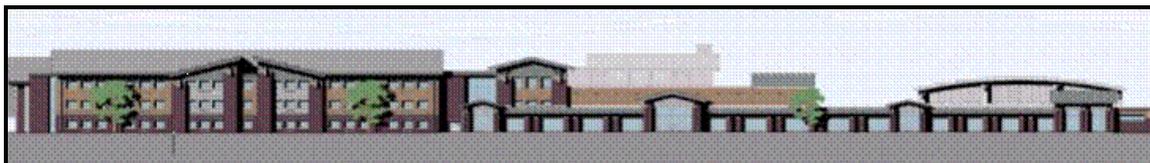


# **Sampling Results for the Keith Middle School Foundation Vent Stack and Indoor Air for Polychlorinated Biphenyls and Volatile Organic Compounds**

## **2007 Monthly Monitoring Rounds: March, April, May, June, and July/August**

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May 2008

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TRC Project No. 115058

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## EXECUTIVE SUMMARY

TRC Environmental Corporation (TRC) of Lowell, Massachusetts was retained by the City of New Bedford (the City) to provide sampling support in conducting foundation vent stack and indoor air sampling for polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs) at the Keith Middle School (KMS) in New Bedford, Massachusetts. Monthly indoor air and vent stack sampling was performed by TRC in 2007 for the following months: March, April, May, June, and July/August.

Sampling and analysis of vent stack and indoor air was conducted in accordance with the approved *Long-Term Monitoring and Maintenance Plan* (LTMMIP), revision 4, dated October 20, 2006. The indoor air quality sampling program involved the monthly collection of one indoor air quality sample from the ground floor of each of the three school building sections (Building A, Building B, and Building C). Concurrently with the indoor air quality sampling, air sampling of the sub-slab foundation ventilation system was performed from four selected rooftop vent stacks, including VS-1 and VS-4 which vent building Section A (classrooms) and two other vent stacks which were rotated monthly to cover the remaining collection zones. The passive sub-slab ventilation system was installed to allow any sub-slab soil gases to migrate from beneath the vapor barrier to the vent stacks, installed through the school building roof. Air samples were also collected immediately outside of the school during each round to provide comparative background results.

Following collection, the samples were analyzed for VOCs according to EPA Method TO-15 (VOCs in Air) by Alpha Woods Hole Labs of Westborough, Massachusetts and PCBs according to EPA Method 680 (PCB Homologues) by Northeast Analytical Labs of Schenectady, New York. Though this PCB method was not specified in the LTMMIP, the homolog analytical method is a reliable analytical method to quantify total PCBs. By quantifying PCB homologues, total PCB air data gathered at the KMS are directly comparable to total PCB air data gathered at the high school.

PCBs and VOCs were detected in both indoor air and vent stack air samples. However, concentrations of PCBs and VOCs in indoor air samples were consistently lower than those observed in vent stack air samples. It is likely that VOCs are present in indoor air due to off-gassing from building materials and the storage and use of cleaners, adhesives, paints, and other VOC-containing products indoors at the school. Concentrations of PCBs detected in indoor air samples are consistent with background levels measured in indoor environments. Levels of PCBs and VOCs detected in indoor air fluctuate and demonstrate noticeable trends in measured concentrations overtime due to: (1) the degree of building air exchange that occurs during normal school operation (i.e., open conditions) versus vacation periods when the school is not in session (i.e., closed conditions); (2) changes in ambient temperatures that may increase or decrease the off-gassing of contaminants from indoor building materials, as well as fugitive releases from VOC-containing products in storage; (3) the degree to which activities within the school building (e.g., cleaning and repairs) are contributing to ambient levels of contaminants; and (4) the dissipation of building material related VOC sources over time. The presence of higher levels of VOCs and PCBs in vent stack air samples is an expected finding for a sub-slab ventilation system and indicates that the passive ventilation system is performing as designed.

The presence of VOCs in vent stack air may also be indicative of off-gassing from the venting system components in addition to subsurface VOC release.

PCB indoor air and vent stack air sampling results were compared to site-specific outdoor air concentrations and risk-based air concentrations (RBACs). Two PCB RBACs have been developed for the KMS, assuming occupational exposures within the school (8 hours/day, 250 days/year, for 25 years). The first RBAC is the Action Level (AL; 0.05 ug/m<sup>3</sup>) used as an initial indicator that PCB air concentrations above background levels have been detected. The second RBAC is the Acceptable Long-Term Average Exposure Concentration (ALTAEC; 0.3 ug/m<sup>3</sup>), indicative of the maximum acceptable air concentration that should not be exceeded for an extended time period. No indoor air or vent stack air PCB concentrations exceed RBACs.

VOC data were compared to MassDEP Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs), published in December 1995, consistent with the LTMMIP. TELs are developed to be applicable to short-term exposure concentrations (average 24-hour levels) while AALs are developed to be protective of long-term exposure concentrations (average annual levels over 30 years). Because TELs and AALs have not been updated since 1995, VOC concentrations in excess of AALs and TELs were discussed relative to ambient air risk-based concentrations (RBCs) developed by EPA Region III (2007) to be protective of continuous long-term exposures and using the most current toxicity information available. Because AALs, TELs, and RBCs are set at risk levels that are only a portion of the MassDEP risk management criteria, concentrations that slightly exceed (i.e., less than 5-fold) one or more comparison criteria may not be cause for concern, especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. VOC concentrations in excess of comparison criteria were also compared to MassDEP indoor air background values, used by MassDEP in the development of the Massachusetts Contingency Plan (MCP) numeric standards.

A small number of VOCs exceed AALs, TELs, and/or RBCs. The VOCs exceeding one or more comparison criteria in at least one sampling event include: methylene chloride, 1,2,4-trichlorobenzene, 1,2,4-trimethylbenzene, 2-butanone, ethanol, xylenes, toluene, styrene, and tetrahydrofuran. Of these VOCs, methylene chloride and ethanol results were likely influenced by laboratory derived contamination and hence do not reflect actual vent stack and indoor air concentrations of these contaminants at KMS. The LTMMIP specifies that the LSP-of-Record should submit the indoor air data to a toxicologist/risk assessor for further assessment if indoor air VOC concentrations exceed TELs, AALs, or 150% of outdoor air background concentrations. Further quantitative assessment of the indoor air data indicated that the maximum detected VOC concentrations were associated with a condition of no significant risk to potentially exposed individuals.

A greater number of VOCs in vent stack air exceeded risk-based comparison criteria than VOCs in indoor air. Even though the LTMMIP specifies that both indoor air and vent stack air VOC concentrations are to be compared to comparison criteria, this comparison is not appropriate for vent stack air results. The vent system is designed to capture VOCs being released from the subsurface beneath the KMS and transport the gases through PVC piping to outdoor air, limiting migration through the building slab and into indoor air. Little if any human exposure is

occurring to air within the vent stack system itself. Air from the vent stack is released to outdoor air where the VOCs are quickly diluted and dispersed. Therefore, comparison of vent stack air results to comparison criteria developed assuming short-term (24-hour) and long-term exposure is highly conservative, if not conceptually irrelevant.

Overall, VOC concentrations are decreasing in indoor air suggesting that off-gassing from the newly constructed school building is diminishing over time. The sporadic detection of slightly higher VOC concentrations is noted during the spring and summer school vacation periods when the building is experiencing lower than normal air exchange and the indoor use of VOC-containing cleaning products and repair materials increases. Low level fluctuations in PCB concentrations in indoor air are representative of indoor background conditions. Positive detections of PCBs and VOCs in vent stack air are expected, and indicate that the passive ventilation system is performing as designed. The fluctuations in PCB vent stack air concentrations and decreasing vent stack air VOC concentrations suggest that the range of measured concentrations is representative of typical conditions within the subsurface ventilation system and that off-gassing from the system is diminishing overtime.

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## 1.0 INTRODUCTION

### 1.1 Overview

TRC Environmental Corporation (TRC) of Lowell, Massachusetts was retained by the City of New Bedford (the City) to provide sampling support in conducting foundation vent stack and indoor air sampling for polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs) at the Keith Middle School (KMS) in New Bedford, Massachusetts. This report documents the monthly indoor air and vent stack sampling performed by TRC in 2007 for the following months: March, April, May, June, and July/August.

Soil gas sampling was performed under the location of the KMS building in December 2001. In addition to PCBs present in soil at this location, the primary VOCs detected in the soil gas samples include acetone, 2-butanone, cyclohexane, ethanol, n-heptane, n-hexane, and toluene. Lesser concentrations of benzene, carbon disulfide, ethylbenzene, methyl tert butyl ether, tetrachloroethene, 1,2,4-trimethylbenzene, and xylenes were also detected in soil gas samples. The results of the December 2001 soil gas sampling event were evaluated for potential adverse impacts on indoor air quality, assuming no vapor barrier was installed. Despite the conclusion that no significant risk to human health is posed by the measured soil gas concentrations, the City and School Department decided to install a vapor barrier on top of the soil beneath the school building concrete floor as an added layer of protection against intrusion of any gases that may accumulate under the building. Passive ventilation has been installed to allow any sub-slab soil gases to migrate from beneath the vapor barrier to the vent stacks, installed through the school building roof. Sampling of indoor air quality and vent stack air is conducted to confirm the proper functioning of the passive ventilation system. This report presents monitoring data collected as part of this effort.

The remaining sections of the report include Section 2 (Sampling Locations), Section 3 (Field Sampling Program), Section 4 (Analytical Program), Section 5 (Quality Assurance), Section 6 (Summary of Results), Section 7 (Comparison of PCB Results to Risk-Based Action Levels), and Section 8 (Comparison of VOC Results to Comparison Criteria). Supporting appendices include Appendix A (Field Sampling Data Sheets), Appendix B (Field Reduced Data), Appendix C (Equipment Calibration Sheets), Appendix D (Laboratory Data Package), Appendix E (Laboratory Data Validation Memoranda), and Appendix F (Indoor Air Risk Calculation Spreadsheet).

### 1.2 Scope of Work

Sampling and analysis of vent stack and indoor air is required as part of United States Environmental Protection Agency (EPA) approved *Long-Term Monitoring and Maintenance Plan* (LTMMIP), revision 4, dated October 20, 2006. The LTMMIP was prepared by The BETA Group, Incorporated (BETA) in accordance with the August 31, 2005 *Approval for Risk-Based PCB Cleanup and Disposal under 40 CFR §761.6(c)* letter issued by EPA to the City. The LTMMIP set forth a vent stack and indoor air sampling schedule consisting of three monitoring events per year for the first year (July/August, December, April 2007), with the understanding that the City may submit a written request to EPA to reduce the indoor air sampling frequency

after the first year of monitoring. However, per the order of the Mayor of the City, vent stack and indoor air monitoring took place monthly during the period of September 2006 to July/August 2007. Monitoring from September 2006 through February 2007 was conducted by BETA and is reported elsewhere.

The indoor air quality sampling program involved the collection of samples over a 24-hour period. The sampling methodology consisted of the collection of high volume air samples using filters in tandem with polyurethane foam (PUF) cartridges for analysis of PCBs by EPA Method TO-4A and the collection of air samples using six-liter SUMMA™ canisters for the analysis of volatile organic compounds (VOCs) by EPA Method TO-15. The PUF and filter for TO-4A indoor air quality samples were analyzed separately. Concurrently with the indoor air quality sampling, air sampling of the sub-slab foundation ventilation system was performed. Vent sampling consisted of the collection of low volume air samples from four selected rooftop vent stacks. Vent stack samples were collected on PUF cartridges for PCBs analysis using EPA Method TO-10A and in 2.75-liter SUMMA™ canisters for VOCs analysis by Method TO-15. The sample collection procedures and analytical methods are described in detail within BETA's LTMMIP.

Following collection of the samples by TRC, the samples were analyzed for VOCs according to EPA Method TO-15 (VOCs in Air) by Alpha Woods Hole Labs of Westborough, Massachusetts and PCBs according to EPA Method 680 (PCB Homologues) by Northeast Analytical Labs of Schenectady, New York.

## **2.0 SAMPLING LOCATIONS**

### **2.1 Indoor Air Quality Sample Locations**

During each sampling event, one indoor air quality sample was collected from the ground floor of each of the three school building sections (Building A, Building B, and Building C). Each sampling location was selected to be representative of portions of the school building normally occupied by students and teachers. The Building A sampling location is located within a hallway in an area of student classrooms. The Building B sampling location is located in the school auditorium. The Building C sampling location is in a faculty dining area. One sample and a duplicate were collected immediately outside of the school to provide comparative background results for ambient air.

Figure 2-1 presents the approximate locations of the indoor air quality sample locations. Table 2-1 summarizes the indoor air quality samples collected during the March, April, May, June, and July/August sampling events. Indoor air quality samples collected during the monthly sampling events were designated with the letter A, B, or C to identify the building section from which the sample was collected and a unique sample identification suffix, indicating the month of sampling (e.g., A-10). Sample identification suffixes of -10 through -14 were sequentially used for the March through July/August sampling events.

### **2.2 Foundation Vent Air Monitoring Sample Locations**

The Keith Middle School foundation venting system is comprised of six sub-slab vapor collection zones, each vented by two or four vent stacks penetrating the roof. A total of four vent stacks are sampled during each round, including VS-1 and VS-4 which vent from the two collection zones located under building Section A (classrooms), and two other vent stacks which are rotated monthly to cover the remaining collection zones. One air sample is collected immediately outside of the school during each round to provide comparative background results.

Figure 2-2 presents the approximate locations of the vent stack sample locations. Table 2-1 summarizes the vent stack samples collected during the March, April, May, June, and July/August sampling events. Vent stack samples collected during the monthly sampling events were designated with the vent stack number (e.g., VS-1) and a unique sample identification suffix indicating the month of sampling (e.g., VS-1-10). Sample identification suffixes of -10 through -14 were sequentially used for the March through July/August sampling events.

## 3.0 FIELD SAMPLING PROGRAM

### 3.1 Overview

This section describes the procedures that TRC followed during the field sampling program.

### 3.2 Indoor Air Quality Sampling

Each of the indoor air quality field samples was collected by TRC over the course of one 24-hour test period. Indoor air quality samples were collected for analysis of PCBs by EPA Method TO-4A and VOCs by EPA Method TO-15.

#### 3.2.1 Method TO-4A

Indoor air quality (IAQ) samples were collected for PCBs following the procedures described in the EPA Compendium Method TO-4A, *Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using High Volume Polyurethane Foam (PUF) Sampling followed by Gas Chromatographic/Multi-Detector Detection (GC/MD)*, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition*, USEPA, January 1999.

TRC placed a high volume sampler at each PCB indoor air sampling location. A multi-point calibration was performed on each high volume sampler prior to sample collection using a calibrated orifice. A high volume polyurethane foam (PUF) sampling cartridge was then unsealed and inserted into the high volume sampler and the sampler turned on. The start time, elapsed hours counter reading, and flow rate (magnehelic reading) were then recorded on a data sheet. After 24 hours of sampling, the elapsed hours counter reading and flow rate (magnehelic reading) were recorded on a data sheet along with the stop time. The PUF cartridge was then removed from the sampler, sealed, and labeled. A single-point post sampling calibration audit was performed to document that the high volume sampler remained calibrated.

Following the collection of the TO-4A samples, the total volume of ambient air sampled for each cartridge was calculated based on the duration of sampling and the average flow rate, as determined from the initial and final flow rates.

The data sheets are provided in Appendix A and the reduced data are presented in Appendix B. The calibration certifications of the critical orifice can be found in Appendix C.

#### 3.2.2 Method TO-15

IAQ samples were collected for VOCs following the procedures described in the EPA Compendium Method TO-15, *Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)*, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition*, USEPA, January 1999.

At each sampling location a six-liter evacuated SUMMA™ canister was set up with a flow-controller set to collect a sample over a 24-hour sampling period, and the canister valve opened. The flow controllers are pre-set by the laboratory performing the VOC analysis. The start time, SUMMA™ canister and flow-controller serial numbers, and SUMMA™ canister initial vacuum are then recorded on a data sheet. After 24 hours of sampling, the SUMMA™ canister valve was closed and the final SUMMA™ canister vacuum and stop time recorded

The data sheets can be found in Appendix A and the reduced data can be found in Appendix B

### **3.3 Foundation Vent Air Sampling**

Each of the vent air field samples was collected by TRC over the course of a 4-hour test period. Vent air samples were collected for analysis of PCBs by EPA Method TO-10A and VOCs by EPA Method TO-15. Prior to sampling, all of the foundation vents were temporarily capped for approximately 24 hours. Just prior to sampling, TRC removed the caps from all vent stacks that were not being sampled to allow for the inflow of air. This approach is a modification to the procedure outlined in the LTMMIP to improve representativeness by allowing sample air to be drawn from the entire vent stack zone without potential stagnation of flow impacted by capped vent stacks.

#### **3.3.1 Method TO-10A**

Vent stack air samples were collected for PCBs following the procedures described in the EPA Compendium Method TO-10A, *Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using High Volume Polyurethane Foam (PUF) Sampling followed by Gas Chromatographic/Multi-Detector Detection (GC/MD)*, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, USEPA, January 1999.

In order to sample each vent stack without collecting ambient air, a cap with Teflon™ tubing penetrating through it was placed over the vent stack. Prior to capping the stack, a low volume PUF sampling cartridge was unsealed and connected to the length of tubing that would extend inside the vent stack. The tubing on the opposite side of the cap (that would be outside of the vent stack after the cap was installed) was attached to a Dawson® vacuum pump. A vacuum was applied to the tubing and cartridge using the pump and the vacuum was adjusted so that a flow rate of five liters per minute (LPM) of air was flowing through the PUF. The flow rate was confirmed using a mini-Buck Calibrator™ bubble meter. The cap was then placed over the vent stack with the PUF cartridge suspended in the stack. The start time and flow rate was then recorded on a data sheet. After 4 hours of sampling, the flow rate was confirmed using the bubble meter. The final flow rate and stop time are then recorded on the data sheet. The PUF cartridge was then disconnected from the tubing, sealed with the supplied end caps, placed into a sample jar and labeled.

