



Air Quality Management Services, Inc.
“Discovering Solutions for Healthier Living”

INDOOR AIR QUALITY EVALUATION

Biddeford High School

20 Maplewood Avenue – Biddeford, Maine



PREPARED FOR

Biddeford School Department
C/o Mr. Phil Radding – Director of Facilities
PO Box 586
Biddeford, Maine 04005

Date of Inspection

November 29th, 2010

AQM PROJECT #10-495

Nick Ferrala, B.A., CIEC
Microbiologist, Industrial Hygienist

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AQM SUMMARY REPORT: Project # 10-495						Report Type: IAQ <input checked="" type="checkbox"/>						
<i>Inspection Date:</i> November 29 th , 2010				<i>Onsite Industrial Hygienist:</i> Nick Ferrala, CIEC								
<i>Client:</i> Biddeford School Department C/o Mr. Phil Radding				<i>Property Owner:</i> City of Biddeford								
<i>Mailing Address:</i> PO Box 586 - Biddeford, Maine				<i>Location:</i> High School				20 Maplewood Ave, Biddeford, Maine				
<i>Concern:</i> Client requested air samples (for mold) in Rooms 203, 215 and 216.												
<i>Actions to Date:</i>												
<input type="checkbox"/> No Actions To Date				<input type="checkbox"/> Carpeting Cleaned / Extracted / Treated								
<input type="checkbox"/> Installed Fresh-air Source and/or Air Exchange Unit				<input checked="" type="checkbox"/> Area(s) HEPA Vacuumed and Damp Dusted								
<input type="checkbox"/> Cleaned Mechanical System - including Ductwork				<input type="checkbox"/> HEPA Air Cleaners Installed - Portable								
<input type="checkbox"/> Mechanical System Filter(s) Changed				<input type="checkbox"/> Water-damaged Materials Removed – See Comments								
<i>Comments:</i> It was reported to AQM that the Client performed detailed-cleaning in the above rooms.												
TESTING												
<i>Sampling Decision Logic</i>				<input checked="" type="checkbox"/> Air samples were collected to determine airborne influences. <input type="checkbox"/> Surface samples were collected to characterize suspect contamination. <input checked="" type="checkbox"/> Health Issues reported <input type="checkbox"/> None <input checked="" type="checkbox"/> Allergies <input type="checkbox"/> Asthma <input type="checkbox"/> Other:								
<i>Comments:</i> Specific symptoms / complaints have not been reported to AQM.												
RECOMMENDED GUIDELINES						TESTING METHOD						
<i>Carbon Dioxide (CO₂)</i>		ASHRAE	Not Applicable	<i>Gray Wolf DirectSense 100</i>		<input checked="" type="checkbox"/>		Airborne Mold		<i>Allergenco-D</i>		<input checked="" type="checkbox"/>
		OSHA	5000 ppm	<i>Colorimetric</i>		<input type="checkbox"/>				<i>N6</i>		<input type="checkbox"/>
<i>Carbon Monoxide (CO)</i>		ASHRAE	9 ppm	<i>Gray Wolf DirectSense 100</i>		<input checked="" type="checkbox"/>		Surface Mold		<i>Tape</i>		<input type="checkbox"/>
		OSHA	50 ppm	<i>Colorimetric</i>		<input type="checkbox"/>				<i>Swab</i>		<input type="checkbox"/>
<i>Relative Humidity (%)</i>		ASHRAE	30 – 60%	<i>Gray Wolf DirectSense 100</i>		<input checked="" type="checkbox"/>		Airborne Particulate		<i>Lighthouse IAQ 3016</i>		<input checked="" type="checkbox"/>
				<i>Extech RH-401 Pen</i>		<input type="checkbox"/>				<i>NIOSH/EPA</i>		<input type="checkbox"/>
<i>Optimal Recommended Temperatures (°F)</i>		Summer	72 - 78 °F	<i>Gray Wolf DirectSense 100</i>		<input checked="" type="checkbox"/>		Total Volatile Organic Compounds (TVOC)		<i>ppb-RAE</i>		<input type="checkbox"/>
		Winter	68 - 76 °F	<i>WBGT</i>		<input type="checkbox"/>				<i>Detector Tube</i>		<input type="checkbox"/>
<i># of Air Samples</i>	5		<i># of Surface Samples</i>	0		<i># of Bulk Samples</i>	0		<i># of Swab Samples</i>	0		
<i>Other Testing:</i>		None										
FINDINGS												
Air Quality Monitoring Readings					TPM (Total Particulate Matter), ug / m³ Sampled for 1 minute						TVOC	
Location	CO₂ (ppm)	CO (ppm)	Temp. °F	RH%	0.3um	0.5um	1.0um	2.5um	5um	10um		
Instrument Zero	----	----	----	----	0.00	0.00	0.00	0.00	0.00	0.00	----	
Outdoor	210	0.0	52.1	32.7	0.88	1.14	1.56	3.71	15.0	19.2	----	
Room 203	497	0.3	70.7	24.4	1.92	6.00	33.4	181	502	544	----	
Room 215	480	0.2	71.1	22.8	1.27	2.54	9.24	38.6	95.0	105	----	
Room 216	370	0.2	72.8	21.2	1.31	2.96	12.6	60.8	159	170	----	
Room 215 / 216 above ceiling	----	----	----	----	1.90	5.06	25.1	144	417	469	----	
EPA Criteria	----	----	----	----	----	----	----	15 / 35	----	150	----	
Comments	EPA Criteria = National Ambient Air Quality Standards (NAAQS). AQM sample times are 1 minute; EPA criteria based on 24hrs for 10um and larger value for 2.5um, and annual average for smaller 2.5um value. Particulate levels determined by AQM are a screening only, and use methodology different than that required by EPA. NAAQS values are for outdoor air - there are no standards for indoor air.											
OBSERVATIONS / FINDINGS												
<i>Comments</i>	<p>► Carbon monoxide and carbon dioxide readings were within published Guidelines, and for carbon dioxide, indoor levels were not significantly higher than outdoor levels - no risks anticipated.</p> <p>► Temperature readings were within the ASHRAE Comfort Guidelines. However, relative humidity (RH%) values were below comfort guidelines in all areas sampled, which is common in the Northeast during colder months as cold outdoor air is brought indoors and heated, further reducing the RH%. Low RH% can dry mucus membranes and cause irritations to the eyes, nose, throat and upper airways. RH% is often difficult to maintain within comfort zones during the heating season.</p> <p>► Total Particulate Matter (TPM) exceeded outdoor levels as well as EPA reference levels for all particle sizes in all areas sampled. Levels were particularly high in Room 203 as well as above ceiling tiles in Rooms 215 / 216. AQM observed significant amounts of visible dust still remaining under the heating unit in Room 203. Visible dust accumulation was also seen above ceiling tiles, but this was not atypical as in most buildings the area above ceiling tiles tends to contain settled dusts especially from work performed in this area (e.g. roof work, replacement of ceiling tiles, etc).</p>											

