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# GLENWOOD MIDDLE SCHOOL: MOLD INVESTIGATION PROGRESS REPORT

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Prepared for: Howard County Public School System

## 1.0 EXECUTIVE SUMMARY

*Note: BDL drafted this Progress Report based on initial findings from a comprehensive evaluation of mold concerns at Glenwood Middle School (GMS). Please send comments to- Elight@Building-Dynamics.com. BDL will conduct further investigation based on additional information.*

GMS is in excellent condition and is safe to occupy. Extensive sampling has found air quality to be consistent with normal background. Mold growth occurrences have been typical for schools in general and have been effectively remediated by HCPSS. Mold growth has not been accumulating in the building.

While mold growth is a concern as a trigger of allergy symptoms in some individuals, it is not a hazard and does not affect the health of most occupants. Several parents and a few staff attribute symptoms to mold at GMS. BDL reviewed available information and found reported symptoms unlikely to be mold-related. These could be investigated further based on additional information from physicians.

Detailed evaluation found most surfaces at GMS free of mold growth. Exceptions were limited to sink cabinets in the Home Economics Room, minor suspect spots on furniture and non-exposed surfaces in the portables. These were remediated by HCPSS.

The most extensive mold episode at GMS occurred during the summer of 2013, which was caused by malfunctioning HVAC equipment during exceptionally hot/wet weather. This was remediated by HCPSS prior to return of staff and students. A new HVAC system has been installed this year which provides excellent humidity control. Several roof leaks developed during construction of the new HVAC system. These were repaired by HCPSS before mold growth could occur.

## 2.0 PRELIMINARY FINDINGS

*BDL is conducting a comprehensive assessment of environmental conditions at GMS and has found the following based on work conducted to date. These may be modified based on comments received from the public and additional investigation by BDL.*

2.1 GMS is in excellent condition and is safe to occupy. Extensive sampling has found air quality to be consistent with normal background. Mold growth occurrences have been typical for schools in general and have been effectively remediated by HCPSS. Mold growth has not been accumulating in the building.

2.2 While mold growth is a concern as a trigger of allergy symptoms in some individuals, it is not a hazard and does not affect the health of most occupants. Several parents attribute their children's symptoms to mold at GMS. BDL reviewed available information and found reported symptoms unlikely to be mold-related. These could be investigated further based on additional information from physicians.

2.3 Most teachers have not attributed symptoms to time spent at GMS. A few have concerns which could be investigated further with additional medical information.

2.4 Detailed evaluation of the following surfaces at GMS has found them free of mold growth:

- Ceilings, walls and floors
- Furnishings

- Room contents
- Above ceilings
- Pipe tunnels
- Shelves, cabinets and closets (exceptions noted below)
- HVAC equipment (exceptions noted below)
- Furniture (exceptions noted below)

2.5 Surfaces reported to be moldy by parents were evaluated. The gym ceiling, Band Room, cloth-backed chairs, etc. were found to be free of mold growth.

2.6 There was no exposed mold growth in the Spanish Portable, but some was found in the walls. This was remediated by HCPSS.

2.7 Air conditioning units in the portables were not in good hygienic condition. These were cleaned and sanitized by HCPSS.

2.8 Sink cabinets in the Home Economics Room had suspect growth. This was remediated by HCPSS.

2.9 While most furniture was free of mold growth, BDL observed several minor spots. These were remediated by HCPSS.

2.10 The most extensive mold episode at GMS occurred during the summer of 2013, which was caused by malfunctioning HVAC equipment during exceptionally hot/wet weather. This was remediated by HCPSS prior to return of staff and students. HVAC equipment was adjusted to improve humidity control.

2.11 A new HVAC system has been installed this year which provides excellent humidity control.

2.12 Several roof leaks developed during construction of the new HVAC system. These were repaired by HCPSS before mold growth could occur.