Following the collection of all the TO-10A samples, the total volume of ambient air sampled for each cartridge was calculated based on the duration of sampling and the average flow rate, as determined from the initial and final flow rates.

The data sheets can be found in Appendix A and the reduced data can be found in Appendix B. The calibration certifications of the mini-Buck Calibrator™ can be found in Appendix C.

### **3.3.2 Method TO-15**

Foundation vent stack samples were collected for VOCs following the procedures described in the EPA Compendium Method TO-15, ***Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)***, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition*, USEPA, January 1999.

At each sampling location a 2.75-liter evacuated SUMMA™ canister was set up (connected to the vent stack air space via Teflon™ tubing) with a flow-controller set to collect a sample over a 4-hour sampling period, and the canister valve opened. The flow controllers are pre-set by the laboratory performing the VOC analysis. The start time, SUMMA™ canister and flow-controller serial numbers, and SUMMA™ canister initial vacuum are then recorded on a data sheet. After 24 hours of sampling, the SUMMA™ canister valve was closed and the final SUMMA™ canister vacuum and stop time recorded

The data sheets can be found in Appendix A and the reduced data can be found in Appendix B

## 4.0 ANALYTICAL PROGRAM

Samples collected by EPA Method TO-10A and TO-4A were prepared by the Soxhlet Extraction Method (EPA Method 3540C/TO-4A) and analyzed by gas chromatography/mass spectroscopy (EPA Method 680) for PCB Homolog distribution. Though the LTMMIP specified that PCBs were to be analyzed by the congener analytical method, the homolog analytical method is as reliable as the congener analytical method in quantifying total PCBs which is the basis for the EPA Action Level ( $0.05 \mu\text{g}/\text{m}^3$ ) and Acceptable Long-Term Average Exposure Concentration ( $0.3 \mu\text{g}/\text{m}^3$ ) described in Section 7. In addition, by quantifying PCB homologues, total PCB air data gathered at the KMS are directly comparable to total PCB air data gathered at the high school since both are based on homologues rather than congeners, which greatly facilitates communication and discussion with the general public on the results of analyses.

Samples collected by EPA Method TO-15 were analyzed by gas chromatography/mass spectroscopy (EPA Method TO-15) for volatile organic compounds.

Laboratory analytical results are presented in Appendix D.

## **5.0 QUALITY ASSURANCE**

### **5.1 Overview**

TRC management is fully committed to an effective Quality Assurance/Quality Control (QA/QC) Program whose objective is the delivery of a quality product. For much of TRC's work, that product is data developed from field measurements, sampling and analysis activities, engineering assessments, and the analysis of gathered data for planning purposes. TRC's QA/QC Program works to provide complete, precise, accurate, representative data in a timely manner for each project, considering both the project's needs and budget.

This section highlights the specific QA/QC procedures that were followed on this sampling and analysis program.

### **5.2 Field Quality Control Summary**

Calibrations of the field sampling equipment were performed prior to the field sampling effort. Copies of the calibration sheets were submitted to the Field Team Leader to take onsite and for the project file. Calibrations were performed as described in the EPA 40 CFR Part 50 Appendix B. All calibrations were available for review during the test program. Copies of the equipment calibration forms can be found in Appendix C. All instrument calibrations met the performance criteria defined in 40 CFR 50 Appendix B.

### **5.3 Data Reduction and Validation**

Specific QC measures were used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in all projects.

#### ***5.3.1 Field Data Reduction***

Appendix A of this document presents the standardized forms that were used to record field sampling data. The data collected was reviewed in the field by the Field Team Leader and at least one other field crewmember. Errors or discrepancies were noted in the field book.

#### ***5.3.2 Data Validation***

TRC supervisory and QC personnel used validation methods and criteria appropriate to the type of data and the purpose of the measurement. Records of all data were maintained, including that judged as "outlying" or spurious value. The persons validating the data have sufficient knowledge of the technical work to identify questionable values.

Field sampling data was validated by the Field Team Leader and/or the Field QC Coordinator based on their review of the adherence to an approved sampling protocol and written sample collection procedure.

The following criteria were used to evaluate the field sampling data:

- Use of approved test procedures;
- Proper operation of the process being tested;
- Use of properly operating and calibrated equipment;
- Proper chain-of-custody maintained.

Laboratory analytical data was validated by TRC chemists. The sample results were assessed using the EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- System Monitoring Compound recoveries
- Laboratory control sample (LCS) and LCS Duplicate (LCSD) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

The laboratory data validation memoranda can be found in Appendix E. All data are reported in standard units depending on the measurement and the ultimate use of the data.

## **5.4 Data Validation Summary**

### ***5.4.1 March 2007 Sampling Event***

In general, the TO-4A and TO-10A data appear to be valid as reported and may be used for decision-making purposes. The monochlorobiphenyl and dichlorobiphenyl PCB homolog results for the air vent sample (TO-10A) should be considered estimated (J/UJ) due to low laboratory control sample and laboratory control sample duplicate (LCS/LCSD) recoveries of the associated congener spikes.

The TO-15 data also appear to be valid as reported and may be used for decision-making purposes. All positive acetone results should be considered estimated (J) due to initial calibration RSD exceedances. All positive 2-butanone results in the vent stack samples should be considered estimated (J) due to lack of precision in the field duplicates.

### ***5.4.2 April 2007 Sampling Event***

The TO-4A and TO-10A data appear to be valid as reported and may be used for decision-making purposes.

The TO-15 data also appear to be valid as reported and may be used for decision-making purposes. All positive acetone and 2-butanone results should be considered estimated (J) due to initial calibration RSD nonconformance.

#### ***5.4.3 May 2007 Sampling Event***

In general, the TO-4A and TO-10A data appear to be valid as reported and may be used for decision-making purposes. Detected and non-detected results for sample B-12-PF should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery. Detected and non-detected TO-10A samples results for monochlorobiphenyl, dichlorobiphenyl, and trichlorobiphenyl should be considered estimated (J/UJ) with detected results considered biased low.

The TO-15 data also appear to be valid as reported and may be used for decision-making purposes. All positive 4-methyl-2-pentanone should be considered estimated (J) due to initial calibration RSD nonconformance. Positive methylene chloride results for both duplicate pairs (BG-12/BG-12-DUP and VS-8-12/VS-8-12-DUP) should be considered estimated (J) due to poor duplicate precision. Positive results for 2-butanone, acetone, ethanol, and isopropanol should be considered estimated (J) for duplicate pair VS-8-12/VS-8-12-DUP due to poor duplicate precision.

#### ***5.4.4 June 2007 Sampling Event***

In general, the TO-4A and TO-10A data appear to be valid as reported and may be used for decision-making purposes. Detected and non-detected results for sample VS-9-13-DUP should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery. Detected and non-detected TO-10A samples results for monochlorobiphenyl should be considered estimated (J/UJ) with detected results considered biased low.

The TO-15 data also appear to be valid as reported and may be used for decision-making purposes. Chloromethane results for field samples VS-4-13, VS-BG-13, VENT-TB, C-13, and B-13 should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected benzyl chloride and styrene results for samples VS-9-13, VS-9-13 DUP, and VS-1-13 should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery. Hexachlorobutadiene, 1,2,4-trichlorobenzene, and vinyl bromide results for field samples VS-7-13, A-13, BG-13, BG-13-DUP, and the trip blank should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected acetone and methylene chloride results for field samples VS-7-13, A-13, BG-13, BG-13-DUP should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery.

#### ***5.4.5 July/August 2007 Sampling Event***

In general, the TO-4A and TO-10A data appear to be valid as reported and may be used for decision-making purposes. Detected and non-detected monochlorobiphenyl, dichlorobiphenyl, trichlorobiphenyl, and tetrachlorobiphenyl results for all TO-10A and TO-4A (when both fractions are combined) samples should be considered estimated (J/UJ) with detected results considered biased low due to poor LCS/LCSD recoveries. Detected and non-detected pentachlorobiphenyl TO-4A sample results should be considered estimated (J/UJ) with detected results considered biased low due to poor LCS/LCSD recoveries. Detected and non-detected results for sample BG-14-DUP should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery.

The TO-15 data also appear to be valid as reported and may be used for decision-making purposes. 1,1,2,2-Tetrachloroethane, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and hexachlorobutadiene results for field samples VS-14-14, VS-14-14-DUP, VS-1-14, VS-16-14, VS-4-14, VENT TB, B-14, and A-14 should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected carbon disulfide results for samples previously mentioned should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery. Hexachlorobutadiene and 1,2,4-trichlorobenzene results for field samples C-14, BG-14, BG-14-DUP, and trip blank should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected 1,1,1-trichloroethane, carbon disulfide, and chloromethane results for field samples C-14, BG-14, BG-14-DUP, and the trip blank should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery.

## **5.5 TO-15 - Persistent Laboratory Contaminants**

Based upon review of quality control data, TRC has determined that the results for four compounds reported throughout this report (acetone, ethanol, methylene chloride and isopropanol) were influenced by laboratory derived contamination and hence do not reflect actual vent stack and indoor air concentrations at Keith Middle School in New Bedford, Massachusetts. This conclusion is supported by 1) the high concentrations of these compounds in contrast to other VOCs within samples, 2) TRC experience with these same compounds when using EPA Method TO-15A on prior programs, and 3) concentrations over time do not follow trends observed for other VOCs known to be associated with products in storage and use at Keith Middle School.

## **5.6 Collocated Sampler Precision**

Single collocated sampler pairs were included for both indoor and vent stack air (PCBs and VOCs) during each sampling event. Collocated samplers were operated for the same duration at near identical flow rates and were in close proximity to each other so as to represent near identical air space. The data resulting from the analyses of the collocated sampler pairs were used to define the precision of the combined sample and analyses scheme.

Precision was determined by the collection and analysis of replicate samples and is expressed as the relative percent difference (RPD), which is determined according to the following equation:

$$\text{RPD} = \left[ \frac{X_1 - X_2}{\frac{X_1 + X_2}{2}} \right] \times 100$$

where  $X_1$  and  $X_2$  are the measurement results of each replicate sample expressed as an absolute value (always positive).

The collocated sampler data for the two pairs collected throughout the sampling program at Keith Middle School from March to August 2007 are summarized in Tables 5-1 and 5-2 for the indoor air and vent stack samples, respectively. Results are provided for each of the analytes measured in the sampler pair in units of  $\mu\text{g}/\text{m}^3$ . Method precision is expressed as the relative percent difference value derived from the above equation on a parameter specific basis.

EPA Method TO-15 identifies a data quality of  $\pm 25\%$  for RPD for analytes measured in replicate or collocated samples. For all sampling events conducted from March through August 2007, the majority of RPDs calculated were within 25%. RPD data can be used to identify if differences in measured concentrations are attributable to actual concentration differences or if they are within the precision of the sampling and analytical procedure.

## **6.0 SUMMARY OF RESULTS**

The following section describes the findings from the sampling events conducted by TRC at Keith Middle School during the period of March 2007 to July/August 2007. Table 2-1 provides a summary of the types, numbers, and locations of the samples collected. Appendices D and E contain the laboratory data packages and data validation memoranda, respectively. Along with the samples of each sampling event, TO-4A, TO-15, and TO-10A trip blanks were analyzed as a quality assurance measure.

PCBs were not detected in any of the trip blanks from any of the sampling events. However, methylene chloride was detected in the indoor air trip blank collected during the July/August sampling event. Acetone, isopropanol, methylene chloride, and n-hexane were detected in the vent stack air trip blank collected during the July/August sampling event. Trip blanks are used as a check on shipping and laboratory-related sources of contamination. These detections indicate that VOC concentrations in the companion samples may be biased high. In addition, TRC believes that the results for four compounds reported throughout this report (acetone, ethanol, methylene chloride and isopropanol) were influenced by laboratory derived contamination and hence do not reflect actual vent stack and indoor air concentrations at KMS, as previously discussed in more detail in Section 5.5.

### **6.1 Indoor Air Quality Results**

The following sections discuss the results of the indoor air quality sampling, by sampling event. Indoor air quality results are provided in Tables 6-1 through 6-5 for the March, April, May, June, and July/August 2007 sampling events, respectively.

It is possible that a positive detection of VOCs and PCBs in indoor air might indicate limited subsurface migration that is not entirely mitigated by the passive foundation ventilation system. However, it is more likely that VOCs are present in indoor air due to off-gassing from building materials and the use of cleaners, adhesives, paints, and other VOC-containing products indoors at the school. Levels of PCBs and VOCs detected in indoor air may fluctuate and demonstrate noticeable trends in concentrations over time due to: (1) the degree of building air exchange that occurs during normal school operation (i.e., open conditions) versus vacation periods when the school is not in session (i.e., closed conditions); (2) changes in ambient temperatures that may increase or decrease the off-gassing of contaminants from indoor building materials; (3) the degree to which activities within the school building (e.g., cleaning and repairs) are contributing to ambient levels of contaminants; and (4) the dissipation of building material related VOC sources over time.

#### ***6.1.1 March 2007 Sampling Event***

On March 30 and 31, 2007, TRC collected three indoor and one outdoor background (with duplicate) 24-hour TO-4A and TO-15 air samples at the Keith Middle School. Table 6-1 provides a summary of positive compound results for the indoor air quality samples.

PCBs were detected in all three indoor air samples collected, but not in the background outdoor air sample. The highest total PCB concentration (0.0015 ug/m<sup>3</sup>) was noted in the Building A sample, with the lowest concentration (0.00037 ug/m<sup>3</sup>) noted in the Building C sample.

A total of six VOCs were detected in the three indoor air quality samples collected during March 2007. Two VOCs were detected in the outdoor air background sample, indicating ambient conditions in the vicinity of the school unrelated to the site. Acetone was detected in the three indoor air samples collected and at the background location. Indoor air concentrations of acetone were up to twice the concentrations detected in the background sample, with the highest detected concentration in the Building A sample. Ethanol and toluene were also detected in the three indoor air samples collected, but not in the outdoor air background sample. The highest ethanol concentration was detected in the Building A sample, and the highest toluene concentration was detected in the Building C sample. Methylene chloride was detected only in the Building B sample, but at a concentration less than in the outdoor air background sample. Two additional compounds, isopropanol and cyclohexane, were only detected in the Building C sample.

Acetone and methylene chloride are common laboratory contaminants while all of the other VOCs detected in the indoor air samples are found in cleaning products, adhesives, paints and other VOC-containing products, and as components of building materials. Their presence in indoor air may not be representative of site conditions, but rather a result of off-gassing from building materials, the use of VOC-containing materials within the school, or partially contributed by ambient concentrations in the vicinity of the school.

#### ***6.1.2 April 2007 Sampling Event***

On April 17 and 18, 2007, TRC collected three indoor and one outdoor background (with duplicate) 24-hour TO-4A and TO-15 air samples at the Keith Middle School. Table 6-2 provides a summary of positive compound results for the indoor air quality samples.

PCBs were detected in all three indoor air samples collected, but not in the background outdoor air sample. The highest total PCB concentration (0.0016 ug/m<sup>3</sup>) was noted in the Building C sample, with the lowest concentration (0.00031 ug/m<sup>3</sup>) noted in the Building B sample. These results indicate a slight increase in total PCBs in Building C and a slight decrease in total PCBs in Building B, compared to the March 2007 results. The total PCB concentration detected in the Building A sample was consistent with that measured during the March 2007 sampling event.

A total of nine VOCs were detected in the three indoor air quality samples collected during April 2007, with three VOCs detected in the outdoor air background samples. The higher number and overall concentrations of VOCs detected in indoor air during the April sampling event, compared to the March sampling event, are likely related to sampling under closed building conditions (April school vacation) and the observed usage of cleaning and brick sealing materials during the sampling event.

Acetone and ethanol were detected in the three indoor air samples collected and at the background location. The Building A indoor air concentration of acetone was approximately

three-fold the concentrations detected in the background sample and the Building B and Building C samples. The highest detected ethanol concentration was also noted in the Building A sample, with this concentration more than 20-fold the concentrations in the background outdoor air sample and the Building B and Building C samples. Toluene was also detected in the three indoor air samples collected. The highest toluene concentration was detected in the Building A sample, with the lowest toluene concentration detected in the Building B sample.

Six additional VOCs were only detected in the Building A sample and include 1,2,4-trichlorobenzene, 2-butanone, ethylbenzene, p/m-xylene, o-xylene, and n-heptane. These VOCs are also known components of cleaning products and repair materials (e.g., adhesives) and may be present as a result of off-gassing from building materials.

The frequency and magnitude of VOC detections in Building A during this sampling event are likely a result of cleaning activities that were observed to be occurring in the classroom areas during the school vacation period. Concentrations of acetone, ethanol and toluene detected in the Building B and Building C samples are consistent or only slightly greater than those observed during the March sampling event and are likely a result of the closed building conditions which trap slightly higher levels of VOCs off-gassed from building materials and released from other VOC-containing materials present in the school due to reduced air exchanges.

One additional compound, tetrahydrofuran, was only detected in the outdoor air background sample. The presence of this compound in outdoor air may be related to the venting of air from the passive ventilation system to the outdoors since tetrahydrofuran is a component of PVC pipe cement and is frequently detected in vent stack air samples. However, it is more likely that the presence of this compound in outdoor background air is representative of ambient conditions in the vicinity of the school.

### ***6.1.3 May 2007 Sampling Event***

On May 18 and 19, 2007, TRC collected three indoor and one outdoor background (with duplicate) 24-hour TO-4A and TO-15 air samples at the Keith Middle School. Table 6-3 provides a summary of positive compound results for the indoor air quality samples.

