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January 8, 2002

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
Stuyvesant High School (M477)
345 Chambers Street
New York, New York 10007
ATC Project No. 15-19125-0246**

Dear Mr. Orlan:

ATC Associates Inc. (ATC) is pleased to provide this report of indoor air quality (IAQ) measurements collected on January 7, 2002, at the referenced school. The New York City Board of Education (BOE) requested these measurements as part of a program to determine if acceptable indoor air quality is being maintained.

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.

Jimmy Choy, Industrial Hygienist, 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 (PM_{2.5}) with a Dust-Trak® Aerosol Monitor Model 8520, manufactured by TSI, Inc.

ATC measured concentrations of TVOCs using a RAE Systems, Inc. MiniRAE® photoionization detector (PID).

The assessment was 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 indoor air quality parameters and

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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 times. The information presented in this report should be used by the BOE 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)*;
- *Industrial Hygienists Guide to Indoor Air Quality Investigations (1993)*, American Industrial Hygiene Association (AIHA).

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	ASHRAE 62 (adopted from USEPA NPAAQS)
Respirable Particulates (PM _{2.5})	65 micrograms per cubic meter of air (µg/m ³) 24-hour average	USEPA NPAAQS
Temperature	Summer: 73-79°F at 50% RH Winter: 68-75°F at 50% RH	ASHRAE 55
Relative Humidity	30 – 60 %	ASHRAE 55
Total Volatile Organic Compounds (TVOC)	1 ppm	AIHA

USEPA = United States Environmental Protection Agency
NPAAQS = National Primary Ambient-Air Quality Standard
AIHA = American Industrial Hygiene Association

REAL-TIME ENVIRONMENTAL MEASUREMENTS

ATC collected one hundred and twenty-seven (127) sets of real-time environmental measurements consisting of one hundred and twenty-five (125) in the school building and two (2) outdoors. All ten floors of the school were surveyed. These results are described below. Field data sheets are found in Attachment 1. Readings began at 8:15 A.M. and concluded after 2:36 P.M.

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Temperature

Indoor dry bulb temperature measurements ranged from 68.7 °F to 75.5 °F. Only one (1) measurement was above the range of 68 to 75°F (at 50 percent relative humidity) recommended by ASHRAE Standard 55-1992 during the heating season (wintertime conditions). This measurement was collected from room 231. The outdoor temperature range was 36.9 to 38.5 °F.

Relative Humidity

The relative humidity indoors ranged from 22.1 percent to 33.7 percent. Only sixteen (16) measurements were within the ASHRAE-recommended range of 30 to 60 percent for occupant comfort. All other measurements were below the ASHRAE-recommended range. The outdoor relative humidity range was 26.9 and 32.1 percent.

Carbon Dioxide Concentration

Carbon dioxide concentrations indoors ranged from 569 ppm to 1824 ppm. Eighteen (18) CO₂ measurements were above the ASHRAE Standard 62-1999 recommended maximum concentration of <700 ppm above the background level. The outdoor (background) CO₂ concentrations were 445 ppm and 468 ppm. Therefore, the maximum acceptable level of CO₂ at this location was 1168 ppm (background level + 700 ppm). The highest reading, 1824 ppm, was in Room 738. Rooms with CO₂ levels above the recommended maximum were found on 3rd, 4th, 5th, 6th, 7th, 9th and 10th floors. 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 0 ppm for all readings. These concentrations were below the NPAAQS/ASHRAE guideline of 9 ppm. The outdoor CO concentration was 2 ppm.

Respirable Particulates (PM_{2.5})

Respirable particulate concentrations* indoors ranged between 8 µg/m³ to 30 µg/m³. All measurements were below the NPAAQS of 65 µg/m³ 24-hour average concentration of particulate matter 2.5 micrometers or less in aerodynamic diameter. The outdoor respirable particulate concentrations were 15 and 32 µg/m³.

Filters with a higher efficiency rating were installed on the HVAC units that serve rooms on the 3rd, 4th, 6th and 7th floors (See Attachment 1). The PM_{2.5} concentration range for those rooms was 11 - 23 µg/m³ with an average of approximately 18 µg/m³. The PM_{2.5} concentration range for the other rooms was 8 - 30 µg/m³ with an average of approximately 14 µg/m³. The average PM_{2.5} concentration for the entire school building was approximately 15 µg/m³. In addition to higher efficiency rating filters on their HVAC units, portable High Efficiency Particulate Air (HEPA) purifiers were placed in Rooms 327, 333, 638 and 740. The PM_{2.5} concentration range for these rooms was 9 - 35 µg/m³ with an average of approximately 22 µg/m³.

* The measurements made during this assessment were instantaneous readings, the NPAAQS is a 24-hour average.

TVOC Concentration

TVOCs were not detected anywhere inside the building (0.0 ppm). The outdoor TVOC concentration was also 0.0 ppm.

OBSERVATIONS

During this assessment, ATC noted the following:

- The interior of the building appeared clean and free of dust and debris;
- The building was occupied at the time of the assessment;
- No smoke odor was detected in the building;
- The HEPA air purifiers in rooms 638 and 740 were shut off.

FINDINGS

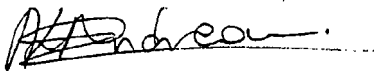
Based on the real-time measurements, the following findings are presented:

1. Measurements of temperature and concentrations of respirable particulates, CO and TVOCs were within applicable standards and guidelines.
2. Eighteen (18) CO₂ measurements were above the range recommended by ASHRAE 62-1999. All others were below the recommended maximum concentration.
3. Sixteen (16) indoor measurements of relative humidity were within the ASHRAE-recommended range of 30 to 60 percent for occupant comfort. All other measurements were below the ASHRAE-recommended range.

It is our pleasure to provide these indoor air quality 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.

Sincerely,

ATC ASSOCIATES INC.



Andreas C. Andreou
Senior Project Manager

Reviewed by:



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

Attachment

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