Aria Environmental, Inc.
INDUSTRIAL HYGIENE & SAFETY CONSULTANTS

March 29, 2018

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

RE: Indoor Air Quality Assessments during Renovations at Waverly Elementary School
Project #J17-1037 (January 4, 12, 15, 25 and 29, 2018)

Dear Mr. Klenk,

Aria Environmental, Inc. (AE) is pleased to present this report of findings for indoor air quality assessments conducted at Waverly Elementary School (Waverly). Jeff Klenk of HCPSS requested AE make frequent visits to Waverly to monitor indoor air quality that may be affected by the current major renovation of the school. The visits discussed in this report were performed on January 4, 12, 15, 25 and 29, 2018 and included work site observations, and real-time measurements for particles, indoor air quality parameters (temperature, humidity, carbon monoxide (CO) and carbon dioxide (CO_2)) and volatile organic compounds (VOCs). These assessments were performed by Julie Barth, CIH, CSP, LEED Green Associate or Tony Schwegmann, Industrial Hygienist, of AE. Presented below are observations and recommendations made based upon conditions readily observed on the reported dates.

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 (PM10) and "fine particles," with diameters that are 2.5 micrometers and smaller (PM2.5). 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 in from outside, paper dust and dust and fibers from building materials.

ANSI/ASHRAE Standard 62.1–2016 suggests target indoor concentrations for PM2.5 and PM10 of 15 $\mu g/m^3$ and 50 $\mu g/m^3$, 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 (PM1, PM 2.5, PM 7, PM10 and total suspended particles (TSP)). Results of particulate monitoring are presented in Tables 1, 2, 3 and 4.

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Discussion of Particle Results for January 4, 2018
Particle measurements were not taken during the survey on January 4, 2018 because the particle monitor was out for calibration.

Discussion of Particle Results for January 12, 2018
The PM2.5 particle concentrations ranged from 0 to 27 µg/m^3 and PM10 particle concentrations ranged from 3 to 279 µg/m^3 in the hallways outside the construction zones and in non-construction areas. The school was occupied as usual for a normal school day. PM 2.5 concentrations were below the target concentration in all areas monitored outside of the construction area. PM 10 concentrations were above the target concentrations in one non-construction area location, with student activity nearby. It was reported by the construction superintendent that some demolition had been done over the weekend. Results of particulate monitoring are presented in Table 1.

Table 1 – Results of Particulate Monitoring Waverly Elementary School on January 12, 2018

Location	Time	PM1 (µg/m^3)	PM2.5 (µg/m^3)	PM7 (µg/m^3)	PM10 (µg/m^3)	TSP (µg/m^3)
Lobby	1:58 PM	0	1	4	8	17
Rm 115 (Band)	2:02 PM	0	6	39	**54**	71
Closet in Rm 115	2:13 PM	0	3	12	15	22
Hall at Containment near Rm 115	2:23 PM	0	3	17	28	55
Front Office	2:29 PM	0	1	8	21	40
Hall near Front Office	2:31 PM	0	1	3	4	5
Hall near A123	2:33 PM	0	2	6	17	33
Hall near Media Center	2:37 PM	0	1	8	12	18
Media Center	2:43 PM	0	1	6	10	16
Back Hall near B136	2:46 PM	0	1	4	6	8
Door at Containment	2:48 PM	0	0	3	11	26
Inside Construction Area	2:52 PM	3	**27**	187	**279**	369
Hall near Rm 115	3:05 PM	0	0	3	3	18
Rm 115	3:07 PM	0	3	20	32	54
Outside	3:10 PM	0	5	13	14	16

Bold-faced results indicate results above target concentrations.

Discussion of Particle Results for January 15, 2018
The PM2.5 particle concentrations ranged from 1 to 36 µg/m^3 and PM10 particle concentrations ranged from 9 to 1,042 µg/m^3. PM2.5 particle concentrations were below the target concentration in all locations measured outside the construction area. PM10 particle concentrations were above the target concentrations in three areas outside of the construction zone. The building was occupied as usual for a normal school day. Construction workers had opened a ceiling tile and were running wires above the ceiling tiles in the Media Center during the measurements inside the Media Center. Active excavation was taking place inside the containment. Results of particulate monitoring are presented in Table 2.

Table 2 – Results of Particulate Monitoring Waverly Elementary School on January 15, 2018

Location	Time	PM1 (µg/m³)	PM2.5 (µg/m³)	PM7 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)
Rm 115 (Band)	12:35 PM	0	2	13	17	23
Hall near Containment and RM 115	12:38 PM	0	1	7	9	13
Front Office	12:40 PM	0	2	15	18	20
Hall near Front Office and Containment	12:42 PM	0	4	32	41	52
Hall near Rm A123 and Containment	12:44 PM	0	5	27	33	37
Hall at Media Center	12:48 PM	0	1	6	9	9
Media Center	12:52 PM	1	11	70	**116**	146
Back Hall near B136	12:55 PM	1	5	35	**53**	71
Hall at door to Containment	12:58 PM	1	7	46	**94**	162
Inside Construction Area on Music Room Side	1:02 PM	0	**20**	101	**343**	783
Inside Construction Area near Active Excavation	1:05 PM	2	**36**	672	**1,042**	1,599
Outside	1:09 PM	3	5	15	18	21