PCBs were detected in all three indoor air samples collected, but not in the background outdoor air sample. The highest total PCB concentration ( $0.001 \text{ ug/m}^3$ ) was noted in the Building B sample, with the lowest concentration ( $0.00038 \text{ ug/m}^3$ ) noted in the Building A sample. These results indicate a slight increase in total PCBs in Building B, compared to the March and April 2007 results, and a decrease to March 2007 levels in Building C. The total PCB concentration detected in the Building A sample was less than those measured in the March and April 2007 sampling events.

A total of seven VOCs were detected in the three indoor air quality samples collected during May 2007, when the school was in session. Three VOCs were detected in the outdoor air background sample. Acetone and ethanol were detected in the three indoor air samples collected, but not at the background sampling location. The highest acetone and ethanol

concentrations were detected in the Building C sample, and the lowest concentrations were detected in the Building A sample. Methylene chloride was detected in the Building B and Building C samples, but at levels less than detected in the outdoor air background sample. Toluene and isopropanol were only detected in the Building B sample. 1,2,4-Trichlorobenzene and 2-butanone were only detected in the Building A sample and Building C sample, respectively.

The concentrations of acetone, ethanol, methylene chloride, isopropanol, and toluene returned to levels consistent with those seen during the March 2007 sampling event. This suggests the previously noted relationship of indoor air concentrations to sampling conditions including whether the school is in session (open condition) or undergoing increased maintenance during a school vacation period (closed condition).

#### ***6.1.4 June 2007 Sampling Event***

On June 23 and 24, 2007, TRC collected three indoor and one outdoor background (with duplicate) 24-hour TO-4A and TO-15 air samples at the Keith Middle School. Table 6-4 provides a summary of positive compound results for the indoor air quality samples.

PCBs were detected in all three indoor air samples collected, but not in the background outdoor air sample. The highest total PCB concentration ( $0.003 \text{ ug/m}^3$ ) was noted in the Building A sample, with the lowest concentration ( $0.0016 \text{ ug/m}^3$ ) noted in the Building C sample. These results indicate an overall increase in total PCBs in samples collected from Building A and Building B, compared to the March, April and May 2007 results. The total PCB concentration detected in the Building C sample was at the same level as that measured in the April 2007 sampling event. The overall higher results are likely indicative of sampling under closed building conditions associated with the beginning of the summer vacation period, and may also be contributed to by the higher ambient temperatures increasing the volatilization of PCBs from ambient sources.

A total of nine VOCs were detected in the three indoor air quality samples collected during June 2007, while four VOCs were detected in the outdoor air background samples. The higher number and overall concentrations of VOCs detected in indoor air during the June sampling event, compared to the March and May sampling events, are likely related to sampling under closed building conditions (beginning of summer school vacation) and the observed usage of cleaning materials during the sampling event. Higher ambient temperatures may also increase compound vapor pressure, resulting in higher detected concentrations.

Acetone, 2-butanone, chloromethane, and ethanol were detected in the three indoor air samples collected and at the background location. The Building C indoor air concentrations of 2-butanone and chloromethane were approximately three-fold the concentrations detected in the background sample and the Building A and Building B samples. The highest detected acetone and ethanol concentrations were noted in the Building A samples, with concentrations approximately 5-fold higher than the concentrations in the background outdoor air sample and less than 4-fold higher than in the Building B and Building C samples. Toluene was also detected in the three indoor air samples collected, but not on the outdoor air background sample.

The highest toluene concentration was detected in the Building C sample, with the lowest toluene concentration detected in the Building B sample. Isopropanol was detected in both the Building A and Building C samples, with the Building A sample concentration approximately 4-fold higher. Styrene was also detected in both Building A and Building C, but with a slightly higher level detected in Building C. Styrene and chloromethane are known components of cleaning products, repair materials (e.g., adhesives), and construction materials (coatings and resins) and may be present as a result of off-gassing from building materials.

One additional VOC, tetrahydrofuran, was only detected in the Building A sample, and 1,2,4-trimethylbenzene and cyclohexane were only detected in the Building C sample.

Tetrahydrofuran is a component of adhesives and 1,2,4-trimethylbenzene and cyclohexane are solvents found as components of petroleum compounds, paint removers, and cleaners.

### ***6.1.5 July/August 2007 Sampling Event***

On July 31 and August 1, 2007, TRC collected three indoor and one outdoor background (with duplicate) 24-hour TO-4A and TO-15 air samples at the Keith Middle School. Table 6-5 provides a summary of positive compound results for the indoor air quality samples.

PCBs were detected two of the three indoor air samples collected. As in previous rounds of sampling, PCBs were not detected in the background outdoor air sample. The highest total PCB concentration ( $0.0057 \text{ ug/m}^3$ ) was noted in the Building C sample, with the lowest concentration ( $0.0018 \text{ ug/m}^3$ ) noted in the Building A sample. PCBs were not detected in the Building B sample. These results indicate a decrease in total PCBs in Building A and Building B, compared to the June 2007 results, and an increase in total PCB concentrations in Building C. The total PCB concentration detected in the Building C sample was the highest concentration detected over all sampling events between March and August 2007. This Building C result is likely indicative of sampling under closed building conditions associated with the summer vacation period, and may also be contributed to by the higher ambient temperatures increasing the volatilization of PCBs from ambient sources.

A total of twelve VOCs were detected in the three indoor air quality samples collected during July/August 2007, with six VOCs detected in the outdoor air background samples. The higher number and overall concentrations of VOCs detected in indoor air during the July/August sampling event, compared to previous sampling events, are likely related to sampling under prolonged closed building conditions (midpoint in summer school vacation), higher ambient temperatures increasing the volatilization of VOCs from building materials, and the observed usage of cleaning materials during the sampling event.

Acetone, ethanol, isopropanol, n-hexane, and methylene chloride were detected in the three indoor air samples collected and at the background location. Methylene chloride was also detected in the trip blank. The Building C indoor air concentrations of n-hexane and methylene chloride were approximately ten-fold the concentrations detected in the background sample and the Building A and Building B samples. The Building C ethanol concentrations, though approximately 10-fold greater than the background outdoor air concentration, was only slightly greater (up to 3-fold) than the Building A and Building B samples. The highest detected acetone

and isopropanol concentrations were noted in the Building A sample, with concentration approximately 3-fold higher than the concentrations in the background outdoor air sample and only slightly higher than in the Building B and Building C samples. Toluene, styrene, and 2-butanone were also detected in the three indoor air samples collected, but not on the outdoor air background sample. The highest toluene and 2-butanone concentrations were detected in the Building C sample, with the highest styrene concentration detected in the Building A sample. One additional VOC, tetrahydrofuran, was only detected in the Building B sample, and 1,2,4-trimethylbenzene, cyclohexane, and trichlorofluoromethane were only detected in the Building C sample. Trichlorofluoromethane was used until recently as a solvent, in fire extinguishers, refrigerant and as a propellant for aerosol pesticide and paint applications.

One additional compound, chloromethane, was only detected in the outdoor air background sample and may be indicative of ambient conditions in the vicinity of the school, unrelated to the site.

## **6.2 Vent Stack Air Results**

The following sections discuss the results of the vent stack air sampling, by sampling event. Vent stack air results are provided in Tables 6-6 through 6-10 for the March, April, May, June, and July/August 2007 sampling events, respectively.

As previously described, the primary compounds detected in the soil gas samples collected by BETA from beneath the location of the KMS in 2001 include acetone, 2-butanone, cyclohexane, ethanol, n-heptane, n-hexane, and toluene. Lesser concentrations of benzene, carbon disulfide, ethylbenzene, methyl tert butyl ether, tetrachloroethene, 1,2,4-trimethylbenzene, and xylenes were also detected in soil gas samples. A vapor barrier was installed on top of the soil beneath the school building concrete floor to protect against intrusion of any gases that may accumulate under the building. Passive ventilation has been installed to allow any sub-slab soil gases to migrate from beneath the vapor barrier to the vent stacks, installed through the school building roof.

VOCs are consistently detected in the sub-slab passive vent stacks, while PCBs are sporadically detected in the vent stacks. Positive detections of PCBs and VOCs in vent stack air are expected, and indicate that the passive ventilation system is performing as designed. Vent stack air sampling occurs from the rooftop vent stacks after they have been sealed with temporary covers for 24 hours prior to sampling, maximizing the concentrations of VOCs and PCBs in the foundation venting system contributed from the soil beneath the building and VOCs released from the PVC piping and adhesives. Acetone, 2-butanone, and tetrahydrofuran are common components in PVC pipe cement and may leach into vent stack air overtime. Therefore, the presence of these compounds in vent stack air may be indicative of off-gassing from the venting system components rather than a site-related impact.

### ***6.2.1 March 2007 Sampling Event***

On March 31, 2007, TRC collected four vent stack air samples (plus one duplicate) and one ground level outdoor background 4-hour TO-10A and TO-15 samples at the Keith Middle School. Table 6-6 provides a summary of positive compound results for the vent stack samples.

PCBs were detected at a concentration of 0.017 ug/m<sup>3</sup> in the sample collected from VS-4 of the Building A vapor collection zone. No other PCB detections were noted in the remaining vent stack samples collected or in the outdoor air background sample.

A total of nineteen VOCs were detected in vent stack air samples collected in March 2007. No VOCs were detected at the outdoor air background sampling location. Ethanol, 2-butanone, and tetrahydrofuran were detected in all vent stack air samples collected indicating that these compounds are being released from the subsurface ventilation system and/or uniformly from the subsurface and vented by the system. The remaining VOCs were detected in one or two of the subsurface collection zones indicating a more localized subsurface release.

### ***6.2.2 April 2007 Sampling Event***

On April 18, 2007, TRC collected four vent stack air samples (plus one duplicate) and one ground level outdoor background 4-hour TO-10A and TO-15 samples at the Keith Middle School. The vent stack duplicate sample was not analyzed due to a malfunctioning flow controller. Table 6-7 provides a summary of positive compound results for the vent stack samples.

No PCB detections were noted in the vent stack samples collected or in the outdoor air background sample.

A total of nine VOCs were detected in vent stack air samples collected in April 2007, while two VOCs were detected at the outdoor air background location. Acetone and carbon disulfide were detected in all vent stack air samples collected and also at the outdoor air background sampling location. These data indicate that these two VOCs are being released uniformly from the subsurface or from the ventilation system, but may also be present as a result of ambient conditions in the vicinity of the school. Tetrahydrofuran was also detected in all vent stack air samples collected indicating that this compound is being released from the subslab ventilation system. The remaining VOCs were detected in one or two of the subsurface collection zones, indicating a more localized subsurface release.

### ***6.2.3 May 2007 Sampling Event***

On May 19, 2007, TRC collected four vent stack air samples (plus one duplicate) and one ground level outdoor background 4-hour TO-10A and TO-15 samples at the Keith Middle School. Table 6-8 provides a summary of positive compound results for the vent stack samples.

No PCB detections were noted in the vent stack samples collected or in the outdoor air background sample.

A total of eighteen VOCs were detected in vent stack air samples collected in May 2007, while three VOCs were detected at the outdoor air background location. 2-Butanone was detected in all vent stack air samples collected and also at the outdoor air background sampling location. These data indicate that this VOC is being released uniformly from the subsurface ventilation system, but may also be present as a result of ambient conditions in the vicinity of the school. Ethanol and tetrahydrofuran were also detected in all vent stack air samples collected indicating that these compounds are being released from the subslab ventilation system or uniformly from the subsurface beneath the school building. The remaining VOCs were detected in one or two of the subsurface collection zones, indicating a more localized subsurface release. Two additional VOCs (carbon disulfide and chloromethane) were detected only in the outdoor air background sample, indicating that their presence may be a result of ambient conditions in the vicinity of the school.

#### ***6.2.4 June 2007 Sampling Event***

On June 24, 2007, TRC collected four vent stack air samples (plus one duplicate) and one ground level outdoor background 4-hour TO-10A and TO-15 samples at the Keith Middle School. Table 6-9 provides a summary of positive compound results for the vent stack samples.

No PCB detections were noted in the vent stack samples collected or in the outdoor air background sample.

A total of thirteen VOCs were detected in vent stack air samples collected in June 2007, while four VOCs were detected at the outdoor air background location. Higher detection limits for this sampling event may have prevented the detection of some VOCs, contributing to the lower number of VOCs detected. In addition, certain VOCs (e.g., tetrahydrofuran and acetone) were detected with a lower frequency, compared to previous sampling events, likely also the result of the higher detection limits. 2-Butanone was detected in all vent stack air samples collected and also at the outdoor air background sampling location. These data indicate that this VOC is being released uniformly from the subsurface, but may also be present as a result of ambient conditions in the vicinity of the school. Chloromethane and acetone were also detected in at least one vent stack sample and in the outdoor air background sample, suggesting that these compounds may partially be present as a result of ambient conditions in the vicinity of the school. The remaining VOCs were detected in one or two of the subsurface collection zones, indicating a more localized subsurface release. One additional VOC (trichloroethene) was detected only in the outdoor air background sample, indicating that its presence may be related to ambient conditions in the vicinity of the school.

#### ***6.2.5 July/August Sampling Event***

On August 1, 2007, TRC collected four vent stack air samples (plus one duplicate) and one ground level outdoor background 4-hour TO-10A and TO-15 samples at the Keith Middle School. Table 6-10 provides a summary of positive compound results for the vent stack samples.

PCBs were detected at concentrations of 0.01 ug/m<sup>3</sup> from VS-1 and 0.028 ug/m<sup>3</sup> from VS-4, both representative of the Building A vapor collection zone. No other PCB detections were noted in the remaining vent stack samples collected or in the outdoor air background sample.

A total of thirteen VOCs were detected in vent stack air samples collected in July/August 2007, while six VOCs were detected at the outdoor air background location. Higher detection limits for this sampling event may have prevented the detection of some VOCs, contributing to the lower number of VOCs detected. In addition, certain VOCs (e.g., tetrahydrofuran and acetone) were detected with a lower frequency, compared to previous sampling events, likely also the result of the higher detection limits. Acetone, 2-butanone and methylene chloride were detected in three of four vent stack air samples collected and also at the outdoor air background sampling location. These data indicate that these VOC are being released uniformly from the subsurface, but may also be present as a result of ambient conditions in the vicinity of the school. Ethanol and n-hexane were also detected in at least one vent stack sample and in the outdoor air background sample, suggesting that these compounds may partially be present as a result of ambient conditions in the vicinity of the school. The remaining VOCs were detected in one or two of the subsurface collection zones, indicating a more localized subsurface release. One additional VOC (chloromethane) was detected only in the outdoor air background sample, indicating that its presence may be a result of ambient conditions in the vicinity of the school.

## 7.0 COMPARISON OF PCB RESULTS TO RISK-BASED AIR CONCENTRATIONS

This section of the report discusses the PCB indoor air and vent stack air sampling results, relative to site-specific outdoor air concentrations and risk-based air concentrations (RBACs). Air sampling results, background outdoor air results, and RBACs are presented in Tables 7-1 through 7-10 for the March, April, May, June, and July/August 2007 sampling events. Compound-specific results exceeding RBACs are highlighted on these tables. The detected concentrations of compounds exceeding RBACs are discussed in Sections 7.1 and 7.2 for indoor air and vent stack air, respectively.

Two PCB RBACs have been developed for the KMS, assuming occupational exposures within the school (8 hours/day, 250 days/year, for 25 years). Both non-carcinogenic and carcinogenic health endpoints were considered in the calculation of the RBACs; however, RBACs are based on noncarcinogenic effects as the most sensitive endpoint. The first RBAC is the Action Level (AL;  $0.05 \text{ ug/m}^3$ ) used as an initial indicator that PCB air concentrations above background levels have been detected. The risk basis for the AL is a noncarcinogenic hazard index of approximately 0.2. The second RBAC is the Acceptable Long-Term Average Exposure Concentration (ALTAEC;  $0.3 \text{ ug/m}^3$ ), indicative of the maximum acceptable air concentration that should not be exceeded for an extended time period. The ALTAEC could be exceeded over the short-term and still result in acceptable risk levels. The risk basis for the ALTAEC is a noncarcinogenic hazard index of one.

Both RBACs were developed to be applied to a total PCB air concentration, measured as either the sum of all detected Aroclors or the sum of all detected congeners. Because of imprecision associated with the Aroclor analytical method due to overlapping congener content, this method was not used to measure total PCBs in air. Instead, PCB homologues have been quantified and summed to generate total PCB air concentrations. Though this method was not specified in the LTMMIP for comparison to RBACs, the homolog analytical method is as reliable as the congener analytical method in quantifying total PCBs. By quantifying PCB homologues, total PCB air data gathered at the KMS are directly comparable to total PCB air data gathered at the high school since both are based on homologues rather than congeners, which greatly facilitates communication and discussion with the general public on the results of analyses.

The LTMMIP specifies that both indoor air and vent stack air gas-phase total PCB concentrations are to be compared to RBACs. This comparison is appropriate for indoor air results since exposures to indoor air at the KMS are occurring over a similar duration and frequency as that assumed for RBAC development (8 hours/day, 250 days/year for 25 years). However, this comparison is less appropriate for vent stack air results. The vent system is designed to capture gas-phase PCBs being released from the subsurface beneath the KMS and transport the gases through PVC piping to outdoor air, limiting migration through the building slab and into indoor air. Little if any exposure is occurring to air within the vent stack system itself. Air from the vent stack is released to outdoor air where the PCBs are quickly diluted and dispersed. Therefore, comparison of vent stack air results to RBACs developed assuming exposures of 8 hours/day, 250 days/year for 25 years is highly conservative, if not conceptually irrelevant. The results of the comparison of vent stack air results to RBACs should be

interpreted with caution due to the significantly lesser degree of exposure to vent stack air than indoor air.

