INDOOR AIR QUALITY SURVEY

PROJECT DESCRIPTION:
Mold Spore Trap Sampling, Carbon Dioxide {CO_2},
Carbon Monoxide {CO}, Temperature, Relative Humidity, Particulates,
Volatile Organic Compounds {VOC's}, Nitrogen Dioxide (NO2),
Hydrogen Sulfide (H_2S), and Formaldehyde

PROJECT LOCATION:
Southern Huntingdon County High School
Room #205
10339 Pogue Road
Three Springs, Pennsylvania

PROJECT DATE:
August 27, 2022

PREPARED FOR:
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CALI PROJECT NUMBER:
22-1049-005

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August 29, 2022

SURVEY PERFORMED BY:

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Table of Contents

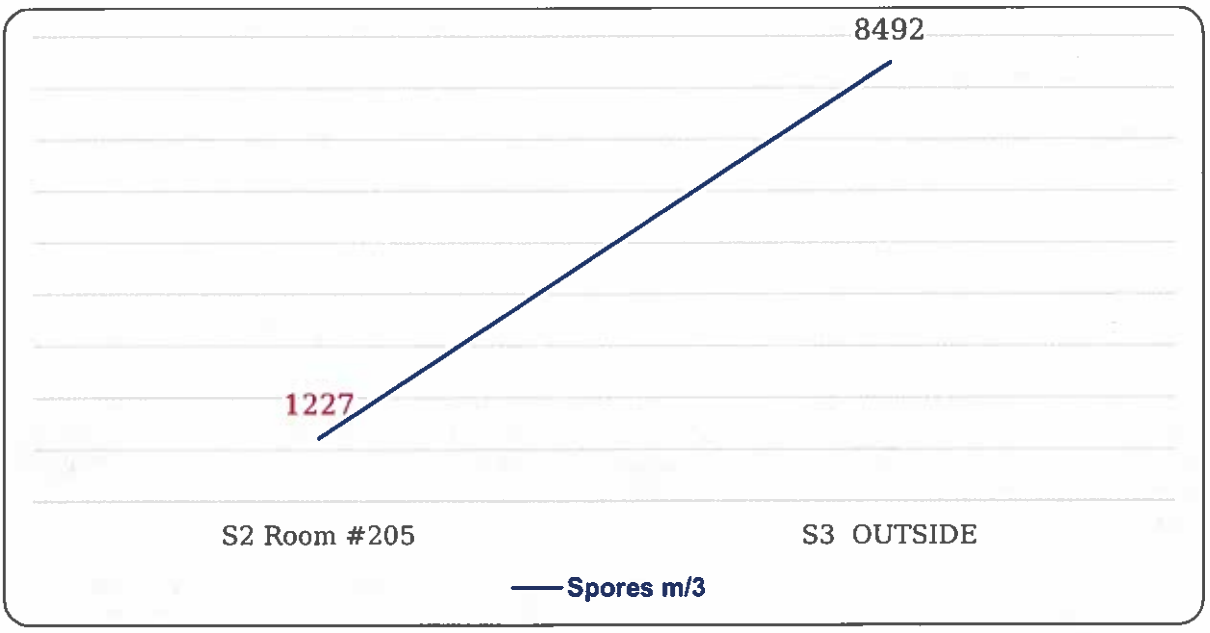
Scope of Work for Airborne Fungal Contaminants (Mold Sampling):

In August of 2022, Cumberland Analytical Laboratories, Inc. (CALI) was contracted by the Southern Huntingdon County School District to perform an Indoor Air Quality Survey of the Southern Huntingdon County High School Room #205 Project. This survey consisted of the collection of Air Samples for Airborne Fungal Contaminants.

Mold Survey Results:

The results table listed below showed that unusual mold condition exists in Room #205. Please refer to the Non-Viable Mold Spore Trap Sample Results Table for more detailed information regarding these individual samples.

Non-Viable Mold Spore Trap Samples IAQ Chart:



Mold Recommendations:

Room #205 was high for Penicillium/Aspergillus Spores this area should be recleaned and resampled.