Bold-faced results indicate results above target concentrations

Discussion of Particle Results for January 25, 2018

The PM2.5 particle concentrations ranged from 1 to 8 µg/m³ and PM10 particle concentrations ranged from 13 to 78 µg/m³. PM2.5 particle concentrations were below the target concentration in all locations measured outside the construction area. PM10 particle concentrations were below the target concentrations in all areas with the exception of the measurement taken in the hallway outside the main office and near the back containment door. The building was occupied as usual for a normal school day. Inside the construction containment, plastic sheeting was in place and well-sealed and two large air filters were operating to control dust. On the day of monitoring, construction workers were compacting soil and drilling concrete in certain areas. Results of particulate monitoring are presented in Table 3.

Table 3 – Results of Particulate Monitoring Waverly Elementary School on January 25, 2018

Location	Time	PM1 (µg/m³)	PM2.5 (µg/m³)	PM7 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)
Outside Main Office	11:00	0	5	38	**53**	82
Hall Near Room A123	11:03	0	6	37	49	67
Health Room – Back work bench	11:06	1	8	28	34	41
Health Room – Nurses Desk	11:09	0	7	29	36	43
Lobby	11:16	0	3	17	23	35
Room 115	11:18	0	2	10	15	21
Pod Center – B158	11:22	0	1	8	13	23
Hall Outside Media Center	11:24	0	2	18	27	49

Location	Time	PM1 (µg/m³)	PM2.5 (µg/m³)	PM7 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)
Media Center	11:36	0	3	14	20	30
Hallway Near A130	11:42	0	5	22	32	47
Back Containment	11:44	0	4	35	**78**	134
Outside	11:52	0	6	37	39	40

Bold-faced results indicate results above target concentrations

Discussion of Particle Results for January 29, 2018

The PM2.5 particle concentrations ranged from 0 to 2 µg/m³ and PM10 particle concentrations ranged from 1 to 21 µg/m³. PM2.5 and PM10 particle concentrations were below the target concentration in all locations measured outside the construction area. The building was occupied as usual for a normal school day. Results of particulate monitoring are presented in Table 4.

Table 4 – Results of Particulate Monitoring Waverly Elementary School on January 29, 2018

Location	Time	PM1 (µg/m³)	PM2.5 (µg/m³)	PM7 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)
Outside Main Office	14:38	0	1	11	21	44
Hall Near Room A123	14:40	0	0	5	16	41
Health Room	14:42	0	0	9	13	24
Lobby	14:45	0	1	7	12	22
Room 115	14:47	0	1	6	11	16
Pod Center – 155	14:51	0	0	0	1	1
Hall Outside Media Center	14:53	0	0	7	12	24
Media Center	14:55	0	2	8	12	17
Hallway Near C106	14:59	0	0	6	9	18
Back Containment	15:02	0	1	9	18	30
Outside	15:09	0	1	5	5	7

Bold-faced results indicate results above target concentrations

Indoor Air Quality Measurements

Industry guidelines or standards for seasonal temperature and humidity ranges for thermal comfort are established by the American National Standards Institute (ANSI) and the American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) standard 55-2013. These ranges are presented in Table 5. 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. 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. Results of temperature, relative humidity, carbon dioxide and carbon monoxide monitoring are presented in Tables 6-10 below.

Table 5- 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

Real Time Volatile Organic Compounds Measurements

Instantaneous measurements for volatile organic compounds (VOCs) were collected using a ppbRae 3000 monitor calibrated using isobutylene gas. This instrument is used as a screening tool for VOCs in general with a limit of detection of 1 ppb. VOCs include a variety of chemicals, some of which may cause adverse health effects. Concentrations of many VOCs are generally higher indoors than outdoors. VOCs are emitted by many common products including paints, paint strippers, cleaning supplies, building materials, furnishings, fuels, office equipment and supplies, glues, and permanent markers, as well as cosmetics, perfumes and other personal hygiene products. These products can release organic compounds while being used or stored. It is important to note that the measurements taken are instantaneous and are intended to aid the inspector in detecting potential sources of VOC contamination. A VOC source is suspected when the measured concentration is significantly higher than the outdoor concentration or if a spike in concentration is seen in one location compared to others. Results of VOC monitoring are also presented in Tables 6-10 below.

Discussion of IAQ and VOC Measurements for January 4, 2018

The indoor temperatures for January 4, 2018 ranged from 64.1°F to 69.3°F. Temperature measurements in classrooms and occupied areas of the school were within the recommended comfort ranges in all areas with a few exceptions. Indoor relative humidity measurements ranged from 11.9% to 21.0%. All locations were below the recommended range of 30 to 60%. Lower than normal relative humidity is expected in the winter season in buildings that do not add humidity to conditioned air.

