total suspended particles (TSP)). Results of particulate monitoring are presented in Tables 1.

Table 1 – Results of Particulate Monitoring Patuxent Valley Middle School on January 11, 2017

Location	Time	PM1 (µg/m^3)	PM2.5 (µg/m^3)	PM7 (µg/m^3)	PM10 (µg/m^3)	TSP (µg/m^3)
Room 107	07:17	0	0	0	0	2
Room 107	07:21	0	0	0	0	1

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Location	Time	PM1 (µg/m³)	PM2.5 (µg/m³)	PM7 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)
Hall Outside 124	07:25	0	0	12	15	26
Near entrance to Construction	07:28	0	2	25	**88**	208

Bold-faced results indicate results above target concentrations.

The PM 2.5 particle concentrations ranged from 0 to 2 µg/m³ and PM10 particle concentrations ranged from 0 to 88 µg/m³. Particle concentrations were below the target concentrations in all areas monitored with the exception of the PM10 measurement at the entrance to construction near Room 128 and a back exit door to the outside (88 µg/m³). Sampling was conducted prior to the start of the school day.

Indoor Air Quality Measurements

Industry guidelines or standards for seasonal temperature and humidity ranges for thermal comfort are established by the American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) standard 55-2013. These ranges are presented in Table 3. The U.S. Environmental Protection Agency (EPA) recommends maintaining indoor relative humidity below 60% and ideally between 30 and 50%. Low humidity is expected in buildings that do not add humidity during the heating season. The comfort ranges are only set for the Summer and Winter seasons when temperatures are usually consistent. There are no Fall or Spring ranges because these seasons can include both heating and cooling modes of HVAC operation. Results of temperature, relative humidity, carbon dioxide and carbon monoxide monitoring are presented in Table 4.

Table 3- Acceptable Ranges of Temperature and Relative Humidity in Summer and Winter[a]

Relative Humidity	Winter Temperature	Summer Temperature
30%	68.5°F – 76.0°F	74.0°F – 80.0°F
40%	68.5°F - 75.5°F	73.5°F – 79.5°F
50%	68.5°F - 74.5°F	73.0°F – 79.0°F
60%	68.0°F - 74.0°F	72.5°F – 78.0°F

[a]adapted from ASHRAE Standard 55-2013

Carbon dioxide and carbon monoxide measurements are used to assess ventilation system performance. The exhaled breath of building occupants is the main indoor source of carbon dioxide; therefore, the build-up of carbon dioxide indicates inadequate ventilation.

Table 4 – Results of Indoor Air Quality (IAQ) Measurements at Patuxent Valley Middle School on January 11, 2017

Location	Time	Temperature (°F)	Relative Humidity (Rh)(%)	Carbon Monoxide (CO)	Carbon Dioxide (CO_2)
Room 107	07:17	68.6	**23.3**	0	453
Room 107	07:21	69.3	**23.4**	0	351
Hall Outside 124	07:25	69.2	**25.2**	0	418
Near entrance to Construction	07:28	69.2	**26.2**	0	421
Outside at Front Entrance	07:30	57.1	**25.2**	0	348

Bold-faced indicates results outside of recommended comfort ranges or target concentrations.

The indoor temperatures for January 11, 2017 ranged from 68.6°F to 69.2°F. Measurements in classrooms and occupied areas of the school were acceptable compared to the comfort ranges. No measurements were taken within the construction area. Indoor relative humidity measurements on January 11, 2017 were all between 23.3% and 26.2% which is below the recommended range of 30 to 60%. Low humidity is expected during the heating season in buildings that do not add humidity.

Carbon dioxide concentrations ranged from 351 to 453 ppm indoors. The concentration of concern for carbon dioxide is set by ASHRAE standard 62.1 as 700 ppm above outdoor air. On the day of monitoring, the outdoor air concentration of carbon dioxide was 348 ppm; therefore, concentrations were within the parameters in all areas monitored.

Carbon monoxide is mainly attributed to incomplete combustion. Concentrations of CO were consistently 0.0 ppm for all indoor and outdoor locations monitored and therefore, below the ASHRAE concentration of concern (9 ppm).

Conclusions and Recommendations

Based upon our observations and sampling results on January 11, 2017 at Patuxent Valley Middle School (PVMS), particle measurements in Room 107 were very low and no dust accumulation was observed on surfaces in Room 107. Room 107 is on the opposite side of the building from where construction was occurring on the day of monitoring. Measurements close to the construction entrance were slightly above the guidelines for PM 10 particle concentrations (88 µg/m^3). Workers were not observed using this construction door but it had been used prior to the start of the school day and was not sealed. When possible, construction workers should only access the construction areas from outside the building. Any access doors on the occupied side of the building should have sticky mats on the floor and a poly-sheeting air lock entrance should be built to reduce the infiltration of dust into the occupied areas. A PM10 particle concentration of 88 µg/m^3 is not indicative of excessive activity and could have occurred because of one or two workers, students or teachers entering the building in that area of the school or from a small amount of dust blowing in from the exit door.

Thank you for choosing Aria Environmental, Inc. for your industrial hygiene consulting needs. Should you have any questions about the information contained herein, please do not hesitate to contact us at 410-549-5774.

Sincerely,
Aria Environmental, Inc.

Julie Barth, CIH, CSP, LEED Green Associate