



31 August 2021

Mr. Chris Locarno  
Director of Finance and Facilities  
Central Vermont Supervisory Union #68  
111B Brush Hill Road  
Williamstown, Vermont 05679

Re: Indoor Air Quality Assessment – Northfield Elementary School, Northfield, Vermont  
K-D Project No. 20173-001

Dear Mr. Locarno:

At your request, K-D Associates, Inc. conducted an indoor air quality assessment of the Northfield Elementary School in Northfield, Vermont. This assessment was conducted as part of a periodic monitoring plan for all schools within the Central Vermont Supervisory Union. The assessment included measurements of carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), temperature (°F), and volatile organic compounds (VOC's). Measurements were made both indoors and outdoors for comparison purposes. The assessment was conducted on the morning of July 14, 2021. This report includes a description of the testing methodologies and measurements made while on site, laboratory analysis results for VOC's and airborne mold spores, a floor plan sketch showing the location of mold and VOC sampling, and a discussion of the sampling results.

### Field Screening Results

Field screening results for carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), and temperature (F) are presented below. All measurements were made using an Extech EA80 Indoor Air Quality Meter, MSA Altair4 Carbon Monoxide meter.

<b>Location</b>	<b>CO (ppm)</b>	<b>CO<sub>2</sub> (ppm)</b>	<b>Temp (°F)</b>	<b>RH (%)</b>
Outdoors	0	380	67.0	70.0
Music Room	0	442	73.2	78.4
Stairway	0	440	73.0	76.3
Entry	0	416	72.8	70.6
Copier Room	0	425	73.4	71.2
Room 229	0	422	72.1	73.8
Room 280	0	427	72.0	73.4
Hallway	0	430	70.6	73.4
Room 236	0	429	72.1	72.6
Room 242	0	430	73.0	73.0
Hallway	0	479	72.4	73.6
Room 251	0	451	71.1	73.1
Room 144	0	492	74.0	71.0
Room 143	0	481	71.2	72.0

Room 135	0	441	72.3	70.1
Hallway	0	443	70.6	70.8
Entry	0	448	71.0	70.2
Gymnasium	0	452	71.2	70.1
Kitchen	0	450	72.6	69.8
Room 203	0	471	71.8	71.8
Maine Office	0	497	69.3	72.5
Room 224	0	513	71.6	71.6
Room 229	0	480	71.2	71.2

### **Temperature and Relative Humidity**

Indoor temperatures ranged from 69.8 to 74.0 degrees F throughout the school. Most people are comfortable in this temperature range when sedentary or slightly active with a relative humidity above 20%. Relative humidity ranged from 69.8% to 78.4%, which is higher than is generally a comfortable range of 20% to 60%.

### **Carbon Dioxide**

The adequacy of ventilation can sometimes be evaluated using CO<sub>2</sub> measurements. CO<sub>2</sub> is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of fresh air are being introduced and CO<sub>2</sub> exhausted. The outdoor ambient concentration of CO<sub>2</sub> is typically between 380 and 450 parts per million (ppm). Usually the CO<sub>2</sub> level is higher inside than outside, even in buildings with few complaints about indoor air quality. CO<sub>2</sub> levels ranged from a low of 416 ppm to a high of 513 ppm. As a rule of thumb, indoor CO<sub>2</sub> concentrations greater than 1000 ppm are an indication of inadequate ventilation. These measurements are within expected limits. The school was unoccupied at the time of these measurement.

### **Carbon Monoxide**

Carbon monoxide (CO) is a colorless, odorless and toxic gas. Improperly vented gas, oil or kerosene heaters, or poorly adjusted and maintained combustion devices are typical sources of carbon monoxide. Auto and bus exhaust also contains carbon monoxide, which can be introduced into indoor air through poorly located fresh air intakes to a heating/ventilation system. Monitored with a calibrated, direct-reading air monitor, the levels of carbon monoxide in the office were recorded for comparison to the OSHA Permissible Exposure Limit (PEL) of 50 parts per million (ppm). Carbon Monoxide measurements were found to be 0 ppm in all areas.

### **Volatile Organic Compounds**

The VOC sampling utilized Mini Can collection devices and high flow regulators to collect grab samples of the indoor air. The indoor sampler was placed in the Cafeteria as shown on the attached floor plan. At the end of the sampling period, the sample canisters were shipped under chain-of-custody to EMSL Analytical, Inc for analysis. Analysis was performed by EPA Method TO-15, using GC/MS to identify 62 regulated target compounds. The EMSL laboratory report for this sample is attached. All target compounds sampled for were found to be either none detected (ND) or well within the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Level (REL) and the Occupational Safety and Health Administration (OSHA) Permissible

Exposure Level (PEL) with one exception:

- Freon 12 (Dichlorodifluoromethane) was found at a level of 20 ug/m<sup>3</sup>. This level is well below the NIOSH REL (4,900,000 ug/m<sup>3</sup>) and the OSHA PEL (4,900,000 ug/m<sup>3</sup>) but exceeds the EPA RSL of 10.0 ug/m<sup>3</sup> that would be considered a theoretical risk that 1 in 100,000 would experience deleterious health effects. This is a widely used refrigerant.

### Airborne Mold Spores

Laboratory analysis results for four Air-O-Cell cassettes, which were used to collect air samples from three areas within the school and outdoors (for comparison) are attached. Analysis of these samples provides a rough measure of airborne spores and a general description of the species present.

Air-O-Cell cassettes are a self-contained sampling device with a pre-applied collection/sampling media. Potential, inadvertent contamination is prevented because the media does not require handling. This method generally provides good consistency between samples. The cassettes are attached to a high volume, sampling pump with an adaptor and air is drawn through the cassettes. Particles (spores, pollen and other particles) in the air being sampled impact the slide, coated with a sticky transparent "acrylic" substrate and adhere. The pump is calibrated at the beginning and the end of the sampling period, using a rotometer to measure the flow rate at the face of the cassette. The cassette inlet orifice is oriented at a 45° angle downward and a minimum of 15 liters per minute is maintained for approximately 5 to 10 minutes. At the completion of sampling, the cassette is sealed and transported to the laboratory for analysis. Analysis data is separated into three categories: fungal spores, pollen, and other particles. Each category is looked at individually for interpretation. We are primarily concerned with the number of spores per cubic meter of air and the variety of spores found.