The LTMMIP specifies follow-up actions to be taken if PCB air data exceed the AL, including verbal notification to school officials, a visual inspection of the sample location area for potential air contaminant sources, consultation with the analytical laboratory to confirm the validity of the result, and resampling of the subject location. Because sampling was being performed on a monthly schedule between March and August 2007, evaluation of the results and follow-up assessments were occurring within the specified schedule, regardless of whether the AL was exceeded.

## **7.1 Indoor Air**

Indoor air sampling results, outdoor air background results, and RBACs are presented in Tables 7-1 through 7-5 for the March, April, May, June, and July/August 2007 sampling events, respectively. PCBs were detected at each indoor air sampling location (Buildings A, B, and C) during each sampling event, except for the Building B sample collected in July/August 2007 which showed non-detect levels of PCBs in indoor air. Concentrations of PCBs in indoor air are consistent with levels associated with ambient conditions. All PCB indoor air detections are at least 10-fold less than the PCB AL. Because the PCB ALTAEC is approximately 10-fold greater than the PCB AL, all PCB indoor air detections are also approximately 100-fold less than the PCB ALTAEC. PCBs were not detected in the outdoor air background sample during any of the sampling events between March and August 2007.

The highest indoor air total PCB concentration was detected during the July/August 2007 sampling event when the school is likely experiencing lower than normal air exchange and the potential for volatilization of PCBs from ambient sources is greatest due to the warmer weather. The lowest indoor air total PCB concentration was detected during the March 2007 sampling event when air exchange was higher due to the active use of the school and ambient temperatures were lower. Indoor air reporting limits ranged from  $<0.00015 \text{ ug/m}^3$  to  $<0.00038 \text{ ug/m}^3$ , which allowed for the quantification and reporting of total PCB air concentrations at levels much lower than RBACs.

Temporal trends for total PCB indoor air concentrations at the sampling location in Building A (classrooms), Building B (auditorium), and Building C (faculty dining area) are shown in Figure 7-1. Figure 7-1 also shows concentration trends at the outdoor air background sampling location. Data included on this figure are for the time period August 2006 to August 2007. No clear trends are noted for total PCB concentrations in indoor air. Measured concentrations fluctuate over time, with slightly higher concentrations noted during the summer school vacation period when the building is experiencing lower than normal air exchange and the potential for volatilization of PCBs from ambient sources is greatest due to warmer weather. The low level fluctuations in PCB indoor air concentrations suggest that the range of measured concentrations is representative of background conditions within the KMS building.

Because there are no indoor air PCB concentrations in excess of the RBACs between March and July/August 2007, no specific follow-up actions are recommended at this time. December 2007 is the date of the next (subsequent) sampling event.

## 7.2 Vent Stack Air

Vent stack air sampling results, outdoor air background results, and RBACs are presented in Tables 7-6 through 7-10 for the March, April, May, June, and July/August 2007 sampling events, respectively. PCBs were only detected on three occasions: sample location VS-4-10 (March 2007), sample location VS-1-14 (July/August 2007), and sample location VS-4-14 (July/August 2007). All other vent stack sample locations were non-detect for total PCBs. Though the comparison of vent stack PCB detections to RBACs is not appropriate due to limited, if any exposure to vent stack air, PCB vent stack air detections were between 2 and 5-fold less than the PCB AL, and approximately 20 to 50-fold less than the PCB ALTAEC. PCBs were not detected in the outdoor air background sample during any of the sampling events between March and August 2007.

Overall, detected concentrations of total PCBs in vent stack air are higher than detected concentrations in indoor air. Concentrations of PCBs in indoor air are attributable to background conditions. However, concentrations of PCBs in vent stack air are due to the subslab venting of PCBs from beneath the school and/or equilibration with ambient air. Vent stack air reporting limits were higher than those for indoor air, ranging from  $<0.012 \text{ ug/m}^3$  to  $<0.024 \text{ ug/m}^3$ . The higher reporting limit likely masked the presence of PCBs in the vent stack air system. However, reporting limits were below the AL indicating that PCBs, even if not detected by the analytical method, were present at concentrations less than the RBACs. Consistent with the indoor air results, the highest vent stack air total PCB concentrations was detected during the July/August 2007 sampling event when the potential for volatilization of PCBs is greatest due to warmer weather.

Temporal trends for total PCB vent stack air concentrations are shown in Figure 7-2. Two vent stack locations were consistently sampled over the monthly program to establish a basis for concentration trends. The vents selected were VS-1 and VS-4 which were chosen because they both vent from the Building A vapor collection zone and Building A consists of classrooms where children spend most of the day. Figure 7-2 also shows concentrations trends at the outdoor air background sampling location. Data included on this figure are for the time period August 2006 to August 2007. Many of the vent stack air samples collected during this time period displayed non-detect levels of total PCBs. Total PCB concentrations in VS-1 are consistent over time and similar to levels present at the outdoor air background location. Total PCB concentrations in VS-4 displayed greater variability with slightly higher concentrations noted during warmer ambient temperatures. The low level fluctuations in PCB vent stack air concentrations suggest that the range of measured concentrations is representative of typical conditions within the subsurface ventilation system.

Because there are no exceedances of the RBACs between March and July/August 2007, no specific follow-up actions are recommended at this time. December 2007 is the date of the next (subsequent) sampling event.

## 8.0 COMPARISON OF VOC RESULTS TO COMPARISON CRITERIA

This section of the report discusses the VOC indoor air and vent stack air sampling results, relative to site-specific outdoor air and generic indoor air background concentrations and available comparison criteria. Air sampling data, background data, and comparison criteria are presented in Tables 8-1 through 8-10 for the March, April, May, June, and July/August 2007 sampling events. Compound-specific results exceeding comparison criteria are highlighted on these tables. The detected concentrations of compounds exceeding comparison criteria are discussed by sampling event in Section 8.1 for indoor air quality samples and Section 8.2 for vent stack air samples, followed by a discussion of observed trends in Section 8.3.

Comparison criteria for the VOC data include MassDEP Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs), published in December 1995, consistent with the LTMMIP. TELs are developed to be applicable to short-term exposure concentrations (average 24-hour levels) while AALs are developed to be protective of long-term exposure concentrations (average annual levels over 30 years). AALs and TELs are risk-based values, corresponding to the lower of a non-carcinogenic hazard of 0.2 or an excess lifetime cancer risk of one in one million ( $1 \times 10^{-6}$ ) for potentially carcinogenic compounds. Indoor air and vent stack air VOC concentrations are conservatively compared to both criteria even though it is unlikely that actual exposures to measured air concentrations would occur for either an entire 24-hour day or continually for 30 years. Short-term exposures at the KMS are likely to occur for approximately 8 hours per day, while long-term exposures are likely to occur for approximately 250 days/year for an exposure duration of 25 years.

Because TELs and AALs have not been revised since 1995 and may not include the most up-to-date toxicity information available, VOC concentrations in excess of AALs and TELs are discussed relative to alternate comparison criteria. The alternate comparison criteria are primarily ambient air risk-based concentrations (RBCs) developed by EPA Region III (2007) using the most current toxicity information available. Similar to AALs, ambient air RBCs are applicable to continuous long-term exposures and are associated with the same cancer risk threshold used in establishing AALs and TELs. Because ambient air RBCs are based on a hazard of 1 for non-carcinogenic endpoints, ambient air RBCs provided on Tables 8-1 through 8-10 have been adjusted to a non-carcinogenic hazard of 0.2 to be consistent with AALs and TELs based on non-carcinogenic effects. In interpreting concentrations in excess of ambient air RBCs, it is important to consider how the frequency and duration of actual exposures may differ from continuous long-term exposures assumed for ambient air RBC development.

Because AALs, TELs, and ambient air RBCs are set at risk levels (i.e., non-carcinogenic hazard of 0.2 and excess lifetime cancer risk of  $1 \times 10^{-6}$ ) that are only a portion of the MassDEP risk management criteria of a non-carcinogenic hazard of 1 and an excess lifetime cancer risk of one in one-hundred thousand ( $1 \times 10^{-5}$ ), concentrations that slightly exceed (i.e., less than 5-fold) one or more comparison criteria may not be cause for concern, especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development.

For compounds lacking comparison criteria, detected concentrations are discussed relative to available comparison criteria for a surrogate compound, selected based on similarities in chemical structure and/or known toxicity. Compounds lacking comparison criteria are also discussed relative to site-specific outdoor and indoor air background concentrations, as available. Surrogate assignments are identified in footnotes on Tables 8-1 through 8-10.

Levels of VOCs in air present as a result of background or ambient conditions were not factored into the establishment of comparison criteria. Therefore, comparison criteria may be set at values that are below typical background levels of VOCs in indoor air, present as a result of off-gassing from building materials or indoor activities unrelated to site-specific releases. To account for anticipated background conditions at the KMS, VOC concentrations in excess of comparison criteria are framed relative to site-specific outdoor air background concentrations, indicating ambient conditions in the vicinity of site. To provide additional perspective, VOC concentrations in excess of comparison criteria are also discussed relative to MassDEP indoor air background values, used by MassDEP in the development of the Massachusetts Contingency Plan (MCP) numeric standards. Therefore, the presence of one or more VOCs at concentrations that exceed comparison criteria should be interpreted with caution and may not indicate the need for immediate action.

The LTMMIP specifies that both indoor air and vent stack air VOC concentrations are to be compared to comparison criteria. This comparison is appropriate for indoor air results since exposures to indoor air at the KMS are occurring over a similar though lesser duration and frequency as that assumed for comparison criteria development. However, this comparison is less appropriate for vent stack air results. The vent system is designed to capture VOCs being released from the subsurface beneath the KMS and transport the gases through PVC piping to outdoor air, limiting migration through the building slab and into indoor air. Little if any exposure is occurring to air within the vent stack system itself. Air from the vent stack is released to outdoor air where the VOCs are quickly diluted and dispersed, similar to but to a greater degree than the dilution and dispersion that occurs in indoor air. Therefore, comparison of vent stack air results to comparison criteria developed assuming short-term (24-hour) and long-term exposure is highly conservative, if not conceptually irrelevant. The results of the comparison of vent stack air results to comparison criteria should be interpreted with caution due to the significantly lesser degree of exposure to vent stack air than indoor air.

The LTMMIP specifies follow-up actions to be taken if VOC air data exceed the comparison criteria including verbal notification to school officials, a visual inspection of the sample location area for potential air contaminant sources, consultation with the analytical laboratory to confirm the validity of the result, and resampling of the subject location. Because sampling was being performed on a monthly schedule between March and August 2007, evaluation of the results and follow-up assessments were occurring within the specified schedule, regardless of whether comparison criteria were exceeded.

There are a small number of compounds in indoor air, vent air, and outdoor air background samples for which reporting limits consistently exceed comparison criteria set at very low values, which are not readily achievable with standard analytical methods. The comparison criteria for each of the affected compounds (i.e., benzene, chloroform, methylene chloride,

styrene, tetrachloroethene, and trichloroethene) are based on an excess lifetime cancer risk of  $1 \times 10^{-6}$  for continuous lifetime exposure. For these compounds, the reporting limit typically exceeds the comparison criteria by 10-fold or less, indicating that the reporting limit is associated with an excess lifetime cancer risk of up to  $1 \times 10^{-5}$  for long-term exposures. However, because the development of comparison criteria does not consider airborne levels present as a result of background or ambient activities, it is important to note that comparison criteria for these compounds are set at levels that are below typical indoor air background levels and cannot be distinguished from levels in site-specific outdoor air samples. Tables 8-1 through 8-10 provide the sample-specific detection limits for these compounds as well as the MassDEP indoor air background levels and site-specific outdoor air background sample results.

There are also a small number of vent air samples where reporting limits for all compounds were elevated due to dilutions required by the sample matrix from one or a small number of compounds that were present at elevated concentrations. These samples include VS-7-13 and VS-9-13 (plus its duplicate) collected in June 2007 and samples VS-14-14 (plus its duplicate), VS-16-14, and VS-1-14 collected in July/August 2007. For these samples, the compounds present at elevated concentrations include methyl tert butyl ether, cyclohexane, 1,2,4-trimethylbenzene, 2-butanone, and n-hexane. The presence of these compounds at elevated levels in vent stack air during warmer weather may be related to increased VOC vapor pressure during periods of higher ambient temperatures. In addition, VOCs present as a component of PVC pipe cement (e.g., acetone, tetrahydrofuran, and 2-butanone) may be released to a greater degree during warmer temperatures.

## **8.1 Indoor Air**

### ***8.1.1 March 2007 Sampling Event***

As presented on Table 8-1, only the concentration of methylene chloride in the Building B indoor air sample exceeds both its AAL and ambient air RBC. The detected concentration is less than the TEL for methylene chloride, indicating that short-term exposures are not of concern for this compound. However, the detected indoor air concentration is less than the concentration detected in the outdoor air background sample and the MassDEP indoor air background concentration, suggesting that the presence of this compound is likely associated with ambient conditions at the site rather than a site-related finding. Methylene chloride is also a common laboratory contaminant which may have been introduced at low levels during laboratory analysis, and thus may not be representative of site conditions.

Isopropanol which lacks compound-specific comparison criteria is also detected in the Building A and Building C indoor air samples at concentrations above the detection limit for the outdoor air background sample. There are no published comparison criteria specific for this compound. However, because isopropanol is similar in chemical structure and toxicity to isobutyl alcohol, the detected concentrations of isopropanol can be compared to the AAL/TEL for isobutyl alcohol to give some perspective on the significance of the detected isopropanol concentrations. The detected indoor air concentrations are below the AAL/TEL for isobutyl alcohol suggesting that the detections are unlikely to be of concern. Note that isopropanol is a common constituent

of household disinfectants, solvents for paints, inks and shellacs, and as a component of flavor ingredients for baked goods and candies.

### ***8.1.2 April 2007 Sampling Event***

As indicated on Table 8-2, concentrations of six VOCs in the Building A indoor air sample exceeded both concentrations in corresponding outdoor air background sample and one or more comparison criteria. The compounds include 1,2,4-trichlorobenzene, 2-butanone, ethanol, p/m-xylene, o-xylene, and toluene.

Of these compounds, detected concentrations of 2-butanone, o-xylene, and toluene do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that these compounds are unlikely to be of concern. Because the detected p/m-xylene, 1,2,4-trichlorobenzene, and ethanol concentrations are only two to three-fold greater than comparison criteria, these compounds are also unlikely to be of concern especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. Of these compounds, 2-butanone, o-xylene, and p/m-xylene detections are below MassDEP indoor air background concentrations, indicating that the presence of these compounds in indoor air is not a site-related finding. No MassDEP indoor air background value is available for ethanol.

n-Heptane which lacks compound-specific comparison criteria is also detected in the Building A indoor air sample at a concentration above the outdoor air background sample. There is no published AAL/TEL for this compound. However, because n-heptane is similar in chemical structure and toxicity to n-hexane, the detected concentration of n-heptane can be compared to the ambient air RBC for n-hexane to give some perspective on the significance of the detected n-heptane concentrations. The detected indoor air concentration is below the ambient air RBC for n-hexane indicating that its detection is unlikely to be of concern.

Tetrahydrofuran is present only in the outdoor air background sample at a concentration that exceeds its ambient air RBC. The presence of this compound in background outdoor air indicates that its detection is associated with ambient conditions at the site rather than a site-related finding.

The presence of higher levels and more numerous detections of VOCs in indoor air during the April school vacation is not surprising given that the school undergoes intensive cleaning and maintenance while the school is out of session and the building is likely experiencing lower than normal air exchanges.

### ***8.1.3 May 2007 Sampling Event***

As presented on Table 8-3, concentrations of methylene chloride in the Building B and Building C indoor air samples and the concentration of 1,2,4-trichlorobenzene in the Building A indoor air sample exceed comparison criteria.

The detected concentrations of methylene chloride are less than the concentration detected in the outdoor air background sample and also less than the MassDEP indoor air background concentration, indicating that the presence of this compound is associated with ambient conditions at the site rather than a site-related finding. Methylene chloride is also a common laboratory contaminant which may have been introduced at low levels during laboratory analysis. Because the detected 1,2,4-trichlorobenzene concentration is less than two-fold greater than comparison criteria, this compound is also unlikely to be of concern especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. No MassDEP indoor air background value is available for ethanol.

Isopropanol, which lacks compound-specific comparison criteria, was also detected in the Section B indoor air sample at a concentration slightly above the outdoor air background concentration. There is no published AAL/TEL for this compound. However, a comparison to the AAL/TEL for isobutyl alcohol can give some perspective on the significance of the detected isopropanol concentrations, based on similarities in chemical structure and toxicity. The detected indoor air concentration is below the AAL/TEL for isobutyl alcohol suggesting that the detected concentration is unlikely to be of concern.

#### ***8.1.4 June 2007 Sampling Event***

As indicated on Table 8-4, concentrations of two VOCs in the Building A indoor air sample (styrene and tetrahydrofuran) and three VOCs in the Building C indoor air sample (1,2,4-trimethylbenzene, 2-butanone, and styrene) exceed both concentrations in corresponding outdoor air background sample and one or more comparison criteria.

Of these compounds, detected concentrations of 2-butanone, and styrene do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that these compounds are unlikely to be of concern. In addition, because the detected concentration of 1,2,4-trimethylbenzene is less than 4-fold greater than its ambient air RBC, this compound is also unlikely to be of concern especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. Of these compounds, the 2-butanone detection is below the MassDEP indoor air background concentration, suggesting that its presence in indoor air is not a site-related finding.

The TEL for tetrahydrofuran is not exceeded suggesting that short-term exposures are not of concern for this compound. In contrast, detected concentrations of tetrahydrofuran exceed ambient air RBCs by more than one order of magnitude, indicating that long-term exposures could be of potential concern for this compound. Tetrahydrofuran does not have a published MassDEP indoor air background values. However, tetrahydrofuran is a common component of cleaning and adhesive products and may be present due to releases during indoor cleaning or repairs.

