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:
Spring Farms Elementary School
12075 Old Plank Road
Three Springs, Pennsylvania

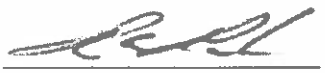
PROJECT DATE:
April 4, 2022

PREPARED FOR:
Mr. Stanley Hall
shall@shcsd.org
Southern Huntingdon County School District
10339 Pogue Road
Three Springs, Pennsylvania 17249

CALI PROJECT NUMBER:
22-1049-001

REPORT DATE:
April 6, 2022

SURVEY PERFORMED BY:



Richard E. Roush, CIAQM/Project Manager

CUMBERLAND ANALYTICAL LABORATORIES, INC.
125 Frytown Road
Carlisle, Pennsylvania 17015
Phone: (717) 379-3782
E-Mail: rich. roush@c-analytical .com www.cumberlandanalyticallabs.com

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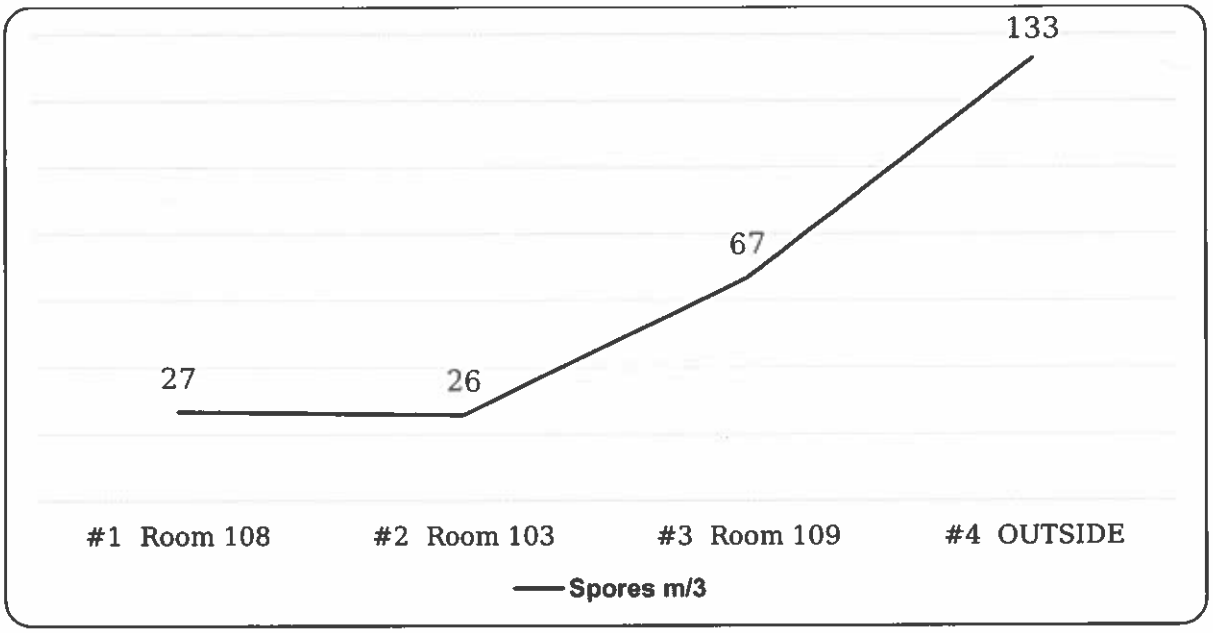
Executive Summary for Airborne Fungal Contaminants (Mold Sampling):

In April 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 Spring Farms Elementary School. This survey consisted of the collection of Air Samples for Airborne Fungal Contaminants.

Mold Survey Results:

The results table listed below showed that **NO unusual mold condition exists** in any of the samples listed below. 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:

No further testing is warranted at this time.

