INDOOR AIR QUALITY ASSESSMENT
ST. BERNARDS ELEMENTARY SCHOOL
WITLESS BAY, NL

Prepared for:

EASTERN SCHOOL DISTRICT
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EXECUTIVE SUMMARY

Pinchin LeBlanc Environmental Limited (Pinchin) was retained by Eastern School District representative Mr. Jim Sinnott to conduct an indoor air quality (IAQ) assessment. The assessment was conducted at St Bernard's Elementary School, located in Witless Bay, NL. Mr. Craig Hollett, P Tech, performed the assessment on October 20th and 21st, 2009.

IAQ parameters including carbon dioxide, temperature and relative humidity were measured in various locations throughout the school.

Average levels of carbon dioxide were above the comfort parameter on both days of the assessment in most locations.

In addition to Eastern School Districts protocol of daily reminders of opening classroom windows and doors, the following actions could be taken to aid in the reduction of carbon dioxide levels throughout the school.

- Teachers opening windows at end of school day and have custodian close them at end of his/her work day;
- Custodian slightly opening windows prior to start of classes and close them as the need arises;
- Open windows during lunch break if classes are unoccupied; and
- Open windows and doors when classrooms are unoccupied throughout school day.

With the exception of Room 107, temperature levels recorded in all of the locations were within the recommended comfort range of between 19.5 – 25.0 ^{0}C.

The outdoor viable airborne mould concentration was 144 CFU/m^3 dominated by yeasts. Six (6) indoor sample locations, Rooms 125, 120, 117, 116, 122 and 104 recovered the mould species *Penicillium chrysogenum* as the dominant species. This species was not recovered on the outside air sample. *Stachybotrys chartatum* was recovered from the sample collected in Room 109.

Based on the mould air sample results and visual inspection further investigation and visual inspection of building materials located in the above mentioned rooms to determine the possible presence of any hidden mould growth. As well the water stained ceiling tile should be replaced from next to the exit sign in the hallway located at the center entrance to the school and the source of the water infiltration investigated and corrected.

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1.0 INTRODUCTION AND SCOPE

1.1 Statement of Understanding

Pinchin LeBlanc Environmental Limited (Pinchin) was retained by Eastern School District representative Mr. Jim Sinnott to conduct an indoor air quality (IAQ) assessment. The assessment was conducted at St Bernard's Elementary School, located in Witless Bay, NL. Mr. Craig Hollett, P Tech, performed the assessment on October 20th and 21st, 2009.

1.2 Scope of Work

The assessment involved the following activities:

- Assessment of the building's environment
- Development of a sampling strategy
- Collection and analysis of the following samples, including an outdoor reference sample:
    - 18 air samples to determine viable airborne mould concentrations
- Spot check and continuous measurement of the following indoor air quality factors:
    - Carbon dioxide
    - Temperature
    - Relative humidity
- Evaluation of moisture content in building components
- Visual inspection for presence of water damaged and/or mould impacted building materials.
- Preparation of this report

1.3 Assessment Methodology

Continuous monitoring in two (2) locations and spot check monitoring in other locations for carbon dioxide (CO_2) was performed on Day 1 and Day 2, during normal school operating condition. It should be noted that normal school operating condition as per Eastern School Districts Protocol currently consist of the principle reminding the teachers on a daily basis to open classroom windows for ventilation purposes. Temperature and relative humidity were also recorded on Day 1 and Day 2.

A mould investigation was conducted in the school for possible mould growth. This included a visual assessment of the building and mould air monitoring in all classrooms.

1.4 Test Methods

Mould air sampling was performed to assist in the identification of hidden mould growth and to determine if the air quality at those locations was being affected by mould growth. Pinchin collected viable fungal air samples using an RCS centrifugal impactor on Rose Bengal sampling media. This instrument utilizes the principal of impaction, where individual mould and bacteria spores are impacted onto a collection media. This collection media is an agar strip specific to what is being sampled for; in this case, one type of agar strip for fungi was used. RCS samples were collected for a four-minute duration (160 L). The sampling head was sterilized prior to each use. One outdoor reference sample was collected in addition to samples collected inside the building. All inside air samples are compared to the outside reference sample.

The Consultant used a Tramex Moisture Encounter Plus moisture meter to measure the moisture content of accessible building materials where they were suspected of being wet. The moisture meter is useful for measuring elevated surface moisture, but may not detect moist conditions deep within a wall or ceiling cavity. The moisture meter is calibrated for moisture content of wood and drywall. Measurements made on other materials were compared to measurements made on the same materials in reference locations, known to be unaffected by water damage. Wood surfaces with moisture content below 17 % will generally not support mould growth. Drywall with moisture content below 0.7 % will generally not support mould growth[1].

IAQ parameters measurements were made using direct reading equipment and continuous data logging equipment. The consultant collected spot measurements of the concentrations of carbon dioxide, temperature and relative humidity in all classrooms using a TSI brand Q-Trak IAQ monitor. IAQ continuous monitoring was performed using Young YES Trend Recorders. This piece of equipment records carbon dioxide, temperature and relative humidity levels on a minute-by-minute basis and stores the data for later extraction and reporting. The consultant placed two (2) monitors in separate locations for the assessment.

Outdoor ambient air measurements were made in addition to samples in the building. Measurements were collected throughout the school in twenty-four (24) locations. A measurement was collected in each location in the morning and again in the afternoon.

All sampling was performed in compliance with current professional practice[2.]

[1] American Conference of Governmental Industrial Hygienists: Bioaerosols: Assessment and Control. J, Macher, Ed. ACGIH Cincinnati OH (1999).

[2] American Industrial Hygiene Association: Field Guide for the Determination of Biological Contaminants in Environmental Samples. H.K. Dillon, P.A. Heinsohn, and J.D. Miller, Eds. AIHA, Fairfax, VA (1996).

1.5 Sample Analysis

The mould air samples were analyzed at Mycotaxon Consulting Ltd., Microbiology Laboratory, located in Halifax, Nova Scotia. The laboratory is a Public Works Canada Accredited Mycology laboratory that participates in the American Industrial Hygiene Association (AIHA) Environmental Microbiology Proficiency Analytical Testing Program and is accredited as a Reference Mycologist by the AIHA Environmental Microbiology Laboratory Accreditation Program (EMPAT).

2.0 ASSESSMENT AND FINDINGS

2.1 Facility Description

St. Bernard's Elementary School, located in Witless Bay NL is a K-6 school that enrols approximately 235 students. The building is a single storey structure built on a concrete, slab on grade foundation with exterior envelope walls clad with pre-formed, prefinished vertical metal siding. The building has a flat roof system. Interior building materials consisted of for the most part of concrete block walls in classrooms and hallways with some drywall walls, and tiled floors. The ceiling consists of a suspended ceiling system with 2' x 4' lay-in acoustic tiles. The super structure of the building located above the ceiling tiles consists of metal structural support beams, steel webbed joisting and corrugated metal commonly known as Q-decking. The building has a roof top air conditioning unit servicing the hallways, cafeteria, library and two guidance offices, room numbers 113 and 116.

2.2 Indoor Air Quality

2.2.1 Background

Good indoor air quality is essential to the comfort and good health of building occupants. A variety of agencies including Health Canada and the American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) have issued guidelines regarding what constitutes acceptable indoor air quality.

The American Conference of Governmental Industrial Hygienists (ACGIH) has documented exposure limits for numerous chemicals found in industrial settings. These exposure levels do not necessarily apply to office workplaces where the focus is typically on occupant comfort as opposed to long-term health effects. The document entitled "Indoor Air Quality in Office Buildings: A Technical Guide" by Health Canada (1995) is used to provide guidance on a number of indoor air quality issues.

Commonly, indoor air quality complaints can be a result of one or more factors including but not limited to extremes of temperature and relative humidity, inadequate ventilation, airborne particulate, microbiological growth, and housekeeping.

2.2.2 Results of Interview

During the interview, the following information was reported to the consultant by the schools principal Ms. Elizabeth Foran:

- As per Eastern School Districts protocol, she reminds teachers on a daily basis via the buildings public announcement system to open classroom windows for ventilation purposes.

2.3 Results of Indoor Air Quality Monitoring

2.3.1 Carbon Dioxide

2.3.1.1 Background

The American Conference of Governmental Industrial Hygienists (ACGIH) has documented exposure limits for numerous chemicals found in industrial settings. These exposure levels do not necessarily apply to office workplaces or school settings where the focus is typically on occupant comfort as opposed to long-term health effects. The threshold limit value for CO_2 in industrial settings is 5000ppm. The document entitled "Indoor Air Quality in Office Buildings:

A Technical Guide" by Health Canada (1995) is used to provide guidance on a number of indoor air quality issues.

An exposure guideline for CO_2 has been published by Health Canada in a report entitled "Exposure Guidelines for Residential Indoor Air Quality". According to this publication, the acceptable long-term exposure range (ALTER) for CO_2 in residential indoor air is ≤ 6300 mg/m3 (≤ 3500ppm)" ("Exposure Guidelines for Residential Indoor Air Quality", ASHRAE 62-2000). These exposure levels also don't closely pertain to indoor air as found in a school or office setting, because occupancy rates in schools and offices are quite different from those of residences.

For this assessment, carbon dioxide (CO_2) concentrations were used as an indicator of ventilation adequacy and occupant comfort. CO_2 is exhaled by people and can therefore by used as a marker of occupant density (i.e. the more people present in an office, the more CO_2 is produced). In turn, as the number of people in a room increases, so does the amount of outside air needed to keep the occupants comfortable by diluting/controlling bio-effluents. The American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) reports that "maintaining a steady-state CO_2 concentration in a space no greater than about 700 parts per million (ppm) above outdoor air levels will indicate that a substantial majority (i.e. 80 percent) of the occupants will be satisfied with respect to human bio-effluents (body odour)." ASHRAE reports that outdoor air normally contains 300 to 500 ppm CO_2 and this as guideline is not based on the toxicity of CO_2; rather, CO_2 is simply used as a surrogate measure of occupant comfort.

As a guideline, levels of CO_2 above 800 ppm are often associated with frequent complaints of "poor air quality." Widespread complaints are associated with CO_2 levels above 1000 ppm. Levels above 1000 ppm would be a clear indication that inadequate outside air is being supplied to an area. Complaints of poor air quality are rare at CO_2 levels below 600 ppm.

