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October 30, 2001

Mr. Bernard P. Orlan
 Director, Environmental Health & Safety
 New York City Board of Education
 28-11 Queens Plaza North
 Long Island City, NY 11101-4008

**Re: Indoor Air Quality Assessment
 Manhattan Academy of Technology @ P.S. 2M
 122 Henry Street
 New York, New York
 ATC Project No. 15-19125-0273**

Dear Mr. Orlan:

ATC Associates Inc. (ATC) is pleased to provide this report of an indoor air quality (IAQ) assessment conducted on October 24, 2001, at the referenced school. The New York City Board of Education (BOE) requested this re-assessment to address air quality concerns expressed by teachers and to follow-up on a previous assessment conducted by ATC on October 12, 2001.

SCOPE OF WORK

ATC conducted this evaluation to assess the basic parameters of temperature, relative humidity, carbon dioxide (CO₂) and carbon monoxide (CO).

Total volatile organic compounds (TVOCs) and respirable particulates were also measured.

Andreas Andreou, Senior Project Manager, of ATC's New York City office, conducted the assessment. ATC's findings and conclusions are based on a visual inspection, real-time environmental measurements and conditions present in the school at the time of the assessment.

ATC measured temperature, relative humidity, CO₂ and CO with a Q-Trak[®] Model 8551, manufactured by TSI, Inc.

ATC measured concentrations of respirable particulates with a Dust-Trak[®] Aerosol Monitor Model 8520, manufactured by TSI, Inc.

The assessments were performed consistent with generally accepted indoor air quality assessment practices. As with all such assessments, there were inherent limitations created by constraints of time, operational and work practice variability, variations in air contaminant concentrations, and sampling and analytical accuracy. The results of the sampling represent conditions found on the dates of the survey and may not represent conditions found at other

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times. The information presented in this report should be used by the Board of Education as a guide to assess the need for further improvements in current indoor air quality control activities.

EVALUATION CRITERIA

Currently, there are no regulatory standards for indoor air quality in non-industrial buildings, such as offices and schools. For the real-time data collected, ATC uses the commonly accepted guidelines cited in the following publications:

- *Ventilation for Acceptable Indoor Air Quality (ASHRAE 62-1999)*, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE);
- *Thermal Environmental Conditions for Human Occupancy (ASHRAE 55-1992)*;

Table 1 lists target guidelines for the parameters that ATC evaluated during this investigation. Meeting one, some, or all of the listed values does not assure that acceptable indoor air quality will be achieved at all times.

TABLE 1
TARGET GUIDELINES FOR INDOOR AIR QUALITY PARAMETERS EVALUATED

PARAMETER	TARGET LEVEL	AGENCY OR ORGANIZATION
Carbon Dioxide (CO ₂)	<700 parts per million (ppm) above background level	ASHRAE 62
Carbon Monoxide (CO)	9 ppm	USEPA NPAAQS (as cited in ASHRAE 62)
Respirable Particulates (PM ₁₀)	50 micrograms per cubic meter of air (µg/m ³) – annual 150 micrograms per cubic meter of air (µg/m ³) – 24 hour	USEPA NPAAQS (as cited in ASHRAE 62)
Temperature	Summer: 73-79°F at 50% RH Winter: 68-75°F at 50% RH	ASHRAE 55
Relative Humidity	30 – 60 %	ASHRAE 55

USEPA = United States Environmental Protection Agency
NPAAQS = National Primary Ambient-Air Quality Standard

SAMPLING RESULTS

REAL-TIME ENVIRONMENTAL MEASUREMENTS

ATC collected eleven (11) sets of real-time environmental measurements consisting of ten (10) in the school building and one (1) outdoors. These results are shown in Table 2. Field data sheets are found in Attachment 1.