The total airborne spore count in Location A (Music Room) was 533 spores per cubic meter of air, 53 spores per cubic meter of air in Location B (Room 144), and 267 spores per cubic meter of air in Location C (Room 135). The total airborne spore counts in all interior locations sampled was very low and at a level that would not be considered unusual in an indoor environment.

### **Mold Types Identified**

**Ascospores** - The largest group of fungi species that are primarily considered to be outdoor spores. They generally are plant pathogens but also include Morel mushrooms and cup fungi.

***Aspergillus/Penicillium***-like spores include a large number of different species that are difficult or impossible to visibly distinguish to the species level unless they are grown in culture. Members of this group are prolific spore producers and both beneficial (fermented foods and cheese products) and destructive (food spoilage, inhalant allergens and toxin producers).

**Basidiospores** - Are usually unicellular spores produced by thousands of different fungi generally considered to be outdoor molds (fungi including mushrooms, bracket fungi, puffballs, etc.)

*Cladosporium sp.* is a group commonly found in both indoors and outdoors. However, when found on samples in elevated quantities, they can be an indicator of wet cellulose-containing building materials, paper or textiles and is a known allergen.

**Deuteromycetes** - These spores are very commonly found outdoors and finding them in small numbers on indoor samples generally would not be a mold concern. These groups of mold spores do not commonly associate themselves with building materials

### Discussion

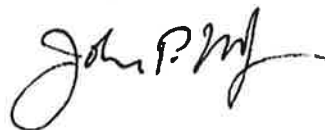
The field measurements made were well within expected limits. Temperature and relative humidity appear to be adequately controlled, to the extent that the system allows, within comfortable levels. No detectable level of carbon monoxide could be detected at the time of the survey and carbon dioxide measurements did not appear to be elevated.

Air sampling for mold spores did not find any unusual levels that would suggest a mold growth issue at this time.

The screening conducted for Volatile Organic Compounds (VOC's) detected one compound at a level that exceeded the EPA Residential Regional Screening Level. EPA Residential Regional Screening Level was developed to assess vapor intrusion from contaminated environmental media into a structure and is being used in this assessment to provide guidance in understanding the potential impact of these compounds. While contamination from an outside source can not be ruled out with what is currently known, it is more likely that the source of these contaminants is a product used within the school. The EPA screening levels are intended to assess the impact of exposure over a life time.

Please do not hesitate to call if you have any questions.

Sincerely,

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John P. Madigan



31 August 2021

Mr. Chris Locarno  
Director of Finance and Facilities  
Central Vermont Supervisory Union #68  
111B Brush Hill Road  
Williamstown, Vermont 05679

Re: Indoor Air Quality Assessment – Northfield Middle and High School, Northfield, Vermont  
K-D Project No. 20173-001

Dear Mr. Locarno:

At your request, K-D Associates, Inc. conducted an indoor air quality assessment of the Northfield Middle and High School in Northfield, Vermont. This assessment was conducted as part of a periodic monitoring plan for all schools within the Central Vermont Supervisory Union. The assessment included measurements of carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), temperature (°F), and volatile organic compounds (VOC's). Measurements were made both indoors and outdoors for comparison purposes. The assessment was conducted on the morning of July 14, 2021. This report includes a description of the testing methodologies and measurements made while on site, laboratory analysis results for VOC's and airborne mold spores, a floor plan sketch showing the location of mold and VOC sampling, and a discussion of the sampling results.

### Field Screening Results

Field screening results for carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), and temperature (F) are presented below. All measurements were made using an Extech EA80 Indoor Air Quality Meter, MSA Altair4 Carbon Monoxide meter.

<u>Location</u>	<u>CO</u> <u>(ppm)</u>	<u>CO<sub>2</sub></u> <u>(ppm)</u>	<u>Temp</u> <u>(°F)</u>	<u>RH</u> <u>(%)</u>
Outdoors	0	425	71.0	66.8
Room 165	0	415	73.8	69.1
Hallway	0	441	72.4	69.6
Room 167	0	412	72.2	71.1
Room 166	0	443	71.0	70.2
Lobby	0	419	72.2	71.7
Hall of Honors	0	410	72.4	72.0
Room 144	0	421	72.1	72.1
Room 140	0	439	71.8	72.4
Gymnasium	0	440	72.0	72.0
Room 123	0	446	72.8	72.0
Room 129	0	460	73.0	72.9
Hallway	0	483	72.4	73.2
Near Room 131	0	481	73.0	73.6
Near Room 132	0	462	73.0	74.1

Room 118	0	451	73.1	72.2
Room 116	0	427	72.2	72.1
Room 114	0	434	71.1	72.0
Hallway	0	430	73.1	70.2
Room 110	0	428	72.0	71.9
Room 101	0	441	71.9	67.1
Room 102	0	490	68.0	64.0
Room 203	0	585	71.9	72.1
Room 205	0	525	71.0	70.4
Hallway	0	525	71.1	71.0
Room 212	0	510	71.3	71.7
Room 217	0	511	72.0	69.2
Room 218	0	507	71.4	68.9

### Temperature and Relative Humidity

Indoor temperatures ranged from 68.0 to 73.8 degrees F throughout the school. Most people are comfortable in this temperature range when sedentary or slightly active with a relative humidity above 20%. Relative humidity ranged from 64.0% to 74.1%, which is above what is generally a comfortable range of 20% to 60%.

