

MEMORANDUM REPORT

TO: Howard County Executive and County Council

DATE: November 3, 2016

FROM: Environmental Sustainability Board

RE: Mold, Howard County Public Schools

The Environmental Sustainability Board (ESB) submits this Memorandum Report in response to your request made pursuant to CR31-2016 (copy attached), to wit: that the Environmental Sustainability Board review the various reports commissioned by Howard County Public School System pertaining to mold at Howard County Public Schools and ... [make] recommendations on addressing environmental concerns, specifically on mold at Howard County Public Schools.

The Environmental Sustainability Board reviewed the following (copies attached):

Doc #	Author	Report Title	Report Date
1	Aria Environmental Inc.	Glenwood Middle School Classroom 29 Indoor Environmental Quality Investigation	May 17, 2010
1a	Asbestos Specialists	Invoice [For Work Performed]	April 24, 2010
2	Aria Environmental Inc.	Glenwood Middle School Classroom 6 and 8 Indoor Environmental Quality Investigation	February 10, 2012
3	Global Facility Solutions, LLC	Summary of Initial Findings from Site Visit at Glenwood Middle School located in Glenwood, MD	September 30, 2013
4	BMS-CAT	Glenwood Middle School, Storage Room	July 30, 2015
5	Building Dynamics, LLC	Mount View Middle School: Mold Investigation Progress Report	January 20, 2016

6	Skelly and Loy Inc.	Recommendations for June and July 2016 Indoor Air Quality Assessments prepared for Howard County Department of Public Works (including IAQ Assessments)	August 18, 2016
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The ESB stresses that the above are the only materials provided in response to our repeated requests and also the following:

1. We did not conduct any independent research or other investigation other than obtaining the ASHRAE Position Document (see below).
2. We did not ask or engage anyone to conduct any independent or other research, study, or other investigation on our behalf.
3. Even though several members of the Board have expertise in aspects of environmental science, only one member can be said to have specific skills related to indoor air quality. The Board felt that it would be a disservice to that member to ask him to render a professional opinion with the limited materials available.
4. We assumed the following without making an independent review to verify the assumptions:
 - a. Whatever testing or other investigation was done in connection with the reports was conducted strictly in accordance with applicable scientific and professional standards;
 - b. Whatever facts reported and factual assumptions that were made in the various reports are true and complete in all respects;
 - c. Whatever test results that the authors of the reports obtained were fully reported and accounted for in the respective reports; and
 - d. Whatever work that was performed in the course of or in response to the reports was done strictly in accordance with applicable scientific and professional standards.

This report is necessarily subject to and limited by the matters stated above and other qualifications. We are providing you with this report exclusively for the purpose of complying with your above request.

SUMMARY OF INDIVIDUAL REPORTS

1. Aria Environmental Inc. (AEI) -- Glenwood Middle School Classroom 29 Indoor Environmental Quality Investigation, dated May 17, 2010

HCPSS engaged AEI to investigate indoor air quality complaints in Classroom 29 at Glenwood Middle School. AEI did the following:

- Visually inspected elements of Classroom's interior and exterior;
- Measured air quality (particulates, relative humidity, carbon dioxide and carbon monoxide, and volatile organic compounds) in it; and
- Conducted interviews with complainants and others.

AEI observed an odor of mold/mildew in the Classroom. AEI observed no overt

wetness, but identified several potentially problematic spots including a known leaky roof that was on HCPSS's schedule for replacement, and an inoperable return air exhaust fan that was then restored to service.

AEI reported that particulates, relative humidity, and volatile organic compounds were within appropriate limits. Carbon dioxide levels increased to above appropriate limits apparently because the return air ventilation system had been turned off. AEI identified problem areas and we understand that in response to AEI's Investigation, HCPSS engaged Asbestos Specialists to address those problem areas. Asbestos Specialists completed its work on April 21, 2010. See, Doc 1a.

AEI then followed up with additional visual observations and meetings. AEI recommended that HCPSS address a leaky roof, a lack of ventilating space between insulation and the roof deck, and a general lack of ventilation.