AQM SUMMARY REPORT: Project # 10-495**FUNGAL GROWTH - See laboratory results for details**

Results are as follows:

Air Samples: Concentrations similar to outdoor control (Sample A1) and / or typical levels for an occupied indoor location – no immediate risks anticipated
 Concentrations above background (outdoor control) Trace Low Low / Moderate High
 Air sample analysis suggests surface contamination is influencing the overall airborne fungal burden.

Surface Samples: Surface samples were not collected: Not authorized / requested No visible Fungi
 No active fungi detected for surfaces tested
 Fungal Growth Detected Trace Low Moderate High
 Personal contents have visible fungal growth or impact.
 Fungal contamination appears to be isolated to surfaces with minimal airborne influences.

Comments: ► Air sample results indicate that indoor spore levels were not significantly above those of the outdoor reference sample in all areas sampled. Spores of concern (Aspergillus/Penicillium-like) were not detected in Room 215, and were present at only trace levels in other areas (these levels would not be considered as significantly above background).

RECOMMENDATIONS

- Ensure adequate fresh-air source to mechanical system with per current applicable ASHRAE Standards.
- Ensure the system filters are pleated with an efficiency rating of at least 40% (or greater) and properly sized for the system.
- Consult a Professional Engineer or Qualified Contractor to determine the appropriate mechanical system modifications.
- The HVAC system should be cleaned (including the ductwork) based on the report that the system has not been cleaned since the original install and / or airborne mold spore levels. The HVAC system should be part of a maintenance plan that includes monthly inspections of the filters and total system cleanings every three (3) to five (5) years, based on location and environmental influences.
- Enlist the services of an HVAC Cleaning Contractor that is competent / knowledgeable with NADCA ACR-2005 Cleaning Standards.
- Upgrade Housekeeping - Detail clean (HEPA vacuum & damp dust) to control dust / particulate levels in the hard to reach areas.
- A resilient floor covering (vinyl tile / linoleum) or like product should be considered as a finished floor covering to afford ease of maintenance and resists moisture influences.
- Control water intrusion into area / space.
- Mold Remediation should be undertaken by a qualified Contractor in accordance with the IICRC S520 Standard or other similarly recognized protocols. Follow-up sampling is recommended to verify cleaning and return of mold levels to background - See Comments.
- Areas of immediate impact should be isolated from the unaffected areas of the building to prevent contaminant communications thus limiting damages and exposure risks.
- High Temperature Steam Clean and Treat all carpeting and ensure areas are rapidly dried to reduce microbial influences.