### Carbon Dioxide

The adequacy of ventilation can sometimes be evaluated using CO<sub>2</sub> measurements. CO<sub>2</sub> is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of fresh air are being introduced and CO<sub>2</sub> exhausted. The outdoor ambient concentration of CO<sub>2</sub> is typically between 375 and 450 parts per million (ppm). Usually the CO<sub>2</sub> level is higher inside than outside, even in buildings with few complaints about indoor air quality. CO<sub>2</sub> levels ranged from a low of 396 ppm to a high of 501 ppm. As a rule of thumb, indoor CO<sub>2</sub> concentrations greater than 1000 ppm are an indication of inadequate ventilation. These measurements are within expected limits. The school was unoccupied at the time of these measurement.

### Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless and toxic gas. Improperly vented gas, oil or kerosene heaters, or poorly adjusted and maintained combustion devices are typical sources of carbon monoxide. Auto and bus exhaust also contains carbon monoxide, which can be introduced into indoor air through poorly located fresh air intakes to a heating/ventilation system. Monitored with a calibrated, direct-reading air monitor, the levels of carbon monoxide in the office were recorded for comparison to the OSHA Permissible Exposure Limit (PEL) of 50 parts per million (ppm). Carbon Monoxide measurements were found to be 0 ppm in all areas.

### Volatile Organic Compounds

The VOC sampling utilized Mini Can collection devices and high flow regulators to collect grab samples of the indoor air. The indoor sampler was placed in the hallway near Room 165, Living Arts as shown on the attached floor plan. At the end of the sampling period, the sample canisters were shipped under chain-of-custody to EMSL Analytical, Inc, for laboratory analysis. Analysis

was performed by EPA Method TO-15, using GC/MS to identify 62 regulated target compounds. The EMSL laboratory report for this sample is attached. All target compounds sampled for were found to be either none detected (ND) or well within the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Level (REL) and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL).

### Airborne Mold Spores

Laboratory analysis results for four Air-O-Cell cassettes, which were used to collect air samples from three areas within the school and outdoors (for comparison) are attached. Analysis of these samples provides a rough measure of airborne spores and a general description of the species present.

Air-O-Cell cassettes are a self-contained sampling device with a pre-applied collection/sampling media. Potential, inadvertent contamination is prevented because the media does not require handling. This method generally provides good consistency between samples. The cassettes are attached to a high volume, sampling pump with an adaptor and air is drawn through the cassettes. Particles (spores, pollen and other particles) in the air being sampled impact the slide, coated with a sticky transparent "acrylic" substrate and adhere. The pump is calibrated at the beginning and the end of the sampling period, using a rotometer to measure the flow rate at the face of the cassette. The cassette inlet orifice is oriented at a 45° angle downward and a minimum of 15 liters per minute is maintained for approximately 5 to 10 minutes. At the completion of sampling, the cassette is sealed and transported to the laboratory for analysis. Analysis data is separated into three categories: fungal spores, pollen, and other particles. Each category is looked at individually for interpretation. We are primarily concerned with the number of spores per cubic meter of air and the variety of spores found.

The total airborne spore count in Location A (Living Arts) was 693 spores per cubic meter of air, 0 spores per cubic meter of air in Location B (Room 144), 53 spores per cubic meter of air in Location C (Room 202). The total airborne spore counts in all locations sampled at the school were very low and at a level that would not be considered unusual in an indoor environment. The spores identified are also common in both indoor and outdoor environments.

### **Mold Types Identified**

**Ascospores** - The largest group of fungi species that are primarily considered to be outdoor spores. They generally are plant pathogens but also include Morel mushrooms and cup fungi.

**Deuteromycetes** - These spores are very commonly found outdoors and finding them in small numbers on indoor samples generally would not be a mold concern. These groups of mold spores do not commonly associate themselves with building materials inside the house.

### Discussion

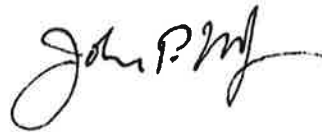
The field measurements made were well within expected limits. Temperature and relative humidity appear to be adequately controlled, to the extent that the system allows, within comfortable levels. No detectable level of carbon monoxide could be detected at the time of the survey and carbon dioxide measurements did not appear to be elevated.

Air sampling for mold spores did not find any unusual levels that would suggest a mold growth issue at this time.

The screening conducted for Volatile Organic Compounds (VOC's) did not detect any compounds at a level that exceeded either the EPA Residential Regional Screening Level and/or the Vermont Indoor Air Standard. The Vermont Indoor Air Standard was developed to assess vapor intrusion from contaminated environmental media into a structure and is being used in this assessment to provide guidance in understanding the potential impact of these compounds. The EPA screening levels are intended to assess the impact of exposure over a life time.

Please do not hesitate to call if you have any questions.

Sincerely,

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Re: Indoor Air Quality Assessment – Williamstown Middle and High School  
Williamstown, Vermont  
K-D Project No. 20173-001

Dear Mr. Locarno:

At your request, K-D Associates, Inc. conducted an indoor air quality assessment of the Williamstown Middle and High School in Williamstown, Vermont. This assessment was conducted as part of a periodic monitoring plan for all schools within the Central Vermont Supervisory Union. The assessment included measurements of carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), temperature (°F), and volatile organic compounds (VOC's). Measurements were made both indoors and outdoors for comparison purposes. The assessment was conducted on the morning of July 15, 2021. This report includes a description of the testing methodologies and measurements made while on site, laboratory analysis results for VOC's and airborne mold spores, a floor plan sketch showing the location of mold and VOC sampling, and a discussion of the sampling results.

### Field Screening Results

Field screening results for carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), and temperature (F) are presented below. All measurements were made using an Extech EA80 Indoor Air Quality Meter, MSA Altair4 Carbon Monoxide meter.