*The final phase of BDL's assessment of environmental conditions at GMS will include a more detailed engineering review. BDL's final report will include recommendations for resolving any observed deficiencies and operating the building to prevent mold growth.*

## 3.0 BACKGROUND

Most schools have occasional incidents involving minor mold growth and reports of occupant symptoms attributed to the building. Glenwood Middle School (GMS) first opened in 1967 and developed the typical history as other school buildings with respect to mold. In July, 2013, mold growth occurred in several areas of GMS because of humidity control deficiencies. Mold was remediated for Howard County Public School System (HCPSS) before the start of the 2013-14 school year and replacement of the HVAC system was expedited. Potential exposure to mold growth at GMS became an issue of community concern in June, 2015. Since that time, HCPSS completed construction of new HVAC systems to serve classrooms and conducted additional mold remediation, as a precaution. Building Dynamics, LLC (BDL) was requested by HCPSS to evaluate the effectiveness of these efforts, review health concerns and make recommendations for improving environmental conditions at GMS.

BDL developed a work plan for this assessment consisting of:

1. Review related documentation (mold identification, testing and remediation, IAQ investigations, health concerns, etc.)

2. Evaluate mold growth episodes for cause, impact, effectiveness of corrective measures and the potential for future reoccurrence
3. Conduct a comprehensive building inspection, including crawl spaces and above ceilings
4. Assess health risks by investigating reported cases of building related symptoms, reviewing Health Room documentation and interviewing staff
5. 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
6. Recommend actions to correct observed deficiencies and ensure environmental conditions remain safe

On November 24, 2015, BDL issued a progress report documenting the resolution of several specific concerns raised by parents:

- Portable 20. The portable was overall in good condition, dry and free of visible mold growth. Minor suspect growth was observed sealed behind wall surfaces and there was particulate buildup in the air conditioner. This work was accomplished by HCPSS and the portable has been restored to pre-existing condition.
- Band Room. No suspect growth was observed. Removal of the wall insulation and carpet is not necessary.
- Chair Testing. This fall, GMS parents claimed that mold was growing on several items in the school, including a plastic bin, two books, cloth-backed chairs and inside a glue stick. These surfaces were sampled for mold growth by Aria Environmental, Inc. The plastic bin and chairs tested negative (no mold growth). There were small mold spots inside the glue stick, unlikely to be building-related. There was localized mold growth on the books. The books had been located near a window, and the mold appeared to be from water damage, not building humidity.
- Roof Leaks. Following installation of the new HVAC system this summer, several rain leaks were noted around ductwork going through the roof. Wet ceiling tiles were changed and these areas dried out before mold could start to grow (surfaces generally need to stay wet for several days before mold growth initiates). HCPSS reports that these penetrations have all been sealed. No new stained ceiling tiles have been observed since that time.
- Gym Ceiling. BDL evaluated staining on eight ceiling panels. These were water stains only, with no suspect growth. Surfaces were dry, indicating the sources as a past roof leak. HCPSS subsequently completed interior repair to the gym ceiling.

This new progress report summarizes all BDL efforts to date. Work items (1) – (4) have been completed and draft conclusions and recommendations are presented for public comment. BDL will finalize remaining work items and conduct additional investigations where needed to resolve any outstanding concerns.

## 4.0 HISTORY OF MOLD INCIDENTS AND RESPONSE ACTIONS

BDL reviewed HCPSS historical documentation of GMS mold incidents and maintenance response. These are summarized below in a chronology starting in 2010. Incidents reported prior to that date were typical for schools in general (occasional maintenance issues involving mold). There was no evidence of an accumulating mold problem at GMS.