Comments: ► Based on air sample results - no risks for mold exposure in the areas sampled.
 ► Detail Clean Room 203 to include under and within the heating unit.
 ► Based on the most-recent combination of mold sample results and particulate results, it appears likely that there may be additional sources of particulate matter other than accumulated dust within the classrooms.

Any reactions from individuals within the school may have been due to a combination of low levels of mold spores and other potential allergens within dust accumulated in classrooms (long-term accumulations that likely include considerable organic matter) as well as particulates from other sources.

In addition to heightened cleaning within classrooms, this ongoing particulate issue should be further evaluated to determine source(s) and control / reduce particulate levels.

END OF SECTION

**GENERAL INDOOR AIR QUALITY GUIDELINES
& TESTING METHODOLOGIES**

General Indoor Air Quality Guidelines and Testing Methodologies

AQM evaluates carbon monoxide, carbon dioxide, temperature and relativity using a Gray Wolf DirectSense100 to evaluate general air quality parameters. These parameters are evaluated to determine fresh air exchange efficiencies and building purge rates as well as background ambient moisture levels.

The data collected was compared to standards outlined by the American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE), American Conference of Governmental Industrial Hygienist (ACGIH), and the Occupational Safety and Health Administration (OSHA).

Airborne Total Mold and Non-viable Particulates

AQM collects airborne fungi samples using Allergenco-D air sampling cassettes designed for evaluating total airborne fungi and non-viable particulates. Samples are collected at 15-liters per minute over 5-minute or 10-minute sampling periods each depending on site conditions. The samples are analyzed using direct microscopy examination.

The Allergenco-D is a direct read total particulate air sampling device. It works using the inertial impaction principle similar to other spore trap devices. It is designed for the rapid collection and analysis of airborne particulate including bioaerosols. The particulate includes fibers (e.g. fiberglass, cellulose, clothing fibers) opaque particles (e.g. fly ash, combustion particles, copy toner, oil droplets, paint), and bioaerosols (e.g. mold spores, pollen, insect parts, skin cell fragments).

Typical Indoor Levels (collected using Allergenco-D)

Particulates	Average Concentrations	Rating 0 - 5
Skin Cell Fragments	7,500 to 10,000	2 - 3
Fiberglass Fibers	50 to 75	n.d. - 2
Other Fibers	1,000 to 2,500	n.d. - 2
Black Opaque Particles	2,500 to 5,000	n.d. - 1
Insect Parts	< 27	n.d. - 1
Pollen Grains	< 27	n.d. - 1
Background Debris Rating	1+ to 4+ (low to high)	n.d. - 2

n.d. – None Detected

Airborne Particulate Assessment

AQM conducts testing in representative areas to determine airborne particulate influences and assess general indoor air quality parameters. Testing is conducted to assess airborne particulates using a Lighthouse IAQ 3016 Laser Particle Counter. This unit quantifies particulates by size (microns 0.3 to 10.0). Results are comparatively evaluated to determine particulate concentrations by size and evaluate the efficiencies of the air filtering systems and to identify areas with elevated particulate concerns.

Fungal influences are usually suspected when predominantly high concentrations are noted between 1.0 microns to 10 microns respectively.

Airborne Bacteria and Fungi

Currently there are no set standards or guidelines for bioaerosol / non-aerosolized microbial exposure levels which suggest dose response risks associated with a specific exposure level to airborne environmental bacteria or fungi. Most important, sensitivities to microbial exposures vary widely between individuals with the immuno-compromised population being the most susceptible.

Current studies suggest indoor airborne microbial levels in mechanically ventilated buildings should be less than the levels identified in outdoor air. Building without mechanical ventilations should be either similar in concentration to the outdoor air or less than the outdoor concentrations.