Carbon dioxide concentrations ranged from 291 to 478 ppm within indoor occupied areas. The concentration of concern for carbon dioxide is set by ANSI/ASHRAE standard 62.1 as 700 ppm above outdoor air. On the day of monitoring, the outdoor air concentration of carbon dioxide was 311 ppm; therefore, concentrations were below the target concentration in all areas monitored. Measurements were made during a snow day when only construction workers were at the school.

Carbon monoxide is mainly attributed to incomplete combustion. Indoor concentrations of CO were 0.0 ppm in all locations measured with two exceptions where the concentration was 0.2 ppm. The outdoor concentration was 0.0 ppm. All measurements were below the ASHRAE concentration of concern (9 ppm).

Indoor concentrations of VOCs measured ranged from 0 to 19 ppb, and the outdoor measurement was 0 ppb. The measurements are considered low and do not indicate any obvious source of VOCs above a normal building background level. Results of IAQ and VOC monitoring are presented in Table 6.

Table 6 – Results of Indoor Air Quality (IAQ) Measurements at Waverly Elementary School on January 4, 2018

Location	Time	Temperature (°F)	Relative Humidity (Rh%)	Carbon Monoxide (CO)	Carbon Dioxide (CO_2)	Volatile Organic Compounds (VOCs)
Outside	3:07 PM	26.3	41.1	0	311	0
At New Containment Door in back of school	3:14 PM	**64.1**	**21.0**	0	478	0
Center of B140 Classroom Pod	3:17 PM	**67.0**	**11.9**	0	316	0
Hall near Media Center	3:18 PM	**67.5**	**14.9**	0	384	0
Media Center	3:19 PM	68.3	**16.8**	0	337	19
Center of B150 Classroom Pod	3:21 PM	68.4	**16.1**	0	342	0
Art Room	3:22 PM	69.3	**15.4**	0	331	0
Classroom 129	3:23 PM	69.4	**14.8**	0	294	0
Hall near A123 at New Containment Wall	3:24 PM	69.1	**14.8**	0	303	0
Front Lobby	3:25 PM	**65.8**	**13.7**	0.2	291	0
Hall near 115 at New Containment Wall	3:26 PM	**64.6**	**14.8**	0.2	321	0

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

Discussion of IAQ and VOC Measurements for January 12, 2018

The indoor temperatures for January 12, 2018 ranged from 68.6°F to 73.9°F. Temperature measurements in classrooms and occupied areas of the school were within the recommended comfort ranges. Indoor relative humidity measurements ranged from 51.1% to 75.5%. Nine of the locations measured were above the recommended range of 30 to 60%.

Carbon dioxide concentrations ranged from 475 to 1,240 ppm within indoor occupied areas. The concentration of concern for carbon dioxide is set by ANSI/ASHRAE standard 62.1 as 700 ppm above outdoor air. On the day of monitoring, the outdoor air concentration of carbon dioxide was 307 ppm; therefore, concentrations were below the target concentration in all areas monitored with the exception of Room 115 and outside the door to the construction containment in the back hallway. Measurements above the target range indicate inadequate ventilation in those areas. Measurements were made during a normal school day when the building was fully occupied.

Carbon monoxide is mainly attributed to incomplete combustion. Indoor concentrations of CO ranged from 0.0 to 0.9 ppm in all locations measured and the outdoor concentration was 0.3 ppm. All measurements were below the ASHRAE concentration of concern (9 ppm).

Indoor concentrations of VOCs measured on January 12, 2018 ranged from 0 to 567 ppb, and the outdoor measurement was 0 ppb. The librarian was using a large magic marker on drawings in the Media Center at the time of the measurements there. Overall, the measurements are considered low and do not indicate any obvious source of VOCs. Results of IAQ and VOC monitoring are presented in Table 7.

Table 7 – Results of Indoor Air Quality (IAQ) Measurements at Waverly Elementary School on January 12, 2018

Location	Time	Temperature (°F)	Relative Humidity (Rh%)	Carbon Monoxide (CO)	Carbon Dioxide (CO_2)	Volatile Organic Compounds (VOCs)
Lobby	1:58 PM	70.2	**75.3**	0.0	479	0-332
Rm 115 (Band)	2:02 PM	71.8	**62.9**	0.9	**1,240**	201-567
Closet in Rm 115	2:13 PM	72.7	54.3	0.9	928	88
Hall at Containment near Rm 115	2:23 PM	73.0	**65.1**	0.0	704	0
Front Office	2:29 PM	73.6	51.1	0.0	534	0
Hall near Front Office	2:31 PM	73.9	**63.9**	0.0	570	0
Hall near A123	2:33 PM	72.8	**62.5**	0.0	573	0
Hall near Media Center	2:37 PM	72.7	**64.1**	0.0	673	114
Media Center	2:43 PM	73.9	56.3	0.0	876	261
Back Hall near B136	2:46 PM	72.8	60.1	0.0	866	0
Door at Containment	2:48 PM	72.0	59.8	0.0	**1,038**	0
Inside Construction Area	2:52 PM	68.6	**75.5**	0.9	475	296
Hall near Rm 115	3:05 PM	72.2	**69.5**	0.0	695	0
Rm 115	3:07 PM	71.9	**62.7**	0.0	960	139
Outside	3:10 PM	65.8	80.6	0.3	307	0

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

Discussion of IAQ and VOC Measurements for January 15, 2018

The indoor temperatures for January 15, 2018 ranged from 67.3°F to 70.2°F. Temperature measurements in classrooms and occupied areas of the school were mostly within the recommended comfort ranges with the exception of the hall near Room 115. Indoor relative humidity measurements ranged from 16.7% to 20.1%. All indoor relative humidity measurements were below the recommended range of 30 to 60%. Lower than normal relative humidity is expected in the winter season in buildings that do not add humidity to conditioned air.

