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March 25, 2011

Mr. Sidney B. Moody
Safety and Regulatory Coordinator
Granville County Schools
101 Delacroix Street
Oxford, NC 27565

Re: Mold Evaluation
South Granville High School

Dear Mr. Moody:

On March 21, 2011 WTVD, local television Channel 11, aired a report of their response to an inquiry made to them by the parent of a South Granville High School parent. I had, at your request, done an air quality investigation in January 2011 at this school. In response to the current publicity I met you at the school on March 22 and 23, 2011 to perform a followup mold evaluation.

A visual inspection of the building showed little difference between the conditions in January and March. Since the current concern is specifically about the possible impact on the respiratory systems of the building occupants a testing program for airborne mold spores was implemented. The history of the building, in particular the history of the air conditioning systems, is significant for this evaluation.

A. The core of the school (Classrooms 1 – 31, the Cafeteria, Library and Gym) was built in the early 1960's. There was heating but no air conditioning. Air conditioning capability was added in the early 1990s to by installing one or more ceiling-mounted units in each room. The chilled water for these units came from a new chiller plant. These AC units, which in classrooms were located opposite the window walls, recirculated the air within the rooms.

B. In the 1970s the Business Hall (Rooms 101 – 111) and in the 1980s the Science Hall (Rooms 200 – 208) were added. This construction included HVAC systems for each of the new classrooms using rooftop units.

C. In 2003 Rooms 301 – 310 were added, again with HVAC systems using rooftop units for the rooms.

Six spore trap samples for airborne mold were collected in the core area of the building. These were in the Cafeteria, the Women's Locker Room, classroom 7, classroom 17, classroom 27, and the hallway between classrooms 16 and 21. Two air samples were taken in the 1970s and 1980s sections, in classroom 107 and classroom 201. In the 2003 section of the building an air sample was taken in classroom 304 and a surface sample was taken in classroom 310. An outside air (reference) air sample was also collected. The samples were submitted to Carolina Environmental, Inc. of Cary, NC. This laboratory is a participant in the Environmental Microbiology Laboratory Accreditation Program (EMPAT) and is qualified to perform these analyses. The laboratory report sheets are attached.

The surface sample was taken in response to a teacher inquiry as to whether spots on the floor tile might be mold. The sample was collected after scraping off the floor wax that was over one of the spots but without removing the material that was the visible spot. The lab result was that there was no mold detected on this sample.

The results of the air sample analyses are summarized here by section of the building:

	Debris Rating	Total Spores, s/m^3	*Cladosporium* s/m^3
Outside (reference)	Moderate	550	50
Core			
Cafeteria	Low	20	0
Women's Locker Room	Moderate	250	20
Classroom 7	Moderate	140	80
Classroom 17	Heavy	270	190
Classroom 27	Moderate	550	90
Hallway 16/23	Heavy	370	60
1970s			
Classroom 107	Low	50	20
Classroom 201	Low	20	0
2003			
Classroom 304	Low	30	0

The laboratory reports only mold spores. The debris rating is the laboratory analyst's qualitative evaluation of the amount of ordinary (non-mold) dust that accompanied the mold sores on the samples. The sampling results indicate that the core section of the building is considerably dustier and that the total spore counts are also higher than in the newer sections.

Cladosporium is the mold type that prefers cooler temperatures, like those found at air conditioning units and on the door gaskets of home refrigerators. *Cladosporium* is the most commonly encountered mold type present in the outside air in the United States, including our part of North Carolina. EMLab P&K, a national microbiological analysis laboratory, has complied data for many years. In their 2008 Pocket Reference Guide they report the median (50% of all values less than, 50% of the values greater than) concentration of *Cladosporium* in the outdoor air during the month of April as 373 s/m^3. The *Cladosporium* spore counts are higher in the core section than either outside or in the newer sections of the building. This indicates that there are active growth colonies present. While the levels reported at South Granville are lower than this national average the fact that there is mold growth in the building is reason enough to take corrective action.

The data show that there is little concern for mold in South Granville High School's 1970s, 1980s and 2003 sections of the building. The focus is the core area, with the ceiling-mounted air conditioning units as the central issue. Before making recommendations as to how to proceed it is important to understand how and why mold happens in buildings. Four things are required:

1. Mold spores must be present.
    a. Mold spores are present outdoors throughout the world. It is estimated that some 25% of the world's biomass is mold.
    b. It is not realistic to expect that an indoor environment could be mold free.

2. There must be food available to support mold growth.
    a. The principal food for mold is cellulose. This could be dead trees and leaves, foodstuffs, paper, and even dust and lint.
    b. It is not realistic to expect that an indoor environment could be free of mold food.

3. Temperature must be within the mold's activity range.
    a. Most molds can grow in temperatures from zero to 120 degrees Fahrenheit.
    b. This is the temperature range of human activity.

4. There must be dampness.
    a. Dampness can be in the form of actual wetting or high humidity.
    b. Water intrusion into buildings, such as from flooding, roof leaks or pipe leaks, is an unfortunate reality.
    c. The condensation of water on chilled surfaces in buildings is an unfortunate reality.

Of these four factors the only two over which a building operator has a measure of control are mold food and moisture. The moisture factor includes humidity and dew point. The dew point is the temperature at which air can absorb no more moisture. When a surface has a temperature below that of the dew point of the air moisture (dew) will form on that surface.

The way this impacts South Granville is that the AC units deliver cooled air at a temperature of about 55^{o}F. In the spring, summer and fall its is not unusual for the outside air to have a dew point that is above 55^{o}F. This means that a film of moisture will form on the metal surfaces of the AC unit. Dust on these surfaces attaches itself securely to the metal and it becomes a food source for mold. The same thing can happen to the parts of ceiling tiles that are directly in the blast of cool air coming out of the grilles. The attached photos of the AC unit in room 27 show the effect of both of these phenomena.

The HVAC systems do not have the capability to be operated in a manner that would prevent condensation on the metal parts where the cool air is delivered into the rooms. This would be the casing and louvers of the ceiling-mounted units in the core section of the building. It is recommended that routine surface cleaning be instituted to remove their buildup of dirt. The dust buildup on HVAC grilles, such as in the Women's Locker Room, should be cleaned off. Surfaces should be wiped down with a damp cloth using a weak solution of the same sanitizing compound used for the cleaning of kitchens and bathrooms. A few drops of a liquid detergent (like Dawn) should be added to the water to cut the greasy deposits. The dirt is to be removed, not just moved around on these surfaces. This should be done at least three times a year; spring, summer and fall. Certain units may attract dirt more frequently, thus needing attention more frequently. The filters in the units should be changed at least three times a year.

Should ceiling tiles become wet enough to sag or develop water stains over more than half of the surface of a tile they should be removed. Small areas of surface mold on ceiling tiles, like that currently noted in classroom 27, can be sanitized in the same manner as used for the HVAC unit casings.

This is a recommendation for a program to control, not prevent, future mold events. Other water intrusion events such as leaky roofs or broken pipes will still have to be addressed as they occur.

Sincerely,

Robert A. Herrick P.E., CIH