| DATE | INCIDENT | MAINTENANCE ACTION | POTENTIAL EXPOSURE |
|---|---|---|---|
| 4/2010 | Odor in 29 | Removed insulation, repaired, expedited roof replacement | (1),(2),(3) |
| 7/2011 | | Roof replacement, removed carpets | |
| 7/2013 | Humidity-related mold in classroom | | Resolved before staff returned, (3) |
| 8/2013 | | Remediation & HVAC adjustment | |
| 2/2014 | Mold above ceiling & in crawl space | Replaced chilled water pipe insulation and cleaned/sealed crawl space | (1) |
| 5/2014 | Spot in 23 | Remediated | (1), (2) |
| 9/2014 | | Exhausted crawl space | |
| 10/2014 | Suspect growth in art/tech ed, | Remediated | (1), (2) |
| 2/2015 | | Adjusted HVAC | |
| 4/2015 | | Replaced classroom HVAC (April - August) | |
| 5/2015 | Spot in 23 | Remediated | (1), (2) |
| 6/2015 | Spot in 31 | Remediated | (1), (2), (3) |
| 8/2015 | Spot in band storage room and art room | Remediated surfaces throughout, cleaned ducts, restored AC for band storage, replaced cork boards | (1), (2), (3) |
| 9/2015 | Spot in girls' locker | Remediated | (1), (2) |
| **EXPOSURE KEY**: (1) = NEGLIGIBLE, (2) = LOCALIZED, (3) = SHORT-TERM | | | |

Mold growth incidents were remediated as they occurred and there was not an accumulating mold problem. Other moisture incidents have occurred at GMS which were repaired and dried before mold growth initiated.

## 5.0 BUILDING INSPECTION

GMS surfaces were evaluated by BDL for indicators of excess moisture and suspect growth following procedures consistent with ASTM D7338-10, Standard Guide for Assessment of Fungal Growth in Buildings. In addition to occupied space, BDL also inspected maintenance areas, crawl spaces (pipe tunnels), above suspended ceilings and inside HVAC equipment.

BDL found overall environmental conditions at GMS to be excellent in comparison to older schools in general. With exception of the following minor spots, surfaces were free of suspect growth and dry:

- Lab cabinet in Room 1
- Teacher's desk in Room 2
- Book case in Room 3
- Chalk board in Room 20
- Table in media center
- Sink cabinets in Room 35

Some of these spots may not have been mold. As a precaution, BDL had HCPSS wipe all these spots with a sanitizing solution on November 25, 2015. BDL was onsite and verified these surfaces were now free of mold growth.

BDL also observed minor spots of suspect growth inside desks in several rooms. This was limited to desks which had been brought into GMS this fall. The affected desks were not present during periods of elevated humidity. These were also remediated and verified by BDL on November 25.

One additional item of potential concern was identified in the Music Room. Acoustical panels on the walls had been exposed to mold growth in the summer of 2013 and had only been sanitized on the outer surface. These panels were covered with perforated aluminum. A limited view of surfaces inside the panels did not detect growth, but replacing or sealing the panels might be considered as a precaution.

A pipe tunnel extends under all classroom wings at GMS. BDL found these to be free of mold growth and penetrations to occupied space above were sealed. The pipe tunnel was damp in some areas. The dirt floor of the pipe tunnel was exposed and it is generally recommended that this be covered with a plastic vapor barrier to control moisture. To further isolate the pipe tunnel, HCPSS installed an exhaust system.

Above ceilings, BDL found chilled water pipe insulation to be in good condition. Suspect growth was present on pipe insulation in the boiler room. This space is isolated from occupied space. Remediation is a lower priority here, since occupants are not exposed.

BDL did observe dust spots on gypsum panels under the roof decking. Although suspect growth can usually be distinguished visually from other discoloration, BDL had this dust tested to ensure that all mold growth was identified. Tape lifts of this material were free of fungal growth structures and these deposits were classified as dust, not mold.

BDL accessed representative HVAC units to evaluate mechanical hygiene (is mold present on surfaces exposed to air flow?). Roof top units, air handlers and wall ventilators were observed to be clean and in good sanitary condition. This is achieved by regular preventative maintenance. As an additional precaution, HCPSS cleaned GMS ducts in August, 2015.