Carbon dioxide concentrations ranged from 341 to 550 ppm within indoor occupied areas. The concentration of concern for carbon dioxide is set by ANSI/ASHRAE standard 62.1 as 700 ppm above outdoor air. On the day of monitoring, the outdoor air concentration of carbon dioxide was 301 ppm; therefore, concentrations were below the target concentration in all areas measured. Measurements were made during a normal school day when the building was fully occupied.

Carbon monoxide is mainly attributed to incomplete combustion. Indoor concentrations of CO ranged from 0.0 to 0.3 ppm in all locations measured and the outdoor concentration was 2.1 ppm. All measurements were below the ASHRAE concentration of concern (9 ppm).

Indoor concentrations of VOCs measured on January 15, 2018 ranged from 0 to 91 ppb, and the outdoor measurement was 0 ppb. The measurements are considered low and do not indicate any obvious source of VOCs. Results of IAQ and VOC monitoring are presented in Table 8.

Table 8 – Results of Indoor Air Quality (IAQ) Measurements at Waverly Elementary School on January 15, 2018

Location	Time	Temperature (°F)	Relative Humidity (Rh%)	Carbon Monoxide (CO)	Carbon Dioxide (CO_2)	Volatile Organic Compounds (VOCs)
Rm 115 (Band)	12:35 PM	69.0	**20.1**	0.0	458	0
Hall near Containment and RM 115	12:38 PM	**67.3**	**17.7**	0.0	457	0
Front Office	12:40 PM	68.2	**16.7**	0.0	550	0
Hall near Front Office and Containment	12:42 PM	68.1	**17.6**	0.0	482	0
Hall near Rm A123 and Containment	12:44 PM	68.6	**17.3**	0.0	341	0
Hall at Media Center	12:48 PM	68.9	**17.1**	0.0	443	0
Media Center	12:52 PM	69.8	**18.9**	0.2	501	60-91
Back Hall near B136	12:55 PM	70.1	**16.9**	0.2	377	14
Hall at door to Containment	12:58 PM	70.2	**17.7**	0.3	446	45-82
Inside Construction Area on Music Room Side	1:02 PM	47.0	31.1	0.0	320	0
Inside Construction Area near Active Excavation	1:05 PM	55.4	38.6	1.1	770	300-500
Outside	1:09 PM	37.8	26.2	2.1	301	0

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

Discussion of IAQ and VOC Measurements for January 25, 2018

The indoor temperatures for January 25, 2018 ranged from 65.3°F to 69.7°F. Temperature measurements in classrooms and occupied areas of the school were below the recommended comfort ranges in five of the locations measured. Indoor relative humidity measurements ranged from 20.2% to 25.8% and were lower than the recommended range of 30 to 60% in all areas measured. Lower than normal relative humidity is expected in the winter season in buildings that do not add humidity to conditioned air.

Carbon dioxide concentrations ranged from 532 to 879 ppm within indoor occupied areas. The concentration of concern for carbon dioxide is set by ANSI/ASHRAE standard 62.1 as 700 ppm above outdoor air. On the day of monitoring, the outdoor air concentration of carbon dioxide was 334 ppm; therefore, concentrations were below the target concentration in all areas measured. Measurements were made during a normal school day when the building was fully occupied.

Carbon monoxide is mainly attributed to incomplete combustion. Indoor concentrations of CO were 0.0 ppm in all locations measured and the outdoor concentration was 2.0 ppm. All measurements were below the ASHRAE concentration of concern (9 ppm).

Indoor concentrations of VOCs measured on January 25, 2018 ranged from 0 to 737 ppb, and the outdoor measurement was 0 ppb. The measurements are considered low and do not indicate any obvious source of VOCs. Results of IAQ and VOC monitoring are presented in Table 9.

Table 9 – Results of Indoor Air Quality (IAQ) Measurements at Waverly Elementary School on January 25, 2018

Location	Time	Temperature (°F)	Relative Humidity (Rh%)	Carbon Monoxide (CO)	Carbon Dioxide (CO_2)	Volatile Organic Compounds (VOCs)
Outside Main Office	11:00	**65.3**	**25.4**	0.0	879	165
Hall Near Room A123	11:03	**65.7**	**24.3**	0.0	686	479
Health Room	11:06	**66.8**	**22.7**	0.0	532	737
Lobby	11:16	68.3	**20.2**	0.0	568	0
Room 115	11:18	**67.7**	**23.1**	0.0	685	200
Pod Center – B158	11:22	68.4	**24.5**	0.0	792	17
Hall Outside Media Center	11:24	69.6	**21.9**	0.0	665	0
Media Center	11:36	**66.0**	**25.8**	0.0	698	0
Hallway Near A130	11:42	69.0	**22.3**	0.0	708	506
Back Containment	11:44	69.7	**20.4**	0.0	593	0
Outisde	11:52	47.2	26.6	2.0	334	0

