ECS
Environmental Control Systems, Inc.
Environmental Engineers and Management Consultants

January 6, 2021

Mr. Jake Gallagher
Director of Operations
Marple Newtown School District
40 Media Line Road
Newtown Square, PA 19073

Re: Marple Newtown High School - Indoor Air Quality Investigation

Dear Mr. Gallagher,

In the capacity as the Marple Newtown School District's (MNSD) environmental risk engineer, we offer you the following narrative.

On December 30, 2020, Environmental Control Systems, Inc. (ECS) conducted an airborne mold exposure assessment in the Marple Newtown High School. Cooresponding sampling cassette numbers are as follows:

1. High School

a) Outdoor Control - Sample Cassette # 31421551
b) Outdoor Control - Sample Cassette # 31422926
c) Room B102 – Sample Cassette # 31422919
d) Room A104 – Sample Cassette # 31519317
e) Room A113 – Sample Cassette # 31519254
f) Room A141 – Sample Cassette # 31519267
g) Room A131 – Sample Cassette # 31519309
h) Room C001 – Sample Cassette # 31422995
i) Room B202 – Sample Cassette #31519257
j) Room B212 – Sample Cassette #31519275
k) Room A225 – Sample Cassette #31519300

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Air Sampling Method

If mold is suspected, but not visibly detected after a thorough inspection, then microbial air sampling conducted in accordance with guidance documents can be useful. ECS elected to use Air-O-Cell^{TM} sampling cassettes as the screening device for this cursory event. The Air-O-Cell^{TM} Air Sampling cassette is a sampling device designed for the rapid collection and analysis of a wide range of airborne aerosols. These include fungal spores, pollen, insect parts, skin cell fragments, fibers, and inorganic particulates. Air enters the cassette, the particles become impacted on the sampling substrate, and the air leaves through the exit orifice. The airflow and patented cassette housing is designed in such a way that the particles are distributed and deposited equally on a special glass slide contained in the cassette housing called the “trace”.

Air Sampling Laboratory Report

Attached you will find the laboratory report of the samples taken on December 30, 2020. Sample locations and corresponding sample numbers are listed above. The “Control” sample is referred to and becomes the “Background” sample to which all other samples acquired on this date are compared.

Regulatory Guidance

The most common fungi are ubiquitous within our environment and we are constantly exposed to them both in the air and on many surfaces. Current filtration systems are designed to prevent a majority of these high outdoor counts from getting inside, however, the EPA states that “There is no practical way to eliminate all mold and mold spores in the indoor environment and spores can be found almost anywhere and can grow on virtually any substance, providing moisture is present”. Constituents travel indoors inside through normal everyday actions such as through open doors/windows, and attaching itself to clothing, shoes, and bags. Constituents that get inside require moisture to grow mold on any organic surface (i.e.: wood, paper, plastic & carpet) so the most effective course is to limit the potential for microbial growth indoors by reducing the causes of persistent dampness. Mold growth does not require the presence of standing water; it can occur when high relative humidity or the hygroscopic properties (the tendency to absorb and retain moisture) of building surfaces allow sufficient moisture to accumulate.

Currently, there are no EPA, CDC or OSHA regulations or standards for airborne mold contaminants, therefore, there are no quantitative health-based guidelines, values, or thresholds for acceptable, tolerable, or normal concentrations for airborne fungi spores. The most commonly cited indoor air quality standards and generally accepted practices supporting acceptable indoor air quality are those established by the American Society of Heating and Air Conditioning Engineers (ASHRAE), and the American Industrial Hygiene Association (AIHA).

- ASHRAE Standards 55 & 62 provide guidelines addressing optimum achievable "thermal comfort" for occupants of buildings and system requirements which are expected to result in indoor air quality "acceptable" to human occupants.

  (ANSI/ASHRAE Standard 55: Thermal Environmental Conditions for Human Occupancy establishes the ranges of indoor environmental conditions to achieve acceptable thermal comfort for occupants of buildings and ANSI/ASHRAE Standards 62.1 and 62.2 are the recognized standards for ventilation system design and acceptable IAQ).

  Since there are individual differences in preferences for thermal comfort, it may not be possible to achieve an acceptable comfort level for all occupants. That being said, ASHRAE guidelines recommend 68ºF to 74ºF in the winter and 75ºF to 80ºF in the summer. as well as a relative humidity (RH) range of 30% to 60%.
  In addition, the required minimum ventilation rate in cubic feet per minute (CFM) per person in an educational classroom is suggested to have 15 CFM per person (students ages 5-8); and 13 CFM per person (students age 9+) **ASHRAE 62.1-2016 recommends that relative humidity in occupied spaces be controlled to less than 65% to reduce the likelihood of conditions leading to microbial growth.