Non-Viable Mold Spore Trap Sample Results Table:

Sampling Information	S2 Room #205		S3 OUTSIDE	
Analysis Using STL	105C		105C	
Sample Type	Air Cassette – Allergenco - D		Air Cassette – Allergenco - D	
Volume	75.00 liter		75.00 liter	
Analytical Sensitivity	13 spores/m³		13 spores/m³	
Background Density	1+		1+	
Other	**Raw Count**	**Count /m³**	**Raw Count**	**Count /m³**
Dander	40	533	8	107
Fibers	2	27	1	13
Fungal Identification	**Raw Count**	**Count /m³**	**Raw Count**	**Count /m³**
Ascospores	1	13	127	1693
Aspergillus/ Penicillium	73	973	7	93
Basidiospores	16	213	478	6373
Cladosporium Species	2	27	16	213
Epicoccum Species	0	0	5	67
Fusarium Species	0	0	3	40
Pithomyces Species	0	0	1	13
Rusts	0	0	0	0
Total	92	1227	637	8492

Organism Description:

Dander - Comprised of human and/or animal skin cells. Counts may be higher in carpeted rooms and in rooms with more traffic.

Fibers - This category can include clothing, carpet, and insulation fibers.

Ascospores - From the fungal Subphylum Ascomycotina. Ascospores are ubiquitous in nature and are commonly found in the outdoor environment. This class contains the "sac fungi" and yeasts. Some ascospores can be identified by spore morphology, however; some care should be exercised with regard to specific identification. They are identified on tape lifts and non-viable analysis by the fact that they have no attachment scars and are sometimes enclosed in sheaths with or without sacs. Ascomycetes may develop both sexual and asexual stages. Rain and high humidity may help asci to release, and dispurse ascospores, which is why during these weather conditions there is a great increase in counts.
Health Effects: This group contains possible allergens.

Aspergillus/Penicillium - These spores are easily aerosolized. Only through the visualization of reproductive structures can the genera be distinguished. Also included in this group are the spores of the genera Acremonium, Phialophora, Verticillium, Paecilomyces, etc. Small, round spores of this group lack the necessary distinguishing characteristics when seen on non-viable examination.
Health Effects: Can cause a variety of symptoms including allergic reactions. Most symptoms occur if the individual is immunocompromised in some way (HIV, cancer, etc.). Both Penicillium and Aspergillus spores share similar morphology on nonviable analysis and therefore are lumped together into the same group.

Basidiospores - From the Subphylum Basidiomycotina which contains the mushrooms, shelf fungi, and a variety of other macrofungi. They are saprophytes, ectomycorrhizal fungi, or agents of wood rot, which may destroy the structure wood of buildings. It is extremely difficult to identify a specific genus of mushrooms by using standard culture plate techniques. Some basidiomycete spores can be identified by spore morphology; however, some care should be exercised with regard to specific identification. The release of basidiospores is dependent upon moisture, and they are dispersed by wind.
Health Effects: Many have the potential to produce a variety of toxins. Members of this group may trigger Type I and III fungal hypersensitivity reactions. Rarely reported as opportunistic pathogens.

Cladosporium Species - The most commonly identified outdoor fungus. The outdoor numbers are reduced in the winter and are often high in the summer. Often found indoors in numbers less than outdoor numbers. It is commonly found on the surface of fiberglass duct liner in the interior of supply ducts. A wide variety of plants are food sources for this fungus. It is found on dead plants, woody plants, food, straw, soil, paint, and textiles. Often found in dirty refrigerators and especially in reservoirs where condensation is collected, on moist window frames it can easily be seen covering the whole painted area with a velvety olive-green layer.
Health Effects: It is a common allergen. It can cause mycosis. Common cause of extrinsic asthma. Acute symptoms include edema and bronchiospasms, chronic cases may develop pulmonary emphysema. Illnesses caused by this genus can include phaeohyphomycosis, chromoblastomycosis, hay fever and common allergies.
Epicoccum Species - It is found in plants, soil, grains, textiles, and paper products. Frequently isolated from air and occasionally occurs in house dust. Is a saprophyte and considered a weakly parasitic secondary invader of plants, moldy paper, and textiles.
Health Effects: A common allergen. It also has the potential to produce Type I fungal hypersensitivity reactions.

Fusarium Species - A common soil fungus and plant pathogen. Fusarium is frequently isolated from plants and grains. It is often found in humidifiers and requires wet conditions to grow.
Health Effects: An allergen. Frequently involved in eye, skin and nail infections. Fusarium is the most common cause of mycotic keratitis and has been isolated from patients with a variety of infections. Some species produce mycotoxin. Food safety issues are related to some species of this genus.