2. Aria Environmental Inc. -- Glenwood Middle School Classroom 6 and 8 Indoor Environmental Quality Investigation, dated February 10, 2012

In the Fall of 2011, HCPSS engaged AEI to investigate indoor air quality complaints in Classrooms 6 and 8. AEI did the following in September and November, 2011:

- Inspected the interior and exterior of the Classrooms;
- Measured air quality (particulates, relative humidity, carbon dioxide and carbon monoxide, and volatile organic compounds) in it; and
- Conducted interviews with complainants and others.

In September, AEI did not smell mold or mildew, but did smell an ozone-like odor. AEI did not observe evidence of mold growth. There was spotty moisture in the carpet of Classrooms 6 and 8. AEI reported that particulates, relative humidity, carbon dioxide and carbon monoxide, and volatile organic compounds were within appropriate limits.

In November, AEI smelled mildew in Classroom 8, but did not observe evidence of mold or mildew growth and could not identify a source for the odor. AEI again reported that particulates, relative humidity, carbon dioxide and carbon monoxide, and volatile organic compounds were within appropriate limits.

AEI identified a possible problem with inadequate ventilation in Classroom 6 where a wheelchair battery often charged. AEI recommended better vacuuming procedures to reduce mold spore loads and to keep the carpet dry.

3. Global Facility Solutions, LLC (GFS) -- Summary of Initial Findings from Site Visit at Glenwood Middle School, dated September 30, 2013

HCPSS engaged GFS to review the HVAC systems serving the building in an effort to determine the source and cause of higher than normal humidity within the classroom areas of the school. GFS found the following:

- GMS is under a large negative pressure with respect to the outside, so that

- potentially moisture saturated outside air comes into the building.
- HVAC system controls and dampers were not functioning properly.
- Excessive air infiltration whether from an old steam tunnel or through insufficient weatherization.

GFS recommended several short term corrections, e.g., addressing excessive exhaust, to reduce humidity in the building. GFS also recommended repairs or replacement of HVAC elements as long term corrections.

4. BMS-CAT (BMS) -- Glenwood Middle School, Storage Room, dated July 30, 2015

HCPSS engaged BMS to clean up microbial growth in a storage room connected to the Band Room at Glenwood Middle School. BMS observed mildew on instrument cases. BMS isolated the storage room, cleaned the room and its contents, and removed contaminated materials.

5. Building Dynamics, LLC (BDL) -- Mount View Middle School: Mold Investigation Progress Report, dated January 20, 2016

HCPSS engaged BDL to assess environmental conditions and health concerns at Mount View Middle School (MVMS), evaluate the ability of HVAC systems to prevent future mold issues and make recommendations for improving indoor air quality (IAQ). BDL's work plan was to do the following:

- Review related documentation (mold identification, testing and remediation, IAQ investigations, health concerns, etc.);
- Evaluate mold growth episodes for cause, impact, effectiveness of corrective measures and the potential for future reoccurrence;
- Conduct a comprehensive building inspection, including above ceilings;
- Assess health risks by investigating reported cases of building related symptoms, reviewing Health Room documentation and interviewing staff;
- Complete an engineering review of HVAC design, operations and maintenance with a focus on system operation during past mold episodes and current humidity control by the new HVAC system; and
- Recommend actions to correct observed deficiencies and ensure environmental conditions remain safe

The Progress Report covers only items a-d, above, with the remaining two items to be completed.

BDL reported the following:

- MVMS is in overall good condition, is safe to occupy, and no hazards were identified.
- Elevated humidity during the cooling season caused mold growth. HVAC controls are being modified to improve humidity control and prevent a reoccurrence of mold growth next summer.
- BDL reviewed available information with the school nurses and found no cases where student symptoms were consistent with mold-related illness.
- BDL identified locations with localized suspect growth. HCPSS subsequently

- resolved all of them.
- BDL identified areas with water stains caused either by leaks or sweating caused by elevated humidity. HCPSS either resolved the leaks or scheduled work needed to resolve the problem.
- BDL identified HVAC-related issues, such as chiller problems, negative pressure, and control deficiencies, all of which contributed to excessive relative humidity. BDL recommended, and HCPSS apparently implemented, adjustments and fixes.