Isopropanol which lacks compound-specific comparison criteria was also detected in Section A and Section C indoor air samples at concentrations above the detection limit for the outdoor air background sample. The detected indoor air concentrations are below the AAL/TEL for isobutyl

alcohol, its selected toxicological surrogate, suggesting that the detection is unlikely to be of concern.

The presence of higher levels and more numerous detections of VOCs in indoor air during the summer months is not surprising given that the school is undergoing extensive cleaning and repairs, the building is likely experiencing lower than normal air exchanges, and the higher ambient temperatures may be increasing the off-gassing of VOCs from building materials into indoor air.

#### ***8.1.5 July/August 2007 Sampling Event***

As indicated on Table 8-5, concentrations of six VOC in indoor air samples exceed both concentrations in corresponding outdoor air background sample and one or more comparison criteria. The compounds include 1,2,4-trimethylbenzene, 2-butanone, ethanol, methylene chloride, styrene, and tetrahydrofuran.

Of these compounds, detected concentrations of 2-butanone, and styrene do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that these compounds are unlikely to be of concern. In addition, because the detected concentrations of 1,2,4-trimethylbenzene and ethanol are less than 2-fold greater than their ambient air RBCs, these compounds are also unlikely to be of concern especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. Of these compounds, the 2-butanone detection is below the MassDEP indoor air background concentration, suggesting that its presence in indoor air is not a site-related finding.

Even though the maximum methylene chloride concentration exceeds its AAL/TEL and ambient air RBC, the detected concentrations in indoor air are consistent with MassDEP indoor air background concentrations suggesting that the detected levels are unrelated to site-specific impacts. Methylene chloride is also a common laboratory contaminant which may have been introduced at low levels during laboratory analysis, and thus may not be representative of site conditions.

The TEL for tetrahydrofuran is not exceeded suggesting that short-term exposures are not of concern for this compound. In contrast, detected concentrations of tetrahydrofuran exceed its ambient air RBC by more than one order of magnitude, indicating that long-term exposures could be of potential concern for this compound. Tetrahydrofuran does not have a published MassDEP indoor air background values. However, tetrahydrofuran is a common component of cleaning and adhesive products and may be present due to releases during indoor repairs or off-gassing from building materials.

Isopropanol which lacks compound-specific comparison criteria is also present in the three indoor air samples above the concentrations detected in the outdoor air background sample. The detected indoor air concentrations are below the AAL/TEL for isobutyl alcohol, its selected toxicological surrogate, suggesting that the detection is unlikely to be of concern.

The presence of higher levels and more numerous detections of VOCs in indoor air during the summer months is not surprising given that the school is undergoing extensive cleaning and repairs while the students are on vacation, the building is likely experiencing lower than normal air exchanges, and the higher ambient temperatures may be increasing the release of VOCs from building materials and cleaning products in storage or being used on the premises into indoor air.

## **8.2 Vent Stack Air**

### ***8.2.1 March 2007 Sampling Event***

As indicated on Table 8-6, concentrations of eleven VOCs in vent stack air samples exceed both concentrations in the corresponding outdoor air background sample and one or more comparison criteria. The compounds include 2-butanone, benzene, carbon disulfide, chloroform, ethanol, methylene chloride, methyl tert butyl ether, n-hexane, tetrachloroethene, tetrahydrofuran, and trichloroethene. Comparison of vent stack air results to risk-based comparison criteria assumes that exposures to the air within the vent system are occurring at the same duration and intensity as indoor air, which is unlikely as previously noted. Therefore, VOC concentrations detected in excess of comparison criteria for VOCs in the vent stack system are unlikely to be indicative of a health concern since little, if any exposure is occurring to vent stack air.

Of the compounds exceeding comparison criteria, detected concentrations of 2-butanone and carbon disulfide do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that these compounds are unlikely to be of concern. 2-Butanone may be present in vent stack air due to its release from PVC pipe cement. Because the maximum ethanol and n-hexane concentrations are less than two-fold greater than comparison criteria, these compounds are also unlikely to be of concern.

Even though the AAL for methylene chloride is exceeded, the maximum detected methylene chloride vent stack air concentration does not exceed its TEL and only slightly exceeds its ambient air RBC based on the most current toxicity information, indicating that this compound is unlikely to be of concern especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. The methylene chloride detections are also less than the MassDEP indoor air background value. Methylene chloride is also a common laboratory contaminant which may have been introduced at low levels during laboratory analysis, and thus may not be representative of site conditions.

TELs for chloroform, tetrachloroethene, tetrahydrofuran, and trichloroethene are not exceeded suggesting that short-term exposures are not of concern for these compounds. In contrast, detected concentrations of benzene, chloroform, methyl tert butyl ether, tetrachloroethene, tetrahydrofuran, and trichloroethene exceed AALs or ambient air RBCs by more than one order of magnitude, indicating that long-term exposures could be of potential concern for these compounds, should they be occurring in the vent system. Even though the TEL for benzene is exceeded, short-term benzene exposures are of low concern since the TEL is only exceeded by approximately 3-fold. Of these compounds, detected concentrations of benzene and tetrachloroethene are below MassDEP indoor air background concentrations while chloroform and trichloroethene concentrations only slightly exceed MassDEP indoor air background

concentrations, indicating that their presence is unlikely to be associated with site-related impacts. Tetrahydrofuran and methyl tert butyl ether do not have published MassDEP indoor air background values. Tetrahydrofuran is a component of PVC pipe cement and may be present due to off-gassing from vent system components.

Three additional VOCs lacking compound-specific comparison criteria are also detected in vent stack air samples. These compounds include 2,2,4-trimethylpentane, n-heptane, and trichlorofluoromethane. The maximum detected trichlorofluoromethane concentration is less than its ambient air RBC. The maximum 2,2,4-trimethylpentane and n-heptane detections are less than the ambient air RBC for n-hexane, selected as the most appropriate toxicity surrogate for both compounds to provide perspective on the detected concentrations.

Many of the compounds detected in vent stack air were detected in the December 2001 subsurface soil gas sampling event conducted by BETA, including but not limited to benzene, tetrachloroethene, and n-heptane. Therefore, the presence of these compounds in vent stack air, but at lower or non-detect concentrations and not in indoor air, indicates that the passive foundation venting system is performing as designed and limiting or preventing the migration of subsurface VOCs to indoor air.

### ***8.2.2 April 2007 Sampling Event***

As indicated on Table 8-7, concentrations of three VOCs in the vent stack air samples exceed both concentrations in the corresponding outdoor air background sample and one or more comparison criteria. The compounds are carbon disulfide, chloroform, and tetrahydrofuran. Comparison of vent stack air results to risk-based comparison criteria assumes that exposures to the air within the vent system are occurring at the same duration and intensity as indoor air, which is unlikely.

Of the compounds exceeding comparison criteria, detected concentrations of carbon disulfide do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that this compound is unlikely to be of concern.

TELs for chloroform and tetrahydrofuran are not exceeded indicating that short-term exposures are not of concern for these compounds. However, the detected concentrations of chloroform and tetrahydrofuran exceed AALs and/or ambient air RBC by more than one order of magnitude. This finding could suggest that long-term exposures may be of concern except little, if any exposure is occurring to air within the passive vent system. It should further be noted that the detected concentration of chloroform is less than the MassDEP indoor air background concentration indicating that this compound is associated with ambient conditions at the site rather than a site-related finding. No MassDEP indoor air background value is available for tetrahydrofuran. However, as noted previously, tetrahydrofuran is a component of PVC pipe cement and may be present due to off-gassing from vent system components.

Isopropanol which lacks compound-specific comparison criteria is also present in two vent stack air samples at concentrations above the detection limit for the outdoor air background sample. There are no published comparison criteria specific for this compound. However, because

isopropanol is similar in chemical structure and toxicity to isobutyl alcohol, the detected concentrations of isopropanol can be compared to the AAL/TEL for isobutyl alcohol to give some perspective on the significance of the detected isopropanol concentrations. The detected concentrations are below the AAL/TEL for isobutyl alcohol suggesting that the detections are unlikely to be of concern. As noted previously, isopropanol is a common constituent of household disinfectants and medical antiseptics; solvents for paints, inks and shellacs; and as a component of flavor ingredients for baked goods and candies.

Many of the compounds detected in vent stack air were detected in the December 2001 subsurface soil gas sampling event. Therefore, the presence of these compounds in vent stack air, but at lower or non-detect concentrations and not in indoor air, indicates that the passive foundation venting system is performing as designed and limiting the migration of subsurface VOCs to indoor air.

### ***8.2.3 May 2007 Sampling Event***

As indicated on Table 8-8, concentrations of eight VOCs in the vent stack air samples exceed both concentrations in the corresponding outdoor air background sample and one or more comparison criteria. The compounds include 1,2,4-trimethylbenzene, 2-butanone, chloroform, methylene chloride, methyl tert butyl ether, styrene, tetrahydrofuran, and trichloroethene. Comparison of vent stack air results to risk-based comparison criteria assumes that exposures to the air within the vent system are occurring at the same duration and intensity as indoor air, which is unlikely.

Of the compounds exceeding comparison criteria, detected concentrations of 2-butanone and styrene do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that these compounds are unlikely to be of concern. Because the detected 1,2,4-trimethylbenzene concentration is less than three-fold greater than comparison criteria, this compound is also unlikely to be of concern especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. Of these compounds, 2-butanone detections are below MassDEP indoor air background concentrations, suggesting that its presence in vent stack air is not a site-related finding. 2-Butanone is a component of PVC pipe cement and may be present due to releases from the vent system.

Even though the AAL and TEL for methylene chloride are exceeded, the detected methylene chloride vent stack air concentrations only exceed its ambient air RBC based on the most current toxicity information by 4-fold, suggesting that this compound is unlikely to be of immediate concern. The methylene chloride detections are also less than the MassDEP indoor air background value further suggesting that its presence in vent stack air is not a site-related finding. Methylene chloride is also a common laboratory contaminant which may have been introduced at low levels during laboratory analysis, and thus may not be representative of site conditions.

TELS for chloroform, tetrahydrofuran, and trichloroethene are not exceeded suggesting that short-term exposures are not of concern for these compounds. In contrast, detected concentrations of chloroform, methyl tert butyl ether, tetrahydrofuran, and trichloroethene

exceed AALs or ambient air RBCs by more than one order of magnitude. This finding could suggest that long-term exposures may be of concern except little, if any exposure is occurring to air within the passive vent system. Of these compounds, detected concentrations of chloroform and trichloroethene only slightly exceed MassDEP indoor air background concentration, indicating that their presence is unlikely to be associated with site-related impacts. Tetrahydrofuran and methyl tert butyl ether do not have published MassDEP indoor air background values. However, tetrahydrofuran is a component of PVC pipe cement and may be present due to off-gassing from vent system components.

Isopropanol, which lacks compound-specific comparison criteria, is also detected in vent stack air samples. The maximum isopropanol detection is less than the AAL/TEL for isobutyl alcohol, selected as an appropriate toxicity surrogate to provide perspective on the detected concentrations.

Carbon disulfide is only present in the outdoor air background sample at concentration that exceeds its AAL/TEL, but less than its ambient air RBC. The presence of this compound only in background outdoor air indicates that its detection is associated with ambient conditions at the site rather than a site-related finding.

Many of the compounds detected in vent stack air were detected in the December 2001 subsurface soil gas sampling event including but not limited to 2-butanone, 1,2,4-trimethylbenzene, and methyl tert butyl ether. Therefore, the presence of these compounds in vent stack air, but at lower or non-detect concentrations in indoor air, indicates that the passive foundation venting system is performing as designed and limiting the migration of subsurface VOCs to indoor air.

#### ***8.2.4 June 2007 Sampling Event***

As indicated on Table 8-9, concentrations of five VOCs in vent stack air samples exceed both concentrations in the corresponding outdoor air background sample and one or more comparison criteria. The compounds include 2-butanone, ethanol, methylene chloride, methyl tert butyl ether, and tetrahydrofuran. Comparison of vent stack air results to risk-based comparison criteria assumes that exposures to the air within the vent system are occurring at the same duration and intensity as indoor air, which is unlikely.

Of the compounds exceeding comparison criteria, detected concentrations of 2-butanone and methylene chloride do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that these compounds are unlikely to be of concern. Because the detected ethanol concentration is less than two-fold greater than comparison criteria, this compound is also unlikely to be of concern especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. Of these compounds, methylene chloride detections are below MassDEP indoor air background concentrations, suggesting that its presence in vent stack air is not a site-related finding. Methylene chloride is also a common laboratory contaminant which may have been introduced at low levels during laboratory analysis, and thus may not be representative of site conditions.

Detected concentrations of methyl tert butyl ether exceed its ambient air RBC by more than one order of magnitude. This finding could suggest that long-term exposures may be of concern except little, if any exposure is occurring to air within the passive vent system. Detected concentrations of tetrahydrofuran exceed its ambient air RBC by less than 10-fold, suggesting that long-term exposures are not of concern for this compound especially considering that actual exposures may be of lesser duration and frequency than assumed in comparison criteria development. Methyl tert butyl ether and tetrahydrofuran do not have a published MassDEP indoor air background values. However, tetrahydrofuran is a component of PVC pipe cement and may be present due to off-gassing from vent system components.

Three VOCs lacking compound-specific comparison criteria are also present in vent stack air samples. These compounds include: 2,2,4-trimethylpentane, isopropanol, and n-heptane. The maximum 2,2,4-trimethylpentane and n-heptane detections are less than the ambient air RBC for n-hexane, selected as the most appropriate toxicity surrogate for both compounds to provide perspective on the detected concentrations. In addition, the detected vent stack air concentrations of isopropanol are below the AAL/TEL for isobutyl alcohol, its most appropriate toxicity surrogate, suggesting that the detections are unlikely to be of concern.

Trichloroethene was also detected in the outdoor air background sample at a concentration that exceeds comparison criteria. The presence of trichloroethene only in background outdoor air indicates that its detection is associated with ambient conditions at the site rather than a site-related finding.

Many of the compounds detected in vent stack air were detected in the December 2001 subsurface soil gas sampling event. Therefore, the presence of these compounds in vent stack air, but at lower or non-detect concentrations not in indoor air, indicates that the passive foundation venting system is performing as designed and limiting the migration of subsurface VOCs to indoor air.

### ***8.2.5 July/August 2007 Sampling Event***

As indicated on Table 8-10, concentrations of ten VOCs in vent stack air samples exceeded both concentrations in the corresponding outdoor air background sample and one or more comparison criteria. The compounds include 2,2,4-trimethylpentane, 2-butanone, benzene, carbon disulfide, cyclohexane, ethanol, methylene chloride, methyl tert butyl ether, n-hexane, and tetrahydrofuran. Comparison of vent stack air results to risk-based comparison criteria assumes that exposures to the air within the vent system are occurring at the same duration and intensity as indoor air, which is unlikely.

Of the compounds exceeding comparison criteria, detected concentrations of 2-butanone, carbon disulfide, and cyclohexane do not exceed their ambient air RBCs based on the most current toxicity information available, indicating that these compounds are unlikely to be of concern. Because the detected ethanol and 2,2,4-trimethylpentane concentrations are less than two-fold greater than comparison criteria, these compounds are also unlikely to be of concern. Though n-hexane detections exceed its ambient air RBC by approximately 6-fold, this compound is also

unlikely to be of immediate concern considering the lesser degree of exposure at the KMS compared to that assumed for the criterion (i.e., continuous long-term exposure).

Even though the maximum benzene and methylene chloride concentrations exceed their AALs/TELs and ambient air RBCs, the detected concentrations in vent stack air are consistent with MassDEP indoor air background concentrations suggesting that the detected levels are unrelated to site-specific impacts. Methylene chloride is also a common laboratory contaminant which may have been introduced at low levels during laboratory analysis.

Detected concentrations of tetrahydrofuran and methyl tert butyl ether exceed ambient air RBCs by more than one order of magnitude. This finding could suggest that long-term exposures may be of concern except little, if any exposure is occurring to air within the passive vent system. Methyl tert butyl ether and tetrahydrofuran do not have published MassDEP indoor air background values. However, tetrahydrofuran is a component of PVC pipe cement and may be present due to off-gassing from vent system components.

Two additional VOCs lacking compound-specific comparison criteria are also detected in vent stack air samples. These compounds include isopropanol and n-heptane. The n-heptane detection is less than the ambient air RBC for n-hexane, selected as the most appropriate toxicity surrogate to provide perspective on the detected concentration. In addition, the detected vent stack air concentrations of isopropanol are below the AAL/TEL for isobutyl alcohol, its selected toxicological surrogate, suggesting that the detections are unlikely to be of concern.

Many of the compounds detected in vent stack air were detected in the December 2001 subsurface soil gas sampling event. Therefore, the presence of these compounds in vent stack air, but at lower or non-detect concentrations not in indoor air, indicates that the passive foundation venting system is performing as designed and limiting the migration of subsurface VOCs to indoor air.

### **8.3 Risk Characterization for VOCs**

The LTMMIP specifies that the LSP-of-Record should submit the indoor air data to a toxicologist/risk assessor for further assessment if indoor air VOC concentrations exceed TELs, AALs, or 150% of outdoor air background concentrations. Therefore, non-carcinogenic hazards and excess lifetime cancer risks have been estimated based on maximum indoor air concentrations detected across all sampling events to determine whether a condition of no significant risk exists within the school, assuming worst-case exposure conditions. All VOCs detected in indoor air samples between March 2007 and July/August 2007 were included in the risk characterization. A commercial worker scenario was used which assumed exposures for 8 hours/day, 250 days/year for 25 years, consistent with the assumptions used in the development of the site-specific PCB action levels. Appendix F contains the calculation spreadsheet presenting the VOC concentrations, exposure assumptions and toxicity values used in the assessment.