Pithomyces Species - Grows on dead grass in pastures and decaying plant material.
Health Effects: Causes facial eczema in ruminants.

Rusts – From the group Uredinales, called Rusts due to the color spores, which are known for causing disease in plants.
Health Effects: No health effects data available at this time.

Mold Methods and Analysis – Air Sampling:

Particle air sampling techniques were used. Air samples were collected using a calibrated high volume-sampling pump and Allergenco D Cassettes. The samples were packaged for proper shipment and delivered to SanAir Technologies Laboratory (North Chesterfield, Virginia) an American Industrial Hygiene Association (AIHA) accredited laboratory. While the results and information of this analysis are considered to be reliable, CALI assumes no responsibility for the accuracy of these results.

Standards – Bacterial/Mold:

There are no current Permissible Exposure Levels or Safe Levels established by OSHA or NIOSH. EPA has guidelines on mold remediation in schools, yet no clearance levels have been established. Molds are a major source of indoor allergens. There are no national standards for the numbers of fungal spores that may be present in the indoor environment. As a general rule and guideline that is widely accepted in the indoor air quality field, the numbers and types of spores that are present in the indoor environment should not exceed those that are present outdoors at any given time. There will always be some mold spores present in "normal" indoor environments. The purpose of sampling and counting spores is to help determine whether an abnormal condition exists within the indoor environment and if it does, to help pinpoint the area of contamination. Spore counts should not be used as the sole determining factor of mold contamination. There are many factors that can cause anomalies in the comparison of indoor and outdoor samples due to the dynamic nature of both of those environments.

Molds can also trigger asthma. Even when dead or unable to grow, mold can cause health effects such as allergic reactions. The types and severity of health effects associated with exposure to mold depend, in part, on the type of mold present and the extent of the occupants' exposure and existing sensitivities or allergies. Prompt and effective remediation of moisture problems is essential to minimize potential mold exposures and their potential health effects.

Statistically, total spore counts are always significantly correlated with counts conducted on Agar Plate samples. On average, total mold spore to culturable mold ratios are in the range of 10:1. A concentration dominated by one genus such as Penicillium or Aspergillus even at 10,000 Particles/m^3 is unacceptable. Total levels should not exceed 2,000 Particles/m^4, and each individual count should not exceed 650 Particles/m^3. For remediation, a reduction of airborne spores based upon Pre and Post sampling, compared to exterior sample results, and no evidence of mold growth present is the goal.

Section 1 – Scope of Work for Indoor Air Quality (IAQ):

Cumberland Analytical Laboratories, Inc. (CALI) was retained by the Southern Huntingdon County School District to perform and Indoor Air Quality (IAQ) Survey at the Southern Huntingdon County Area High School in Three Spring, Pennsylvania. The scope of work for this survey was to conduct a general IAQ Survey of Room #205. CALI conducted a visual inspection of accessible areas and tested for the following parameters:

1. Carbon Monoxide (CO),
2. Carbon Dioxide (CO_2) (ventilation),
3. Temperature,
4. Relative Humidity,
5. Particulates (dust),
6. Total Volatile Organic Compounds (VOC's); and
7. Formaldehyde,

Section 2 – Notes and Observations:

The following is a summary of concerns or observations made by CALI personnel on-site at the time of this survey: No concerns or observations were noted at the time of the survey.

Section 3 – Recommended Ranges/Guidelines:

1. The recommended guideline for **carbon monoxide** is 9 ppm as an 8-hour time weighted average in an indoor environment.

2. The recommended range for carbon dioxide (CO_2) as a measure of ventilation is 700 ppm over ambient or 1,100 ppm. Carbon dioxide concentrations that exceed 1,100 ppm indicate there is insufficient ventilation or introduction of outdoor air into the space.

3. The recommended **temperature** range is 20°C – 26.1°C (Summer 22.7°C – 26.1°C – Winter 20°C – 24.4°C) for comfort depending on season. Ideally temperature should be 20°C – 21.1°C.

4. The recommended range for **relative humidity** is 30%-60% for comfort and to inhibit microbial growth and proliferation.

5. The recommended guideline for **formaldehyde** is 50 ppb in an indoor environment as a 24-hour average. All samples within the occupied areas of the building were within acceptable recommended guidelines.