6. Skelly and Loy Inc.(SL) -- Recommendations for June and July 2016 Indoor Air Quality Assessments prepared for Howard County Department of Public Works, dated August 18, 2016

Howard County Department of Public Works retained SL to conduct Indoor Air Quality (IAQ) assessments at twelve Howard County schools, the results of which SL reported in separate IAQ Assessments for each school. Each assessment included the following: (a) visually inspecting accessible portions of the school; (b) measuring comfort parameters (including CO₂, temperature, and relative humidity); (c) measuring airborne CO and particulates; and (d) collecting and analyzing fungal spore trap samples.

We do not recap the specific results of each school's IAQ Assessment, but note that SL did not identify elevated spore counts in all schools or uniformly elevated counts in those schools where that condition existed. This suggests that highly localized conditions account for elevated counts.

We state below some of SL's more generally applicable recommendations.

- a. "If elevated moisture levels are identified, wall and/or ceiling cavities associated with the moist materials should be opened up to the extent necessary to visually inspect and determine if hidden mold growth exists."
- b. "Better insulation on the chiller lines should limit, if not eliminate, moisture condensation in the future on the lines; however, removal of the existing mold-impacted insulation should be done in a controlled manner by experienced and trained workers observing industry-accepted mold abatement techniques."
- c. "Moisture level measurements should occur as well as a thorough visual inspection whereby normally inaccessible areas are explored."
- d. "Moisture level measurements with possible intrusive investigation visual inspections should occur ... If elevated moisture levels are identified, wall and/or ceiling cavities associated with the moist materials should be opened up to the extent necessary to visually inspect and determine if hidden mold growth exists."
- e. "[Evaluate] moisture content of various building materials and [perform] a thorough visual inspection looking for signs and symptoms of past and/or ongoing water infiltration and mold growth."
- f. "Stained and water-damaged ceiling tiles should also be replaced."

- g. “[I]t is recommended that the stained tiles ... and the wet pipe jacket ... be replaced and the source of water causing the staining/moisture be identified and corrected.”
- h. “The maintenance staff should take measures to see that water leakage around the door ... ceases and replace any water-damaged materials caused by the past water leakage.”
- i. “All dust generated during the roof replacement work that has been deposited on horizontal surfaces should be removed with high-efficiency particulate air (HEPA) vacuums followed by wet wiping (hard/impervious surfaces). Duct work leaving these areas should be assessed and, if found to contain construction-generated dust, such dust should be removed and the return ducts cleaned.”

SL concluded:

SL has identified concerns regarding indoor air quality within the 12 Howard County Public Schools. We have also offered recommendations to address these concerns which include moisture level assessments in suspect areas and intrusive visual inspections of wall and ceiling cavities exhibiting elevated moisture content. Lastly, minor and overall limited building material replacement is recommended along with eliminating the sources of suspected water leakage and infiltration.

ENVIRONMENTAL SUSTAINABILITY BOAD REVIEW OF REPORTS

Given the limited scope of the documents provided to us and the assumptions that we necessarily made, we have no reason to question the methodology used, validity of any testing performed, the recommendations made, or general professionalism stated in or underlying any of the various reports.

In addition to reviewing the above reports, the ESB considered the *ASHRAE Position Document on Limiting Indoor Mold and Dampness in Buildings*. ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) issued that Position Document in 2012 and reaffirmed it in 2016. As noted above, the ESB did not conduct any independent research or other investigation other than obtaining that ASHRAE Position Document.

The ESB suggests that these are most applicable points from the ASHRAE Position Document, all of which are echoed in not only the SL report, but also all of the other reports:

- “When humidity and moisture are not effectively controlled, persistent dampness can lead to material damage, corrosion, structural decay, and microbial growth, including mold”
- “Problems occur when the dampness becomes persistent.”