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TABLE 2
REAL-TIME MEASUREMENTS

Location	Temperature (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Respirable Particulates (µg/m ³)
Staircase 4 & 5	76.8	71.6	1240	2	103
Office 301	76.9	70.5	1275	2	67
Hallway outside room 303	77.3	69.5	1043	1	80
Room 303	77.8	69.0	1290	1	97
Room 306	77.8	68.1	935	1	72
Room 305	77.8	66.0	946	2	66
Room 308	77.9	62.1	1764	2	62
Room 309	78.4	68.1	1423	1	74
Staircase / Exit 6	78.8	68.9	948	1	110
Room 318	79.2	69.3	1120	1	112
Outdoors	77.8	64.1	506	1	86

Temperature

Indoor dry bulb temperature measurements ranged from 76.8 °F to 79.2 °F. All measurements were above the range of 69 to 76°F (at 50 percent relative humidity) recommended by ASHRAE Standard 55-1992 during the heating season (wintertime conditions). The outdoor temperature was 77.8°F.

Relative Humidity

The relative humidity indoors ranged from 62.1 percent to 71.6 percent. All of the indoor measurements were above the ASHRAE's recommended range of 30 to 60 percent for occupant comfort. The outdoor relative humidity was 64.1 percent.

Carbon Dioxide Concentration

Carbon dioxide concentrations indoors ranged from 935 ppm to 1764 ppm. Six (6) CO₂ measurements were above the ASHRAE Standard 62-1999 recommended maximum concentration of <700 ppm above the background level. The outdoor (background) CO₂ concentration was 410 ppm. Therefore, the acceptable level of CO₂ at this location was 1,110 ppm (background level + 700 ppm). Levels above the recommended maximum do not indicate a health risk. Carbon dioxide measurements are used as an indicator of available outdoor air. The primary source of CO₂ indoors is occupant respiration.

Carbon Monoxide Concentration

Carbon monoxide concentrations indoors were 1-2 ppm. These concentrations were below the NPAAQS/ASHRAE guideline of 9 ppm. The outdoor CO concentration was 1 ppm.

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Respirable Particulates

Respirable particulate concentrations indoors ranged between $62 \mu\text{g}/\text{m}^3$ and $112 \mu\text{g}/\text{m}^3$. All measurements were above the NPAAQS/ASHRAE guideline of $50 \mu\text{g}/\text{m}^3$ (annual average concentration of particulate matter 10 micrometers or less in aerodynamic diameter) but below the NPAAQS/ASHRAE guideline of $150 \mu\text{g}/\text{m}^3$ (24-hour average concentration of particulate matter 10 micrometers or less in aerodynamic diameter). The outdoor respirable particulate concentration was $86 \mu\text{g}/\text{m}^3$. The high outdoor level is the major factor in the elevated indoor levels.

OBSERVATIONS

During this assessment, ATC noted the following:

- The exhaust system was operating during the assessment;
- The air conditioning was running in Room 301;
- Windows were open in Rooms 305 and 309.

FINDINGS

Based on the visual inspection of the occupied spaces and real-time measurements, the following findings are presented:

1. Measurements of temperature, relative humidity in all locations examined were above applicable standards and guidelines.
2. Measurements of CO and respirable particulates were within acceptable ranges.
3. Six out of ten CO_2 measurements were above the range recommended by ASHRAE 62-1999.

CONCLUSION

Based on our observations and measurements, ATC concludes that the assessed locations were suitable for occupancy at the time of ATC's investigation. However, the temperature and relative humidity may be uncomfortable for some occupants. The supply of outdoor air to the classrooms should be increased.

RECOMMENDATIONS

Based on the findings and conclusions above, ATC recommends the following:

- Keep CO_2 levels below the recommended maximum by increasing the level of outdoor air;
- Perform an assessment of the entire building to compare the 3rd floor, where Manhattan Academy of Technology is located, with the rest of the P.S. 2M building;
- Keep a log of all complaints and illnesses to better target problem areas and times;

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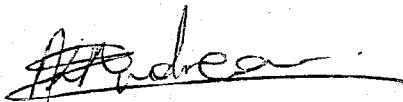
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- Conduct timely follow-up monitoring/inspection to ensure that recommendations were effective.

It is our pleasure to provide these indoor air consultative services to the New York City Board of Education. If you have any questions about this report, please call (212) 353-8280, extension 261 or 212.

Yours truly,
ATC ASSOCIATES INC.



Andreas C. Andreou
Senior Project Manager

Reviewed by:



James R. Cohn, CIH, CSP
Regional Manager
Industrial Hygiene Division

Attachments