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

Discussion of IAQ and VOC Measurements for January 29, 2018

The indoor temperatures for January 29, 2018 ranged from 66.8°F to 71.2°F. Temperature measurements in classrooms and occupied areas of the school were mostly within the recommended comfort ranges with the exception of the hallway outside the main office. Indoor relative humidity measurements ranged from 26.0% to 33.4% and were mostly within the recommended range of 30 to 60% with some areas that were lower. Lower than normal relative humidity is expected in the winter season in buildings that do not add humidity to conditioned air.

Carbon dioxide concentrations ranged from 505 to 835 ppm within indoor occupied areas. The concentration of concern for carbon dioxide is set by ANSI/ASHRAE standard 62.1 as 700 ppm above outdoor air. On the day of monitoring, the outdoor air concentration of carbon dioxide was 315 ppm; therefore, concentrations were below the target concentration in all areas measured. Measurements were made during a normal school day when the building was fully occupied.

Carbon monoxide is mainly attributed to incomplete combustion. Indoor concentrations of CO were 0.0 ppm in all locations measured and the outdoor concentration was 1.9 ppm. All measurements were below the ASHRAE concentration of concern (9 ppm).

Indoor concentrations of VOCs measured on January 29, 2018 were 0 ppb in all areas, and the outdoor measurement was 0 ppb. The measurements are considered low and do not indicate any obvious source of VOCs. Results of IAQ and VOC monitoring are presented in Table 10.

Table 10 – Results of Indoor Air Quality (IAQ) Measurements at Waverly Elementary School on January 29, 2018

Location	Time	Temperature (°F)	Relative Humidity (Rh%)	Carbon Monoxide (CO)	Carbon Dioxide (CO_2)	Volatile Organic Compounds (VOCs)
Outside Main Office	14:38	**66.8**	32.8	0.0	785	0
Hall Near Room A123	14:40	68.0	**29.6**	0.0	505	0
Health Room	14:42	69.4	30.7	0.0	610	0
Lobby	14:45	69.4	**29.7**	0.0	595	0
Room 115	14:47	69.1	33.4	0.0	835	0
Pod Center – 155	14:51	70.1	32.2	0.0	692	0
Hall Outside Media Center	14:53	70.9	31.5	0.0	735	0
Media Center	14:55	71.2	31.3	0.0	810	0
Hallway Near C106	14:59	70.7	**26.2**	0.0	725	0
Back Containment	15:02	70.0	**26.0**	0.0	525	0
Outside	15:09	48.6	35.0	1.9	315	0

