Aria Environmental, Inc.
INDUSTRIAL HYGIENE & SAFETY CONSULTANTS

May 17, 2010

Mr. Jeffrey M. Klenk
Howard County Public School System
10910 Route 108
Ellicott City, MD 21042

RE: Glenwood Middle School Classroom 29
Indoor Environmental Quality Investigation
AEI Project No.: 100501

Dear Mr. Klenk,

Aria Environmental, Inc. (AEI) responded to an indoor environmental quality concern at Glenwood Middle School in classroom 29 on April 19, 2010 at the request of Mr. Jeffrey Klenk and Mr. Ron Miller. AEI visited the room again on April 21st during insulation removal and on April 22nd approximately 24 hours after the work was complete. AEI attended a 7th grade staff meeting on April 27th to discuss the findings from our investigation and follow-up, to address further action that will be undertaken by HCPSS, and to provide an opportunity for faculty and staff to ask questions. This letter presents the findings from the site visit including indoor air quality testing, and interviews with room occupants. The investigation was performed by Michele Twilley, DrPH, CIH.

Observations

The 20' x 32' classroom serves as an office for Ms. Patricia Young, Ms. Susan Rice and Mr. John Castle and as a small pull-out room for special education students requiring additional assistance with their work. Room finishes include a carpeted floor over concrete slab on grade and partial concrete floored/concrete masonry unit (CMU) walled crawl space; CMU walls extend to the roof deck, aluminum operable windows on the west wall, suspended cellulose ceiling tiles concealing fiberglass batt insulation with foil backing located between metal trusses, and a gypsum plank covered roof deck. Two pipe chases were observed that conceal the PVC pipe connected to the roof drains and metal pipes to the unit ventilator.

The odor of mold/mildew was observed upon entry into the room. Carpet was observed to be clean and free of stains, moisture and odors. A section of carpet was pulled away from the floor near the unit ventilator to observe the concrete slab. No evidence of moisture or odor was detected. Inspection of the walls, including walls behind book cases and filing cabinets did not reveal evidence of mold growth or water intrusion. Minor light brown water droplet staining was observed at the headers to the windows at the interface with the ceiling tile grid. The pattern appears to be consistent with condensation caused by the temperature change between the two surfaces.

The ceiling tiles did not show any evidence of staining or mold growth. However, the school system replaced water damaged ceiling tiles throughout the school approximately six weeks before the site visit. Ceiling tiles were removed in the northeast corner, along the west

wall, approximately 12' south of the north wall and 12' west of the east wall, and near the return air duct near the east wall for observation of the roof system. The odor was strongest in the northeast corner near the top of a pipe chase. The pipe chase had a plug of copper wire and foam at a clean out located just above the floor. The Pest Control Department reportedly had plugged the hole a few days prior to the site visit. The foil-backed fiberglass insulation was pulled away from the roof deck but no water staining was observed. The presence of the foil backing prevented the determination of water saturation of the insulation. Throughout the ceiling space, metal pipe hangers were corroded and some minor corrosion was observed on the metal roof trusses. Paper backed fiber glass insulation on pipes was observed to have some black speckling characteristic of mold growth. The insulation was not wet to the touch. The skylight in the corridor was inspected for leaks both above and below the roofline. No evidence of leaking was observed.

Inspection of the multi-ply asphalt roof over the classroom revealed two operational roof drains and several depressions in the roof characterized by a slight discoloration from water staining. Two roof drains were found in the vicinity of the classroom. Pine straw was packed around the screens covering the drains. There was no standing water on the roof at the time of the inspection. Two crimped lead roof vents were observed. The vents were associated with sinks that had been removed from the classroom. Additionally, a penetration associated with an exhaust fan that was removed from service was observed and was capped with a sheet metal covering. The aging roof has been reported to leak and is scheduled for replacement in 2011.

Mechanical systems include a unit ventilator on the west wall and a single return air duct at the ceiling near the east wall. The unit ventilator covers were removed and the fan coils, filters and drip pan were inspected and found to be clean and dry. The return air diffuser and duct was inspected and found to be clean. Further inspection found that the return air exhaust fan was not operational due to a tripped circuit presumably caused by a power failure. The return air exhaust fan was restarted.