2.3.1.2 Summary of Data

Carbon dioxide continuous monitoring in two (2) locations and spot check monitoring in other locations was performed on Day 1, during normal school operating conditions. In addition to closed window testing, CO_2 testing was performed on Day 2, with windows and classroom doors open periodically for ventilation.

Continuous Monitoring Day 1 - October 20, 2009

Two (2) locations in the school were continuously monitored for carbon dioxide during school hours on October 20 and 21, 2009. One (1) monitor was stationed in Classroom 107 and one (1) monitor was stationed in Classroom 132. Carbon dioxide was monitored continually in these areas of the school from approximately 9:00 AM until approximately 3:00 PM on each day of the assessment. The data is presented in tabular and graphical format in Appendix I of the report.

The following tables provide a summary of the results of carbon dioxide continuous monitoring conducted in the school:

Continuous Monitoring of Carbon Dioxide
Day 1 - October 20, 2009
9:00 AM – 3:00 PM

Location	Low	High	Average
Classroom 107	725 ppm	1647 ppm	1155 ppm
Classroom 132	667 ppm	2515 ppm	1430 ppm

The outdoor concentration of carbon dioxide on October 20, 2009 was 405 ppm, giving a site-specific maximum recommended comfort level of 1105 ppm for monitoring period.

Classroom 107 - Day 1 – October 20, 2009

The low level of carbon dioxide was recorded to be 725ppm, the average level was 1155ppm and the high level was 1647ppm.

Reference to the graph for this location on this sampling day indicate that carbon dioxide levels steadily increased above the site specific comfort parameter of 1105ppm at approximately 10:00 AM to peak at approximately 1607ppm at 10:20 AM. From here levels decreased and remained below the comfort parameter until approximately 12:15 PM, where levels again increased to peak at 1571ppm at 12:18 PM and then decreased into the comfort level again at approximately 12:20 PM. Carbon dioxide levels again gradually increased above the comfort parameter at approximately 12:50 PM to record the high level of carbon dioxide recorded for the day, 1647ppm at approximately 2:15 PM. From here carbon dioxide levels slightly decreased recording 1350ppm at 2:30 PM and hovering between this level and 1600ppm for the remainder of the day.

The average level of carbon dioxide (1155ppm) recorded on Day 1 slightly exceeded the recommended site specific comfort range of 1105ppm.

Classroom 132 – Day 1 – October 20, 2009

The low level of carbon dioxide was recorded to be 667ppm, the average level was 1432ppm and the high level was 2515ppm.

Reference to the graph for this location on this sampling day indicate that carbon dioxide levels steadily increased above the site specific comfort parameter of 1105ppm at approximately 9:20 AM to record the high level of carbon dioxide recorded for the day, 2515ppm at 11:30 AM. From here levels steadily decreased to below the comfort parameter at approximately 12:30 PM, then down to record 925ppm at 12:35 PM. From here carbon dioxide levels again gradually increased above the comfort parameter at approximately 12:55 PM to peak at 1980ppm at 2:10 PM. Levels then gradually decreased to record 949ppm at approximately 2:40 PM. From here levels gradually increased again to peak at approximately 1620ppm at 3:00PM.

The average level of carbon dioxide (1430ppm) recorded on Day 1 exceeded the recommended site specific comfort range of 1105ppm.

Continuous Monitoring Day 2 - October 21, 2009

Continuous Monitoring of Carbon Dioxide
Day 2 - October 21, 2009

Location	Low	High	Average
Classroom 107	882 ppm	2588 ppm	1437 ppm
Classroom 132	1078 ppm	2074 ppm	1570 ppm

The outdoor concentration of carbon dioxide on October 21, 2009 was 401 ppm, giving a site-specific maximum recommended comfort level of 1101 ppm for monitoring period.

Classroom 107 – Day 2 – October 21, 2009

The low level of carbon dioxide was recorded to be 882ppm, the average level was 1437ppm and the high level was 2588ppm.

Reference to the graph for this location on this sampling day indicate that carbon dioxide levels recorded a level above the site specific comfort parameter of 1101ppm at 9:00 AM recording 1250ppm at this time. From here levels steadily increased to peak at 1728ppm at 10:40 AM. Levels then decreased to record 1140ppm at 11:30 AM and then increase again to 1366ppm at 11:50 AM. From here levels gradually decreased into the site specific comfort parameter at approximately 11:55 AM then decreased record the lowest level of carbon dioxide, 882ppm at

12:15 PM. From this point, carbon dioxide levels again gradually increased above the comfort parameter of 1101ppm at approximately 12:30 PM, to record 1550ppm at 2:30 PM. Levels then continued to increase to record the highest level for the day, 2588ppm at approximately 2:50 PM. Levels then decreased to 2295ppm by 3:00 PM.

The average level of carbon dioxide (1437ppm) recorded on Day 2 exceeded the recommended site specific comfort range of 1101ppm.

Classroom 132 – Day 2 – October 21, 2009

The low level of carbon dioxide was recorded to be 1078ppm, the average level was 1570ppm and the high level was 2074ppm.

Reference to the graph for this location on this sampling day indicate that carbon dioxide levels recorded a level above the site specific comfort parameter of 1101ppm at 9:00 AM recording 1272ppm at this time. From here levels steadily increased to record the highest level for the day, 2074ppm at 10:00 AM. Levels then gradually decreased to record 1215ppm at 10:30 AM and then increase again to 1960ppm at 11:35 AM. From here levels gradually decreased to 1393ppm at approximately 12:35 PM. Carbon dioxide levels again gradually increased to peak at 1976ppm at approximately 1:35 PM then decreased to 1120ppm at 2:15 PM. From this point, the carbon dioxide level gradually increased to record 1465ppm at 3:00 PM.

The average level of carbon dioxide (1570ppm) recorded on Day 2 exceeded the recommended site specific comfort range of 1101ppm.

A graphical representation of the data is provided in Appendix I.

Spot-Check Monitoring

Carbon dioxide was also monitored on a spot-check basis within other classrooms/locations throughout the school on October 20 and 21, 2009. Carbon dioxide measurements were collected using a TSI Q-Trak IAQ Monitor, a direct read instrument. Measurements were collected in twenty-four (24) locations throughout the school. Detailed measurements and sample locations are provided in Appendix II.

Spot Check Monitoring – Day 1 October 20, 2009

Indoor carbon dioxide concentrations in the classrooms ranged from 463 to 1820 ppm with an average concentration of 1229 ppm during the morning sampling period. In the afternoon

sampling period carbon dioxide concentrations in the classrooms ranged from 533 to 3201 ppm with an average concentration of 1658 ppm.

Indoor carbon dioxide concentrations from four (4) locations in the hallways ranged from 503 to 1121 ppm with an average concentration of 821 ppm during the morning sampling period. In the afternoon sampling period carbon dioxide concentrations from four (4) locations in the hallways ranged from 810 to 1964 ppm with an average concentration of 1388 ppm.

Spot Check Monitoring Day 2 October 21, 2009

Indoor carbon dioxide concentrations in the classrooms ranged from 489 to 2447 ppm with an average concentration of 1377 ppm during the morning sampling period. In the afternoon sampling period carbon dioxide concentrations in the classrooms ranged from 960 to 2794 ppm with an average concentration of 1706 ppm.

Indoor carbon dioxide concentrations from four (4) locations in the hallways ranged from 863 to 1365 ppm with an average concentration of 1190 ppm during the morning sampling period. In the afternoon sampling period carbon dioxide concentrations from four (4) locations in the hallways ranged from 658 to 1265 ppm with an average concentration of 1074 ppm.

Detailed measurements and sample locations are provided in Appendix I.

2.3.1.3 Conclusions and Recommendations

As previously indicated, a site-specific maximum recommended comfort level range of between 1101 and 1105ppm of carbon dioxide was indicated for both days of the assessment.

For the most part, average levels of carbon dioxide were above the comfort parameter on both days of the assessment. The average level of carbon dioxide recovered from the continuous monitoring on Day 1 and Day 2 in Room 107 were 1155ppm and 1430ppm respectively. The average level of carbon dioxide recovered from the continuous monitoring on Day 1 and Day 2 in Room 132 were 1437ppm and 1570ppm respectively.

The combined average level of carbon dioxide recovered from the morning and afternoon spot check monitoring in the classrooms was 1443ppm on Day 1 and 1541ppm on Day 2.

The combined average level of carbon dioxide recovered from the morning and afternoon spot check monitoring in the Hallways was 1104ppm on Day 1 and 1132ppm on Day 2.

It should be noted that normal operating conditions of the school, like on Day 1 of the assessment, would include the principal, as per Eastern School Districts protocol to remind teachers to open classroom windows and doors periodically for ventilation purposes.

Recommendations: In addition to Eastern School Districts protocol of daily reminders to open classroom windows and doors, the following actions could be taken to aid in the reduction of carbon dioxide levels throughout the school.

- Teachers opening windows at end of school day and have custodian close them at end of his/her work day;
- Custodian slightly opening windows prior to start of classes and close them as the need arises;
- Open windows during lunch break if classes are unoccupied;
- Open windows and doors when classrooms are unoccupied throughout school day.

2.3.2 Thermal Comfort

2.3.2.1 Background

Temperature and relative humidity contribute substantially to occupants' sense of comfort in a space. Due to individual differences, it is difficult to provide a thermal environment that will satisfy all occupants. ASHRAE Standard 55-2004, *Thermal Environmental Conditions for Human Occupancy*, suggests sets of thermal factors that can be expected to satisfy at least 80% of occupants. A comprehensive thermal assessment to comply with the Standard would require a review of all of the following factors: dry bulb air temperature; global temperature (measuring the air temperature plus the effects of radiant heating or cooling by radiant heating systems or hot or cod adjacent surfaces); air speed; clothing type; occupant activity; floor temperature; differences between air temperature and temperatures of ceilings or walls; differences between temperatures at the ankles and head; and stability of temperature with time.