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

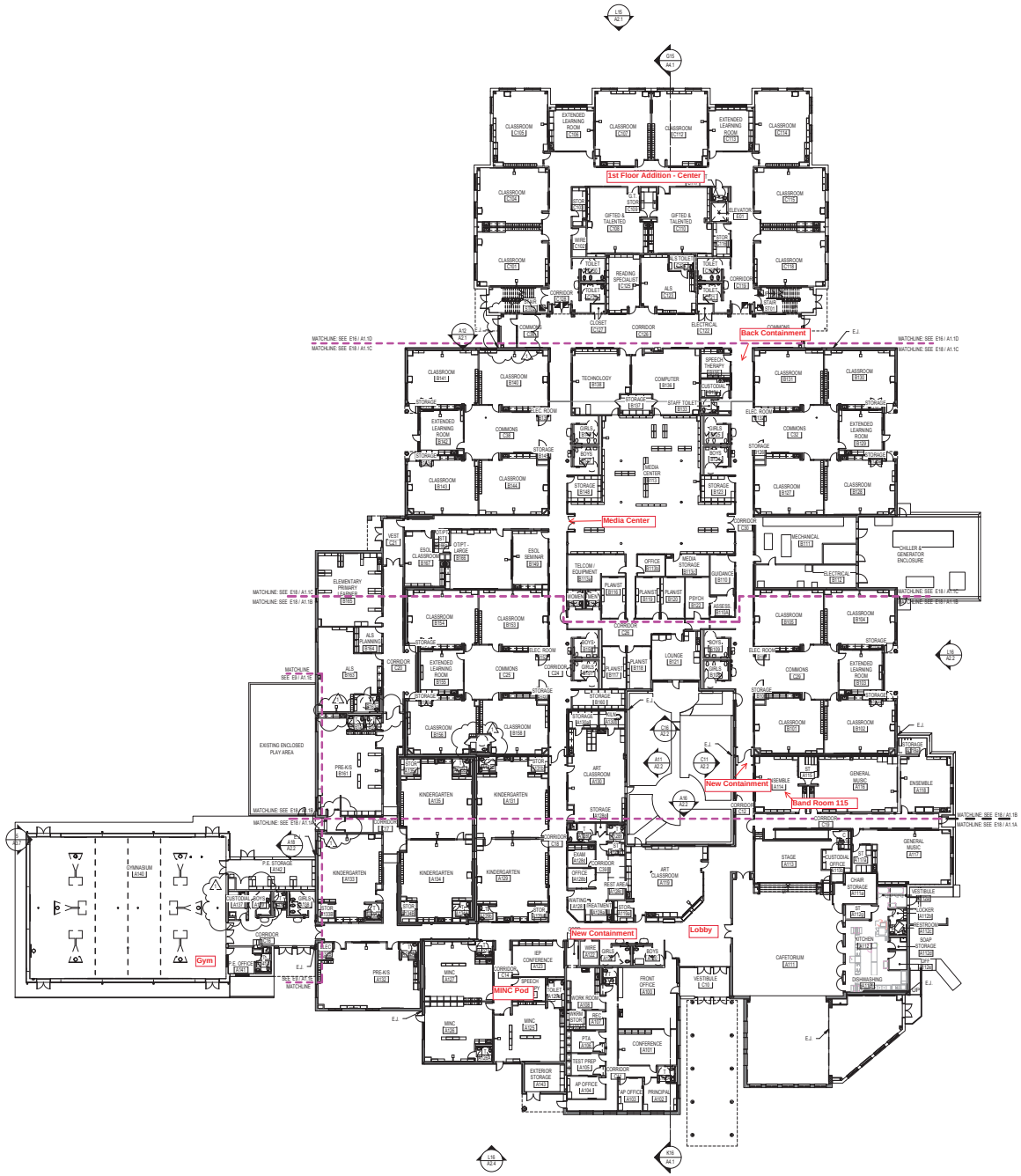
Conclusions and Recommendations

Based upon our observations and sampling results on January 4, 12, 15, 25 & 29, 2018 at Waverly Elementary School, measures are being taken to prevent construction dust and odors from entering the occupied areas of the school. Only a few measurements were above the recommended concentrations in a few areas during these five school visits. The school is fully occupied. Elevated concentrations are expected and are not entirely due to construction activities. The tiled floors were being kept clean of visible dust. Fluctuations of dust and VOC concentrations are influenced by the types of construction activities occurring and also by student and staff activities and are expected to vary over time. A floor plan with measurement locations for the school is attached.

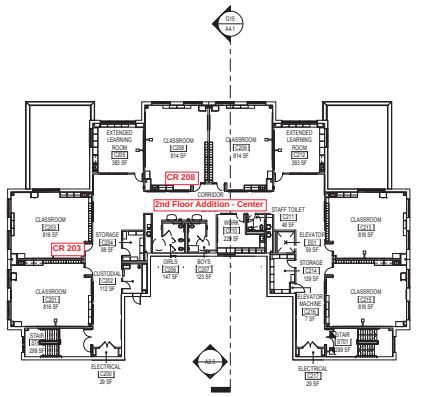
AE will continue to make weekly visits to Waverly Elementary School as requested. Thank you for choosing Aria Environmental, Inc. for your industrial hygiene consulting needs. Should you have any questions about the information contained herein, please do not hesitate to contact us at 410-549-5774.

Sincerely,
Aria Environmental, Inc.

Julie Barth, CIH, CSP, LEED Green Associate

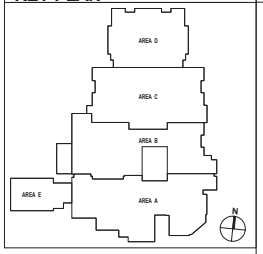


A15 OVERALL FIRST FLOOR PLAN
1" = 20'-0"
FIRST FLOOR 104,414 SF



A6 OVERALL SECOND FLOOR PLAN
1" = 20'-0"
SECOND FLOOR 11,328 SF

KEY PLAN



GENERAL NOTES

GENERAL NOTE APPLICABLE TO ALL DRAWINGS - ITEMS AND CONDITIONS DETAILED, NOTED OR OTHERWISE IDENTIFIED ON ONE OF THE SECTIONS OR DETAILS ARE APPLICABLE AND BINDING TO ALL OTHER SECTIONS AND DETAILS FOR IDENTICAL OR SIMILAR CONDITIONS.