The perimeter of the building near the classroom was inspected for evidence of mold growth in soil or planting beds near the air intake for the unit ventilator. The outdoor environment appeared to be free of moldy soil and materials. The west side of the classroom is shaded by pine trees.

Air Quality Measurements

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)). ASHRAE Standard 62.1 – 2007 suggests target indoor concentrations for PM 2.5 and PM 10 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. None of the PM 2.5 samples exceed the NAAQS. The PM 10 concentrations ranged from 26 to 87 $\mu g/m^3$ and averaged 47 $\mu g/m^3$. During the monitoring period, ceiling tiles and fiberglass insulation were moved and may have caused a temporary increase in particle counts at the PM 10 size. Approximately one hour after the return air exhaust system was activated the PM 10 concentration was 24 $\mu g/m^3$.

The room air temperature ranged from 61.9°-65.4° which is colder than recommended to maintain thermal comfort by ASHRAE. The school HVAC system transitioned from heating to

cooling during the week of April 5th. Outdoor temperatures reported by Weather Underground (available at www.wunderground.com) for the period 7:30 am to 8: 30 am ranged from 36.4 to 39.0°F. The relative humidity was 35.5-38.1%. The U.S. Environmental Protection Agency (EPA) recommends maintaining relative humidity below 60% and ideally between 30 and 50% to prevent mold growth.

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 CO2 indicates inadequate ventilation. Carbon monoxide was not detected. Carbon dioxide was 355 ppm and peaked at 888 ppm as the room and school occupancy increased. The concentration of concern for carbon dioxide is set by ASHRAE standard 62.1 – 2007 as 700 ppm above outdoor air (typically 350 ppm). While the US Green Building Council's Leadership in Energy and Environmental Design (LEED) Program has established 800 ppm for maintaining acceptable indoor air quality. Carbon dioxide measurements were not repeated after the return air ventilation system was restored.

Volatile Organic Compounds (VOC's) were measured using a ppbRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp and operated in industrial hygiene mode to identify point sources of odor causing contaminants. The measured VOC concentration in the classroom ranged from 0.07 to 0.19 parts per million (ppm) and peaked at 0.60 ppm at some recently installed foam at the bottom of a rain leader pipe chase. The lowest concentrations of VOC's appeared to be near the northwest corner of the room and the highest were in the northeast corner near the pipe chase. The VOC concentrations detected do not indicate a potential health hazard.

Interviews

The inspection was performed in the presence of Mr. Jeffrey Klenk and Mr. Steve Harrison. Mr. Harrison is an HVAC Mechanic with HCPSS and is also the father of one of the asthmatic students that occupies the room. He said that his son had not experienced any asthma attacks from spending time in the classroom.

Ms. Susan Rice indicated that after the heavy snow and rain, the odor was noticeable and allergy symptoms began. She has witnessed Ms. Young experience acute symptoms. Mr. John Castle also stated that the odor problems began after the snow and heavy rains.

Ms. Patricia Young entered the room after Ms. Rice and Mr. Castle and was noticeably upset about the mold problem and the asthma attacks that it triggers. She used a rescue inhaler immediately after sitting at her desk. She indicated that mold is a known trigger for her asthma and that while she cannot smell the mold odor she knows it is there because she can feel it. She said that she has some relief when the windows are open or when the air conditioner is running.

Ms. Young was interviewed again in a one-on-one session with Dr. Twilley. She indicated that the symptoms started during the second week of MSA testing (on or about March 16, 2010) when she experienced a massive asthma attack. Her triggers are mold, hay and sometimes heavy cologne; she is treated using controller medication and rescue inhalers during school. She does not take medications during breaks or over the summer. Her symptoms typically abate within 15 minutes of leaving the school or within 20 minutes of taking the rescue inhaler. She reported no other co-morbidities that would involve breathing difficulty.

Ms. Young indicated that she has a past history of asthma and upper respiratory symptoms when she spent time in Room 30. She no longer has symptoms when she is in the science classrooms because the carpet was removed. She experiences some symptoms in room 31 when the air conditioning is off. She summarized that the entire 7th grade wing was problematic. Opening windows or having the air conditioning running appears to give Ms. Young some relief from her symptoms. She mentioned that someone manually turned off the unit ventilator and the problem returned. She put a note on the ventilator indicating that the unit should never be turned off as it is the only source of fresh air.