The data also suggests that indoor microbial concentrations that exceed outdoor concentrations by 30% or more should be considered elevated. Additionally, identification of specific microorganisms indoors not identified in the outdoor samples collected suggests an indoor source and should be considered a potential risk based on genera or species isolated. It is important for determining health risk associated with bioaerosols and non-aerosolized microbials to keep in mind that the colony count alone is not the only determining factor. The species of organism(s) identified is sometimes more important than the colony count (number of organisms). The World Health Organization (WHO) and the Indoor Air Quality Association recommends fungi levels not exceed 50 CFUs m³ (for any single species) or 150 to a max of 300 CFUs m³ (for total species) when compared to the outdoor samples collected, considering species and/or other risk factors that might be present.

Fungi Bulk Dusts (Carpet Vacuum Samples)

The current Industry Guidelines suggest the following:

< 5,000 CFU / Ft ²	Normal
< 25,000 CFU / Ft ²	Moderate Risk
< 75,000 CFU/ Ft ²	High Risk
> 75,000 CFU/ Ft ²	Very Active Growth

General Indoor Air Quality Testing

Carbon Dioxide

The OSHA Permissible Exposure Limit (PEL) for carbon dioxide is 5000 ppm. These OSHA standards were designed for industrial settings and not office or school settings.

The ASHRAE 62 comfort guidelines for indoor air recommends levels be maintained below 1000 parts of carbon dioxide per million parts of air (ppm) or no more than 700

ppm greater than the outdoor readings. Elevated carbon dioxide concentrations can cause symptoms such as headaches, nausea, dizziness, fatigue, and drowsiness.

Carbon Monoxide

OSHA's Permissible Exposure Limit (PEL) for carbon monoxide is 50 ppm. These OSHA standards were designed for industrial settings and not office or school settings.

ASHRAE guidelines for indoor air quality comfort limits recommend levels be maintained below 9 ppm. Elevated carbon monoxide concentrations can cause symptoms such as; severe headaches, nausea, dizziness, fatigue, and drowsiness, and in high concentrations, death.

Relative Humidity

Relative Humidity levels should be maintained between 30% to 60%. AQM recommends levels be maintained between 35% to 55% optimally. When relative humidity levels are below these guidelines, symptoms can occur causing discomfort such as; dry eyes, nose, throat, and irritated upper respiratory tract. Low relative humidity dries the mucus membranes, which prohibits the body's normal ability to rid our body of certain contaminants increasing the potential for discomforts associated with eyes, noses, and throats. Elevated relative humidity can contribute to a conducive environment for microbial growth associated with moisture damage.

Temperature

Temperatures can affect people psychologically; they may assume there is a problem when it is too warm or when there is no air movement in their work area, even in the absence of an air contaminant.

ASHRAE Recommended Comfort Guidelines

Relative Humidity %		Winter Season °F		Summer Season °F
30		68.5 to 76.0		74.0 to 80.0
40		68.5 to 75.5		73.5 to 79.5
50		68.5 to 74.5		73.0 to 79.0
60		68.0 to 74.0		72.5 to 78.0

Applies for persons clothed in typical summer and winter clothing, at light, mainly sedentary activity.

END OF SECTION

ASSESSMENT LIMITATIONS

ASSESSMENT LIMITATIONS

The observations, conclusions and recommendations described in this assessment report were made under the conditions stated herein, taking into account any information / concerns provided or reported to AQM, and were arrived at in accordance with generally accepted standards related to indoor air quality investigations and good industrial hygiene practice. The conclusions presented in the report were based solely upon the services described herein, and not on scientific tasks or procedures beyond the scope of described services, time and / or any budgetary constraints. Assessments were made at the request of the Client based on information provided at the time of authorization to proceed with the evaluation. This report is prepared for the Client's use only and in accordance with scope of services requested, and should not be distributed to other parties for review and reliance.

The findings relating to this assessment were not intended to be exhaustive in nature, nor do they attempt to identify all possible sources of indoor contaminants, chemicals or even mold throughout the entire structure. Building materials may contain asbestos. In the event that asbestos building materials are suspected, further evaluation should be made prior to renovations in accordance with Federal, State, and Local regulations – as applicable. **Note:** Effective April 22nd, 2010 Environmental Protection Agency's (EPA) Renovation, Repair, and Painting (RRP) rule is in effect. This means that any renovation, repair and painting activities on **target housing** or **child-occupied facility** built before 1978 performed for compensation after April 22nd, 2010 falls under this rule. It is mandatory that any renovation impacting painted surfaces in a facility built before 1978 be tested for presence of lead-based paints. A Contractor (or Firm) trained and certified under this rule shall perform removal of lead-base painted surfaces, **ONLY** if lead-based paints are present and renovation / remediation of the structure falls under the definition of EPA's new rule. You can find EPA's RRP rule and definitions at their website: <http://www.epa.gov/lead/pubs/renovation.htm>. The chosen contractor to perform activities disturbing lead-based painted surfaces will comply with all State, Federal, Local Health and Safety Regulatory Requirements (which ever is more stringent).