1. ALL CONSTRUCTION AND WORK SHOWN ON THE COMPLETE SET OF DRAWINGS IS ASSUMED TO BE NEW AND FURNISHED AND INSTALLED BY THE CONTRACTOR.
2. IF A CONFLICT EXISTS BETWEEN DRAWINGS (AND/OR SPECIFICATIONS), THE MORE STRINGENT AND MORE COSTLY REQUIREMENT SHALL APPLY. ITEMS SHOWN ON THE DRAWINGS, BUT NOT SPECIFIED, SHALL APPLY AND BE FURNISHED AND INSTALLED BY THE CONTRACTOR. IF AN ITEM IS SHOWN ON THE DRAWINGS, BUT IS NOT INCLUDED IN THE SPECIFICATIONS, PROVIDE ITEM OF A QUALITY LEVEL CONSISTENT WITH THE GENERAL QUALITY LEVEL OF THE CONTRACT REQUIREMENTS. BRING CONFLICTS BETWEEN THE DRAWINGS AND SPECIFICATIONS TO THE ATTENTION OF THE ARCHITECT IMMEDIATELY.
3. WRITTEN INFORMATION TAKES PRECEDENT OVER DRAWING LINES. BRING CONFLICTS BETWEEN WRITTEN INFORMATION AND DRAWN LINES TO THE ATTENTION OF THE ARCHITECT IMMEDIATELY.
4. IF A CONFLICT EXISTS BETWEEN DRAWINGS OF DIFFERENT SCALES, CONSULT THE ARCHITECT FOR CLARIFICATION.
5. IN THE ABSENCE OF A WRITTEN DIMENSION, OR IN CASE OF DOUBT AS TO THE PROPER MEASUREMENT, CONSULT THE ARCHITECT FOR CLARIFICATION.
6. IF AN AREA OR SPACE IS SHOWN, BUT IS NOT CLEARLY DEFINED OR INDICATED BY NOTES, PROVIDE THE SAME MATERIALS AND FINISHES AS SCHEDULED OR DETAILED FOR AREAS OF SIMILAR USE ELSEWHERE IN THE BUILDING.
7. SECTIONS INDICATED ARE INTENDED TO SHOW THE SPECIFIC CONSTRUCTION WHERE REFERENCED AS WELL AS ESTABLISH THE GENERAL CONSTRUCTION DETAILS FOR SECTIONS THROUGHOUT THE PROJECT WHICH DO NOT HAVE SPECIFIC SECTIONS DRAWN. THE MOST SIMILAR SECTIONS SHALL BE ADAPTED TO ANY SECTIONS NOT DETAILED. ANY SPECIFIC QUESTIONS CONCERNING CONSTRUCTION NOT ADEQUATELY COVERED BY THE ABOVE SHOULD BE DIRECTED TO THE ARCHITECT DURING BIDDING.
8. TYPICAL DETAILS THROUGHOUT THE DRAWING SET SHALL APPLY FOR ALL APPLICABLE CONDITIONS EVEN IF NOT SPECIFICALLY SHOWN OR REFERENCED.
9. SEE STRUCTURAL DRAWINGS FOR ACTUAL STRUCTURAL STEEL AND BEARING ELEVATIONS.
10. REFER TO ARCHITECTURAL SITE PLAN FOR THE LAYOUT OF CONCRETE WALKS, MOW STRIPS, PAVING PATTERNS, ETC. IN THE BUILDING VICINITY. REFER TO CIVIL DRAWINGS FOR THE CONTINUATION OF THIS WORK.
11. UNLESS NOTED OTHERWISE, WALLS SHALL EXTEND TO THE ROOF OR FLOOR DECK ABOVE AND BE SEALED IN ACCORDANCE WITH GENERAL PLAN NOTE #2 ON SHEET A1.1 AND WALL TERMINATION DETAILS ON WALL TYPE SHEET.
12. AT ALL OUTSIDE CORNERS OF INTERIOR CMU WALLS, COLUMN ENCLOSURES, PIPE CHASES OR OTHER WALL PROJECTIONS, PROVIDE MASONRY UNITS AND/OR GLAZED MASONRY UNITS WITH BULLNOSED (ROUNDED) EDGES WITH 1" RADIUS, UNLESS OTHERWISE NOTED OR WHERE SCHEDULED TO RECEIVE CERAMIC TILE. WHERE MASONRY CORNERS ALIGN WITH BULLNOSED, TRANSITION FROM BULLNOSE CORNER UNITS TO SQUARE CORNER UNITS.
13. UNLESS SPECIFICALLY NOTED OTHERWISE, ENCLOSE ALL VERTICAL MECHANICAL PIPES, RAIN LEADERS, ETC. WITH 4" CMU OR GYPSUM BOARD TO MATCH SURROUNDING FINISHES.
14. REFER TO PLANS AND ELEVATIONS FOR LOCATIONS OF CONTROL JOINTS (C.J.) AND EXPANSION JOINTS (E.J.) IN EXTERIOR MASONRY WALLS. IF A CONFLICT EXISTS BETWEEN JOINT LOCATIONS SHOWN ON THE ELEVATIONS AND PLANS, CONSULT THE ARCHITECT FOR CLARIFICATION PRIOR TO CONSTRUCTION. REFER TO FLOOR PLANS FOR LOCATIONS OF CONTROL JOINTS (C.J.) IN INTERIOR MASONRY WALLS.
15. ALL EXTERIOR CAVITY WALLS TO HAVE THRU-WALL FLASHING AT THE BOTTOM OF THE CAVITY WITH WEEP HOLES TO THE OUTSIDE. ALL FLASHING BUILT INTO WALLS SHALL BE LAPPED AND SEALED. REFER TO FLASHING DETAILS.