She expressed concern that HCPSS has not taken her complaints seriously and that not only is she at risk but other faculty and staff and the children occupying the classroom are at risk. Ms. Young indicated that all of the students who enter the classroom get runny noses and itchy eyes. She said that two students had asthma attacks the prior week. She also said that the special education staff refuses to hold meetings in classroom 29 because of the air quality. She recommended that I also speak with Ms. Newman who uses the adjacent classroom and has symptoms and with Ms. Bacon who is an advocate in the 6th grade wing to get different perspectives on the problem.

The health nurse, Ms. Maryann Taneyhill, was consulted about the reports of children experiencing asthma attacks after spending time in room 29. She indicated that she was unaware of students experiencing asthma attacks after spending time in room 29. One student was reported the previous week by Ms. Young as needing to be checked by the nurse due to upper respiratory symptoms. The nurse called him to the health room and did not observe any evidence of upper respiratory distress. The student indicated that he had itchy and water eyes while he was in room 29 but that the symptoms went away when he was in the next classroom. The student did not have a record of asthma. No other students have reported to the health room for asthma. After visiting the health nurse, Ms. Young was asked about the two students who had asthma attacks the preceding week. She confirmed that the one student was checked by the health nurse at her request due to upper respiratory symptoms and because he had a heart problem. The other student did not go to the health room.

Ms. Mahalko in the adjacent room 31 indicated that she did not have indoor air quality issues in her classroom. Ms. Newman was on funeral leave and was not interviewed.

Mr. David Brown, Principal, was away from the school on Thursday and Friday of last week and made the decision to remove students from the room based upon the e-mail correspondence from Ms. Young. Faculty and staff continued to use the room.

Dr. Twilley and Mr. Klenk returned to the classroom after a debriefing with Mr. Brown and Mr. Miller to check on whether the operation of the return air system had any affect on the indoor environmental quality. Mr. Castle indicated that he no longer smelled any odor in the room. Ms. Young indicated that her symptoms were tolerable while the window was open but since the window was closed because the room became too cold her symptoms had returned. She could not detect any odor due to her upper respiratory congestion.

Abatement

Based upon our observations and interviews, the room occupants and their possessions were relocated temporarily in order to allow Asbestos Specialists, Inc. (ASI) to remove the

fiberglass batt insulation and the fiberglass pipe insulation above the suspended ceiling. Work was performed on April 21, 2010. The room was emptied of all furniture and supplies; polyethylene sheeting was installed over the carpet and on the walls to the underside of the suspended ceiling tile. A High Efficiency Particulate Air (HEPA) filtered exhaust unit was installed to trap fiberglass particles and to prevent dispersion of contaminants to the adjacent hallway. ASI removed the fiberglass batt insulation revealing a damp gypsum ceiling deck. Little to no air gap existed between the gypsum roof deck and the insulation and is most likely the cause of the condensation and corrosion observed earlier. Other than light speckling of mold on the paper-backed fiberglass pipe insulation, there was no evidence of mold observed.

Follow-up

AEI revisited Glenwood Middle School the afternoon of April 22nd to observe the conditions in the classroom. New ceiling tile was installed and the pipes were reinsulated. The mold odor was not observed. A new ceiling tile odor was observed in its place.

AEI was invited to speak with the Seventh Grade Faculty and Staff on April 27th. We reported that the damp basement/moldy odor observed in Classroom 29 appeared to have gone away since the fiberglass batt insulation and pipe insulation was removed. We believe that the leaky roof and the lack of space between the insulation and the roof deck has contributed to a moist environment that has contributed to the moldy odor. The leaky roof will be replaced next year to prevent this problem from occurring in the future. HCPSS will be inspecting the roof, making temporary repairs as needed, and will continue to monitor the conditions in the 7th grade wing on a regular basis but particularly after power failures and severe weather. AEI has recommended that the fiberglass insulation that exists throughout the wing be lowered to allow an adequate air gap between the insulation and the roof deck. This work is most likely to take place over the summer.