Any measured results, analysis data, and / or physical conditions observed are only valid for the period in which this inspection / testing was conducted. Certain assumptions can be made based on information provided to AQM on or before the time of the assessment coupled with analytical data and observations made at the time of the inspection / testing.

Where such quantitative laboratory analyses have been conducted by an outside laboratory, AQM has relied upon the data provided, and has not conducted an independent evaluation of the reliability of the data. This data have been reviewed and interpretations made as presented in the report.

Historical events or ambient air conditions that may have existed prior to this assessment cannot be correlated in any way with the enclosed data. No warranty, real or implied, is made as to what was or is the exact cause or source that may have adversely affected the indoor air quality prior to the date of this assessment.

The report is based on AQM's professional opinion and on our experience in conjunction with information gathered during the assessment and laboratory data provided. Information and recommendations set forth in this report are intended to characterize current conditions based on the reported concerns and discoveries made at the time of the inspection and testing period. Information is being provided to aid in the development of corrective actions or remediation that may improve overall conditions identified and/or to improve the overall air quality.

PHOTO DOCUMENTATION

AQM



Dust and debris accumulated under the heating unit in Room 203



Dust and debris accumulated under the heating unit in Room 203



Dust and debris accumulated under the heating unit in Room 203



Room 215 / 216 area above ceiling tiles – no mold / moisture issues noted, residual dust typical for type of space



Room 215 / 216 area above ceiling tiles – no mold / moisture issues noted, residual dust typical for type of space

SUPPORTING DOCUMENTATION

AQM



Client: Air Quality Management
 Address: 19B Portland Road
 Gray ME 04039
 Project Number: 10-495

Date Sampled: 11/29/10
 Date Received: 11/30/10
 Date Reported: 11/30/10

1-800-244-8378 Phone
 1-207-873-7022 FAX
 227 China Rd., Winslow, ME 04901
 SOP 4.3.24

Sample Type:	Allergenco-D	Percent of Trace Assayed (1):	Analyst	Tom Cheetham					
Volume Sampled (L):	150	150	150	150					
Sample Description:	A1	A2	A3	A4					
Lab Number:	Outdoors	Room 203	Room 215	Room 216					
Sample Condition:	MJ 21550	MJ 21551	MJ 21552	MJ 21553					
Background Debris rating, 0-5 (2)	Good	Good	Good	Good					
	2	4	4	5					
Total Mold Spores & Fragments	Raw Ct.	GL/m ³	%	Raw Ct.	GL/m ³	%	Raw Ct.	GL/m ³	%
Aspergillus/Penicillium-like	11	290	100	3	80	100	5	140	100
Bacillus spores	11	290	100	4	110	29	1	27	20
Unidentified Spores				8	210	57	3	80	100
Particulates (3)				2	53	14			
Skin cell fragments (2-3)	n.d.			1			2		
Black opaque particles (n.d. - 2)	2			1			1		
Other fibers (n.d. - 2)	n.d.			1			1		
Misc. Clear particulates (n.d. - 2)	2			4			2		

Note: Some values may not appear to be perfectly additive due to rounding.
 (1) Value indicates % of sample trace analyzed. 100% of Sample Trace is always examined for anomalies, spore clusters and Stachybotrys / Memnonella spores, and any appropriate corrections are made as a result of findings. This process results in a lower MDL for Stachybotrys / Memnonella spores and a more accurate overall analysis.
 (2) Debris Rating Scale: 0 = No trace visible; 1 = Contiguous debris; Background debris levels greater than 3 indicate poor visibility for the analyst reading the slide, which can result in under-counting of small spores such as those from members of the Aspergillus/Penicillium-like group.
 (3) Particulates are categorized as follows: (n.d. - 2) (not detected) to 5 (highest abundance). Values in parentheses indicate typical indoor levels.
 No discernable mold was submitted with these samples. Minimum detection limit varies with amount of air sampled: 30L = 133 cf./m³; 75L = 53 cf./m³; 150L = 19 cf./m³

Created by: Tom Cheetham, PhD, Environmental Microbiology Division
 Reviewed By: Brett Goodrich, Manager, Environmental Microbiology Division

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