16. REFER TO BUILDING ELEVATIONS AND ELEVATION DETAILS FOR MASONRY PATTERNS.
17. INCLUDE PROJECTIONS, BEAM ENCLOSURES, RECESSES, BULKHEADS, PILASTERS AND SIMILAR ENCLOSURES AS PART OF WALL AND CEILING FINISHES AS SCHEDULED.
18. ALL APPURTENANCES BUILT INTO OR THROUGH WALLS, INCLUDING DOORS, DUCTS, WINDOWS, LOUVERS, GRILLES, MECHANICAL WORK, ETC. SHALL FIT TIGHT AND BE THOROUGHLY SEALED AROUND PERIMETERS. WORK AT EXTERIOR WALLS SHALL BE FLASHED OR OTHERWISE WATERPROOF SEALED.
19. SEE FURNISHING PLANS (A-9 SERIES) FOR CASEWORK, CABINETS, LOCKERS, DISPLAY BOARDS AND CASES AND SIMILAR ITEMS.
20. FIELD CHECK ROUGH AND/OR FINISHED DIMENSIONS FOR ACCURATE FITTING OF CABINETS, COUNTERS, LOCKERS, DOORS, WINDOWS, FIXTURES, SHELVING, GATES AND OTHER INSTALLATIONS PRIOR TO SHOP OR FACTORY FABRICATION. PROVIDE FILLER STRIPS, SCRIBE STRIPS, BASES, CLOSURE FINISHES AND TRIM FOR A COMPLETE INSTALLATION.
21. PROVIDE APPROPRIATE TRANSITION STRIPS AT CHANGES IN FLOOR ELEVATIONS. ALL TO BE ADA COMPLIANT.
22. EACH CONTRACTOR SHALL REFER TO MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS AND BE RESPONSIBLE FOR WORK PERTAINING TO THEIR PARTICULAR TRADE. ALL CONTRACTORS SHALL COORDINATE THE WORK OF ALL TRADES AND FIELD CHECK AGAINST ANY CONFLICTS BETWEEN DRAWINGS. REPORT CONFLICTS TO THE ARCHITECT FOR CLARIFICATION.
23. REFER TO PLUMBING, HVAC AND ELECTRICAL DRAWINGS FOR LOCATIONS AND DESCRIPTIONS OF ACCESS PANELS, LOUVER OPENINGS, VENTILATORS, GRILLES, VALVE CABINETS, FIRE DAMPERS OR OTHER APPURTENANCES AFFECTING WALLS, CEILINGS OR FLOORS. PROVIDE NECESSARY LINTELS, SUPPORT AND ANCHORAGE. SEE STRUCTURAL NOTES FOR LINTEL REQUIREMENTS.
24. REFER TO MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS FOR LOCATIONS OF CONCRETE PADS TO BE PROVIDED BELOW OR AROUND EQUIPMENT.
25. INSTALL ELECTRIC SWITCHES, OUTLETS, THERMOSTATS, CONTROLS, CLOCKS, SPEAKERS, FLAGPOLE HOLDERS AND OTHER WALL-MOUNTED ACCESSORIES IN LOCATIONS WHICH ARE UNOBSTRUCTED BY CABINETS, COUNTERS, RACKS, DISPLAY BOARDS, FIXTURES, SHELVING OR OTHER FURNISHINGS OR EQUIPMENT DESIGNATED FOR SPACES SHOWN ON DRAWINGS. THESE DEVICES ARE SHOWN ON THE ARCHITECTURAL DRAWINGS TO ALERT OTHER SUB-CONTRACTORS OF THEIR PRESENCE. COORDINATE INSTALLATION WITH THE ELECTRICAL DRAWINGS. ADVISE THE ARCHITECT OF CONFLICTS IN LOCATION OR TYPES OF DEVICES SHOWN PRIOR TO INSTALLATION. DO NOT INSTALL WALL-MOUNTED ITEMS ON, THROUGH OR INTO ANY EQUIPMENT UNLESS INDICATED.
26. MOUNT ELECTRIC SWITCHES, THERMOSTATS AND OTHER ELECTRONIC CONTROLS LOCATED IN THE SAME VICINITY AT THE SAME HEIGHT ABOVE FINISHED FLOOR IN A UNIFORM, ORDERLY FASHION UNLESS NOTED OTHERWISE. ALL MOUNTING HEIGHTS TO BE ADA COMPLIANT.

DRAWING KEY

GRID LINE
DRAWING NUMBER
SECTION
SHEET NUMBER
DETAIL NUMBER
SHEET NUMBER
ENLARGED PLAN/SECTION OR DETAIL
TYPICAL CMU PARTITION - SEE WALL TYPE SHEET FOR SPECIFIC WALL TYPES
GYPSUM & MTL. STUD PARTITION - SEE WALL TYPE SHEET FOR SPECIFIC WALL TYPES
EXISTING WALLS - VIF.
DETAIL NUMBER
SHEET NUMBER
INTERIOR ELEVATION
ROOM NAME
ROOM NUMBER
DOOR NO. ON PLAN
H.M. FRAME NO. ON PLAN
REVISION TYPE = A,B,(I/P,R,/C,C,D,)ADD.
CASEWORK (FURNISHING PLANS ONLY)
ALUM. FRAME/WINDOW TYPE
WALL TYPE

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OVERALL PLANS

ΔP	DATE	DESCRIPTION
1	06/21/16	Addendum #1

A0.9
06/07/2016
BID SET