<u>Location</u>	<u>CO</u> <u>(ppm)</u>	<u>CO<sub>2</sub></u> <u>(ppm)</u>	<u>Temp</u> <u>(°F)</u>	<u>RH</u> <u>(%)</u>
Outdoors	0	430	73.1	70.6
Room 123	0	482	74.0	73.6
Room 153	0	485	73.2	72.2
Room 155	0	458	74.1	81.2
Room 161	0	471	73.7	79.6
Hallway	0	473	72.9	79.8
Room 168	0	470	73.1	78.6
Room 170	0	469	72.0	78.4
Room 176	0	460	72.3	79.0
Room 178	0	464	72.4	79.1
Room 179	0	462	72.3	78.2

Room 199	0	467	72.4	77.8
Room 213	0	471	73.1	76.4
Room 197	0	470	73.0	77.0
Hallway	0	469	72.6	76.1
Room 242	0	472	73.0	75.3
Room 118	0	469	72.5	74.1
Room 231	0	472	74.1	74.9
Room 235	0	483	73.6	75.0
Room 220	0	469	72.0	74.1

### **Temperature and Relative Humidity**

Indoor temperatures ranged from 72.0 to 74.1 degrees F throughout the school. Most people are comfortable in this temperature range when sedentary or slightly active with a relative humidity above 20%. Relative humidity ranged from 72.2% to 81.2%, which is above what is generally a comfortable range of 20% to 60%.

### **Carbon Dioxide**

The adequacy of ventilation can sometimes be evaluated using CO<sub>2</sub> measurements. CO<sub>2</sub> is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of fresh air are being introduced and CO<sub>2</sub> exhausted. The outdoor ambient concentration of CO<sub>2</sub> is typically between 375 and 450 parts per million (ppm). Usually the CO<sub>2</sub> level is higher inside than outside, even in buildings with few complaints about indoor air quality. CO<sub>2</sub> levels ranged from a low of 458 ppm to a high of 485 ppm. As a rule of thumb, indoor CO<sub>2</sub> concentrations greater than 1000 ppm are an indication of inadequate ventilation. These measurements are within expected limits. The school was unoccupied at the time of these measurement.

### **Carbon Monoxide**

Carbon monoxide (CO) is a colorless, odorless and toxic gas. Improperly vented gas, oil or kerosene heaters, or poorly adjusted and maintained combustion devices are typical sources of carbon monoxide. Auto and bus exhaust also contains carbon monoxide, which can be introduced into indoor air through poorly located fresh air intakes to a heating/ventilation system. Monitored with a calibrated, direct-reading air monitor, the levels of carbon monoxide in the office were recorded for comparison to the OSHA Permissible Exposure Limit (PEL) of 50 parts per million (ppm). Carbon Monoxide measurements were found to be 0 ppm in all areas.

### **Volatile Organic Compounds**

The VOC sampling utilized Mini Can collection devices and high flow regulators to collect grab samples of the indoor air. The indoor sampler was placed in the hallway as shown on the attached floor plan. At the end of the sampling period, the sample canisters were shipped under chain-of-custody to EMSL Analytical, Inc, for laboratory analysis. Analysis was performed by EPA Method TO-15, using GC/MS to identify 62 regulated target compounds. The EMSL laboratory report for this sample is attached. All target compounds sampled for were found to be either none detected (ND) or well within the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Level (REL) and the Occupational Safety and Health Administration

(OSHA) Permissible Exposure Level (PEL) with the exception of one compound.

- Isopropyl alcohol (2-Propanol) was found at a level of 29 ug/m<sup>3</sup>. This level is well below the NIOSH REL (980,000 ug/m<sup>3</sup>) and the OSHA PEL (980,000 ug/m<sup>3</sup>) but exceeds the EPA RSL of 21.0 ug/m<sup>3</sup> that would be considered a theoretical risk that 1 in 100,000 would experience deleterious health effects. This slightly elevated level is likely the result of the use of alcohol-based cleaning and disinfectant products currently in use at schools.

### Airborne Mold Spores

Laboratory analysis results for four Air-O-Cell cassettes, which were used to collect air samples from three areas within the school and outdoors (for comparison) are attached. Analysis of these samples provides a rough measure of airborne spores and a general description of the species present.

Air-O-Cell cassettes are a self-contained sampling device with a pre-applied collection/sampling media. Potential, inadvertent contamination is prevented because the media does not require handling. This method generally provides good consistency between samples. The cassettes are attached to a high volume, sampling pump with an adaptor and air is drawn through the cassettes. Particles (spores, pollen and other particles) in the air being sampled impact the slide, coated with a sticky transparent "acrylic" substrate and adhere. The pump is calibrated at the beginning and the end of the sampling period, using a rotometer to measure the flow rate at the face of the cassette. The cassette inlet orifice is oriented at a 45° angle downward and a minimum of 15 liters per minute is maintained for approximately 5 to 10 minutes. At the completion of sampling, the cassette is sealed and transported to the laboratory for analysis. Analysis data is separated into three categories: fungal spores, pollen, and other particles. Each category is looked at individually for interpretation. We are primarily concerned with the number of spores per cubic meter of air and the variety of spores found.

The total airborne spore count in Location A (Hallway) was 267 spores per cubic meter of air, 107 spores per cubic meter of air in Location B (Room 153), 213 spores per cubic meter of air in Location C (Room 242), and 25,120 spores per cubic meter of air outdoors. The total airborne spore counts in the interior locations sampled at the school were all very low and at a level that would not be considered unusual in an indoor environment. The spores identified are also common in both indoor and outdoor environments.

### **Spore Types Identified**

**Basidiospores** - Are usually unicellular spores produced by thousands of different fungi generally considered to be outdoor molds (fungi including mushrooms, bracket fungi, puffballs, etc.)

**Deuteromycetes** - These spores are very commonly found outdoors and finding them in small numbers on indoor samples generally would not be a mold concern. These groups of mold spores do not commonly associate themselves with building materials inside the house.

## Discussion

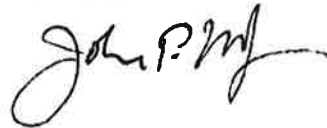
None of the testing results described above indicate unusual conditions that would suggest poor indoor air quality at the time of testing.