The results presented in Appendix F document that a condition of no significant risk exists associated with commercial worker indoor air exposures at the KMS. Because workers are the

most highly exposed individuals at the KMS, exposures of school children and staff would also be associated with a condition of no significant risk. The risk and hazard to the commercial worker is overestimated due to the assumption that a worker would be continuously exposed to the maximum detected VOC concentrations over 25 years. VOC concentrations associated with off-gassing from building materials have been demonstrated to be trending downward (see discussion in Section 8.4).

The LTMMIP also specified that the LSP-of-Record should submit the vent stack air data to a toxicologist/risk assessor for further assessment if vent stack air VOC results exceed TELs and AALs. Because exposures to vent stack air are negligible or non-existent, further quantitative assessment of the vent stack air VOC results were not required.

#### **8.4 Trend Analysis for VOCs**

Temporal trends for VOC indoor air concentrations at the sampling location in Building A (classrooms), Building B (auditorium), and Building C (faculty dining area) are shown in Figures 8-1 through 8-3, respectively. Five VOCs were selected for data presentation including 2-butanone, methyl tert butyl ether, tetrahydrofuran, toluene, and total xylenes (the sum of m/p-xylene and o-xylene isomers). These VOCs were selected because they are not common laboratory contaminants, were frequently detected in indoor air samples, and were noted as exceeding one or more comparison criteria. Data included on these figures are for the time period August 2006 to August 2007. Bars on the figures outlined in black indicate that the compound was not detected during the specific sampling event, and the value presented on the figure is half the analytical detection limit. Though some degree of temporal fluctuation is observed, all five indicator VOCs display clearly decreasing concentration trends overtime in each building suggesting that off-gassing from the newly constructed school building is diminishing. In more recent months, most of the five selected compounds have not been detected. The sporadic detection of slightly higher VOC concentrations is noted during the spring and summer school vacation periods when the building is experiencing lower than normal air exchange and the indoor use of VOC-containing cleaning products and repair materials increases.

Temporal trends for VOC vent stack air concentrations are shown in Figures 8-4 and 8-5 for VS-1 and VS-4, respectively. The same five VOCs selected for presentation for indoor air were also used for data presentation purposes for vent stack air. Data included on these figure are for the time period August 2006 to August 2007. All five indicator VOCs display clearly decreasing trends overtime at both vent stack air sampling locations. Though some degree of temporal fluctuation is observed, the sporadic detection of slightly higher vent stack air VOC concentrations is noted during times of warmer ambient temperatures, increasing the subsurface release of VOCs or the off-gassing of VOCs from the ventilation system.

## 9.0 CONCLUSIONS

Indoor air quality sampling and vent stack air sampling was conducted monthly at the Keith Middle School between March and July/August 2007 for total PCBs and VOCs. Data were evaluated for quality and usability, discussed relative to risk-based air concentrations, and analyzed for concentration trends over the period of sampling from August 2006 to August 2007. The following summarizes the conclusions of the air sampling data evaluation.

In general, all TO-4A, TO-10A, and TO-15 data collected between March 2007 and July/August 2007 were determined to be valid as reported and usable for decision-making purposes.

No indoor air PCB concentrations exceed risk-based air concentrations, established to be protective of exposures occurring for 8 hours/day, 250 days/year for 25 years. A small number of VOCs exceed MassDEP AALs and/or TELs, developed to be protective of long-term and short-term exposures, or ambient air risk-based concentrations, developed to be protective of continuous long-term exposures. The VOCs exceeding one or more comparison criteria in at least one sampling event include: methylene chloride, 1,2,4-trichlorobenzene, 1,2,4-trimethylbenzene, 2-butanone, ethanol, xylenes, toluene, styrene, and tetrahydrofuran. Further assessment of the indoor air data indicated that the maximum detected VOC concentrations were associated with a condition of no significant risk to exposed individuals at the Keith Middle School.

No vent air PCB concentrations exceeded risk-based air concentrations. A greater number of VOCs in vent stack air exceeded comparison criteria as compared to VOCs in indoor air. However, this comparison is not appropriate for vent stack air results. The vent system is designed to capture VOCs being released from the subsurface beneath the KMS and transport the gases through PVC piping to outdoor air, limiting migration through the building slab and into indoor air. Little if any exposure is occurring to air within the vent stack system itself. Air from the vent stack is released to outdoor air where the VOCs are quickly diluted and dispersed. Therefore, comparison of vent stack air results to comparison criteria developed assuming short-term (24-hour) and long-term exposure is highly conservative, if not conceptually irrelevant.

Positive detection of VOCs are likely present in indoor air due to off-gassing from building materials and the storage and use of cleaners, adhesives, paints, and other VOC-containing products indoors at the school. Levels of PCBs and VOCs detected in indoor air may fluctuate and demonstrate noticeable concentrations trends overtime due to: (1) the degree of building air exchange that occurs during normal school operation (i.e., open conditions) versus vacation periods when the school is not in session (i.e., closed conditions); (2) changes in ambient temperatures that may increase or decrease the off-gassing of contaminants from indoor building materials; (3) the degree to which activities within the school building (e.g., cleaning and repairs) are contributing to ambient levels of VOCs, and (4) the dissipation of building material related VOC sources over time. The low level fluctuations in PCB indoor air concentrations suggest that the range of measured concentrations is representative of background conditions within the school building. Overall, VOC concentrations are decreasing in indoor air suggesting that off-gassing from an aggregate of sources within the newly constructed school building is diminishing. The sporadic detection of slightly higher VOC concentrations is noted during the

spring and summer school vacation periods when the building is experiencing lower than normal air exchange and the indoor use of VOC-containing cleaning products and repair materials increases.

VOCs are consistently detected in the sub-slab passive vent stacks, while PCBs are sporadically detected in the vent stacks. Positive detections of PCBs and VOCs in vent stack air are expected, and indicate that the passive ventilation system is performing as designed. VOCs detected in vent stack air samples may also have been released from the ventilation system. The low level fluctuations in PCB vent stack air concentrations and decreasing vent stack air VOC concentrations suggest that the range of measured concentrations is representative of typical conditions within the subsurface ventilation system and that off-gassing from the system is diminishing overtime.

## 10.0 REFERENCES

- BETA Group, Inc. (BETA). 2006. Final Completion and Inspection Report: Long-Term Monitoring and Maintenance Plan. McCoy Field/Keith Middle School, 225 Hathaway Boulevard, New Bedford, Massachusetts. Prepared for the City of New Bedford. October 4, 2006.
- United States Environmental Protection Agency (USEPA). 2007. Risk-Based Concentration Table. Region III. <http://www.epa.gov/reg3hwmd/risk/human/index.htm>. October 16, 2007.
- Massachusetts Department of Environmental Protection (MassDEP). 1995. Revised Air Guidelines. Massachusetts Threshold Effects Exposure Limits (TELEs) and Allowable Ambient Limits (AALs) for Ambient Air. December 6, 1995.

# **TABLES**

**Table 2-1. March to July/August 2007 Sample Summary****Keith Middle School  
New Bedford, Massachusetts**

Sample ID	Sample Location	Sampling Events (suffix)					Sample Type
		March (-10)	April (-11)	May (-12)	June (-13)	July/August (-14)	
A	Building A, center of west hallway	X	X	X	X	X	IAQ
B	Building B, Auditorium	X	X	X	X	X	IAQ
C	Building C, Faculty Dining Room	X	X	X	X	X	IAQ
BG	Background, flagpole area outside main entrance to Building A	XX	XX	XX	XX	XX	IAQ
VS-1	Building A, vent stack 1	X	X	X	X	X	Vent Stack
VS-4	Building A, vent stack 4	X	X	X	X	X	Vent Stack
VS-7	Building B, vent stack 7	X			X		Vent Stack
VS-8	Building B, vent stack 8			XX			Vent Stack
VS-9	Building B, vent stack 9				XX		Vent Stack
VS-10	Building B, vent stack 10		X				Vent Stack
VS-11	Gymnasium , vent stack 11			X			Vent Stack
VS-14	Gymnasium, vent stack 14	XX				XX	Vent Stack
VS-16	Building A , vent stack 16		XX			X	Vent Stack
VS-BG	On the ground at main entrance to Building A	X	X	X	X	X	Vent Stack

**Notes:**

IAQ = Indoor Air Quality

BG = Sample designation for background samples.

VS = Sample designation for vent stack samples.

XX = Designation indicating duplicate samples collected at specified location.

**Table 5-1. Comparison of VOC Indoor Air Sample Results - Collocated Sampler Precision**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Mar-07			Apr-07			May-07			Jun-07			July/Aug-07		
		BG-10	BG-10 Dup	RPD (%)	BG-11	BG-11 Dup	RPD (%)	BG-12	BG-12 Dup	RPD (%)	BG-13	BG-13 Dup	RPD (%)	BG-14	BG-14 Dup	RPD (%)
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	NC	< 3.71	< 3.71	NC	< 3.71	< 13.4	NC	< 3.71	< 3.71	NC	< 6.10	< 3.71	NC
	1,2,4-trimethylbenzene	< 2.46	< 2.46	NC	< 2.46	< 2.46	NC	< 2.46	< 8.87	NC	< 2.46	< 2.46	NC	< 4.04	< 2.46	NC
	2,2,4-trimethylpentane	< 2.33	< 2.33	NC	< 2.33	< 2.33	NC	< 2.33	< 8.43	NC	< 2.33	< 2.33	NC	< 3.84	< 2.33	NC
	2-butanone	< 1.47	< 1.47	NC	< 1.47	< 1.47	NC	< 1.47	< 5.32	NC	<b>2.24</b>	<b>2.39</b>	<b>6.48</b>	< 2.42	< 1.47	NC
	acetone	<b>5.51 J</b>	< 4.75	NC	<b>15.7</b>	<b>19.5</b>	<b>21.59</b>	< 4.75	< 17.2	NC	<b>24.2</b>	<b>24.2</b>	<b>0.00</b>	<b>15.6</b>	<b>14.9</b>	<b>4.59</b>
	benzene	< 1.60	< 1.60	NC	< 1.60	< 1.60	NC	< 1.60	< 5.77	NC	< 1.60	< 1.60	NC	< 2.62	< 1.60	NC
	carbon disulfide	< 1.56	< 1.56	NC	< 1.56	< 1.56	NC	< 1.56	< 5.62	NC	< 1.56	< 1.56	NC	< 2.56	< 1.56	NC
	chloroform	< 2.44	< 2.44	NC	< 2.44	< 2.44	NC	< 2.44	< 8.81	NC	< 2.44	< 2.44	NC	< 4.01	< 2.44	NC
	chloromethane	< 1.03	< 1.03	NC	< 1.03	< 1.03	NC	<b>1.13</b>	< 3.73	NC	<b>1.68</b>	<b>1.72</b>	<b>2.35</b>	<b>1.74</b>	<b>1.74</b>	<b>0.00</b>
	cyclohexane	< 1.72	< 1.72	NC	< 1.72	< 1.72	NC	< 1.72	< 6.21	NC	< 1.72	< 1.72	NC	< 2.83	< 1.72	NC
	ethanol	< 3.76	< 3.76	NC	<b>5.76</b>	< 3.76	NC	< 3.76	< 13.6	NC	<b>5.12</b>	<b>9.95</b>	<b>64.10</b>	< 6.19	<b>6.57</b>	NC
	ethylbenzene	< 2.17	< 2.17	NC	< 2.17	< 2.17	NC	< 2.17	< 7.84	NC	< 2.17	< 2.17	NC	< 3.57	< 2.17	NC
	isopropanol	< 1.23	< 1.23	NC	< 1.23	< 1.23	NC	< 1.23	<b>6.77</b>	NC	< 1.23	< 1.23	NC	<b>3.44</b>	<b>2.68</b>	<b>24.84</b>
	methylene chloride	<b>6.8</b>	< 3.47	NC	< 3.47	< 3.47	NC	< 3.47	<b>14.8</b>	NC	< 3.47	< 3.47	NC	<b>18.8</b>	<b>21.2</b>	<b>12.00</b>
	methyl tert butyl ether	< 1.80	< 1.80	NC	< 1.80	< 1.80	NC	< 1.80	< 6.51	NC	< 1.80	< 1.80	NC	< 2.96	< 1.80	NC
	p/m-xylene	< 4.34	< 4.34	NC	< 4.34	< 4.34	NC	< 4.34	< 15.7	NC	< 4.34	< 4.34	NC	< 7.13	< 4.34	NC
	o-xylene	< 2.17	< 2.17	NC	< 2.17	< 2.17	NC	< 2.17	< 7.84	NC	< 2.17	< 2.17	NC	< 3.57	< 2.17	NC
	n-heptane	< 2.05	< 2.05	NC	< 2.05	< 2.05	NC	< 2.05	< 7.40	NC	< 2.05	< 2.05	NC	< 3.37	< 2.05	NC
	n-hexane	< 3.52	< 3.52	NC	< 3.52	< 3.52	NC	< 3.52	< 12.7	NC	< 3.52	< 3.52	NC	< 5.79	<b>7.89</b>	NC
	styrene	< 2.13	< 2.13	NC	< 2.13	< 2.13	NC	< 2.13	< 7.69	NC	< 2.13	< 2.13	NC	< 3.50	< 2.13	NC
	tetrachloroethene	< 3.39	< 3.39	NC	< 3.39	< 3.39	NC	< 3.39	< 12.2	NC	< 3.39	< 3.39	NC	< 5.57	< 3.39	NC
	tetrahydrofuran	< 1.47	< 1.47	NC	< 1.47	<b>2.42</b>	NC	< 1.47	< 5.32	NC	< 1.47	< 1.47	NC	< 2.42	< 1.47	NC
	toluene	< 1.88	< 1.88	NC	< 1.88	< 1.88	NC	< 1.88	< 6.80	NC	< 1.88	< 1.88	NC	< 3.10	< 1.88	NC
trichloroethene	< 2.68	< 2.68	NC	< 2.68	< 2.68	NC	< 2.68	< 9.70	NC	< 2.68	< 2.68	NC	< 4.41	< 2.68	NC	
trichlorofluoromethane	< 2.81	< 2.81	NC	< 2.81	< 2.81	NC	< 2.81	< 10.1	NC	< 2.81	< 2.81	NC	< 4.61	< 2.81	NC	

RPD - Relative Percent Difference = ABS(Dup-Sample)/((Dup+Sample)/2)\*100  
 NC - RPD not calculable due to a non-detect in one or both of the collocated samples

**Table 5-2. Comparison of VOC Vent Stack Air Sample Results - Collocated Sampler Precision**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Mar-07			Apr-07			May-07			Jun-07			July/Aug-07		
		VS-14-10	VS-14-10 Dup	RPD (%)	VS-16-11	VS-16-11 Dup	RPD (%)	VS-8-12	VS-8-12 Dup	RPD (%)	VS-9-13	VS-9-13 Dup	RPD (%)	VS-14-14	VS-14-14 Dup	RPD (%)
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	NC	< 3.71	x	N/A	< 3.71	< 7.93	NC	< 74.2	< 74.2	NC	< 148	< 148	NC
	1,2,4-trimethylbenzene	< 2.46	< 2.46	NC	< 2.46	x	N/A	< 2.46	< 5.25	NC	< 49.1	< 49.1	NC	< 98.2	< 98.2	NC
	2,2,4-trimethylpentane	<b>13.6</b>	<b>13.5</b>	<b>0.74</b>	< 2.33	x	N/A	< 2.33	< 4.99	NC	<b>89.3</b>	<b>94.9</b>	<b>6.08</b>	<b>122</b>	<b>165</b>	<b>29.97</b>
	2-butanone	<b>110</b>	<b>J 139</b>	<b>J 23.29</b>	<b>7.72</b>	x	N/A	<b>25.3</b>	<b>14.6</b>	<b>53.63</b>	<b>52.6</b>	<b>85.3</b>	<b>47.43</b>	< 58.9	< 58.9	NC
	acetone	<4.75	<4.75	NC	<b>49.3</b>	x	N/A	<b>41.1</b>	<b>57</b>	<b>32.42</b>	< 94.9	< 94.9	NC	< 190	< 190	NC
	benzene	<b>5.74</b>	<b>6</b>	<b>4.43</b>	< 1.60	x	N/A	< 1.60	< 3.41	NC	< 31.9	< 31.9	NC	< 63.8	< 63.8	NC
	carbon disulfide	<1.56	<1.56	NC	<b>4.45</b>	x	N/A	< 1.56	< 3.33	NC	< 31.1	< 31.1	NC	< 62.2	< 62.2	NC
	chloroform	<2.44	<b>2.49</b>	NC	< 2.44	x	N/A	< 2.44	< 5.22	NC	< 48.8	< 48.8	NC	< 97.6	< 97.6	NC
	chloromethane	< 1.03	< 1.03	NC	< 1.03	x	N/A	< 1.03	< 2.20	NC	< 20.6	< 20.6	NC	< 41.3	< 41.3	NC
	cyclohexane	<b>47.3</b>	<b>49.9</b>	<b>5.35</b>	< 1.72	x	N/A	<b>3.3</b>	< 3.68	NC	<b>92.4</b>	<b>106</b>	<b>13.71</b>	<b>256</b>	<b>347</b>	<b>30.18</b>
	ethanol	<b>32.3</b>	<b>32.5</b>	<b>0.62</b>	<b>8.19</b>	x	N/A	<b>10.3</b>	<b>13.1</b>	<b>23.93</b>	< 75.3	<b>93.1</b>	NC	< 151	< 151	NC
	ethylbenzene	< 2.17	< 2.17	NC	< 2.17	x	N/A	< 2.17	< 4.64	NC	< 43.4	< 43.4	NC	< 86.8	< 86.8	NC
	isopropanol	<1.23	<1.23	NC	< 1.23	x	N/A	< 1.23	<b>17.8</b>	NC	< 24.6	< 24.6	NC	< 49.1	< 49.1	NC
	methylene chloride	<b>4.1</b>	<3.47	NC	< 3.47	x	N/A	<b>4.45</b>	<b>17.3</b>	<b>118.16</b>	< 69.4	< 69.4	NC	< 139	< 139	NC
	methyl tert butyl ether	<b>213</b>	<b>225</b>	<b>5.48</b>	< 1.80	x	N/A	<b>4.53</b>	< 3.85	NC	<b>149</b>	<b>172</b>	<b>14.33</b>	<b>563</b>	<b>708</b>	<b>22.82</b>
	p/m-xylene	< 4.34	< 4.34	NC	< 4.34	x	N/A	< 4.34	< 9.28	NC	< 86.8	< 86.8	NC	< 174	< 174	NC
	o-xylene	<b>2.56</b>	<b>2.91</b>	<b>12.80</b>	< 2.17	x	N/A	< 2.17	< 4.64	NC	< 43.4	< 43.4	NC	< 86.8	< 86.8	NC
	n-heptane	<b>8.19</b>	<b>8.35</b>	<b>1.93</b>	< 2.05	x	N/A	< 2.05	< 4.38	NC	< 41.0	< 41.0	NC	< 81.9	< 81.9	NC
	n-hexane	<b>205</b>	<b>223</b>	<b>8.41</b>	<b>5.78</b>	x	N/A	< 3.52	< 7.53	NC	< 70.4	<b>110</b>	NC	<b>651</b>	<b>857</b>	<b>27.32</b>
	styrene	< 2.13	< 2.13	NC	< 2.13	x	N/A	< 2.13	< 4.55	NC	< 42.6	< 42.6	NC	< 85.1	< 85.1	NC
	tetrachloroethene	<3.39	<3.39	NC	< 3.39	x	N/A	< 3.39	< 7.24	NC	< 67.8	< 67.8	NC	< 136	< 136	NC
	tetrahydrofuran	<b>96.7</b>	<b>118</b>	<b>19.84</b>	<b>28.6</b>	x	N/A	<b>27.1</b>	<b>23.9</b>	<b>12.55</b>	< 29.5	< 29.5	NC	< 58.9	< 58.9	NC
	toluene	<b>13.9</b>	<b>14.4</b>	<b>3.53</b>	<b>2.48</b>	x	N/A	< 1.88	< 4.02	NC	< 37.6	< 37.6	NC	< 75.3	< 75.3	NC
trichloroethene	<2.68	<b>2.79</b>	NC	< 2.68	x	N/A	<b>4.54</b>	< 5.74	NC	< 53.7	< 53.7	NC	< 107	< 107	NC	
trichlorofluoromethane	<2.81	<2.81	NC	< 2.81	x	N/A	<b>4.76</b>	< 6.00	NC	< 56.1	< 56.1	NC	< 112	< 112	NC	