Non-Viable Mold Spore Trap Sample Results Table:

Sampling Information	#1 Room 108			#2 Room 103			#3 Room 109			#4 OUTSIDE		
Sample Volume	75.00 liter			75.00 liter			75.00 liter			75.00 liter		
Reporting Limit	13 spores/m³			13 spores/m³			13 spores/m³			13 spores/m³		
Background	2			3			2			2		
Fragments	ND			ND			ND			ND		
Organism	Raw Count	Count / m³	% of Total	Raw Count	Count / m³	% of Total	Raw Count	Count / m³	% of Total	Raw Count	Count / m³	% of Total
Ascospores	2	27	100.0%	1	13	50.0%	2	27	40.0%	6	80	60.0%
Aspergillus/ Penicillium	0	0	0.0%	0	0	0.0%	0	0	0.0%	3	40	30.0%
Chaetomium	0	0	0.0%	1	13	50.0%	0	0	0.0%	0	0	0.0%
Cladosporium	0	0	0.0%	0	0	0.0%	3	40	60.0%	1	13	10.0%
Myxomycetes	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Total	2	27	100%	2	26	100%	5	67	100%	10	133	100%

Color Coding:

Color Coding: Fungi that are present in indoor samples at levels lower than 200 per cubic meter are not color coded on the report, unless they are one of the water damage indicators.

Green: Common Allergen: Although all molds are potential allergens, these are the most common allergens that may be found indoors.

Blue: These molds are commonly seen in conditions of prolonged water intrusion and usually indicate a problem.

Ascospores:
Habitat: A large group of more than 3000 species of fungi. Common plant pathogens and outdoor numbers become very high following rain. Most of the genera are indistinguishable by spore trap analysis and are combined on the report
Effects: Health effects are poorly studied, but many are likely to be allergenic.

Aspergillus/Penicillium:
Habitat: The most common fungi isolated from the environment. Very common in soil and decaying plant material. Are able to grow well indoors on a wide variety of substrates.
Effects: This group contains common allergens, and may can cause hypersensitivity pneumonitis. They may cause extrinsic asthma, and many are opportunistic pathogens. Many species produce mycotoxins which may be associated with disease in humans and other animals. Toxin production is dependent on the species, the food source, competition with other organisms, and other environmental conditions.

Chaetomium:
Habitat: Ascomycete fungus, commonly isolated from soil and decaying plant materials. It is cellulolytic and grows well indoors on damp sheetrock and other paper substrates. It is often found growing with Stachybotrys.
Effects: It is reported to be allergenic and may produce toxins.

Cladosporium:
Habitat: One of the most common genera worldwide. Found in soil and plant debris and on the leaf surfaces of living plants. The outdoor numbers are lower in the winter and often relatively high in the summer, especially in high humidity. The outdoor numbers often spike in the late afternoon and evening. Indoors, it can be found growing on textiles, wood, sheetrock moist windowsills and in HVAC supply ducts.
Effects: A common allergen, producing more than 10 allergenic antigens and a common cause of hypersensitivity pneumonitis.

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 Hayes Microbial Consulting (Midlothian, 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.

Executive Summary for Indoor Air Quality:

In April of 2022, Cumberland Analytical Laboratories, Inc. (CALI) was contracted by the Southern Huntingdon County School District to perform an Indoor Air Quality Survey at the Spring Farms Elementary School for 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.

Section 1 - Introduction to Indoor Air Quality Sampling:

Cumberland Analytical Laboratories, Inc. (CALI) was retained by the Southern Huntingdon County School District to perform and Indoor Air Quality (IAQ) Survey at the Spring Farms Elementary School. The scope of work for this survey was to conduct a general IAQ Survey of Room 108 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),
7. Nitrogen Dioxide (NO2),
8. Hydrogen Sulfide (H_2S); and
9. 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 **Nitrogen Dioxide (NO2)** In the air quality directive (2008/EC/50) the EU has set two **limit** values for nitrogen dioxide (NO2) for the protection of human health: the NO2 hourly mean value may not exceed 200 micrograms per cubic meter (µg/m3) more than 18 times in a year and the NO2 annual mean value may not exceed 40 micrograms per cubic meter (µg/m3).