The field measurements made were well within expected limits. Temperature and relative humidity appear to be adequately controlled, to the extent that the system allows, within comfortable levels. No detectable level of carbon monoxide could be detected at the time of the survey and carbon dioxide measurements did not appear to be elevated.

The screening conducted for Volatile Organic Compounds (VOC's) detected one compound at a level that exceeded the EPA Residential Regional Screening Level. EPA Residential Regional Screening Level was developed to assess vapor intrusion from contaminated environmental media into a structure and is being used in this assessment to provide guidance in understanding the potential impact of these compounds. While contamination from an outside source can not be ruled out with what is currently known, it is more likely that the source of these contaminants is a product used within the school. The EPA screening levels are intended to assess the impact of exposure over a life time.

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Outdoors	0	450	69.0	81.0
Hallway	0	529	76.1	72.2
Room 13	0	516	74.2	73.0
Room 5	0	504	73.9	74.1
Lobby	0	485	75.1	75.1
Room 10	0	490	72.6	74.9
Room 9	0	492	73.1	75.2
Room 11	0	563	73.4	75.2
Room 8	0	527	74.0	75.7
Room 21	0	505	72.1	76.1
Room 31	0	517	73.0	76.7
Room 22	0	500	72.1	76.4
Room 28	0	496	71.6	76.2
Room 26	0	490	72.7	76.0

## Temperature and Relative Humidity

Indoor temperatures ranged from 72.1 to 76.1 degrees F throughout the school. Most people are comfortable in this temperature range when sedentary or slightly active with a relative humidity above 20%. Relative humidity ranged from 72.2% to 76.7%, which is above what is generally a comfortable range of 20% to 60%.

## Carbon Dioxide

The adequacy of ventilation can sometimes be evaluated using CO<sub>2</sub> measurements. CO<sub>2</sub> is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of fresh air are being introduced and CO<sub>2</sub> exhausted. The outdoor ambient concentration of CO<sub>2</sub> is typically between 375 and 450 parts per million (ppm). Usually the CO<sub>2</sub> level is higher inside than outside, even in buildings with few complaints about indoor air quality. CO<sub>2</sub> levels ranged from a low of 491 ppm to a high of 610 ppm. As a rule of thumb, indoor CO<sub>2</sub> concentrations greater than 1000 ppm are an indication of inadequate ventilation. These measurements are within expected limits. The school was unoccupied at the time of these measurement.

## Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless and toxic gas. Improperly vented gas, oil or kerosene heaters, or poorly adjusted and maintained combustion devices are typical sources of carbon monoxide. Auto and bus exhaust also contains carbon monoxide, which can be introduced into indoor air through poorly located fresh air intakes to a heating/ventilation system. Monitored with a calibrated, direct-reading air monitor, the levels of carbon monoxide in the office were recorded for comparison to the OSHA Permissible Exposure Limit (PEL) of 50 parts per million (ppm). Carbon Monoxide measurements were found to be 0 ppm in all areas.

## Volatile Organic Compounds

The VOC sampling utilized Mini Can collection devices and high flow regulators to collect grab samples of the indoor air. The indoor sampler was placed in the hallway as shown on the attached floor plan. At the end of the sampling period, the sample canisters were shipped under chain-of-custody to EMSL Analytical, Inc, for laboratory analysis. Analysis was performed by EPA Method TO-15, using GC/MS to identify 62 regulated target compounds. The EMSL laboratory report for this sample is attached. All target compounds sampled for were found to be either none detected (ND) or well within the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Level (REL) and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL).

## Airborne Mold Spores

Laboratory analysis results for four Air-O-Cell cassettes, which were used to collect air samples from three areas within the school and outdoors (for comparison) are attached. Analysis of these samples provides a rough measure of airborne spores and a general description of the species present.

Air-O-Cell cassettes are a self-contained sampling device with a pre-applied collection/sampling media. Potential, inadvertent contamination is prevented because the media does not require handling. This method generally provides good consistency between samples. The cassettes are attached to a high volume, sampling pump with an adaptor and air is drawn through the cassettes. Particles (spores, pollen and other particles) in the air being sampled impact the slide, coated with a sticky transparent "acrylic" substrate and adhere. The pump is calibrated at the beginning and the end of the sampling period, using a rotometer to measure the flow rate at the face of the cassette. The cassette inlet orifice is oriented at a 45° angle downward and a minimum of 15 liters per minute is maintained for approximately 5 to 10 minutes. At the completion of sampling, the cassette is sealed and transported to the laboratory for analysis. Analysis data is separated into three categories: fungal spores, pollen, and other particles. Each category is looked at individually for interpretation. We are primarily concerned with the number of spores per cubic meter of air and the variety of spores found.

The total airborne spore count in Location A (Hallway) was 53 spores per cubic meter of air, 533 spores per cubic meter of air in Location B (Room 26), and 53 spores per cubic meter of air in Location C (Room 8). The total airborne spore counts in the interior locations sampled at the school were very low and at a level that would not be considered unusual in an indoor environment. The spores identified are also common in both indoor and outdoor environments.

### **Mold Types Identified**

**Basidiospores** - Are usually unicellular spores produced by thousands of different fungi generally considered to be outdoor molds (fungi including mushrooms, bracket fungi, puffballs, etc.).

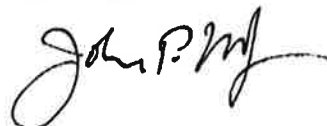
### **Discussion**

None of the testing results described above indicate unusual conditions that would suggest poor indoor or outdoor air quality at the time of testing.

The field measurements made were well within expected limits. Temperature and relative humidity appear to be adequately controlled, to the extent that the system allows, within comfortable levels. No detectable level of carbon monoxide could be detected at the time of the survey and carbon dioxide measurements did not appear to be elevated. The results of the screening for volatile organic compounds does not appear to represent an indoor air quality concern and airborne mold spores are within an expected range.

Please do not hesitate to call if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "John P. Madigan". The signature is fluid and cursive, with the first name "John" being the most prominent part.