RPD - Relative Percent Difference = ABS(Dup-Sample)/((Dup+Sample)/2)\*100  
 NC - RPD not calculable due to a non-detect in one or both of the collocated samples  
 x - this sample not analyzed due to a flow controller malfunction  
 N/A - Not Available

**Table 6-1. Indoor Air Quality Sample Results - March 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank
		A-10	B-10	C-10	BG-10	BG-10 Dup	
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	<2.33	<2.33	<2.33	<2.33	<2.33	<2.33
	2-butanone	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47
	acetone <sup>(1)</sup>	<b>12 J</b>	<b>7.33 J</b>	<b>9.54 J</b>	<b>5.51 J</b>	<4.75	<4.75
	benzene	<1.60	<1.60	<1.60	<1.60	<1.60	<1.60
	carbon disulfide	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56
	chloroform	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
	chloromethane	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03
	cyclohexane	<1.72	<1.72	<b>2.2</b>	<1.72	<1.72	<1.72
	ethanol <sup>(1)</sup>	<b>46.4</b>	<b>9.77</b>	<b>13.7</b>	<3.76	<3.76	<3.76
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	<b>11.2</b>	<1.23	<b>4.3</b>	<1.23	<1.23	<1.23
	methylene chloride <sup>(1)</sup>	<3.47	<b>4.13</b>	<3.47	<b>6.8</b>	<3.47	<3.47
	methyl tert butyl ether	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34
	o-xylene	<2.17	<2.17	<2.17	<2.17	<2.17	<2.17
	n-heptane	<2.05	<2.05	<2.05	<2.05	<2.05	<2.05
	n-hexane	<3.52	<3.52	<3.52	<3.52	<3.52	<3.52
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13
	tetrachloroethene	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39
	tetrahydrofuran	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47
	toluene	<b>2.64</b>	<b>1.92</b>	<b>3.01</b>	<1.88	<1.88	<1.88
trichloroethene	<2.68	<2.68	<2.68	<2.68	<2.68	<2.68	
trichlorofluoromethane	<2.81	<2.81	<2.81	<2.81	<2.81	<2.81	
PCBs (ug/m <sup>3</sup> )							
	Total PCBs	<b>0.0015</b>	<b>0.00064</b>	<b>0.00037</b>	< 0.00037	< 0.00038	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for indoor air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 6-2. Indoor Air Quality Sample Results - April 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank
		A-11	B-11	C-11	BG-11	BG-11 Dup	
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	<b>12.2</b>	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33
	2-butanone	<b>23.6</b>	< 1.47	< 1.47	< 1.47	< 1.47	< 1.47
	acetone <sup>(1)</sup>	<b>60.3</b>	<b>13.3</b>	<b>21.4</b>	<b>15.7</b>	<b>19.5</b>	< 4.75
	benzene	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56
	chloroform	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44
	chloromethane	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03
	cyclohexane	< 1.72	< 1.72	< 1.72	< 1.72	< 1.72	< 1.72
	ethanol <sup>(1)</sup>	<b>160</b>	<b>7.89</b>	<b>4.16</b>	<b>5.76</b>	< 3.76	< 3.76
	ethylbenzene	<b>9.94</b>	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	< 1.23	< 1.23	< 1.23	< 1.23	< 1.23	< 1.23
	methylene chloride <sup>(1)</sup>	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80
	p/m-xylene	<b>37.4</b>	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34
	o-xylene	<b>13.4</b>	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17
	n-heptane	<b>16.5</b>	< 2.05	< 2.05	< 2.05	< 2.05	< 2.05
	n-hexane	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13
tetrachloroethene	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39	
tetrahydrofuran	< 1.47	< 1.47	< 1.47	< 1.47	<b>2.42</b>	< 1.47	
toluene	<b>33.1</b>	<b>2.07</b>	<b>2.45</b>	< 1.88	< 1.88	< 1.88	
trichloroethene	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	
trichlorofluoromethane	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	
PCBs (ug/m <sup>3</sup> )							
	Total PCBs	<b>0.0013</b>	<b>0.00031</b>	<b>0.0016</b>	< 0.00019	< 0.00019	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for indoor air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

Table 6-3. Indoor Air Quality Sample Results - May 2007

Keith Middle School  
New Bedford, Massachusetts

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank
		A-12	B-12	C-12	BG-12	BG-12 Dup	
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	<b>11.7</b>	< 3.71	< 3.71	< 3.71	< 13.4	< 3.71
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 8.87	< 2.46
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 2.33	< 8.43	< 2.33
	2-butanone	< 1.47	< 1.47	<b>2.09</b>	< 1.47	< 5.32	< 1.47
	acetone <sup>(1)</sup>	<b>7.45</b>	<b>17.5</b>	<b>11.5</b>	< 4.75	< 17.2	< 4.75
	benzene	< 1.60	< 1.60	< 1.60	< 1.60	< 5.77	< 1.60
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 1.56	< 5.62	< 1.56
	chloroform	< 2.44	< 2.44	< 2.44	< 2.44	< 8.81	< 2.44
	chloromethane	< 1.03	< 1.03	< 1.03	<b>1.13</b>	< 3.73	< 1.03
	cyclohexane	< 1.72	< 1.72	< 1.72	< 1.72	< 6.21	< 1.72
	ethanol <sup>(1)</sup>	<b>9.19</b>	<b>27.4</b>	<b>17.6</b>	< 3.76	< 13.6	< 3.76
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 7.84	< 2.17
	isopropanol <sup>(1)</sup>	< 1.23	<b>7.96</b>	< 1.23	< 1.23	<b>6.77</b>	< 1.23
	methylene chloride <sup>(1)</sup>	< 3.47	<b>3.48</b>	<b>4.06</b>	< 3.47	<b>14.8</b>	< 3.47
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 1.80	< 6.51	< 1.80
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 15.7	< 4.34
	o-xylene	< 2.17	< 2.17	< 2.17	< 2.17	< 7.84	< 2.17
	n-heptane	< 2.05	< 2.05	< 2.05	< 2.05	< 7.40	< 2.05
	n-hexane	< 3.52	< 3.52	< 3.52	< 3.52	< 12.7	< 3.52
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 7.69	< 2.13
tetrachloroethene	< 3.39	< 3.39	< 3.39	< 3.39	< 12.2	< 3.39	
tetrahydrofuran	< 1.47	< 1.47	< 1.47	< 1.47	< 5.32	< 1.47	
toluene	< 1.88	<b>2.14</b>	< 1.88	< 1.88	< 6.80	< 1.88	
trichloroethene	< 2.68	< 2.68	< 2.68	< 2.68	< 9.70	< 2.68	
trichlorofluoromethane	< 2.81	< 2.81	< 2.81	< 2.81	< 10.1	< 2.81	
PCBs (ug/m <sup>3</sup> )							
	Total PCBs	<b>0.00038</b>	<b>0.001</b>	<b>0.00051</b>	< 0.00021	< 0.00020	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for indoor air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 6-4. Indoor Air Quality Sample Results - June 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank
		A-13	B-13	C-13	BG-13	BG-13 Dup	
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 2.46	< 2.46	<b>4.85</b>	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33
	2-butanone	<b>5.33</b>	<b>3.3</b>	<b>11.5</b>	<b>2.24</b>	<b>2.39</b>	< 1.47
	acetone <sup>(1)</sup>	<b>134</b>	<b>31.5</b>	<b>78.6</b>	<b>24.2</b>	<b>24.2</b>	< 4.75
	benzene	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56
	chloroform	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44
	chloromethane	<b>4.01</b>	<b>4.11</b>	<b>15</b>	<b>1.68</b>	<b>1.72</b>	< 1.03
	cyclohexane	< 1.72	< 1.72	<b>7.36</b>	< 1.72	< 1.72	< 1.72
	ethanol <sup>(1)</sup>	<b>24.1</b>	<b>6.98</b>	<b>12.6</b>	<b>5.12</b>	<b>9.95</b>	< 3.76
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	<b>7.9</b>	< 1.23	<b>1.47</b>	< 1.23	< 1.23	< 1.23
	methylene chloride <sup>(1)</sup>	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34
	o-xylene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17
	n-heptane	< 2.05	< 2.05	< 2.05	< 2.05	< 2.05	< 2.05
	n-hexane	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52
	styrene	<b>3.63</b>	< 2.13	<b>4.69</b>	< 2.13	< 2.13	< 2.13
	tetrachloroethene	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39
	tetrahydrofuran	<b>7.05</b>	< 1.47	< 1.47	< 1.47	< 1.47	< 1.47
	toluene	<b>3.59</b>	<b>2.88</b>	<b>10.6</b>	< 1.88	< 1.88	< 1.88
trichloroethene	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	
trichlorofluoromethane	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	
PCBs (ug/m <sup>3</sup> )	Total PCBs	<b>0.003</b>	<b>0.0032</b>	<b>0.0016</b>	< 0.00020	< 0.00019	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for indoor air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 6-5. Indoor Air Quality Sample Results - July/August 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank
		A-14	B-14	C-14	BG-14	BG-14 Dup	
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 6.10	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 2.46	< 2.46	<b>2.46</b>	< 4.04	< 2.46	< 2.46
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 3.84	< 2.33	< 2.33
	2-butanone	<b>4.82</b>	<b>5.8</b>	<b>12.4</b>	< 2.42	< 1.47	< 1.47
	acetone <sup>(1)</sup>	<b>58.5</b>	<b>31.6</b>	<b>50.6</b>	<b>15.6</b>	<b>14.9</b>	< 4.75
	benzene	< 1.60	< 1.60	< 1.60	< 2.62	< 1.60	< 1.60
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 2.56	< 1.56	< 1.56
	chloroform	< 2.44	< 2.44	< 2.44	< 4.01	< 2.44	< 2.44
	chloromethane	< 1.03	< 1.03	< 1.03	<b>1.74</b>	<b>1.74</b>	< 1.03
	cyclohexane	< 1.72	< 1.72	<b>3.6</b>	< 2.83	< 1.72	< 1.72
	ethanol <sup>(1)</sup>	<b>41</b>	<b>23.8</b>	<b>61.5</b>	< 6.19	<b>6.57</b>	< 3.76
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 3.57	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	<b>13.4</b>	<b>6.67</b>	<b>11.3</b>	<b>3.44</b>	<b>2.68</b>	< 1.23
	methylene chloride <sup>(1)</sup>	<b>17</b>	<b>19.3</b>	<b>318</b>	<b>18.8</b>	<b>21.2</b>	<b>7.48</b>
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 2.96	< 1.80	< 1.80
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 7.13	< 4.34	< 4.34
	o-xylene	< 2.17	< 2.17	< 2.17	< 3.57	< 2.17	< 2.17
	n-heptane	< 2.05	< 2.05	< 2.05	< 3.37	< 2.05	< 2.05
	n-hexane	<b>4.82</b>	<b>4.09</b>	<b>145</b>	< 5.79	<b>7.89</b>	< 3.52
	styrene	<b>7.26</b>	<b>3.52</b>	<b>3.05</b>	< 3.50	< 2.13	< 2.13
	tetrachloroethene	< 3.39	< 3.39	< 3.39	< 5.57	< 3.39	< 3.39
tetrahydrofuran	< 1.47	<b>4.52</b>	< 1.47	< 2.42	< 1.47	< 1.47	
toluene	<b>5.93</b>	<b>3.65</b>	<b>10.7</b>	< 3.10	< 1.88	< 1.88	
trichloroethene	< 2.68	< 2.68	< 2.68	< 4.41	< 2.68	< 2.68	
trichlorofluoromethane	< 2.81	< 2.81	<b>3.08</b>	< 4.61	< 2.81	< 2.81	
PCBs (ug/m <sup>3</sup> )	Total PCBs	<b>0.0018</b>	< 0.00038	<b>0.0057</b>	< 0.00015	< 0.0015	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for indoor air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 6-6. Vent Stack Sample Results - March 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC
		VS-14-10	VS-14-10 Dup	VS-1-10	VS-7-10	VS-4-10	VS-BG-10	Trip Blank-VS
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	<b>13.6</b>	<b>13.5</b>	<2.33	<2.33	<2.33	<2.33	<2.33
	2-butanone	<b>110 J</b>	<b>139 J</b>	<b>114 J</b>	<b>33.3 J</b>	<b>109 J</b>	<1.47	<1.47
	acetone <sup>(1)</sup>	<4.75	<4.75	<b>44.1 J</b>	<b>42.6 J</b>	<b>60.3 J</b>	<4.75	<4.75
	benzene	<b>5.74</b>	<b>6</b>	<1.60	<1.60	<1.60	<1.60	<1.60
	carbon disulfide	<1.56	<1.56	<b>2.24</b>	<1.56	<1.56	<1.56	<1.56
	chloroform	<2.44	<b>2.49</b>	<b>4.15</b>	<b>4.78</b>	<2.44	<2.44	<2.44
	chloromethane	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03
	cyclohexane	<b>47.3</b>	<b>49.9</b>	<b>1.99</b>	<b>7.12</b>	<1.72	<1.72	<1.72
	ethanol <sup>(1)</sup>	<b>32.3</b>	<b>32.5</b>	<b>22</b>	<b>11.3</b>	<b>56.1</b>	<3.76	<3.76
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	<1.23	<1.23	<b>8.2</b>	<1.23	<b>14.2</b>	<1.23	<1.23
	methylene chloride <sup>(1)</sup>	<b>4.1</b>	<3.47	<b>4.16</b>	<3.47	<3.47	<3.47	<3.47
	methyl tert butyl ether	<b>213</b>	<b>225</b>	<1.80	<b>2.3</b>	<1.80	<1.80	<1.80
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34
	o-xylene	<b>2.56</b>	<b>2.91</b>	<2.17	<2.17	<2.17	<2.17	<2.17
	n-heptane	<b>8.19</b>	<b>8.35</b>	<b>5.28</b>	<2.05	<b>8.56</b>	<2.05	<2.05
	n-hexane	<b>205</b>	<b>223</b>	<3.52	<b>5.28</b>	<3.52	<3.52	<3.52
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13
	tetrachloroethene	<3.39	<3.39	<b>5.56</b>	<3.39	<b>4.88</b>	<3.39	<3.39
tetrahydrofuran	<b>96.7</b>	<b>118</b>	<b>73.2</b>	<b>51.3</b>	<b>72.3</b>	<1.47	<1.47	
toluene	<b>13.9</b>	<b>14.4</b>	<1.88	<1.88	<1.88	<1.88	<1.88	
trichloroethene	<2.68	<b>2.79</b>	<b>4.94</b>	<b>3.92</b>	<2.68	<2.68	<2.68	
trichlorofluoromethane	<2.81	<2.81	<2.81	<b>3.76</b>	<2.81	<2.81	<2.81	
PCBs (ug/m <sup>3</sup> )								
	Total PCBs	< 0.021	< 0.021	< 0.021	< 0.021	<b>0.017 J</b>	< 0.016	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for vent stack air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 6-7. Vent Stack Sample Results - April 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC
		VS-10-11	VS-16-11	VS-16-11 Dup	VS-1-11	VS-4-11	VS-BG-11	Trip Blank-VS
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	x	< 3.71	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 2.46	< 2.46	x	< 2.46	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	< 2.33	< 2.33	x	< 2.33	< 2.33	< 2.33	< 2.33
	2-butanone	< 1.47	<b>7.72</b>	x	<b>4.8</b>	< 1.47	< 1.47	< 1.47
	acetone <sup>(1)</sup>	<b>64.4</b>	<b>49.3</b>	x	<b>55.4</b>	<b>15.4</b>	<b>7.07</b>	< 4.75
	benzene	< 1.60	< 1.60	x	< 1.60	< 1.60	< 1.60	< 1.60
	carbon disulfide	<b>4.6</b>	<b>4.45</b>	x	<b>4.98</b>	<b>5.57</b>	<b>4.45</b>	< 1.56
	chloroform	< 2.44	< 2.44	x	<b>2.88</b>	< 2.44	< 2.44	< 2.44
	chloromethane	< 1.03	< 1.03	x	< 1.03	< 1.03	< 1.03	< 1.03
	cyclohexane	< 1.72	< 1.72	x	< 1.72	< 1.72	< 1.72	< 1.72
	ethanol <sup>(1)</sup>	< 3.76	<b>8.19</b>	x	<b>6.63</b>	<b>15.7</b>	< 3.76	< 3.76
	ethylbenzene	< 2.17	< 2.17	x	< 2.17	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	< 1.23	< 1.23	x	<b>15.8</b>	<b>2.8</b>	< 1.23	< 1.23
	methylene chloride <sup>(1)</sup>	< 3.47	< 3.47	x	< 3.47	< 3.47	< 3.47	< 3.47
	methyl tert butyl ether	< 1.80	< 1.80	x	< 1.80	< 1.80	< 1.80	< 1.80
	p/m-xylene	< 4.34	< 4.34	x	< 4.34	< 4.34	< 4.34	< 4.34
	o-xylene	< 2.17	< 2.17	x	< 2.17	< 2.17	< 2.17	< 2.17
	n-heptane	< 2.05	< 2.05	x	< 2.05	< 2.05	< 2.05	< 2.05
	n-hexane	<b>7.22</b>	<b>5.78</b>	x	<b>6.27</b>	< 3.52	< 3.52	< 3.52
	styrene	< 2.13	< 2.13	x	< 2.13	< 2.13	< 2.13	< 2.13
	tetrachloroethene	< 3.39	< 3.39	x	< 3.39	< 3.39	< 3.39	< 3.39
tetrahydrofuran	<b>3.71</b>	<b>28.6</b>	x	<b>24.8</b>	<b>5.63</b>	< 1.47	< 1.47	
toluene	< 1.88	<b>2.48</b>	x	< 1.88	< 1.88	< 1.88	< 1.88	
trichloroethene	< 2.68	< 2.68	x	< 2.68	< 2.68	< 2.68	< 2.68	
trichlorofluoromethane	< 2.81	< 2.81	x	< 2.81	< 2.81	< 2.81	< 2.81	
PCBs (ug/m <sup>3</sup> )	Total PCBs	< 0.015	< 0.016	< 0.015	< 0.016	< 0.012	< 0.018	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for vent stack air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