In many indoor environments without significantly cool or warm surfaces or drafts and with stable temperatures, the dry bulb temperature alone can be used to predict occupants' satisfaction with the thermal environment. Based on the ASHRAE Standard 55-2004, under these conditions the following temperature ranges would be expected to satisfy at least 80% of persons seasonally dressed and performing mostly sedentary office-type activities:

- In summer, 24 – 27 $^{\circ}$C at relative humidity of 50%
- In winter, 19.5 – 25 $^{\circ}$C at typical relative humidity of 30%.

While ASHRAE standard 55 does not recommend ranges for acceptable relative humidity, too high or too low levels of relative humidity should be avoided. Relative humidity should be maintained between 30% and 60%. The lower limit is specified to help prevent dry nasal passages, itchy eyes, coughing, and exacerbation of cold and flu symptoms. The upper limit is set to prevent potential microbiological growth on building finishes.

2.3.2.2 Summary of Data

Temperature and relative humidity continuous monitoring in two (2) locations and spot check monitoring in other locations was performed on Day 1, during normal school operating conditions. In addition to closed window testing, Temperature and relative humidity monitoring was performed on Day 2, windows and classroom doors open periodically for ventilation.

Continuous Monitoring Day 1 - October 20, 2009

Two (2) locations in the school were continuously monitored for temperature and relative humidity during school hours on October 20 and 21, 2009. One (1) monitor was stationed in Classroom 107 and one (1) monitor was stationed in Classroom 132. The data is presented in tabular and graphical format in Appendix I of the report.

The following tables provide a summary of the results of the temperature and relative humidity continuous monitoring conducted in the school:

Continuous Monitoring of Temperature and Relative Humidity
Day 1 - October 20, 2009

Location	Low	High	Average
Classroom 107 Temperature ^{0}C	16.8	20.0	18.6
Classroom 107 Humidity %	41.7	46.8	44.3
Classroom 132 Temperature ^{0}C	18.9	22.1	20.7
Classroom 132 Humidity %	40.1	46.8	44.2

On October 20, 2009 the outdoor temperature was approximately 4.0 °C and the outdoor relative humidity was approximately 95 %. Based on the exterior temperature, and the time of year, the best-suited comfort range would be the winter range (19.5 to 25 °C).

Classroom 107 – Continuous Monitoring – Day 1 - October 20 2009

Temperature

The low level of temperature was recorded to be 16.8 ^{0}C, the average level was 18.6 ^{0}C and the high level was 20.0 ^{0}C.

Reference to the graph for this location on this sampling day indicates that the low level of temperature recorded for the day 16.8 ^{0}C was recorded at the initial start of the assessment. From here temperature levels gradually increased to record 19.0 ^{0}C at approximately 10:20 AM. From here temperature levels slightly decreased and hovered between 18.2 ^{0}C and 19 ^{0}C until approximately 2:10 PM. Temperature levels then gradually increased to record the highest temperature level for the day between 2:20 and 2:25 PM recording 20.0 ^{0}C at this time. From here levels again decreased to record 19.0 ^{0}C at 2:35 PM and hovered between 19.0 and 20.0 ^{0}C for the remainder of the day recording 20.0 ^{0}C at 3:00 PM.

The average level of temperature (18.6 ^{0}C) recorded on Day 1 was below the recommended temperature comfort range of 19.5 to 25 °C.

Relative Humidity

The low level of relative humidity was recorded to be 41.7 %, the average level was 44.3 % and the high level was 46.8 %.

The average level of humidity (44.3 %) recorded on Day 1 was within the recommended comfort range of 30 – 60 %.

Classroom 132 - Continuous Monitoring – Day 1 - October 20 2009

Temperature

The low level of temperature was recorded to be 18.9 ^{0}C, the average level was 20.7 ^{0}C and the high level was 22.1 ^{0}C.

The average level of temperature (20.7 ^{0}C) recorded on Day 1 was within the recommended temperature comfort range of 19.5 to 25 °C.

Relative Humidity

The low level of relative humidity was recorded to be 40.1 %, the average level was 44.2 % and the high level was 46.8 %.

The average level of humidity (44.2 %) recorded on Day 1 was within the recommended comfort range of 30 – 60 %.

Continuous Monitoring Day 2 - October 21, 2009

Continuous Monitoring of Temperature and Relative Humidity
Day 2 - October 21, 2009

Location	Low	High	Average
Classroom 107 Temperature ^{0}C	18.2	20.4	19.3
Classroom 107 Humidity %	39.7	45.0	42.2
Classroom 132 Temperature ^{0}C	20.4	21.8	21.3
Classroom 132 Humidity %	39.6	44.7	42.4

On October 21, 2009 the outdoor temperature was approximately 4.5 $^\circ$C and the outdoor relative humidity was approximately 93 %. Based on the exterior temperature, and the time of year, the best-suited comfort range would be the winter range (19.5 to 25 $^\circ$C).

Classroom 107 - Continuous Monitoring - Day 2 – October 21, 2009

Temperature

The low level of temperature was recorded to be 18.2 ^{0}C, the average level was 19.3 ^{0}C and the high level was 20.4 ^{0}C.

Reference to the graph for this location on this sampling day indicates 19.3 ^{0}C was recorded at the initial start of the assessment and levels hovered between this temperature and 19.6 ^{0}C until approximately 9:40 AM. From here temperature levels gradually decreased to record 18.9 ^{0}C between approximately 9:45 and 10:00 AM. Temperature levels then gradually increased to record the high level recorded for the day between 10:40 and 10:50 AM and then again gradually decreased to record the lowest temperature for the day 18.2 ^{0}C between 12:15 and 12:50 PM. From here temperature levels gradually increased to record the highest temperature level again for the day, 20.4 ^{0}C at approximately 2:30 PM and remained there for the day again recording 20.4 ^{0}C at 3:00 PM.

The average level of temperature (19.3 ^{0}C) recorded on Day 2 was slightly below the recommended temperature comfort range of 19.5 to 25 $^\circ$C.

Relative Humidity

The low level of relative humidity was recorded to be 39.7 %, the average level was 42.2 % and the high level was 45.0 %.

The average level of humidity (42.2 %) recorded on Day 2 was within the recommended comfort range of 30 – 60 %.

Classroom 132 – Continuous Monitoring - Day 2 - October 21, 2009

Temperature

The low level of temperature was recorded to be 20.4 ^{0}C, the average level was 21.3 ^{0}C and the high level was 21.8 ^{0}C.

The average level of temperature (21.3 ^{0}C) recorded on Day 2 was within the recommended temperature comfort range of 19.5 to 25 $^{\circ}$C.

Relative Humidity

The low level of relative humidity was recorded to be 39.6 %, the average level was 42.4 % and the high level was 44.7 %.

The average level of humidity (42.4 %) recorded on Day 2 was within the recommended comfort range of 30 – 60 %.

A graphical representation of the data is provided in Appendix I.

Spot-Check Monitoring

Temperature and relative humidity was also monitored on a spot-check basis within other classrooms/locations throughout the school on October 20 and 21, 2009. Temperature and relative humidity measurements were collected using a TSI Q-Trak IAQ Monitor, a direct read instrument. Measurements were collected in twenty-four (24) locations throughout the school. Detailed measurements and sample locations are provided in Appendix II.

Spot Check Monitoring – Day 1 October 20, 2009

Temperature

Indoor temperature levels in the classrooms ranged from 19.5 to 21.3 ^{0}C with an average level 20.6 ^{0}C during the morning sampling period. In the afternoon sampling period temperature levels in the classrooms ranged from 20.0 to 22.2 ^{0}C with an average level of 21.1 ^{0}C.

The average levels of temperature (20.6 ^{0}C and 21.1 ^{0}C) recorded on Day 1 was within the recommended temperature comfort range of 19.5 to 25 $^\circ$C.

Indoor temperature levels from four (4) locations in the hallways ranged from 20.6 to 21.1 ^{0}C with an average concentration of 20.9 ^{0}C during the morning sampling period. In the afternoon sampling period temperature levels from four (4) locations in the hallways ranged from 21.0 to 21.9 ^{0}C with an average concentration of 21.3 ^{0}C.

The average levels of temperature (20.9 ^{0}C and 21.3 ^{0}C) recorded on Day 1 was within the recommended temperature comfort range of 19.5 to 25 $^\circ$C.

Relative Humidity

Indoor humidity levels in the classrooms ranged from 40.0 to 50.0 % with an average level 45.2 % during the morning sampling period. In the afternoon sampling period humidity levels in the classrooms ranged from 40.7 to 53.9 % with an average level of 47.2 %.

The average levels of humidity (45.2 % and 47.5 %) recorded on Day 1 was within the recommended comfort range of 30 – 60 %.

Indoor humidity levels from four (4) locations in the hallways ranged from 36.7 to 44.8 % with an average concentration of 41.2 % during the morning sampling period. In the afternoon sampling period humidity levels from four (4) locations in the hallways ranged from 37.5 to 47.7 % with an average level of 43.7 %.

The average levels of humidity (41.2 % and 43.7 %) recorded on Day 1 was within the recommended comfort range of 30 – 60 %.

Spot Check Monitoring - Day 2, October 21, 2009

Temperature

Indoor temperature levels in the classrooms ranged from 19.9 to 22.6 ^{0}C with an average level 20.7 ^{0}C during the morning sampling period. In the afternoon sampling period temperature levels in the classrooms ranged from 20.2 to 22.4 ^{0}C with an average level of 21.1 ^{0}C.

The average levels of temperature (20.7 ^{0}C and 21.1 ^{0}C) recorded on Day 2 was within the recommended temperature comfort range of 19.5 to 25 $^\circ$C.

Indoor temperature levels from four (4) locations in the hallways ranged from 20.3 to 21.2 ^{0}C with an average concentration of 20.7 ^{0}C during the morning sampling period. In the afternoon sampling period temperature levels from four (4) locations in the hallways ranged from 21.1 to 21.5 ^{0}C with an average concentration of 21.3 ^{0}C.

The average levels of temperature (20.7 ^{0}C and 21.3 ^{0}C) recorded on Day 2 was within the recommended temperature comfort range of 19.5 to 25 $^\circ$C.

Relative Humidity

Indoor humidity levels in the classrooms ranged from 36.9 to 48.0 % with an average level 42.8 % during the morning sampling period. In the afternoon sampling period humidity levels in the classrooms ranged from 40.8 to 51.7 % with an average level of 45.6 %.