- “Based on past observation of problem buildings, dampness sufficient to cause problems seldom has a single cause. More often, a series of events, including decisions in many areas of professional and personal responsibility, combine in complex ways to cause a problem. Therefore, it is not appropriate to assign responsibility for building dryness to any one group, because it is not likely that any one group can prevent a problematic level of dampness, mold, and microbial growth by their actions alone.”
- “There are known and avoidable contributors to moisture, mold, and microbial growth problems in all areas of professional and personal responsibility (HVAC, architectural design and construction, building operation and maintenance, building occupant’s actions, and the actions of policymakers and regulatory authorities).”
- “The implication of ... observations by cognizant health authorities and public health researchers is that the prudent course for owners, designers, builders, installers, and operators of all buildings and HVAC systems is to make decisions and take actions that limit the potential for long-term accumulation of excess moisture in building materials and systems.”

The ESB observes that Documents #1, 2, 3, 5, and 6 are consistent with the ASHRAE Position Document -- dampness leads to microbial growth, so controlling dampness is essential.¹

The ASHRAE Position Document also notes the following:

- “Currently, no quantitative, health-based exposure guideline or thresholds can be recommended for acceptable levels of contamination by microorganisms [citation omitted].”
- “[I]ndividuals in the same building may be quite different with respect to their particular sensitivities to airborne microbial contaminants. A low level of contamination that causes adverse health effects for one sensitive individual often causes no health effects for others.”
- “In the U.S., no cognizant health authority has yet established microbial exposure limits for residential or commercial buildings. In other countries, such exposure limits have been established [citation omitted], but there is little agreement between different countries concerning what the limits should be to ensure acceptable levels of health risk.”

The most recently dated document made available to the ESB, Document #6, echos these

¹ Documents #2a and 4 describe cleaning and removal work done to alleviate mold/mildew problems in specific spaces. We do not know what work was done to carry out recommendations to control moisture.

points from ASHRAE's Position Document.

OBSERVATIONS

The reports made available to the ESB as well as the additional documents listed above and ancillary research lead to several consistent and unassailable points:

1. Controlling moisture is the single best means to control mold in buildings. ASHRAE's Position Document states, "[T]he prudent course for owners, designers, builders, installers, and operators of all buildings and HVAC systems is to make decisions and take actions that limit the potential for long-term accumulation of excess moisture in building materials and systems."
2. There are no applicable industry or governmental standards for mold. ASHRAE states, "Currently, no quantitative, health-based exposure guideline or thresholds can be recommended for acceptable levels of contamination by microorganisms."
3. Adverse health effects due to mold are highly dependent on individual sensitivity.

That being said, the ESB offers the following observations:

- The protocols adopted by HCPSS are consistent with controlling moisture as a means to limit mold. However, in many cases the studies reviewed by the ESB included specific recommendations to address specific moisture issues. We did not see documentation reporting that the specific recommendation had been taken, nor were we privy to any evaluation of the effectiveness of the corrective actions. The HCPSS website provided only spotty information on the status of specific corrective actions.
- Several studies provided a useful context on indoor mold levels referencing ambient outdoor levels as a means to qualitatively assess indoor levels. The Skelly and Loy report helpfully referenced mold concentrations as "typical for public schools in similar geographic regions for the time of year." Greater reference to industry, experiential, or other baselines in more of the studies would have been useful.
- The primary reason for concern regarding mold is the related health effects. In the ideal world, a rigorous statistical analysis to correlate health effects and mold in the schools would provide at least a context in which to determine the appropriate degree of concern. A statistically valid study is probably not possible for many reasons. These reasons include the nature of individual sensitivity (see point 3, above), the greatly and continually varying operational characteristics of the school environments, and the impossibility of collecting objective health data without creating a bias towards over-reporting. As such, the hard limitation of the mold reports in aggregate is that they remain merely an accumulation of actual and

potential deficiencies and anecdotal health complaints. Less mold is assuredly better but not without cost and effort and zero is never achievable. Without objective standards, there is not a simple answer as to what is acceptable (see point 2, above).