To facilitate communication, we requested that the faculty and staff contact Mr. Brown about water leaks, odors or other changes in the condition of the class rooms so he can determine whether the repair can be handled by the Day Chief or whether Building Services is more appropriate. Mr. Brown will coordinate with Mr. Klenk and outside consultants.

We believe that it is safe to use classroom 29. However, we understand that faculty, staff and students with documented sensitivity to allergens may need to use other rooms in the school and that Howard County intends to make reasonable accommodations available.

Faculty and staff were able to ask questions and express concerns about the indoor environmental quality of the school. The following questions or comments were posed:

1. What is the difference in air quality between the 6th, 7th and 8th grade wings? Can the air be tested for mold to see what is different?

We know that classroom 29 was previously used as art classrooms. We do not know if there is a difference in construction and finishes for the 7th grade wing versus the others. We know that the roof leaks are worse in the 7th grade wing than in the other wings. At this stage we are working to control moisture.

We already know that we will find mold in any samples we take regardless of location. We have a variety of methods to use to identify and quantify mold spores but we do not have

any consensus standards by which to interpret the results. There is no dose-response relationship or threshold for acceptable indoor environmental quality.

2. A strong cat or mouse urine odor was described in classroom 23 that is worse on Monday mornings?

Mr. Klenk and Dr. Twilley visited classroom 23 and the trailer to observe the conditions reported during the staff meeting. A faint pungent odor was observed in classroom 23. The teacher reported that the odor is worst on Monday mornings after the room has been closed for the weekend. Mr. Klenk should follow up on a Monday morning to identify the source of the odor and to determine if the unit ventilator requires cleaning.

3. The trailer is musty and gross. Should we run the fans continuously?

Mr. Klenk answered that the heating, ventilation and air conditioning system in the trailer should be run continuously while the trailer is occupied. Mr. Klenk and Dr. Twilley visited the trailer after the meeting and observed a stagnant odor and a fragrant masking odor. Air circulation through the space is indicated. Also noted, is that the weather stripping was missing from one of the doors making the space drafty and uncomfortable in extreme weather.

After the meeting concluded, Mr. Klenk and Dr. Twilley visited with Ms. Young to get her feedback on the conditions in classroom 29. She reported that there was improvement and she felt more comfortable in that space. She reported that she is still unable to spend time in classroom 30 and reiterated concerns about getting fresh air through open windows or ventilators.

Conclusions and Recommendations

An obvious moldy odor was detected in classroom 29 and more specifically above the suspended ceiling. The fiberglass batt and pipe insulation was removed revealing a damp roof deck. Other than some speckling on the paper backed fiberglass pipe insulation, no mold growth was observed. The fiberglass batt insulation was not replaced to allow the roof deck to dry. No evidence of a moldy odor was detected on follow up visits to the room on April 22nd and 27th.

Understanding that mold requires a moist environment to grow and knowing that the leaking roof will not be replaced until 2011; we recommend that HCPSS should take the following actions for the seventh grade wing of Glenwood Middle School:

1. Remove or lower the fiberglass batt insulation to allow a sufficient air gap between the roof deck and the insulation for the roof deck to dry between rain or snow events;
2. Identify the location of roof leaks and make temporary roof repairs;
3. Ensure that wet or saturated building materials are removed and replaced immediately;
4. Check the function of the return air exhaust fans after power failures or faults to ensure that the equipment is working properly;
5. Check that roof drains and downspouts are free of debris;
6. Start unit ventilators approximately one hour before faculty and staff arrive to school for the day;

7. Make reasonable accommodations for personnel and students with documented sensitivity to building associated allergens; and
8. Make routine site visits until the roof replacement project ends to detect any change in indoor environmental quality.

The Faculty and staff should report any indoor air quality concerns or roof leaks to Mr. Brown immediately. Mr. Brown will follow up with internal staff or Building Services as needed.

Thank you for choosing Aria Environmental, Inc. for your indoor environmental quality needs. Please do not hesitate to contact us should you have any questions, or require additional assistance with this matter.

Sincerely,
Aria Environmental, Inc.

Michele M. Twilley, DrPH, CIH
Principal