- The AIHA Position Statement (Recognition, Evaluation, & Control of Indoor Mold) states that sampling for airborne mold spores can indicate whether the mix of indoor constituents is "typical" of the outdoor mix or, conversely, "atypical" or unusual at the time of airborne sampling. The AIHA suggests a useful method for interpreting microbiological results is to compare the kinds and levels of organisms detected in different environments. Usual comparisons include indoors versus outdoors, or complaint areas versus non-complaint areas. Specifically, in buildings without mold problems, the qualitative diversity (types) of airborne fungi indoors and outdoors should be similar. Conversely, the dominating presence of one or two kinds of fungi indoors, coupled with the absence of the same kind of fungi outdoors, may indicate a moisture problem and degraded air quality. Generally speaking, indoor mold types should be similar to, and airborne concentrations should be no greater than, those found outdoors and in non-complaint areas

Guidelines for Interpretation of Results

Since there are no standards which establish acceptable, tolerable, or normal concentrations for airborne fungi spores, ECS adheres to the following professional standards as sources of guidance:

- The National Allergy Bureau (NAB™) a section of the American Academy of Allergy, Asthma and Immunology's (AAAAI™) considers 'mold counts in outdoor air of 0-6499 spores per cubic meter of air as low, to 6500 to 12,999 spores per cubic meter of air as moderate, to 13,000 to 49,999 spores per cubic meter of air as high, and above 50,000 as very high'.

- The AIHA suggest that indoor mold types should be similar to and airborne concentrations should be no greater than those found outdoors and in non-complaint areas.

- ASHRAE Standards 62.1 and 62.2 (Ventilation for Acceptable IAQ) defines "Acceptable Indoor Air Quality" as "air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction".

- The EPA defines "Good Air Quality" as a result of: Introduction and distribution of adequate ventilation, Control of airborne contaminants, & maintenance of acceptable temperature and relative humidity.
- World Health Organization (WHO) Guidelines for Indoor Air Quality

- Environmental Protection Agency – Indoor Air Quality Best Practices

Findings/Recommendations

1. Outdoor temperature, RH, & Dew Point obtained during the sampling event was 35ºF with 48% RH, & Dew Point 17ºF

2. Indoor temperature, RH & Dew Point obtained during this sampling event:

    A. Room B102 - 70ºF with 30% RH & Dew Point 37ºF. Surface temperatures were greater than the dew point.
    B. Room A104 - 70ºF with 30% RH & Dew Point 37ºF. Surface temperatures were greater than the dew point.
    C. Room A113 - 70ºF with 30% RH & Dew Point 37ºF. Surface temperatures were greater than the dew point
    D. Room A141 - 73ºF with 30% RH & Dew Point 40ºF. Surface temperatures were greater than the dew point

E. Room A131 - 73ºF with 30% RH & Dew Point 40ºF. Surface temperatures were greater than the dew point
F. Room C001 - 72ºF with 28% RH & Dew Point 37ºF. Surface temperatures were greater than the dew point
G. Room B202 - 71ºF with 31% RH & Dew Point 39ºF. Surface temperatures were greater than the dew point
H. Room B212 - 73ºF with 32% RH & Dew Point 42ºF. Surface temperatures were greater than the dew point
I. Room A225 - 73ºF with 32% RH & Dew Point 42ºF. Surface temperatures were greater than the dew point

3. EPA states that *"mold spores will not grow if moisture is not present. Indoor mold growth can and should be prevented or controlled by controlling moisture indoors."*

   a. At the time of this investigation, there was no condensation observed on any horizontal or vertical surfaces as all surface temperatures were higher than the dew point temperature of the space.

   b. No visible mold was observed during this assessment. Water stained ceiling tiles were observed throughout the building both in hallways and classrooms. These tiles must be discarded, replaced and the source of the leak fixed.

   c. The EPA suggests that in order to maintain "good air quality", the following procedures should be followed: introduction and distribution of adequate ventilation, control of airborne contaminants, and maintenance of acceptable temperature and relative humidity.

   Acceptable indoor air quality (IAQ) is typically not achieved by addressing any one specific building product, system, or procedure. Rather, it is the result of careful attention to each of the following fundamental elements:

   - Contaminant Source Control
   - Proper Ventilation
   - Humidity Management
   - Adequate Filtration

   Careful attention to each of the above followed by proper operation and maintenance of your HVAC system can significantly reduce the risk of indoor air quality related problems.

4. The total quantification of fungal structures and the diversity of fungal types do not indicate unusual concentrations during the time of sampling. This falls within the scope of guidelines we follow when qualifying data.

5. Analytical data shows that total fungi in this space was lower than the outdoor airborne control samples obtained and that the types of mold in both the indoor and outdoor samples were "typical".

    a. Microorganisms get indoors through the heating, ventilation, and air conditioning system (HVAC), doors, windows, potted plants (soil), crack in the walls, potable drinking water system, or are brought into the building on shoes and clothes of people coming into the building. As a general rule, total indoor airborne spore concentrations in a typical clean HVAC supplied building should be less or equal to the total outside concentrations.

    b. Current building filtration systems are designed to prevent a good majority of outdoor spores from entering the building space. In reviewing the analytical data, it is apparent that at the time of this inspection, the filtration systems within the areas tested are effective in reducing outdoor particle concentrations to the indoor space per ASHRAE recommendations.

