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November 27, 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
 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 November 26, 2001, 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.

Tenzin Namgyal and Wagdi Abdelshahid, Industrial Hygienists, 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).

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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 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 (120) sets of real-time environmental measurements consisting of one hundred and eighteen (118) 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 I. Readings began at 9:15 A.M. and concluded after 2:10 P.M.

Temperature

Indoor dry bulb temperature measurements ranged from 70.6 °F to 79.2 °F. Eighty-five (85) measurements were 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). These measurements were collected throughout the school building. The outdoor temperature range was 62.1 to 66.9 °F.

Relative Humidity

The relative humidity indoors ranged from 38.3 percent to 66.5 percent. Three (3) measurements were above the ASHRAE-recommended range of 30 to 60 percent for occupant comfort. The outdoor relative humidity range was 38.8 and 50.8 percent.

Carbon Dioxide Concentration

Carbon dioxide concentrations indoors ranged from 501 ppm to 1696 ppm. Seventeen (17) 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 435 ppm and 480 ppm. Therefore, the maximum acceptable level of CO₂ at this location was 1135 ppm (background level + 700 ppm). The highest reading, 1696 ppm, was in Room 125. Rooms with CO₂ levels above the recommended maximum were found on the 1st, 3rd, 4th, 5th, 6th, 7th, 8th 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 0-1 ppm for all readings. These concentrations were below the NPAAQS/ASHRAE guideline of 9 ppm. The outdoor CO concentration was 1 ppm.

Respirable Particulates (PM_{2.5})

Respirable particulate concentrations* indoors ranged between 15 µg/m³ to 63 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 29 and 73 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 21 - 51 $\mu g/m^3$ with an average of approximately 37 $\mu g/m^3$. The $PM_{2.5}$ concentration range for the other rooms was 15 - 63 $\mu g/m^3$ with an average of approximately 37 $\mu g/m^3$. The average $PM_{2.5}$ concentration for the entire school building was approximately 37 $\mu g/m^3$. 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 13 - 45 $\mu g/m^3$ with an average of approximately 23 $\mu g/m^3$.

* 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;
- Windows were open in Rooms 638 and 838.

FINDINGS

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

1. Measurements of concentrations of respirable particulates, CO and TVOCs were within applicable standards and guidelines.
2. Seventeen CO_2 measurements were above the range recommended by ASHRAE 62-1999. All others were below the recommended maximum concentration.
3. Eighty-five (85) temperature measurements were above the range recommended by ASHRAE 55-1992.
4. Three (3) measurements of relative humidity were above the range recommended by ASHRAE 55-1992.

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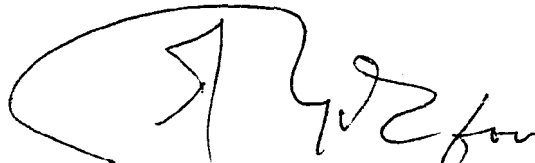
It is our pleasure to provide these indoor air quality services to the New York City Board of Education. If you have any questions about this report, please call (212) 353-8280, extension 261 or 212.

Sincerely,
ATC ASSOCIATES INC.

Reviewed by:



Andreas C. Andreou
Senior Project Manager



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

Attachments