John P. Madigan



31 August 2021

Mr. Chris Locarno  
Director of Finance and Facilities  
Central Vermont Supervisory Union #68  
111B Brush Hill Road  
Williamstown, Vermont 05679

Re: Indoor Air Quality Assessment – Washington Village School, Washington, Vermont  
K-D Project No. 20173-001

Dear Mr. Locarno:

At your request, K-D Associates, Inc. conducted an indoor air quality assessment of the Washington Village School in Washington, Vermont. This assessment was conducted as part of a periodic monitoring plan for all schools within the Central Vermont Supervisory Union. The assessment included measurements of carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), temperature (°F), and volatile organic compounds (VOC's). Measurements were made both indoors and outdoors for comparison purposes. The assessment was conducted on the morning of July 14, 2021. This report includes a description of the testing methodologies and measurements made while on site, laboratory analysis results for VOC's and airborne mold spores, a floor plan sketch showing the location of mold and VOC sampling, and a discussion of the sampling results.

### Field Screening Results

Field screening results for carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), and temperature (F) are presented below. All measurements were made using an Extech EA80 Indoor Air Quality Meter, MSA Altair4 Carbon Monoxide meter.

<b>Location</b>	<b>CO (ppm)</b>	<b>CO<sub>2</sub> (ppm)</b>	<b>Temp (°F)</b>	<b>RH (%)</b>
Outdoors	0	400	68.0	70.2
Room 12	0	434	70.1	68.1
Room 14	0	432	71.1	69.8
Room 11	0	428	70.2	69.0
Room 10	0	417	70.3	69.3
Kitchen	0	424	71.6	71.4
Room 2	0	422	70.2	71.6
Room 3	0	416	71.2	71.5
Hallway	0	418	70.4	71.1
Room 4	0	430	70.3	71.0
Room 6	0	435	71.2	71.2
Room 7	0	431	71.7	71.7
Room 24	0	417	70.9	70.7
Room 23	0	413	71.2	69.4
Room 22	0	412	71.7	69.6



Room 21	0	408	70.9	69.9
Room 17	0	412	71.2	69.6
Room 18	0	429	72.0	69.8
Room 19	0	411	72.1	69.7

### Temperature and Relative Humidity

Indoor temperatures ranged from 70.1 to 72.1 degrees F throughout the school. Most people are comfortable in this temperature range when sedentary or slightly active with a relative humidity above 20%. Relative humidity ranged from 68.1% to 71.6%, which is above what is generally a comfortable range of 20% to 60%.

### Carbon Dioxide

The adequacy of ventilation can sometimes be evaluated using CO<sub>2</sub> measurements. CO<sub>2</sub> is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of fresh air are being introduced and CO<sub>2</sub> exhausted. The outdoor ambient concentration of CO<sub>2</sub> is typically between 375 and 450 parts per million (ppm). Usually the CO<sub>2</sub> level is higher inside than outside, even in buildings with few complaints about indoor air quality. CO<sub>2</sub> levels ranged from a low of 411 ppm to a high of 435 ppm. As a rule of thumb, indoor CO<sub>2</sub> concentrations greater than 1000 ppm are an indication of inadequate ventilation. These measurements are within expected limits. The school was unoccupied at the time of these measurement.

### Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless and toxic gas. Improperly vented gas, oil or kerosene heaters, or poorly adjusted and maintained combustion devices are typical sources of carbon monoxide. Auto and bus exhaust also contains carbon monoxide, which can be introduced into indoor air through poorly located fresh air intakes to a heating/ventilation system. Monitored with a calibrated, direct-reading air monitor, the levels of carbon monoxide in the office were recorded for comparison to the OSHA Permissible Exposure Limit (PEL) of 50 parts per million (ppm). Carbon Monoxide measurements were found to be 0 ppm in all areas.

### Volatile Organic Compounds

The VOC sampling utilized Mini Can collection devices and high flow regulators to collect grab samples of the indoor air. The indoor sampler was placed in Room 12 as shown on the attached floor plan. At the end of the sampling period, the sample canisters were shipped under chain-of-custody to EMSL Analytical, Inc. for laboratory analysis. Analysis was performed by EPA Method TO-15, using GC/MS to identify 62 regulated target compounds. The EMSL laboratory report for this sample is attached. Nearly all target compounds were found to be either None Detected (ND) or well within the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Level (REL), the Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL), or EPA Residential Regional Screening Levels (RSL) with two exceptions:

- 1,2,4-Trimethylbenzene was found at a level of 6.8 ug/m<sup>3</sup>. This level is well below the NIOSH REL (120000 ug/m<sup>3</sup>) but exceeds the EPA RSL of 6.30 ug/m<sup>3</sup> which would be considered a theoretical risk that 1 in 1,000,000 would develop cancer. It is used as a sterilizing agent and in the

making of dyes, perfumes and resins. It is also used as a gasoline additive.

- Isopropyl alcohol (2-Propanol) was found at a level of 32 ug/m<sup>3</sup>. This level is well below the NIOSH REL (980,000 ug/m<sup>3</sup>) and the OSHA PEL (980,000 ug/m<sup>3</sup>) but exceeds the EPA RSL of 21.0 ug/m<sup>3</sup> that would be considered a theoretical risk that 1 in 100,000 would experience deleterious health effects. This slightly elevated level is likely the result of the use of alcohol-based cleaning and disinfectant products currently in use at schools.

### Airborne Mold Spores

Laboratory analysis results for four Air-O-Cell cassettes, which were used to collect air samples from three areas within the school and outdoors (for comparison) are attached. Analysis of these samples provides a rough measure of airborne spores and a general description of the species present.