The average levels of humidity (42.8 % and 45.6 %) recorded on Day 2 was within the recommended comfort range of 30 – 60 %.

Indoor humidity levels from four (4) locations in the hallways ranged from 41.3 to 44.2 % with an average concentration of 43.1 % during the morning sampling period. In the afternoon sampling period humidity levels from four (4) locations in the hallways ranged from 35.9 to 43.9 % with an average level of 40.7 %.

The average levels of humidity (43.1 % and 40.7 %) recorded on Day 2 was within the recommended comfort range of 30 – 60 %.

Detailed measurements and sample locations are provided in Appendix II.

2.3.2.3 Conclusions and Recommendations

Temperature

With the exception of Room 107, temperature levels recorded in all of the locations were within the recommended comfort range of between 19.5 – 25.0 ^{0}C.

The average level of temperature recorded from the continuous monitoring on Day 1 and Day 2 in Room 107 were 18.6 ^{0}C and 19.3 ^{0}C respectively. These temperature levels were below the recommended comfort range of between 19.5 – 25.0 ^{0}C.

When reviewing the spot check tables for this location it was noted that the two (2) windows that could open were open in the morning and afternoon for both days of the assessment. This likely

contributed to decreased temperature level in this location as compared to the continuous temperature monitoring performed in Room 132. When reviewing the spot check table for Room 132 it was noted that one (1) of two (2) windows were open in the morning on Day 1 with both windows closed in the afternoon. One (1) of two (2) windows was open in the morning and afternoon on Day 2.

Recommendation: No recommendation.

Relative Humidity

Relative humidity levels recorded in all of the locations were within the recommended comfort range of between 30 – 60 %.

Recommendation: No Recommendations

2.4 Results of Mould Testing

2.4.1 Indoor Mould Growth

2.4.1.1 Background

Current evidence suggests that excessive moisture in buildings promotes mould growth and is associated with increasing risk symptoms due to irritation, allergy, and infection.[3] These may include complaints of headache, cough, respiratory tract infection, eye irritation, rash, sinus congestion, and allergic responses, such as asthma and hay fever-type symptoms. Not all occupants will react to indoor mould exposure. More severe health effects are rare and typically limited to individuals with suppressed immune systems, infants, and persons with high occupational exposure such as farmers and possibly remediation workers.

Health Canada considers mould growth on the interior surfaces of buildings to be a risk factor for health problems.[4] It has not published specific guidelines on mould. Rather, it recommends compliance with professional standards for the assessment and control of mould contamination in buildings, including the guidelines set in 2008 by the New York City Department of Health[5]. Canadian guidelines for the management of mould in buildings include those set in 2001 by

3 Fung, F., Hughson, W.G.: Health Effects of Indoor Fungal Bioaerosol Exposure. Applied Occupational and Environmental Hygiene, 18:535-544 (2003).
[4] Health Canada: Indoor Air Quality in Office Buildings – A Technical Guide, (1995)
[5] NYCDH: Guidelines on Assessment and Remediation of Fungi in Indoor Environments, New York City Department of Health and Mental Hygiene, New York, NY (2008).

Manitoba Labour[6] and the 2004 guidelines of the Canadian Construction Association[7]. Some of the common features of these guidelines include,

- Water-damaged materials should be dried within 48 hours of wetting to prevent mould growth.
- Mould growth in buildings poses a risk of allergic, irritant, infective, and possibly toxic responses in some occupants.
- All mould growth should be considered a risk for adverse health effects.
- Mould growth must be abated as soon as possible after discovery.
- Information on the presence of mould growth must be communicated to occupants.
- Building wide evacuation in cases of confirmed mould growth is not indicated unless there is both widespread fungal contamination and confirmed linked illness. However, occupants with persistent health complaints potentially linked to mould exposure should be advised to seek medical attention, and should be given copies of any environmental tests or reports. Persons diagnosed with fungal related disease should not return to the environment until remediation and air testing are completed.
- Occupants with an underlying health condition posing an increased risk of reactivity to mould (e.g., asthma triggered by mould, severe allergies, significantly compromised immune function) should not be present during mould abatement. Such susceptible individuals should be removed from areas adjacent to mould remediation work areas, during the remediation process.
- Mould growth should be removed following work practices designed to contain airborne dust and debris, protect the workers performing the removal, and provide a clean condition at completion. The rigor of these procedures is dependant on the extent of mould growth present.
- Medium and large-scale mould abatement work should be performed with the project design and quality assurance assistance of a health and safety professional experienced in mould assessment and remediation.

2.4.1.2 Observations and Summary of Data

During the assessment visual inspections and building material moisture checks were conducted throughout the school. No visible mould was identified and no elevated building material

[6] Manitoba Labour: Guidelines for the Investigation, Assessment & Remediation of Mould In Workplaces, Workplace Safety and Health Division, Manitoba Labour, Winnipeg, MB, (March 2001).
[7] CCA: Mould Guidelines for the Canadian Construction Industry, Guide 82, Canadian Construction Association, Ottawa, ON Canada (2004)

moisture sources were detected on the days of the assessment. One (1) stained ceiling tile was noted next to the Exit Sign in the Hallway located at the center entrance to the school (Photo 1).

Mould Air Sampling

Seventeen (17) indoor locations were chosen to monitor for viable airborne mould. A background sample was also collected outdoors. The following table lists the results of the viable sampling.

Species Identified (CFU/m^3)	**Outdoor Reference**	**Staff Room**	**Room 132**	**Room 124**	**Room 111**	**Room 125**
Sample Number	**M001-2-3-77**	**M002-2-3-77**	**M003-2-3-77**	**M004-2-3-77**	**M005-2-3-77**	**M006-2-3-77**
Aspergillus versicolor	-	-	13	-	6	6
Aspergillus fumagatus	-	-		-	6	-
Acremonium strictum	6	-	13	6	-	-
Cladosporium cladosporioides	-	31	31	31	31	25
Cladosporium sphaerospermum	-	6	-	-	-	6
Penicillium chrysogenum	-	-	-	-	6	281
Penicillium solitium	-	-	-	-	6	6
mucor plumbeus	-	6	-	-	7	
Ulocladium chartarum	13	-	13	13	-	-
Yeasts	113	-	19	6	38	
Non-sporulating isolates	12	7	24	13	38	26
TOTAL CFU/m^3	**144**	**50**	**113**	**69**	**138**	**350**

Species Identified (CFU/m^3)	**Room 120**	**Room 117**	**Room 116**	**Room 122**	**Room 119**	**Room 104**
Sample Number	**M007-2-3-74**	**M008-2-3-77**	**M009-2-3-77**	**M010-2-3-77**	**M012-2-3-77**	**M013-2-3-77**
Aspergillus versicolor	-	-	-	-	12	-
Cladosporium cladosporioides	13	19	116	35	19	19
Cladosporium sphaerospermum	-	-	-	-	7	-
Penicillium chrysogenum	237	88	110	256	38	306
mucor plumbeus	6	6	7	4	6	-

Species Identified (CFU/m^3)	Room 120	Room 117	Room 116	Room 122	Room 119	Room 104
Ulocladium chartarum	6	-	18	9	-	-
Yeasts	-	-	31	9	-	25
Non-sporulating isolates	13	19	12	-	31	25
Eurotium rubrum	-	6	6	-	-	-
TOTAL CFU/m^3	**275**	**138**	**306**	**313**	**113**	**375**

Species Identified (CFU/m^3)	Room 107	Room 109	Room 134	Room 128	Room 129	Room 131
Sample Number	**M014-2-3-77**	**M015-2-3-77**	**M016-2-3-77**	**M17-2-3-77**	**M018-2-3-77**	**M19-2-3-77**
Aspergillus versicolor			6		6	
Cladosporium cladosporioides	19	13		25	25	13
Cladosporium sphaerospermum		6				
Penicillium chrysogenum	6	19	12	6	6	13
mucor plumbeus						6
Stachybortrys chartarum		19				
Ulocladium chartarum		6	7			
Yeasts	6	12				
Non-sporulating isolates			6	7		
Eurotium rubrum				6	7	
Eurotium herbariorum	13					6
TOTAL CFU/m^3	**44**	**75**	**31**	**44**	**44**	**38**

Generally, the composition and concentration of mould recovered from indoor samples should be similar to the composition and concentration of the mould recovered from the outdoor reference samples. However, many elements inside a building can affect the concentration and composition of indoor airborne mould samples. These elements include occupant activities, furnishings, and the amount of air exchange.

The outdoor viable airborne mould concentration was 144 CFU/m^3 dominated by yeasts and also recovering moulds *Ulocladium chartarum*, non-sporulating isolate and *Acemonium strictum*. Indoor viable airborne mould concentrations ranged from 31 to 375 CFU/m^3. The concentrations

of twelve (12) of the seventeen (17) indoor samples collected were lower than the outdoor reference sample. Six (6) samples locations, Rooms 125, 120, 117, 116, 122 and 104 recovered the mould species *Penicillium chrysogenum* as the dominant species. This species was not recovered on the outside air sample. The presence of Pencillium chrysogenum in building environments can be attributed to wet, previously wetted or mouldy structural wood or wall boards[8].

Stachybotrys chartarum was recovered from the sample collected in the Room 109. The presence of this species of mould in indoor environments should be considered unacceptable. This species of mould is a wet cellulose-based loving species and in building environments consequently, it's growth can be attributed to wetted: paper backing on drywall, ceiling tile, blown insulation, fibreglass insulation backing and other paper products.

The recovery any species of mould on an air sample however does not confirm the presence of a growth site therefore further investigation would be required.

The analytical certificate is provided in Appendix III.

2.4.1.3 Conclusions and Recommendations

Based on the mould air sample results and visual inspection, the following recommendations are provided:

> ***Recommendation***: Further investigation and visual inspection of building materials located in Rooms 125, 120, 117, 116, 122, 104 and 109 to determine the possible presence of any hidden mould growth.
>
> ***Recommendation:*** The water stained ceiling tile should be replaced from next to the exit sign in the hallway located at the centre entrance to the school and the source of the water infiltration investigated and corrected.