One air conditioner serving the portables was inspected and had accumulated particulate matter on the coils and in the drain pan. It was assumed that air conditioners in the other portables were in similar conditioning and were in need of coil cleaning. This was recommended to HCPSS, who sanitized all the portable units. Occupant exposure to dirty air conditioning coils is common and generally not significant.

## 6.0 MOLD SAMPLING DATA

HCPSS has had Aria Environmental test GMS for airborne spores since 2013. Mold spores are ubiquitous in both indoor and outdoor air and there are no accepted standards defining acceptable concentrations. HCPSS compares indoor spore samples to concentrations measured outdoors. Interpretation of these data is difficult and must take into account variability. Outdoors, mold concentrations can range from <100 spores per cubic meter during cold, dry weather to >100,000 when conditions are hot and humid. Inside spore concentrations are also highly variable. They are primarily made up of spores infiltrating from the outside and those associated with indoor dust (spore counts increase with building activity). Additional spores generated by moisture problems are not readily distinguished from naturally occurring mold. Spore counts are not a reliable

predictor of either mold growth or health risk. However, in reviewing Aria's data, they do appear to be an accurate reflection of the relative concentration of airborne mold GMS occupants have been exposed to over time. BDL reviewed Aria's extensive data base of GMS spore concentrations and classified them as follows:

"background"= less than outside air
"marginal"= slightly above outside concentration
"elevated"= higher than outside air

It cannot be conclusively determined whether elevated counts are due to water damage or activity disturbing settled dust. Occasional detection of elevated indoor spore concentrations does not necessarily identify a mold growth problem. Moreover, individual air samples only reflect one point in time and do not reflect naturally occurring variations over time.

Measured airborne spore concentrations at GMS are consistent with the following conclusions:

1. Results of mold sampling are typical for schools in general.
2. GMS occupants are exposed to lower mold concentrations in the school than they experience outdoors.
3. Remediation of mold growth at GMS has been effective. Several weeks after the remediation of summer mold growth in 2013, four air samples were collected in rooms on two days. Three were classified as background and one was marginal.
4. Spore concentrations in the crawl space were elevated. Although this is typical for crawl spaces and may not have affected air quality in occupied space, HCPSS elected to remediate mold in the crawl space and seal penetrations as a precaution. After remediation, spore concentrations in the crawl space were at background levels.
5. During 2014, 35 air samples were collected in GMS rooms on four different days, of which 90% were at background levels. One sample was classified as marginal and one elevated.
6. Weekly air samples have been collected at GMS since the start of the 2015-16 school year. Between August 25 and October 14, 100 samples were all in the background range. This indicates that the minor remaining suspect spots identified by BDL did not impact air quality.

HCPSS has also had Aria collect surface samples for mold analysis. These results also do not indicate any exposure hazards. When interpreting the results of mold surface testing, the following should be considered:

- CDC advises that it is not necessary to determine the type of mold present because all indoor growth has equivalent health effects (i.e., none have been established to be toxic).
- Naturally occurring mold spores are generally present on surfaces and there are no accepted standards for surface spore concentrations.
- Microscopic examination for fungal growth structures may indicate whether there has been mold growth, but does not show whether it is active.
- Results of tape lift samples only apply to the small surface tested (i.e., one square inch) and cannot be generalized to other areas.

- Suspect growth on surfaces does not expose occupants if it is dry and undisturbed or sealed behind structures.

## 7.0 HEALTH CONCERNS

While the majority of occupants are not affected by mold growth, some sensitive individuals may experience symptoms when exposed. Mold allergies may occur both inside the building and in the outside environment. These same symptoms are often caused by non-mold factors such as contagious illness and exposure to dust. At GMS, some parents have attributed their child's symptoms to mold in the building and a few staff members have similar concerns.