Air-O-Cell cassettes are a self-contained sampling device with a pre-applied collection/sampling media. Potential, inadvertent contamination is prevented because the media does not require handling. This method generally provides good consistency between samples. The cassettes are attached to a high volume, sampling pump with an adaptor and air is drawn through the cassettes. Particles (spores, pollen and other particles) in the air being sampled impact the slide, coated with a sticky transparent "acrylic" substrate and adhere. The pump is calibrated at the beginning and the end of the sampling period, using a rotometer to measure the flow rate at the face of the cassette. The cassette inlet orifice is oriented at a 45° angle downward and a minimum of 15 liters per minute is maintained for approximately 5 to 10 minutes. At the completion of sampling, the cassette is sealed and transported to the laboratory for analysis. Analysis data is separated into three categories: fungal spores, pollen, and other particles. Each category is looked at individually for interpretation. We are primarily concerned with the number of spores per cubic meter of air and the variety of spores found.

The total airborne spore count in Location A (Room 12) was 267 spores per cubic meter of air, 853 spores per cubic meter of air in Location B (Room 24), 480 spores per cubic meter of air in Location C (Room 4), and 7,627 spores per cubic meter of air outdoors. The total airborne spore counts in the interior locations sampled at the school were at a level that would not be considered unusual in an indoor environment and significantly lower than the outdoor level. The spores identified are also common in both indoor and outdoor environments.

### **Mold Types Identified**

**Ascospores** - The largest group of fungi species that are primarily considered to be outdoor spores. They generally are plant pathogens but also include Morel mushrooms and cup fungi.

*Aspergillus/Penicillium*-like spores include a large number of different species that are difficult or impossible to visibly distinguish to the species level unless they are grown in culture. Members of this group are prolific spore producers and both beneficial (fermented foods and cheese products) and destructive (food spoilage, inhalant allergens and toxin producers).

**Basidiospores** - Are usually unicellular spores produced by thousands of different fungi generally considered to be outdoor molds (fungi including mushrooms, bracket fungi, puffballs, etc.).

*Cladosporium sp.* is a group commonly found in both indoors and outdoors. However, when found on samples in elevated quantities, they can be an indicator of wet cellulose-containing building materials, paper or textiles and is a known allergen.

*Ganoderma sp.* is a group of fungi that are commonly referred to as bracket fungi that grow on the trunks of trees. The spores from this group are considered to be outdoor spores and are not known as an allergen.

**Deuteromycetes** - These spores are very commonly found outdoors and finding them in small numbers on indoor samples generally would not be a mold concern. These groups of mold spores do not commonly associate themselves with building materials inside the house.

### Discussion

The field measurements made were well within expected limits. Temperature and relative humidity appear to be adequately controlled, to the extent that the system allows, within comfortable levels. No detectable level of carbon monoxide could be detected at the time of the survey and carbon dioxide measurements did not appear to be elevated.

Air sampling for mold spores did not find any unusual levels that would suggest a mold growth issue at this time.

The screening conducted for Volatile Organic Compounds (VOC's) detected five compounds at levels that exceeded either the EPA Residential Regional Screening Level and/or the Vermont Indoor Air Standard. While contamination from an outside source can not be ruled out with what is currently known, it is more likely that the source of these contaminants is a product used within the school. The EPA screening levels are intended to assess the impact of exposure over a life time.

While it is possible to explain why Isopropyl Alcohol would be elevated when considering the heightened level of disinfection and cleaning in schools during these times, it is not as obvious for the other elevated compound to suspect a specific product used in the school or to a contaminant from another location. In all cases, the level of these compounds detected is many magnitudes below the OSHA and NIOSH exposure levels for a worker exposed in an occupational setting.

Please do not hesitate to call if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "John P. Madigan". The signature is fluid and cursive, with the first name "John" being the most prominent part.

John P. Madigan



31 August 2021

Mr. Chris Locarno  
Director of Finance and Facilities  
Central Vermont Supervisory Union #68  
111B Brush Hill Road  
Williamstown, Vermont 05679

Re: Indoor Air Quality Assessment - Orange Center School, Barre, Vermont  
K-D Project No. 20173-001

Dear Mr. Locarno:

At your request, K-D Associates, Inc. conducted an indoor air quality assessment of the Orange Center School in Barre, Vermont. This assessment was conducted as part of a periodic monitoring plan for all schools within the Central Vermont Supervisory Union. The assessment included measurements of carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), temperature (°F), and volatile organic compounds (VOC's). Measurements were made both indoors and outdoors for comparison purposes. The assessment was conducted on the morning of July 15, 2021. This report includes a description of the testing methodologies and measurements made while on site, laboratory analysis results for VOC's and airborne mold spores, a floor plan sketch showing the location of mold and VOC sampling, and a discussion of the sampling results.

### Field Screening Results

Field screening results for carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), relative humidity (%RH), and temperature (F) are presented below. All measurements were made using an Extech EA80 Indoor Air Quality Meter, MSA Altair4 Carbon Monoxide meter.

<b>Location</b>	<b>CO (ppm)</b>	<b>CO<sub>2</sub> (ppm)</b>	<b>Temp (°F)</b>	<b>RH (%)</b>
Outdoors	0	374	70.1	69.4
Room 209	0	516	71.0	65.2
Room 207	0	486	70.6	66.7
Room 206	0	490	69.9	67.7
Room 205	0	457	70.7	66.9
Room 202	0	467	71.0	67.8
Room 204	0	466	70.2	70.1
Lower entry	0	489	70.3	70.4
Room 210	0	471	71.2	69.8
Room 212	0	450	71.1	70.1
Room 109	0	466	71.1	70.3
Room 108	0	471	70.2	71.2
Hallway	0	451	70.3	76.6
Room 107	0	452	70.2	74.2

Room104	0	459	71.2	75.2
Room 105	0	440	72.2	73.2
Room 102	0	464	70.1	75.2
Room 101	0	430	70.3	74.7

### Temperature and Relative Humidity

Indoor temperatures ranged from 69.9 to 72.2 degrees F throughout the school. Most people are comfortable in this temperature range when sedentary or slightly active with a relative humidity above 20%. Relative humidity ranged from 66.7% to 75.2%, which is above what is generally a comfortable range of 20% to 60%.