3.0 LIMITATIONS

Work performed by Pinchin was conducted in accordance with generally accepted engineering or scientific practices current in this geographical area at the time the work was performed. No warranty is either expressed or implied, or intended by the agreement executed with the Client, or by furnishing oral or written reports or findings. The Client acknowledges that subsurface and

[8] American Industrial Hygiene Association, (AIHA) Field Guide for the Determination of Biological Contaminants in Environmental Samples, Second Edition, Ling-Ling Hung, PhD, J. David Miller, PhD, H. Kenneth Dillon, PhD, CIH, Copyright 2005.

concealed conditions may vary from those encountered or inspected. Pinchin could only comment on the conditions observed on the date(s) the assessment was performed.

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Pinchin did not attempt to identify locations of deposition of mould spores or particles, or minor mould growth that would not exhibit any signs of spotting/staining on building materials. Pinchin would not be able to identify locations of concealed mould growth within wall cavities and other hidden locations without performing intrusive inspections. The degree of mould growth noted in the report may change with time if water or humidity issues continue or develop after the assessment date(s). Any sources of water infiltration or high humidity must be corrected to prevent the continuation or occurrence of mould growth. Air sampling results (if any) will apply only to the time and conditions of the testing and may not be used to reliably predict conditions on other days.

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APPENDIX I

INDOOR AIR QUALITY COMFORT PARAMETER MEASUREMENTS CONTINUOUS MONITORING TABLES AND GRAPHS

Continuous Monitoring
Carbon Dioxide, Temperature & Relative Humidity
Room 107 - Day 1 - October 20, 2009
9:00 AM – 3:00 PM

Parameter	Low	High	Average
Carbon Dioxide (ppm)	725	1647	1155
Temperature (^{0}C)	16.8	20.0	18.6
Relative Humidity (%)	41.7	46.8	44.3

Continuous Monitoring
Carbon Dioxide, Temperature & Relative Humidity
Room 132 - Day 1 - October 20, 2009
9:00 AM – 3:00 PM

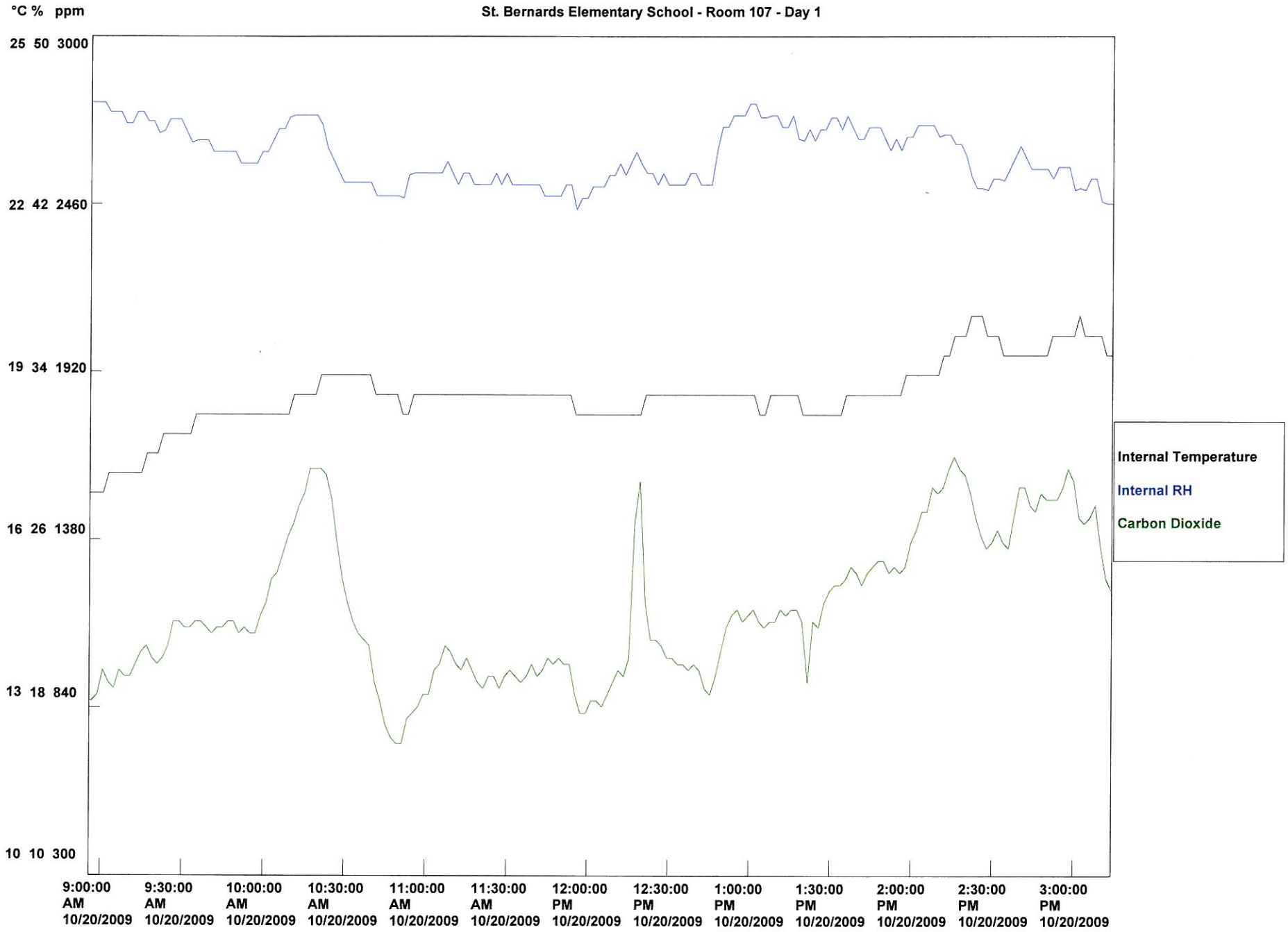
Parameter	Low	High	Average
Carbon Dioxide (ppm)	667	2515	1430
Temperature (^{0}C)	18.9	22.1	20.7
Relative Humidity (%)	40.1	46.8	44.2

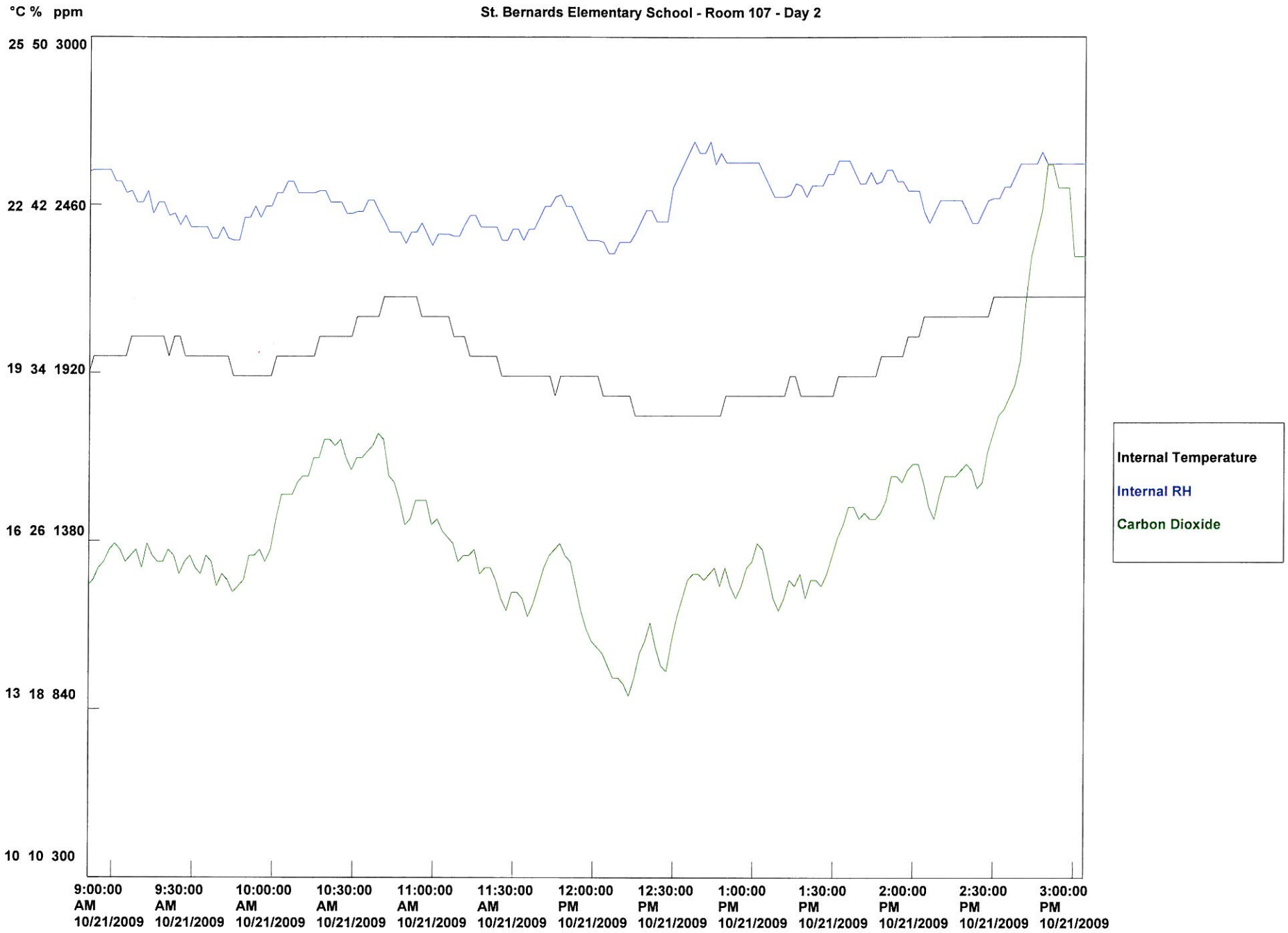
Continuous Monitoring
Carbon Dioxide, Temperature & Relative Humidity
Room 107 - Day 2 - October 21, 2009
9:00 AM – 3:00 PM