6. The recommended guideline for **Volatile Organic Compounds (VOC's)** is 500 ppb. All samples within the occupied areas of the building were within acceptable recommended guidelines.

7. The recommended guideline for **particulate** is less than 50.0 ug/m^3 in an indoor environment as a 24-hour average. All samples within the occupied areas of the building were within acceptable recommended guidelines.

Section 4 – Analytical Test Results							
Location	(CO) ppm	(CO_2) ppm	Temperature (C^o)	Humidity (%)	Dust (ug/m3)	VOC'S (ppb)	Formaldehyde (ppb)
Room #205	0.00	511	20.5	60.0	10.0	0.00	0.00

Section 5 – Standards:

Health experts agree that these industrial workplace standards are not adequate for evaluating indoor air quality in standard office building environments. For this reason, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) has suggested the use of more stringent guidelines for indoor air quality based largely on the National Ambient Air Quality (NAAQ) Standards adopted by the USEPA for outdoor air. These guidelines are based on concentrations, which at least 80% of the building occupants normally do not express dissatisfaction due to unsatisfactory indoor air quality. These guidelines do not address hypersensitive individuals with existing medical conditions.

Recent NIOSH studies indicate over 50% of indoor air quality complaints originate due to ventilation problems in the workplace. ASHRAE Standard 62-1989 recommends a ventilation supply rate of 20 CFM of outdoor air per person in office spaces for satisfactory indoor air quality. The temperature and relative humidity limits are evaluated by comparing them to the guideline standards established by ASHRAE. Specifically, the values are compared to what is considered a comfort zone correlation as described in ASHRAE Standard 55-1981, Thermal Environmental Conditions for Human Occupancy.

Section 6 – Sampling Strategy/Monitoring Methods:

CO, CO_2, Temperature and Relative Humidity: Air monitoring data for CO, CO_2, Temperature and Relative Humidity were recorded utilizing a Zenith 7755 Serial Number 10266268. This direct reading instrument was used over the sampling period to establish average concentration values. This unit is factory calibrated and requires no field calibration.

CO: Carbon Monoxide is a toxic gas, but, being colorless, odorless, tasteless, and initially non-irritating, it is exceedingly difficult for people to detect. When too much carbon monoxide is in the air, the body replaces the oxygen in one's red blood cells with carbon monoxide. This can lead to serious tissue damage, or even death.

CO_2: Is measured to evaluate the ventilation or outdoor air percentage (%) being introduced into the indoor spaces. The lack of ventilation is one of the major causes of indoor air quality complaints.

Temperature: Thermal comfort represents one of the most critical aspects of indoor air quality. Maintaining appropriate indoor thermal comfort represents the single criteria having the greatest potential to reduce occupant complaints from indoor environments.

Relative Humidity: Low relative humidity can lead to the drying of the mucous tissues and an increased susceptibility infection. High relative humidity can provide an environment suitable for microbial growth and proliferation.

Formaldehyde: Formaldehyde sampling was performed utilizing a Zenith 7755 Serial Number 0266268 portable sampling device. This is a real time instrument. This instrument has a resolution of 0.1 resolution and 2 second interval response time with a +/- of 10% accuracy.

Total Volatile Organic Compounds (VOC's): VOC's were recorded utilizing a Zenith 7755 Serial Number 0266268 portable sampling device. This is a real time instrument. This instrument has a resolution of 0.1 resolution and 2 second interval response time with a +/- of 10% accuracy.

Total Particulate (Dust) PM-10: Air monitoring data for the Total Particulates was recorded utilizing a Sensidyne Serial Number U20659. This direct reading instrument was used over the sampling period to establish average concentration values. All samples taken were below the standard of 50 micrograms/m3. This unit is factory calibrated and requires no field calibration. The units for all sample data are micrograms/m3 (ug/m3).

Section 7 – Definitions:

Carbon Monoxide – Inorganic compound, a highly toxic, colorless, odorless, flammable gas, chemical formula CO. It is produced when Carbon (including coal and coke) or carbon-containing fuel (including petroleum hydrocarbons, e.g., gasoline and fuel oil) does not burn completely to Carbon Dioxide, because of insufficient oxygen. CO is present in the exhaust gases of internal combustion engines and furnaces. It is toxic because it binds to hemoglobin in blood much more strongly than dose oxygen and thus interferes with transport of oxygen from lungs to tissues. Symptoms of CO poisoning range from headache, nausea, and syncope to coma, weak pulse, respiratory failure, and death. CO is used industrially as a fuel and in synthesis of numerous organic compounds, including methanol, ethylene, and aldehydes. Exposure to high concentrations can be rapidly fatal.