8. The recommended guideline for **Hydrogen Sulfide (H_2S)** is **OSHA**: The legal airborne permissible exposure limit (PEL) is 20 ppm not to be exceeded at any time, and 50 ppm as a maximum peak, not to be exceeded during any 10-minute work period. **NIOSH:** The recommended airborne exposure limit (REL) is 10 ppm, which should not be exceeded during any 10-minute work period.

9. 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 Room 108:

(CO) ppm	(CO_2) ppm	Temperature (C^o)	Humidity (%)	Dust (ug/m3)	VOC'S (ppb)
0.00	314	18.8	43.12	12.0	0.00

Nitrogen Dioxide (NO2)	Hydrogen Sulfide (N2S)	Formaldehyde (ppb)
0.00	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.

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).

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.

Nitrogen Dioxide (NO2): 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.

Hydrogen Sulfide (H_2S): 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.

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.

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.

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.

Nitrogen Dioxide (NO2) - is one of a group of highly reactive gases known as oxides of nitrogen or nitrogen oxides (NOx). Other nitrogen oxides include nitrous acid and nitric acid. NO 2 is used as the indicator for the larger group of nitrogen oxides. Breathing air with a high concentration of NO_2 can irritate airways in the human respiratory system. Such exposures over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions and visits to emergency rooms. Longer exposures to elevated concentrations of NO_2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections. People with asthma, as well as children and the elderly are generally at greater risk for the health effects of NO_2.

NO_2 along with other NO_x reacts with other chemicals in the air to form both particulate matter and ozone. Both of these are also harmful when inhaled due to effects on the respiratory system.

Hydrogen Sulfide (H_2S) - is a chemical compound with the formula H_2S. It is a colorless chalcogen-hydride gas with the characteristic foul odor of rotten eggs. It is poisonous, corrosive, and flammable. Hydrogen sulfide is often produced from the microbial breakdown of organic matter in the absence of oxygen, such as in swamps and sewers; this process is commonly known as anaerobic digestion which is done by sulfate-reducing microorganisms. H_2S also occurs in volcanic gases, natural gas, and in some sources of well water. The human body produces small amounts of H_2S and uses it as a signaling molecule. When high amounts of this chemical are found in the human body, damage to organs can occur with symptoms ranging from breathing difficulties to convulsions and even death.

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.

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	
Carbon Dioxide (CO_2)	1,100 Parts Per Million (PPM) - ASHRAE	
Carbon Monoxide (CO)	9 Parts Per Million (PPM) - LEED	
Temperature	Winter	20°C - 24.4°C
	Summer	22.7°C - 26.1°C
Relative Humidity	Winter	30% - 50%
	Summer	40% - 60%
Total Particulates	50 Micrograms Per Cubic Meter - LEED	
Nitrogen Dioxide (NO2)	In the air quality directive (2008/EC/50) the EU has set two **limit** values for nitrogen dioxide (NO2) for the protection of human health: the NO2 hourly mean value may not exceed 200 micrograms per cubic meter (µg/m3) more than 18 times in a year and the NO2 annual mean value may not exceed 40 micrograms per cubic meter (µg/m3).	
Hydrogen Sulfide (H_2S)	**OSHA**: The legal airborne permissible exposure limit (PEL) is 20 ppm not to be exceeded at any time, and 50 ppm as a maximum peak, not to be exceeded during any 10-minute work period. **NIOSH:** The recommended airborne exposure limit (REL) is 10 ppm, which should not be exceeded during any 10-minute work period.	
Total VOC's	500 Parts per Billion (PPB) - LEED	
Formaldehyde	50 Parts per Billion (PPB) - LEED	

Section 9 - Recommendations:

No recommendations are warranted at this time.