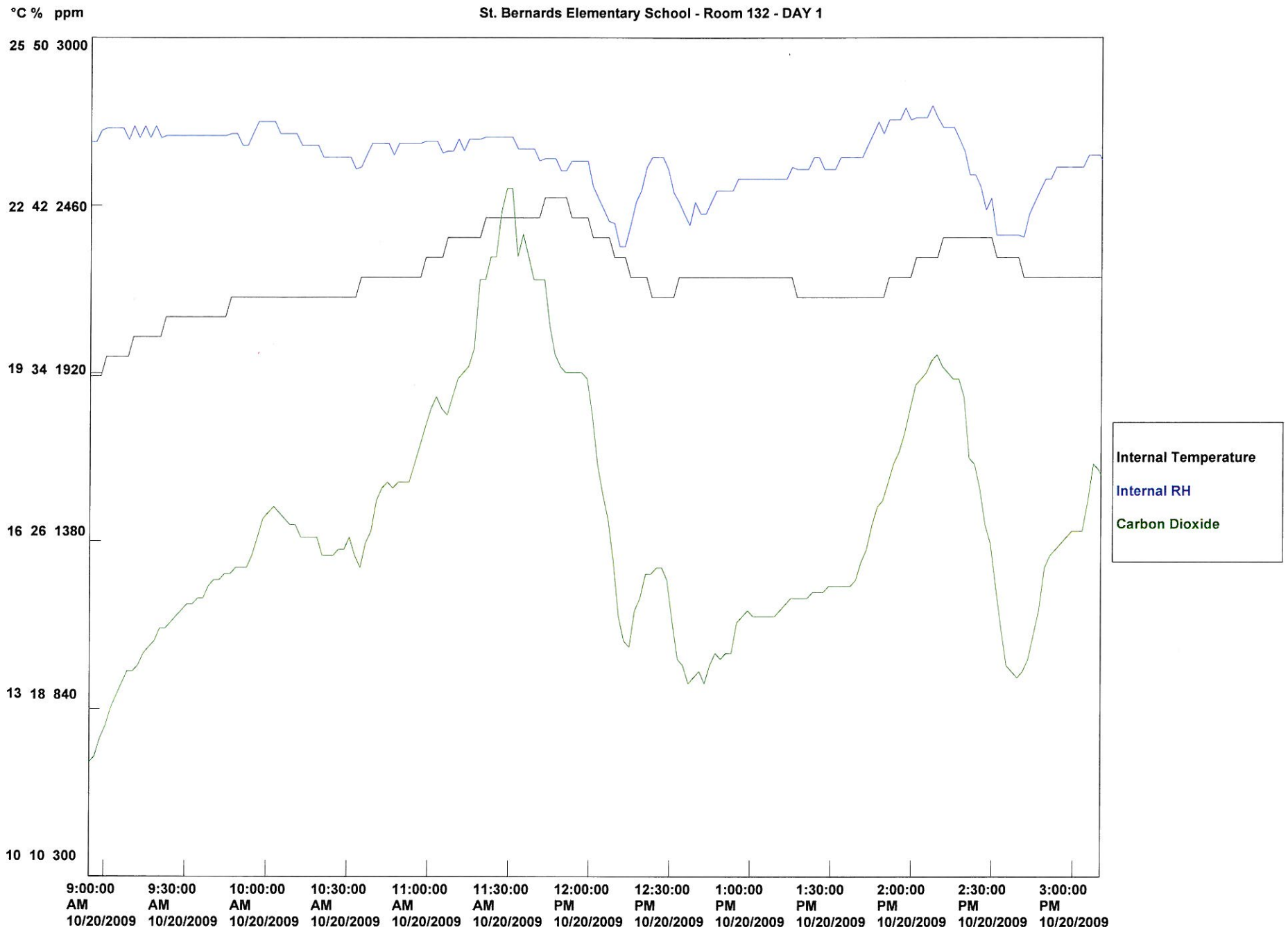
Parameter	Low	High	Average
Carbon Dioxide (ppm)	882	2588	1437
Temperature (^{0}C)	18.2	20.4	19.3
Relative Humidity (%)	39.7	45.0	42.2

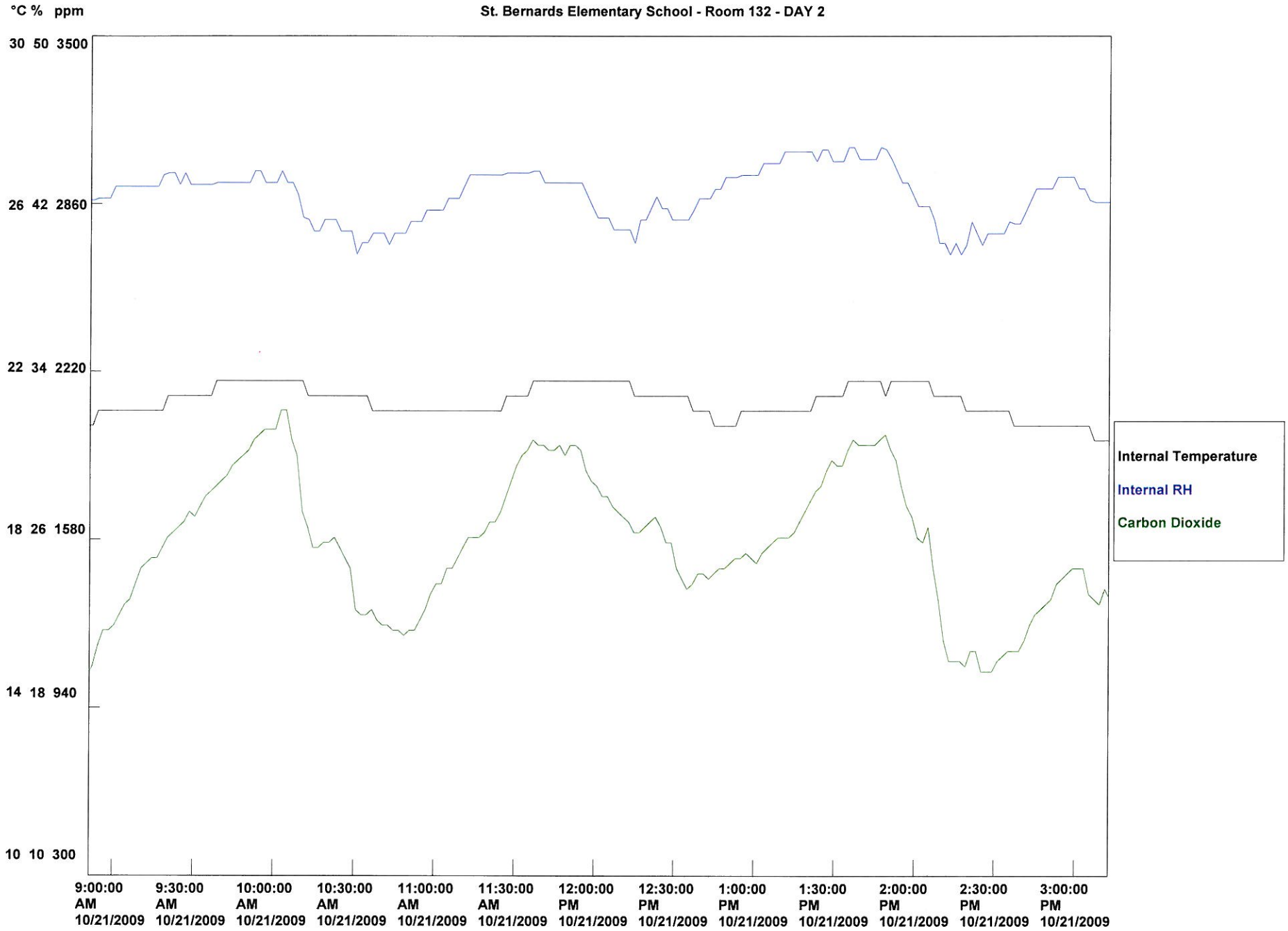
Continuous Monitoring
Carbon Dioxide, Temperature & Relative Humidity
Room 132 - Day 2 - October 21, 2009
9:00 AM – 3:00 PM

Parameter	Low	High	Average
Carbon Dioxide (ppm)	1078	2074	1570
Temperature (^{0}C)	20.4	21.8	21.3
Relative Humidity (%)	39.6	44.7	42.4


°C % ppm
St. Bernards Elementary School - Room 107 - Day 1
25 50 3000
22 42 2460
19 34 1920
16 26 1380
13 18 840
10 10 300
9:00:00 AM 10/20/2009
9:30:00 AM 10/20/2009
10:00:00 AM 10/20/2009
10:30:00 AM 10/20/2009
11:00:00 AM 10/20/2009
11:30:00 AM 10/20/2009
12:00:00 PM 10/20/2009
12:30:00 PM 10/20/2009
1:00:00 PM 10/20/2009
1:30:00 PM 10/20/2009
2:00:00 PM 10/20/2009
2:30:00 PM 10/20/2009
3:00:00 PM 10/20/2009
Internal Temperature
Internal RH
Carbon Dioxide


°C % ppm
St. Bernards Elementary School - Room 107 - Day 2
25 50 3000
22 42 2460
19 34 1920
16 26 1380
13 18 840
10 10 300
9:00:00 AM 10/21/2009
9:30:00 AM 10/21/2009
10:00:00 AM 10/21/2009
10:30:00 AM 10/21/2009
11:00:00 AM 10/21/2009
11:30:00 AM 10/21/2009
12:00:00 PM 10/21/2009
12:30:00 PM 10/21/2009
1:00:00 PM 10/21/2009
1:30:00 PM 10/21/2009
2:00:00 PM 10/21/2009
2:30:00 PM 10/21/2009
3:00:00 PM 10/21/2009
Internal Temperature
Internal RH
Carbon Dioxide


°C % ppm
St. Bernards Elementary School - Room 132 - DAY 1
25 50 3000
22 42 2460
19 34 1920
16 26 1380
13 18 840
10 10 300
9:00:00 AM 10/20/2009
9:30:00 AM 10/20/2009
10:00:00 AM 10/20/2009
10:30:00 AM 10/20/2009
11:00:00 AM 10/20/2009
11:30:00 AM 10/20/2009
12:00:00 PM 10/20/2009
12:30:00 PM 10/20/2009
1:00:00 PM 10/20/2009
1:30:00 PM 10/20/2009
2:00:00 PM 10/20/2009
2:30:00 PM 10/20/2009
3:00:00 PM 10/20/2009
Internal Temperature
Internal RH
Carbon Dioxide