BDL reviewed available information on this to answer the following questions:

1. Are the reported symptoms consistent with mold-related illness?
2. What is the potential exposure to mold in the complaint rooms?
3. Is the timing of symptoms consistent with mold exposure?

### 7.1 STUDENT SYMPTOMS

Limited information was available regarding the health status of students identified by parents as experiencing mold-related symptoms. BDL reviewed mold concerns with the GMS Health Room nurses who stated that Health Room visits do not suggest individual cases or overall patterns consistent with mold-related incidents. The nurses reported that several parents had called the Health Room this fall reporting suspected symptoms and room locations. Detailed information was not included and no supporting documentation has been provided from physicians.

The type of symptoms reported by the GMS parents could be associated with factors other than mold. Research on the health effects of mold exposure has found the following with respect to the type of symptoms reported by GMS parents:

(a) Allergic Reactions (i.e., congestion).
*Mold spores are naturally present both indoors and outdoors, where they are one of many factors potentially triggering allergies (HCPSS mold sampling data for Glenwood MS consistently shows much higher spore counts outside than in the school). Medical research supports an association between exposed mold growth indoors and the triggering of allergy symptoms in some sensitive individuals. Approximately 5% of the population may experience mold-related symptoms. Mold-related symptoms occur very quickly upon exposure and resolve after leaving the environment. Mold-related symptoms are typically minor (i.e., congestion, watery eyes), but may include respiratory difficulty in asthmatics.*

(b) Respiratory Infections (i.e., sinus problems).
*Respiratory infections are typically spread person-to-person and are not related to mold exposure. Fungal infections can occur in immune-compromised individuals and are typically caused by spores normally present in outdoor air and healthcare facilities.*

(c) Nosebleeds.
*These are generally not associated with mold exposure.*

(d) Non-specific symptoms (i.e., dizziness, headaches, fatigue).
*Statements claiming that "black mold" is particularly dangerous are contradicted by medical research. Exposure to indoor mold has not been demonstrated to cause toxic effects, and mold is not considered a health hazard (limited to exposures which can cause illness in the healthy population, such as asbestos and carbon monoxide). All types of mold growth in buildings present similar health risks (may aggravate allergic symptoms in some sensitive individuals).*

Based on information provided to date, the symptoms reported by parents may not be mold-related. The most common health effect of mold exposure is triggering of allergic reactions such as watery eyes and congestion. In these cases, the affected individual generally has a past history of allergies and consistently experiences symptoms in the presence of mold growth. Reported GMS health concerns do not appear to be consistent with this pattern. The various symptoms reported by parents are non-specific and can be caused by many factors. Reports have not been accompanied by a physician's diagnosis and opinion that the condition may be mold-related. If parents continue to suspect that their child's health is being affected by mold, more detailed medical information is needed to resolve this.

GMS parents cited 14 specific rooms in their phone calls to school nurses where they attributed their child's symptoms to mold exposure. BDL reviewed these locations with respect to environmental conditions. No mold growth was found by BDL in most of these rooms. Minor suspect spotting was observed inside some desks in two rooms. However, it was determined that these desks were only brought into GMS recently and were not there at the beginning of the school year. Over 100 air samples have been collected in GMS since the start of this school year of which, all spore counts were classified as normal background. These findings do not show significant exposure to mold in the complaint rooms.

When allergic reactions are building-related, the primary cause is dusty or unsanitary conditions. Mold can also be the triggering factor, but not as often as surface dust or insect residues. In this regard, BDL found GMS surfaces to be exceptionally clean compared to schools in general.

Based on available information, it appears unlikely that GMS students are experiencing mold-related symptoms. It is always possible that an extremely sensitive individual could react to normal background levels of mold. Further evaluation by physicians is needed if this is an ongoing concern.

### 7.2 STAFF SYMPTOMS

On November 17, BDL interviewed GMS staff with respect to their health status in the building and any other concerns for BDL investigation. Most teachers did not attribute symptoms to the building environment. Specific concerns were as follows:

- Many teachers complained that air from the new HVAC blows directly down on them, creating drafts and, in one case, possibly associated with eye irritation. BDL has asked HCPSS to see if air flow adjustments can be made to resolve this.

