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ATC ASSOCIATES INC.

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November 12, 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 an indoor air quality (IAQ) assessment conducted on November 9, 2001, at the referenced school. The New York City Board of Education (BOE) requested this assessment 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 (CO_2) 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, CO_2 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.

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

NYC-WTC_000182709

NYC 9/11 Public Portal Document

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	USEPA NPAAQS (as cited in ASHRAE 62)
Respirable Particulates ($PM_{2.5}$)	65 micrograms per cubic meter of air ($\mu g/m^3$) 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

NYC-WTC_000182710

NYC 9/11 Public Portal Document

REAL-TIME ENVIRONMENTAL MEASUREMENTS

ATC collected one hundred and sixteen (116) sets of real-time environmental measurements consisting of one hundred and fourteen (114) 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 9:00 A.M. and concluded after 1:30 P.M.

Temperature

Indoor dry bulb temperature measurements ranged from 70.7 °F to 78.3 °F. Sixty-six (66) 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 50.1 to 58.9 °F.

Relative Humidity

The relative humidity indoors ranged from 17.2 percent to 31.9 percent. Only four (4) measurements were within the ASHRAE-recommended range of 30 to 60 percent for occupant comfort. The outdoor relative humidity range was 17.5 and 28.0 percent.

Carbon Dioxide Concentration

Carbon dioxide concentrations indoors ranged from 509 ppm to 1994 ppm. Thirteen (13) CO_2 measurements were above the ASHRAE Standard 62-1999 recommended maximum concentration of <700 ppm above the background level. The outdoor (background) CO_2 concentrations were 450 ppm. Therefore, the maximum acceptable level of CO_2 at this location was 1150 ppm (background level + 700 ppm). The highest reading, 1994 ppm, was in Room 735. Rooms with CO_2 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 CO_2 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 0 ppm.

Respirable Particulates ($PM_{2.5}$)

Respirable particulate concentrations indoors ranged between 9 $\mu g/m^3$ to 28 $\mu g/m^3$. All of the measurements were below the NPAAQS of 65 $\mu g/m^3$ 24-hour average concentration of particulate matter 2.5 micrometers or less in aerodynamic diameter. The outdoor respirable particulate concentrations were 26 and 30 $\mu g/m^3$.

NYC-WTC_000182711

NYC 9/11 Public Portal Document

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 9 - 27 $\mu g/m^3$ with an average of approximately 14 $\mu g/m^3$. The $PM_{2.5}$ concentration range for the other rooms was 10 - 28 $\mu g/m^3$ with an average of approximately 14 $\mu g/m^3$. The average $PM_{2.5}$ concentration for the entire school building was approximately 14 $\mu g/m^3$.

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 231, 233, 339, 501, 1004.

FINDINGS

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

1. Concentrations of respirable particulates, CO and TVOCs were within applicable standards and guidelines.

2. Fifteen CO_2 measurements were above the range recommended by ASHRAE 62-1999. All others were below the recommended maximum concentration.

3. Sixty-six (66) temperature measurements were above the range recommended by ASHRAE 55-1992.

4. All but four relative humidity measurements were below the range recommended by ASHRAE 55-1992.

CONCLUSION

Based on our observations and measurements, ATC concludes that the assessed locations were suitable for occupancy at the time of ATC's investigation. Some individuals may find the conditions in some rooms to be uncomfortable. The elevated CO_2 levels indicate the need for increased outdoor air. The higher efficiency filters installed on the HVAC units for rooms on the 3rd, 4th, 6th and 7th floors did not significantly reduce respirable particulate levels compared to the other rooms.

RECOMMENDATIONS

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

NYC-WTC_000182712

NYC 9/11 Public Portal Document

- Keep comfort parameters within established guidelines by using adequate ventilation;
- Discontinue daily TVOC measurements; TVOCs have not been detected since daily measurements began October 9, 2001;
- Ensure that the HVAC system is operating properly;
- Conduct limited follow-up monitoring/inspection to ensure that air quality is acceptable.

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.

Sincerely,
ATC ASSOCIATES INC.

Andreas C. Andreou
Senior Project Manager

Reviewed by:

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

Attachments

NYC-WTC_000182713