°C % ppm
St. Bernards Elementary School - Room 132 - DAY 2
30 50 3500
26 42 2860
22 34 2220
18 26 1580
14 18 940
10 10 300
9:00:00 AM 10/21/2009
9:30:00 AM 10/21/2009
10:00:00 AM 10/21/2009
10:30:00 AM 10/21/2009
11:00:00 AM 10/21/2009
11:30:00 AM 10/21/2009
12:00:00 PM 10/21/2009
12:30:00 PM 10/21/2009
1:00:00 PM 10/21/2009
1:30:00 PM 10/21/2009
2:00:00 PM 10/21/2009
2:30:00 PM 10/21/2009
3:00:00 PM 10/21/2009
Internal Temperature
Internal RH
Carbon Dioxide

APPENDIX II

INDOOR AIR QUALITY COMFORT PARAMETER MEASUREMENTS
MORNING AND AFTERNOON SPOT CHECK TABLES
DAY 1 & DAY 2

INDOOR AIR QUALITY ASSESSMENT - MORNING MONITORING - DAY 1 - OCTOBER 20 2009
ST. BERNARDS ELEMENTARY SCHOOL WITLESS BAY

Project Number: 02-03-00077
Assessment Date: October 20, 2009
Outside Conditions: Drizzle Fog

	MIN	MAX
Carbon Dioxide Limit (ppm):		1105
Temperature Range (°C):	19.5	25
Relative Humidity Range (%):	30	60

Location	Carbon Dioxide (ppm)	Temperature (°C)	Relative Humidity (%)	# Windows Open/closed	Drafty Yes/No	Door open/closed	# Students adults	Room Dinensions
Exterior	405	4	95					
Main Floor								
Room 145 Cafeteria	463	20.1	43.2	6 Closed	No	Open	0 people	30' x 34'
Staff Room	550	20.9	41.4	No Windows	No	Open	0 people	24' x 26'
Room 132	759	20.7	42.4	1 of 2 open	Yes	Open	13/1 adult	24' x 26'
Room 131	**1553**	20.7	50.0	2 closed	No	Closed	17/1 adult	22' x 26'
Room 129	**1468**	20.6	47.7	2 closed	No	Open	21/1 adult	22' x 26'
Room 128	**1475**	20.8	48.9	2 closed	No	Closed	15/1 adult	24' x 26'
Room 124 Library	500	20.6	40.5	1 closed	No	Open	0 people	24' x 32'
Room 122	**1253**	21.0	45.7	2 closed	No	Closed	17/1 adult	20' x 24'
Room 119	**1295**	21.0	45.2	1 of 1 open	No	Closed	13/1 adult	20' x 24'
Room 113 Guidance	**1443**	21.3	42.5	No Windows	No	Open	0 people	6' x 14'
Room 111	**1610**	20.9	47.5	2 closed	No	Closed	20/2 adults	24' x 28'
Room 109	**1820**	20.6	47.2	2 closed	Yes	Closed	27/2 adults	24' x 26'
Room 107	932	19.6	42.0	2 of 2 open	No	Open	15/1 adult	24' x 26'
Room 104	**1626**	19.5	49.9	2 closed	No	Open	0 people	24' x 26'
Room 116 Guidance	**1164**	20.2	45.5	No Windows	No	Closed	0 people	8' x 12'
Room 117	**1282**	20.4	47.2	1 closed	No	Open	5/1 adult	17' x 22'
Room 120	**1759**	20.4	48.9	1 closed	No	Closed	12/1 adult	24' x 24'
Room 125	**1762**	20.5	48.1	2 closed	No	Closed	16/2 adults	24' x 26'
Room 134	**1116**	20.2	41.0	1 of 2 open	Yes	Open	2/1 adults	22' x 26'
Room 138 Main Office	754	21.2	40.0	1 of 1 open	Yes	Open	2 adults	12' x 22'
Minimum	463	19.5	40.0					
Maximum	**1820**	21.3	50.0					
Average	**1229**	20.6	45.2					
Main Floor Hallway								
Hallway Outside Main Office	503	21.1	36.7	No windows	Yes	Not Applicable	None	10' x 94'
Hallway Outside Room 132	**1121**	20.6	44.8	No windows	No	Not Applicable	None	10' x 58'
Hallway Outside Room 120	764	21.0	41.2	No Windows	Yes	Not Applicable	None	10' x 94'
Hallway Outside Room 113	896	20.9	42.1	No Windows	No	Not Applicable	None	10' x 50'
Minimum	503	20.6	36.7					
Maximum	**1121**	21.1	44.8					
Average	821	20.9	41.2					

Notes:
Levels in red are above applicable guideline value range.
Levels in blue are below applicable guideline value range.

INDOOR AIR QUALITY ASSESSMENT - AFTERNOON MONITORING - DAY 1 - OCTOBER 20 2009
ST. BERNARDS ELEMENTARY SCHOOL WITLESS BAY

Project Number: 02-03-00077
Assessment Date: October 20, 2009
Outside Conditions: Drizzle Fog

	MIN	MAX
Carbon Dioxide Limit (ppm):		1105
Temperature Range (°C):	19.5	25
Relative Humidity Range (%):	30	60

Location	Carbon Dioxide (ppm)	Temperature (°C)	Relative Humidity (%)	# Windows Open/closed	Drafty Yes/No	Door open/closed	# Students adults	Room Dinensions
Exterior	405	4	95					
Main Floor								
Room 145 Cafeteria	533	20.9	42.7	2 of 6 open	No	Open	0 people	30' x 34'
Staff Room	**1536**	22.2	45.5	No Windows	No	Open	10 people	24' x 26'
Room 132	1089	20.9	44.1	2 closed	No	Open	0 people	24' x 26'
Room 131	**1918**	20.9	51.8	2 closed	No	Open	17/1 adult	22' x 26'
Room 129	**2028**	21.0	50.6	2 closed	No	Open	19/1 adult	22' x 26'
Room 128	**1953**	21.1	51.1	2 closed	No	Closed	15/1 adult	24' x 26'
Room 124 Library	**1155**	21.4	44.5	1 closed	No	Open	11/1 adult	24' x 32'
Room 122	**1773**	22.2	46.4	2 closed	No	Closed	14/1 adult	20' x 24'
Room 119	**1824**	22.0	47.8	1 of 1 open	No	Closed	13/1 adult	20' x 24'
Room 113 Guidance	1090	21.4	40.7	no windows	No	Open	0 people	6' x 14'
Room 111	**1811**	20.7	48.7	2 closed	No	Open	0/2 adults	24' x 28'
Room 109	**2001**	21.0	49.9	2 closed	No	Open	27/2 adults	24' x 26'
Room 107	**1435**	20.0	44.0	2 of 2 open	Yes	Open	15/1 adult	24' x 26'
Room 104	**1745**	20.2	48.4	2 closed	No	Closed	17/2 adults	24' x 26'
Room 116 Guidance	**1533**	20.9	46.5	no windows	No	Open	3/1 adult	8' x 12'
Room 117	**1303**	20.7	44.7	1 closed	No	Closed	1/1 adult	17' x 22'
Room 120	**1890**	21.1	48.9	1 closed	No	Open	0 people	24' x 24'
Room 125	**2117**	20.7	50.1	2 closed	No	Open	16/2 adults	24' x 26'
Room 134	**3201**	20.7	53.9	2 closed	No	Closed	12/1 adults	22' x 26'
Room 138 Main Office	**1227**	21.5	44.4	1 closed	No	Open	2 adults	12' x 22'
Minimum	533	20.0	40.7					
Maximum	**3201**	22.2	53.9					
Average	**1658**	21.1	47.2					
Main Floor Hallway								
Hallway Outside Main Office	810	21.9	37.5	No windows	No	Not Applicable	None	10' x 94'
Hallway Outside Room 132	**1964**	21.3	47.7	No windows	No	Not Applicable	None	10' x 58'
Hallway Outside Room 120	**1211**	21.0	44.4	No Windows	Yes	Not Applicable	None	10' x 94'
Hallway Outside Room 113	1565	21.0	45.2	No Windows	No	Not Applicable	None	10' x 50'
Minimum	810	21.0	37.5					
Maximum	**1964**	21.9	47.7					
Average	**1388**	21.3	43.7					

Notes:
Levels in red are above applicable guideline value range.
Levels in blue are below applicable guideline value range.

INDOOR AIR QUALITY ASSESSMENT - MORNING MONITORING - DAY 2 - OCTOBER 21 2009
ST. BERNARDS ELEMENTARY SCHOOL WITLESS BAY

Project Number: 02-03-00077
Assessment Date: October 21, 2009
Outside Conditions: Cloudy, Drizzle Fog

	MIN	MAX
Carbon Dioxide Limit (ppm):		1101
Temperature Range (°C):	19.5	25
Relative Humidity Range (%):	30	60