Conclusion

Based on the sampling data received during the December 30, 2020 airborne mold exposure assessment, the total airborne fungal constituents identified within the area sampled were below those found in the outdoor air.

Therefore, considering the specific definitions, standards and guidelines as documented by NAB, AIHA, ASHRAE, WHO, & EPA, it is the opinion of Environmental Control Systems, Inc. that the breathing zones sampled should be considered "acceptable" to persons within these occupied spaces.

Mr. Gallagher, should you have any further questions, please feel free to contact us.

Respectfully Submitted,

Wayne R. Pistoia, MSE, NSPE
Operations Director
Environmental Control Systems, Inc.

Attachment A: -
Recommendations & Guidelines for Acceptable Thermal Comfort & Moisture Control

- A practical guide to indoor air quality (IAQ) cannot overlook temperature and humidity, because thermal comfort concerns underlie many complaints about "poor air quality." Furthermore, temperature and humidity are among the many factors that affect indoor contaminant levels. Thermal comfort is determined by the room's temperature, humidity and air speed. There are many additional factors such as activity level, clothing, age, gender and health status that affect the comfort of the occupant(s). Thermal discomfort is also a common complaint of building occupants. There are individual differences in preferences for thermal comfort, so it may not be possible to achieve an acceptable comfort level for all occupants. The normal levels of relative humidity and temperature for indoor air will also vary widely from region (climate) to region (climate).

  Individuals can also vary widely as to what they find acceptable. Since thermal comfort is subjective to the individual, indoor air quality is not regulated. However, the EPA, CDC, and OSHA follow recommended guidelines published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) who provide guidelines intended to satisfy the majority of building occupants wearing a normal amount of clothing while working at a desk. Guidelines are listed above.

- ASHRAE Standard 62.1-2016, "Ventilation for Acceptable Indoor Air Quality", plus ASHRAE BOD approved addenda requires that relative humidity levels be designed to be limited to 65% or less for mechanical systems with dehumidification capability. For other mechanical system types or where spaces are not served by mechanical systems, Standard 62.1 has no humidity limitations. ASHRAE Standard 55-2013, "Thermal Environmental Conditions for Human Occupancy", plus ASHRAE BOD approved addenda relates reported human comfort to temperature and humidity levels, and establishes a range of temperatures and humidity levels that are considered comfortable by 80% or more of the test subjects. The Standard requires that systems designed to control humidity must be able to maintain a dew point temperature of 16.8°C (62.2°F). There are no established lower humidity limits for thermal comfort; consequently, Standard 55 does not specify a minimum humidity level. However, non-thermal comfort factors, such as skin drying, irritation of mucus membranes, dryness of the eyes, and static electricity generation, may place limits on the acceptability of very low humidity environments

- Moisture problems can have many causes, including water intrusion (leaks), condensation, and uncontrolled high humidity. Therefore, it is important to prevent moisture problems in buildings. Modest wetting and drying in buildings and in ventilation systems is normal and generally poses little risk for occupant health. Similarly, very brief episodes of wetting are not usually a problem provided that steps are taken to rapidly dry all materials. "Dampness" is the presence of unwanted and excessive moisture in buildings. This can lead to the growth of mold, fungi, environmental bacteria.

- The dew point is defined as "the temperature at which air becomes saturated with water vapor; the temperature at which air has a relative humidity (RH) of 100 percent."

    - In order to reduce the moisture level in air during periods of high outdoor humidity:

        1. Exterior air leaks should be sealed.

        2. Indoor air movement should be constant and/or increased during unoccupied periods, since HVAC system controls typically reduce or eliminate outdoor air ventilation at these times. The timing of occupied and unoccupied cycles should be adjusted such that the building is flushed by the ventilation system before occupants arrive

        3. Conditioned space temperature should be higher than the dew point to prevent indoor condensation. Condensation should not occur when the temperature of a material is above the dew point. The lower the temperature of a material, the more water vapor it will pull out of the air. Where you have cool surfaces (*i.e.,* below the dew point), you need to keep humid air to a minimum. Where you have humid air, you need to keep the neighboring surfaces above the dew point.

        4. Dew point is a predictive measure that indicates the temperature at which moisture in the air will reach 100% and condense onto a surface. It can be a useful measure for controlling moisture levels to avoid mold growth because it is usually very easy to determine the temperature of the coldest surfaces within a building. To ensure high moisture levels or condensation does not occur on those surfaces, dew point levels in the air should be controlled in the building to below temperature of the coldest surfaces in a space

        5. Areas should be dehumidified to less than 65% RH using dehumidifiers and/or reheating the area of concern during unoccupied times. Reheating is a form of simultaneously cooling and then heating to enhance dehumidification. A 1ºF change in room temperature (in either direction) can change the relative humidity by 2% (in the opposite direction).

        6. Methods of reheating include direct or indirect gas-fired heating; hot water heating; hot gas reheating for refrigeration-based units; and electric heating.