- Some teachers have noticed a slight, occasional odor from the new HVAC system. It does not appear to be a musty-type odor, HCPSS is in the process of resolving this.
- One teacher has been experiencing migraine headaches. She reports that physicians evaluating her are not sure if this has any relation to mold. BDL's investigation has not found any mold growth in her room.
- Two para-educators have filed Workers' Comp claims for which they attribute to mold at GMS. This an ongoing legal matter with contradictory opinions by medical experts.

In the fall of 2014, several GMS teachers reported symptoms apparently associated with time spent in the building. Their primary complaints were dry irritated eyes and headaches, nosebleeds were also cited. HCPSS investigated and suggested that dry air with the onset of heating season may have been a factor.

## 8.0 HUMIDITY CONTROL

The primary cause of mold growth at GMS has been periods of continuously elevated relative humidity. BDL is evaluating HVAC systems at GMS to identify specific causes of past mold growth incidents and to make recommendations for ongoing HVAC operations which will ensure that humidity-related mold does not reoccur. To date, BDL has reviewed some of the HVAC documentation and made a few initial observations, with these preliminary findings:

1. Mold growth during summer, 2013 occurred during a period of unusually hot, wet weather.
2. Summer mold growth generally does not occur in schools unless the HVAC is being operated in a manner which promotes sustained, very high humidity levels and/or there are equipment malfunctions. HVAC deficiencies identified at GMS during the summer of 2013 included negative pressure (draws unconditioned, humid air into the building), chiller failure and outside air dampers not functioning. These were all resolved by HCPSS by the end of that summer.
3. Teachers have generally noted that humidity has returned to acceptable levels since startup of new HVAC systems.
4. BDL re-tested the building and found that, with the new HVAC system, the building was negatively pressured under some operating conditions and also during after-hours system shutdown. HCPSS is currently making adjustments to system controls to rectify this condition. With onset of the heating season, excessive humidity is not a concern.
5. BDL observed some HVAC fans operating after-hours (i.e., locker room unit ventilators). HCPSS is re-checking this.
6. Many teachers reported concerns for air blowing directly down from the new classroom ceiling air supply vents. HCPSS is currently evaluating adjustments to resolve this.
7. Some teachers have noticed occasional, non-musty odor from the new HVAC system. HCPSS is in the process of resolving this.
8. During a roof inspection, BDL noted a fuel oil smell from the boiler stack. This could potentially affect outdoor air intakes and is being investigated by HCPSS.
9. The sealing of attic vents may have impacted moisture control in the building. This will be investigated by BDL.
10. The new crawlspace exhaust system is operating 24/7 with no makeup air vents inside the pipe tunnel. BDL will review this.

11. HCPSS summer air conditioning schedule for all schools ventilates unoccupied areas for several hours a day, potentially increasing relative humidity.

The final phase of BDL's study will include a more detailed engineering review of HVAC systems and operating procedures.

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BDL President, Ed Light, CIH, *holds degrees in Environmental Science from the University of Massachusetts (B.S.) and Marshall University (M.S.), is a Senior Fellow of the American Industrial Hygiene Association, has authored over 40 scientific publications on assessment and control of the indoor environment and chaired several national scientific committees. In the 1980s, Mr. Light established the West Virginia Department of Health IAQ Program, pioneering efforts to resolve exposure issues related to formaldehyde, asbestos, and termiticides. In the 1990's, he developed widely used protocols for addressing IEQ complaints (published by EPA, NIOSH and ISIAQ) and managing air quality in occupied buildings under construction (now an ANSI standard). As a consultant, Mr. Light has directed more than 1000 multi-disciplinary IEQ investigations, ranging from the White House to the South Pole Station.*