Carbon Dioxide (CO_2) - Inorganic compound, a colorless gas with a faint, sharp odor and a sour taste when dissolved in water, chemical formula CO. Constituting about 0.03% of air by volume, it is produced when carbon-containing materials burn completely, and it is a product of fermentation and animal respiration. Plants use CO in photosynthesis to make carbohydrates. CO in earth's atmosphere keeps some of the sun's energy from radiating back into space. In water, CO forms a solution of a weak acid, carbonic acid (HCO).

The reaction of CO and ammonia is the first step in synthesizing urea. An important industrial material, CO is recovered from sources including flue gases, limekilns, and the process that prepares hydrogen for synthesis of ammonia. It is used as a refrigerant, a chemical intermediate, and an inert atmosphere; in fire extinguishers, foam rubber and plastics, carbonated beverages, and aerosol sprays; in water treatment, welding, and cloud seeding; and for promoting plant growth in greenhouses. Under pressure it becomes a liquid, the form most often used in industry. If the liquid is allowed to expand, it cools and partially freezes to the solid form, dry ice.

Temperature - A measurement of how hot or how cold a place or object is. Temperature is measured in degrees Fahrenheit or Centigrade, which is also called Celsius, using the symbol °.

Relative Humidity - Is a ratio, expressed in percent, of the amount of atmospheric moisture present relative to the amount that would be present if the air were saturated. Since the latter amount is dependent on temperature, relative humidity is a function of both moisture content and temperature. Relative Humidity is derived from the associated Temperature and Dew Point for the indicated hour.

Formaldehyde - Is a naturally-occurring organic compound with the formula CH_2O. It is the simplest of the aldehydes and is also known by its systematic name methanol. The common name of this substance comes from its similarity and relation to formic acid.

Particulates (Dust) – Airborne particulate matter ranging in diameter from 10 to 50 microns, generated by activities such as cutting, crushing, detonation, grinding, and handling of organic and inorganic matter such as coal, grain, metal, ore, rock, wood. Their presence in upper atmosphere can cause either a net warming or a net cooling effect, depending upon their surface color. Dust particles with black upper and gray or white lower surface would cause warming, whereas those with opposite color arrangement would cause cooling. Industrial dust (generated by cutting, drilling, grinding, or sawing) can pose health risks if inhaled and (because such particles usually are less than 10 microns in diameter) would be more hazardous due to its ability to embed deep into lungs and other tissue.

Volatile Organic Compounds (VOC's) – Volatile Organic Compounds (VOC) means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions, except those designated by EPA as having negligible photochemical reactivity.

Volatile organic compounds or VOC's are organic chemical compounds whose composition makes it possible for them to evaporate under normal indoor atmospheric conditions of temperature and pressure. This is the general definition of VOC's that is used in the scientific literature and is consistent with the definition used for indoor air quality. Since the volatility of a compound is generally higher the lower its boiling point temperature, the volatility of organic compounds is sometimes defined and classified by their boiling points.

Section 8 – Conclusion:

The following table summarizes guidelines referenced in this report. All of the guidelines referenced are recommendations and to not necessary represent a threshold above which health symptoms will occur. Individual susceptibility varies and isolated complaints about air quality may occur even if all sampling results are within the recommended guidelines. If sampling results are all within recommend guidelines complaints about air quality should be minimal.

PARAMETER	RECOMMENDED LIMIT OF RANGE	
Temperature	Winter	20°C – 24.4°C
	Summer	22.7°C – 26.1°C
Relative Humidity	Winter	30% - 50%
	Summer	40% - 60%
Carbon Dioxide (CO_2)	1,100 Parts Per Million (PPM) - ASHRAE	
Carbon Monoxide (CO)	9 Parts Per Million (PPM) - LEED	
Total VOC's	500 Parts per Billion (PPB) - LEED	
Formaldehyde	50 Parts per Billion (PPB) - LEED	
Total Particulates	50 Micrograms Per Cubic Meter - LEED	

Section 9 – Recommendations:

No recommendations are warranted at this time.