Location	Carbon Dioxide (ppm)	Temperature (°C)	Relative Humidity (%)	# Windows Open/closed	Drafty Yes/No	Door open/closed	# Students adults	Room Dinensions
Exterior	401	4.5	93					
Main Floor								
Room 145 Cafeteria	489	20.3	36.9	6 Closed	No	Open	0 people	30' x 34'
Staff Room	607	20.4	37.7	No Windows	No	closed	1 adult	24' x 26'
Room 132	**1406**	20.7	44.9	1 of 2 open	Yes	Open	10/1 adult	24' x 26'
Room 131	**1697**	20.5	45.6	2 closed	No	open	12/1 adult	22' x 26'
Room 129	**1663**	20.1	46.4	1 of 2 open	yes	closed	16/1 adult	22' x 26'
Room 128	**1695**	20.3	48.0	1 of 2 open	No	Closed	14/1 adult	24' x 26'
Room 124 Library	923	20.6	40.1	1 closed	No	Open	18/3 adult	24' x 32'
Room 122	**1474**	21.3	45.4	2 closed	No	Closed	17/1 adult	20' x 24'
Room 119	**1930**	21.1	41.1	1 of 1 open	No	open	14/1 adult	20' x 24'
Room 113 Guidance	**1286**	21.2	42.0	No Windows	No	Open	1 adult	6' x 14'
Room 111	**1962**	21.3	44.4	1 of 2 open	yes	open	18/2 adults	24' x 28'
Room 109	**2447**	21.6	47.2	1 of 2 open	no	open	23/2 adults	24' x 26'
Room 107	**1517**	20.4	41.9	2 of 2 open	yes	closed	15/1 adult	24' x 26'
Room 104	**1490**	20.2	43.4	2 closed	yes	closed	0 people	24' x 26'
Room 116 Guidance	**1637**	20.5	46.1	No Windows	no	open	1 person	8' x 12'
Room 117	977	20.4	41.4	1 closed	No	Open	1 adult	17' x 22'
Room 120	781	20.9	37.4	1 of 1 open	yes	open	0 people	24' x 24'
Room 125	**1929**	22.6	46.9	1 of 2 open	no	Closed	17/1 adults	24' x 26'
Room 134	845	19.9	38.2	2 of 2 open	Yes	Open	16/1 adults	22' x 26'
Room 138 Main Office	790	20.1	40.0	1 of 1 open	Yes	Open	2 adults	12' x 22'
Minimum	489	19.9	36.9					
Maximum	**2447**	22.6	48.0					
Average	**1377**	20.7	42.8					
Main Floor Hallway								
Hallway Outside Main Office	863	21.2	41.3	No windows	Yes	Not Applicable	None	10' x 94'
Hallway Outside Room 132	**1280**	20.7	44.2	No windows	No	Not Applicable	None	10' x 58'
Hallway Outside Room 120	**1250**	20.5	43.4	No Windows	Yes	Not Applicable	None	10' x 94'
Hallway Outside Room 113	**1365**	20.3	43.4	No Windows	No	Not Applicable	None	10' x 50'
Minimum	863	20.3	41.3					
Maximum	**1365**	21.2	44.2					
Average	**1190**	20.7	43.1					

Notes:
Levels in red are above applicable guideline value range.
Levels in blue are below applicable guideline value range.

INDOOR AIR QUALITY ASSESSMENT - AFTERNOON MONITORING - DAY 2 - OCTOBER 21 2009
ST. BERNARDS ELEMENTARY SCHOOL WITLESS BAY

Project Number: 02-03-00077
Assessment Date: October 21, 2009
Outside Conditions: Cloudy, Drizzle Fog

	MIN	MAX
Carbon Dioxide Limit (ppm):		1101
Temperature Range (°C):	19.5	25
Relative Humidity Range (%):	30	60

Location	Carbon Dioxide (ppm)	Temperature (°C)	Relative Humidity (%)	# Windows Open/closed	Drafty Yes/No	Door open/closed	# Students adults	Room Dinensions
Exterior	401	4.5	93					
Main Floor								
Room 145 Cafeteria	**1124**	22.4	40.8	2 of 6 open	yes	Open	80 - 90 people	30' x 34'
Staff Room	**1421**	22.0	48.1	No Windows	No	closed	10 people	24' x 26'
Room 132	**1551**	21.4	45.9	1 of 2 open	Yes	Open	9/1 adult	24' x 26'
Room 131	**2140**	21.0	50.7	2 closed	yes	open	13/1 adult	22' x 26'
Room 129	**2794**	20.8	50.7	2 closed	no	closed	16/1 adult	22' x 26'
Room 128	**2095**	21.1	49.2	2 closed	No	Closed	14/1 adult	24' x 26'
Room 124 Library	**1164**	21.2	42.7	1 closed	No	Open	0 people	24' x 32'
Room 122	**2090**	21.7	47.5	2 closed	No	Closed	15/1 adult	20' x 24'
Room 119	**2070**	21.7	48.6	1 of 1 open	No	closed	12/1 adult	20' x 24'
Room 113 Guidance	**1216**	21.2	41.2	No Windows	No	Open	0 people	6' x 14'
Room 111	**1963**	21.5	46.3	1 of 2 open	no	closed	18/1 adults	24' x 28'
Room 109	**1684**	21.3	44.5	2 closed	no	open	11/1 adults	24' x 26'
Room 107	**1297**	20.3	41.7	2 of 2 open	yes	open	14/1 adult	24' x 26'
Room 104	**1490**	20.2	43.4	2 closed	yes	closed	19/2 adults	24' x 26'
Room 116 Guidance	**1737**	20.5	46.2	No Windows	yes	closed	1 adult	8' x 12'
Room 117	**1291**	20.6	42.4	1 closed	No	Open	0 people	17' x 22'
Room 120	**1408**	20.4	42.2	1 of 1 open	yes	closed	12/1 adult	24' x 24'
Room 125	**2620**	21.1	51.7	2 closed	no	open	15/1 adults	24' x 26'
Room 134	**2010**	21.1	47.4	2 closed	no	Open	11/1 adults	22' x 26'
Room 138 Main Office	960	21.4	41.0	1 closed	no	Open	1 adult	12' x 22'
Minimum	960	20.2	40.8					
Maximum	**2794**	22.4	51.7					
Average	**1706**	21.1	45.6					
Main Floor Hallway								
Hallway Outside Main Office	658	21.5	35.9	No windows	Yes	Not Applicable	None	10' x 94'
Hallway Outside Room 132	**1221**	21.4	39.1	No windows	yes	Not Applicable	None	10' x 58'
Hallway Outside Room 120	**1150**	21.1	43.8	No Windows	Yes	Not Applicable	None	10' x 94'
Hallway Outside Room 113	**1265**	21.1	43.9	No Windows	No	Not Applicable	None	10' x 50'
Minimum	658	21.1	35.9					
Maximum	**1265**	21.5	43.9					
Average	1074	21.3	40.7					

Notes:
Levels in red are above applicable guideline value range.
Levels in blue are below applicable guideline value range.

APPENDIX III
RESULTS OF VIABLE FUNGAL AIR SAMPLE ANALYSIS

MYCOTAXON CONSULTING LTD.
3 Rockwood Avenue
Halifax, Nova Scotia
Canada B3N 1X4
Phone: 902-475-1456
Fax: 902-475-1982

Ms. Susan Knight
Pinchin LeBlanc Environmental Ltd.
27 Austin Street, 2nd Floor
St. John's, NL
A1B 4C3

November 4, 2009

Dear Ms. Knight:

Herewith is the list of fungi recovered from the air samples from your project 02-02-00077, which were received by this laboratory on October 22, 2009.

SAMPLE	CFU/m^3	SPECIES
M-001 exterior	144	yeasts (18)* Ulocladium chartarum (2) non-sporulating isolate (2) Acremonium strictum (1)
M-002 staff room	50	Cladosporium cladosporioides (5) Mucor plumbeus (1) non-sporulating isolate (1) Cladosporium sphaerospermum (1)
M-003 room 132	113	Cladosporium cladosporioides (5) non-sporulating isolate (4) yeasts (3) Ulocladium chartarum (2) Acremonium strictum (2) Aspergillus versicolor (2)
M-004 room 124	69	Cladosporium cladosporioides (5) Ulocladium chartarum (2) non-sporulating isolate (2) Acremonium strictum (1) yeast (1)
M-005 room 111	138	non-sporulating isolate (6) yeasts (6) Cladosporium cladosporioides (5) Penicillium chrysogenum (1) Aspergillus versicolor (1) Aspergillus fumigatus (1) Mucor plumbeus (1) Penicillium solitum (1)

M-006 room 125	350	Penicillium chrysogenum (45) Cladosporium cladosporioides (4) non-sporulating isolate (4) Aspergillus versicolor (1) Cladosporium sphaerospermum (1) Penicillium solitum (1)
M-007 room 120	275	Penicillium chrysogenum (38) Cladosporium cladosporioides (2) non-sporulating isolate (2) Mucor plumbeus (1) Ulocladium chartarum (1)
M-008 room 117	138	Penicillium chrysogenum (13) Cladosporium cladosporioides (3) yeasts (3) Mucor plumbeus (1) Penicillium chrysogenum (1) Eurotium rubrum (1)
M-009 room 116	306	Cladosporium cladosporioides (19) Penicillium chrysogenum (18) yeast (5) Ulocladium chartarum (3) non-sporulating isolate (2) Mucor plumbeus (1) Eurotium rubrum (1) Acremonium strictum (1)
M-010 room 122	313	Penicillium chrysogenum (59) Cladosporium cladosporioides (8) yeasts (2) Ulocladium chartarum (2) Mucor plumbeus (1)
M-011 room 119	113	Penicillium chrysogenum (6) non-sporulating isolate (5) Cladosporium cladosporioides (3) Aspergillus versicolor (2) Cladosporium sphaerospermum (1) Mucor plumbeus (1)
M012 room 104	375	Penicillium chrysogenum (49) non-sporulating isolate (4) yeasts (4) Cladosporium cladosporioides (3)
M-013 room 107	44	Cladosporium cladosporioides (3) Eurotium herbariorum (2) Penicillium chrysogenum (1) yeast (1)

M-014 room 109	75	Penicillium chrysogenum (3) Stachybotrys chartarum (3) yeasts (2) Cladosporium cladosporioides (2) Cladosporium sphaerospermum (1) Ulocladium chartarum (1)
M-015 room 134	31	Penicillium chrysogenum (2) non-sporulating isolate (1) Aspergillus versicolor (1) Ulocladium chartarum (1)
M-016 room 128	44	Cladosporium cladosporioides (4) Eurotium rubrum (1) Penicillium chrysogenum (1) non-sporulating isolate (1)
M-017 room 129	44	Cladosporium cladosporioides (4) Aspergillus versicolor (1) Penicillium chrysogenum (1) Eurotium rubrum (1)
M-018 room 131	38	Penicillium chrysogenum (2) Cladosporium cladosporioides (2) Mucor plumbeus (1) Eurotium herbariorum (1)

*Numbers in parenthesis are spore counts for each taxon recovered in sample

I hope this is helpful. If you have any questions concerning this report, please do not hesitate to contact me.

Sincerely yours,
Mycotaxon Consulting Ltd.
AIHA (EMPAT) Proficient Laboratory

Per: Thomas G. Rand, Ph.D. Mycology

APPENDIX IV

PHOTOS

PHOTO 1 – STAINED CEILING TILE – HALLWAY BY CENTER ENTRANCE TO SCHOOL.