### Carbon Dioxide

The adequacy of ventilation can sometimes be evaluated using CO<sub>2</sub> measurements. CO<sub>2</sub> is a normal constituent of exhaled breath and, if monitored, can be used as a screening technique to evaluate whether adequate quantities of fresh air are being introduced and CO<sub>2</sub> exhausted. The outdoor ambient concentration of CO<sub>2</sub> is typically between 375 and 450 parts per million (ppm). Usually the CO<sub>2</sub> level is higher inside than outside, even in buildings with few complaints about indoor air quality. CO<sub>2</sub> levels ranged from a low of 430 ppm to a high of 516 ppm. As a rule of thumb, indoor CO<sub>2</sub> concentrations greater than 1000 ppm are an indication of inadequate ventilation. These measurements are within expected limits. The school was unoccupied at the time of these measurement.

### Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless and toxic gas. Improperly vented gas, oil or kerosene heaters, or poorly adjusted and maintained combustion devices are typical sources of carbon monoxide. Auto and bus exhaust also contains carbon monoxide, which can be introduced into indoor air through poorly located fresh air intakes to a heating/ventilation system. Monitored with a calibrated, direct-reading air monitor, the levels of carbon monoxide in the office were recorded for comparison to the OSHA Permissible Exposure Limit (PEL) of 50 parts per million (ppm). Carbon Monoxide measurements were found to be 0 ppm in all areas.

### Volatile Organic Compounds

The VOC sampling utilized Mini Can collection devices and high flow regulators to collect grab samples of the indoor air. The indoor sampler was placed in the hallway as shown on the attached floor plan. At the end of the sampling period, the sample canisters were shipped under chain-of-custody to EMSL Analytical, Inc, for laboratory analysis. Analysis was performed by EPA Method TO-15, using GC/MS to identify 62 regulated target compounds. The EMSL laboratory report for this sample is attached. All target compounds sampled for were found to be either none detected (ND) or well within the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Level (REL) and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL). No compounds were found to exceed the Environmental Protection Agency Residential Screening Levels (RSL) for carcinogenic and non-carcinogenic compounds with the exception of two compounds.

- Isopropyl alcohol (2-Propanol) was found at a level of 21 ug/m<sup>3</sup>. This level is well below the

NIOSH REL (980,000 ug/m<sup>3</sup>) and the OSHA PEL (980,000 ug/m<sup>3</sup>) and it at the EPA RSL of 21.0 ug/m<sup>3</sup> that would be considered a theoretical risk that 1 in 100,000 would experience deleterious health effects. This slightly elevated level is likely the result of the use of alcohol-based cleaning and disinfectant products currently in use at schools.

- Trans-1,2-Dichloroethane was found at a level of 10 ug/m<sup>3</sup>. This level is well below the OSHA PEL (680,000 ug/m<sup>3</sup>) but exceeds the EPA RSL of 4.2 ug/m<sup>3</sup> (non-carcinogenic risk).

### Airborne Mold Spores

Laboratory analysis results for four Air-O-Cell cassettes, which were used to collect air samples from three areas within the school and outdoors (for comparison) are attached. Analysis of these samples provides a rough measure of airborne spores and a general description of the species present.

Air-O-Cell cassettes are a self-contained sampling device with a pre-applied collection/sampling media. Potential, inadvertent contamination is prevented because the media does not require handling. This method generally provides good consistency between samples. The cassettes are attached to a high volume, sampling pump with an adaptor and air is drawn through the cassettes. Particles (spores, pollen and other particles) in the air being sampled impact the slide, coated with a sticky transparent "acrylic" substrate and adhere. The pump is calibrated at the beginning and the end of the sampling period, using a rotometer to measure the flow rate at the face of the cassette. The cassette inlet orifice is oriented at a 45° angle downward and a minimum of 15 liters per minute is maintained for approximately 5 to 10 minutes. At the completion of sampling, the cassette is sealed and transported to the laboratory for analysis. Analysis data is separated into three categories: fungal spores, pollen, and other particles. Each category is looked at individually for interpretation. We are primarily concerned with the number of spores per cubic meter of air and the variety of spores found.

The total airborne spore count in Location A (Room 209) was 0 spores per cubic meter of air, 107 spores per cubic meter of air in Location B (Room 202), 267 spores per cubic meter of air in Location C (Room 108), and 21,333 spores per cubic meter of air outdoors. The total airborne spore counts in all interior locations sampled at the school were very low and at a level that would not be considered unusual in an indoor environment. The spores identified are also common in both indoor and outdoor environments.

### **Mold Types Identified**

**Basidiospores** - Are usually unicellular spores produced by thousands of different fungi generally considered to be outdoor molds (fungi including mushrooms, bracket fungi, puffballs, etc.).

**Deuteromycetes** - These spores are very commonly found outdoors and finding them in small numbers on indoor samples generally would not be a mold concern. These groups of mold spores do not commonly associate themselves with building materials inside the house.

## Discussion

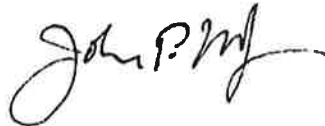
None of the testing results described above indicate unusual conditions that would suggest poor indoor or outdoor air quality at the time of testing.

The field measurements made were well within expected limits. Temperature and relative humidity appear to be adequately controlled, to the extent that the system allows, within comfortable levels. No detectable level of carbon monoxide could be detected at the time of the survey and carbon dioxide measurements did not appear to be elevated.

The screening conducted for Volatile Organic Compounds (VOC's) detected one compound at a level that exceeded the EPA Residential Regional Screening Level. EPA Residential Regional Screening Level was developed to assess vapor intrusion from contaminated environmental media into a structure and is being used in this assessment to provide guidance in understanding the potential impact of these compounds. While contamination from an outside source can not be ruled out with what is currently known, it is more likely that the source of these contaminants is a product used within the school. The EPA screening levels are intended to assess the impact of exposure over a life time.

Please do not hesitate to call if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "John P. Madigan". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

John P. Madigan