x - this sample not analyzed due to a flow controller malfunction

**Table 6-8. Vent Stack Sample Results - May 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC
		VS-11-12	VS-8-12	VS-8-12 Dup	VS-1-12	VS-4-12	VS-BG-12	Trip Blank-VS
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 7.93	< 3.71	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	<b>3.55</b>	< 2.46	< 5.25	< 2.46	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 4.99	< 2.33	< 2.33	< 2.33	< 2.33
	2-butanone	<b>25.1</b>	<b>25.3</b>	<b>14.6</b>	<b>9.94</b>	<b>3.2</b>	<b>1.51</b>	< 1.47
	acetone <sup>(1)</sup>	< 4.75	<b>41.1</b>	<b>57</b>	<b>16.5</b>	<b>42.6</b>	< 4.75	< 4.75
	benzene	< 1.60	< 1.60	< 3.41	< 1.60	< 1.60	< 1.60	< 1.60
	carbon disulfide	< 1.56	< 1.56	< 3.33	< 1.56	< 1.56	<b>1.62</b>	< 1.56
	chloroform	< 2.44	< 2.44	< 5.22	<b>3.47</b>	< 2.44	< 2.44	< 2.44
	chloromethane	< 1.03	< 1.03	< 2.20	< 1.03	< 1.03	<b>1.44</b>	< 1.03
	cyclohexane	<b>3.44</b>	<b>3.3</b>	< 3.68	< 1.72	< 1.72	< 1.72	< 1.72
	ethanol <sup>(1)</sup>	<b>5.4</b>	<b>10.3</b>	<b>13.1</b>	<b>10.5</b>	<b>27.2</b>	< 3.76	< 3.76
	ethylbenzene	<b>12.9</b>	< 2.17	< 4.64	< 2.17	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	< 1.23	< 1.23	<b>17.8</b>	<b>2.55</b>	<b>16.8</b>	< 1.23	< 1.23
	methylene chloride <sup>(1)</sup>	< 3.47	<b>4.45</b>	<b>17.3</b>	< 3.47	< 3.47	< 3.47	< 3.47
	methyl tert butyl ether	<b>93.9</b>	<b>4.53</b>	< 3.85	< 1.80	< 1.80	< 1.80	< 1.80
	p/m-xylene	<b>5.28</b>	< 4.34	< 9.28	< 4.34	< 4.34	< 4.34	< 4.34
	o-xylene	<b>2.73</b>	< 2.17	< 4.64	< 2.17	< 2.17	< 2.17	< 2.17
	n-heptane	< 2.05	< 2.05	< 4.38	< 2.05	< 2.05	< 2.05	< 2.05
	n-hexane	<b>8.02</b>	< 3.52	< 7.53	< 3.52	< 3.52	< 3.52	< 3.52
	styrene	<b>10.6</b>	< 2.13	< 4.55	< 2.13	< 2.13	< 2.13	< 2.13
tetrachloroethene	< 3.39	< 3.39	< 7.24	< 3.39	< 3.39	< 3.39	< 3.39	
tetrahydrofuran	<b>24.2</b>	<b>27.1</b>	<b>23.9</b>	<b>18.9</b>	<b>3</b>	< 1.47	< 1.47	
toluene	<b>5.97</b>	< 1.88	< 4.02	< 1.88	< 1.88	< 1.88	< 1.88	
trichloroethene	< 2.68	<b>4.54</b>	< 5.74	< 2.68	< 2.68	< 2.68	< 2.68	
trichlorofluoromethane	<b>8.76</b>	<b>4.76</b>	< 6.00	<b>3.48</b>	< 2.81	< 2.81	< 2.81	
PCBs (ug/m <sup>3</sup> )								
	Total PCBs	< 0.028	< 0.023	< 0.024	< 0.022	< 0.022	< 0.020	< 0.025

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for vent stack air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 6-9. Vent Stack Sample Results - June 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC
		VS-9-13	VS-9-13 Dup	VS-1-13	VS-7-13	VS-4-13	VS-BG-13	Trip Blank-VS
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 74.2	< 74.2	< 3.71	< 74.2	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 49.1	< 49.1	< 2.46	< 49.1	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	<b>89.3</b>	<b>94.9</b>	< 2.33	< 46.7	< 2.33	< 2.33	< 2.33
	2-butanone	<b>52.6</b>	<b>85.3</b>	<b>26.1</b>	<b>44.6</b>	<b>30</b>	<b>1.71</b>	< 1.47
	acetone <sup>(1)</sup>	< 94.9	< 94.9	<b>84.3</b>	< 94.9	<b>114</b>	<b>17.6</b>	< 4.75
	benzene	< 31.9	< 31.9	< 1.60	< 31.9	< 1.60	< 1.60	< 1.60
	carbon disulfide	< 31.1	< 31.1	< 1.56	< 31.1	< 1.56	< 1.56	< 1.56
	chloroform	< 48.8	< 48.8	< 2.44	< 48.8	< 2.44	< 2.44	< 2.44
	chloromethane	< 20.6	< 20.6	< 1.03	< 20.6	<b>4.21</b>	<b>1.57</b>	< 1.03
	cyclohexane	<b>92.4</b>	<b>106</b>	< 1.72	< 34.4	< 1.72	< 1.72	< 1.72
	ethanol <sup>(1)</sup>	< 75.3	<b>93.1</b>	<b>98.5</b>	< 75.3	<b>5.4</b>	< 3.76	< 3.76
	ethylbenzene	< 43.4	< 43.4	< 2.17	< 43.4	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	< 24.6	< 24.6	<b>6.71</b>	< 24.6	<b>2.38</b>	< 1.23	< 1.23
	methylene chloride <sup>(1)</sup>	< 69.4	< 69.4	< 3.47	< 69.4	<b>3.8</b>	< 3.47	< 3.47
	methyl tert butyl ether	<b>149</b>	<b>172</b>	< 1.80	< 36.0	< 1.80	< 1.80	< 1.80
	p/m-xylene	< 86.8	< 86.8	< 4.34	< 86.8	< 4.34	< 4.34	< 4.34
	o-xylene	< 43.4	< 43.4	< 2.17	< 43.4	< 2.17	< 2.17	< 2.17
	n-heptane	< 41.0	< 41.0	<b>2.31</b>	< 41.0	< 2.05	< 2.05	< 2.05
	n-hexane	< 70.4	<b>110</b>	< 3.52	< 70.4	< 3.52	< 3.52	< 3.52
	styrene	< 42.6	< 42.6	< 2.13	< 42.6	2.13	< 2.13	< 2.13
tetrachloroethene	< 67.8	< 67.8	< 3.39	< 67.8	3.39	< 3.39	< 3.39	
tetrahydrofuran	< 29.5	< 29.5	<b>6.42</b>	< 29.5	<b>3.85</b>	< 1.47	< 1.47	
toluene	< 37.6	< 37.6	<b>1.88</b>	< 37.6	<b>2.03</b>	< 1.88	< 1.88	
trichloroethene	< 53.7	< 53.7	< 2.68	< 53.7	< 2.68	<b>3.61</b>	< 2.68	
trichlorofluoromethane	< 56.1	< 56.1	< 2.81	< 56.1	< 2.81	< 2.81	< 2.81	
PCBs (ug/m <sup>3</sup> )	Total PCBs	< 0.020	< 0.021	< 0.021	< 0.020	< 0.022	< 0.021	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for vent stack air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 6-10. Vent Stack Sample Results - July/August 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC
		VS-14-14	VS-14-14 Dup	VS-1-14	VS-16-14	VS-4-14	VS-BG-14	Trip Blank-VS
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 148	< 148	< 14.8	< 14.8	< 3.71	< 3.71	< 3.71
	1,2,4-trimethylbenzene	< 98.2	< 98.2	< 9.82	< 9.82	< 2.46	< 2.46	< 2.46
	2,2,4-trimethylpentane	<b>122</b>	<b>165</b>	< 9.34	< 9.34	< 2.33	< 2.33	< 2.33
	2-butanone	< 58.9	< 58.9	<b>46.1</b>	<b>42.2</b>	<b>42.7</b>	<b>1.59</b>	< 1.47
	acetone <sup>(1)</sup>	< 190	< 190	<b>57.4</b>	<b>54.5</b>	<b>75</b>	<b>15.3</b>	<b>5.97</b>
	benzene	< 63.8	< 63.8	< 6.38	< 6.38	<b>1.81</b>	< 1.60	< 1.60
	carbon disulfide	< 62.2	< 62.2	< 6.22	< 6.22	<b>2.67</b>	< 1.56	< 1.56
	chloroform	< 97.6	< 97.6	< 9.76	< 9.76	< 2.44	< 2.44	< 2.44
	chloromethane	< 41.3	< 41.3	< 4.13	< 4.13	< 1.03	<b>1.67</b>	< 1.03
	cyclohexane	<b>256</b>	<b>347</b>	< 6.88	< 6.88	< 1.72	< 1.72	< 1.72
	ethanol <sup>(1)</sup>	< 151	< 151	<b>15.9</b>	< 15.1	<b>94</b>	<b>5.67</b>	< 3.76
	ethylbenzene	< 86.8	< 86.8	< 8.68	< 8.68	< 2.17	< 2.17	< 2.17
	isopropanol <sup>(1)</sup>	< 49.1	< 49.1	<b>7.79</b>	< 4.91	<b>15.7</b>	< 1.23	<b>8.76</b>
	methylene chloride <sup>(1)</sup>	< 139	< 139	<b>19.1</b>	<b>17.5</b>	<b>37.6</b>	<b>15.6</b>	<b>19</b>
	methyl tert butyl ether	<b>563</b>	<b>708</b>	< 7.20	< 7.20	< 1.80	< 1.80	< 1.80
	p/m-xylene	< 174	< 174	< 17.4	< 17.4	< 4.34	< 4.34	< 4.34
	o-xylene	< 86.8	< 86.8	< 8.68	< 8.68	< 2.17	< 2.17	< 2.17
	n-heptane	< 81.9	< 81.9	< 8.19	< 8.19	<b>3.19</b>	< 2.05	< 2.05
	n-hexane	<b>651</b>	<b>857</b>	< 14.1	< 14.1	<b>8.58</b>	<b>4.23</b>	<b>4.46</b>
	styrene	< 85.1	< 85.1	< 8.51	< 8.51	< 2.13	< 2.13	< 2.13
tetrachloroethene	< 136	< 136	< 13.6	< 13.6	< 3.39	< 3.39	< 3.39	
tetrahydrofuran	< 58.9	< 58.9	<b>13.8</b>	<b>130</b>	<b>21.2</b>	< 1.47	< 1.47	
toluene	< 75.3	< 75.3	< 7.53	< 7.53	< 1.88	< 1.88	< 1.88	
trichloroethene	< 107	< 107	< 10.7	< 10.7	< 2.68	< 2.68	< 2.68	
trichlorofluoromethane	< 112	< 112	< 11.2	< 11.2	< 2.81	< 2.81	< 2.81	
PCBs (ug/m <sup>3</sup> )								
	Total PCBs	< 0.021	< 0.022	<b>0.01</b>	< 0.021	<b>0.028</b>	< 0.020	< 0.025 ug

**Notes:**

J - Concentration should be considered estimated.

ND - Non-detect

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

PCBs - polychlorinated biphenyls

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

\* - Results for vent stack air are compared to contemporary outdoor air (background) sample

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-1. Comparison of PCB Indoor Air Quality Sample Results to Risk-Based Air Concentrations - March 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC	Comparison Values	
		A-10	B-10	C-10	BG-10	BG-10 Dup	Trip Blank	AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )								AL*	ALTAEC*
	Total PCBs	0.0015	0.00064	0.00037	< 0.00037	< 0.00038	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for indoor air are compared to contemporary outdoor air (background) sample.

\* PCBs are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC).

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-2. Comparison of PCB Indoor Air Quality Sample Results to Risk-Based Air Concentrations - April 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank	Comparison Values	
		A-11	B-11	C-11	BG-11	BG-11 Dup		AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )								AL*	ALTAEC*
	Total PCBs	<b>0.0013</b>	<b>0.00031</b>	<b>0.0016</b>	< 0.00019	< 0.00019	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for indoor air are compared to contemporary outdoor air (background) sample.

\* PCBs are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC).

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-3. Comparison of PCB Indoor Air Quality Sample Results to Risk-Based Air Concentrations - May 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank	Comparison Values	
		A-12	B-12	C-12	BG-12	BG-12 Dup		AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )								AL*	ALTAEC*
	Total PCBs	<b>0.00038</b>	<b>0.001</b>	<b>0.00051</b>	< 0.00021	< 0.00020	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for indoor air are compared to contemporary outdoor air (background) sample.

\* PCBs are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC).

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-4. Comparison of PCB Indoor Air Quality Sample Results to Risk-Based Air Concentrations - June 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank	Comparison Values	
		A-13	B-13	C-13	BG-13	BG-13 Dup		AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )									
	Total PCBs	<b>0.003</b>	<b>0.0032</b>	<b>0.0016</b>	< 0.00020	< 0.00019	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for indoor air are compared to contemporary outdoor air (background) sample.

\* PCBs are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC).

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-5. Comparison of PCB Indoor Air Quality Sample Results to Risk-Based Air Concentrations - July/August 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank	Comparison Values	
		A-14	B-14	C-14	BG-14	BG-14 Dup		AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )								AL*	ALTAEC*
	Total PCBs	<b>0.0018</b>	< 0.00038	<b>0.0057</b>	< 0.00015	< 0.0015	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for indoor air are compared to contemporary outdoor air (background) sample.

\* PCBs are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC).

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-6. Comparison of PCB Vent Stack Air Sample Results to Risk-Based Air Concentrations - March 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	Comparison Values	
		VS-14-10	VS-14-10 Dup	VS-1-10	VS-7-10	VS-4-10	VS-BG-10	Trip Blank-VS	AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )										
	Total PCBs	< 0.021	< 0.021	< 0.021	< 0.021	<b>0.017 J</b>	< 0.016	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for vent stack air are compared to contemporary outdoor air (background) sample.

\* PCBs in vent stack air are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC), as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-7. Comparison of PCB Vent Stack Air Sample Results to Risk-Based Air Concentrations - April 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	Comparison Values	
		VS-10-11	VS-16-11	VS-16-11 Dup	VS-1-11	VS-4-11	VS-BG-11	Trip Blank-VS	AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )	Total PCBs	< 0.015	< 0.016	< 0.015	< 0.016	< 0.012	< 0.018	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for vent stack air are compared to contemporary outdoor air (background) sample.

\* PCBs in vent stack air are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC), as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-8. Comparison of PCB Vent Stack Air Sample Results to Risk-Based Air Concentrations - May 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	Comparison Values	
		VS-11-12	VS-8-12	VS-8-12 Dup	VS-1-12	VS-4-12	VS-BG-12	Trip Blank-VS	AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )										
	Total PCBs	< 0.028	< 0.023	< 0.024	< 0.022	< 0.022	< 0.020	< 0.025	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for vent stack air are compared to contemporary outdoor air (background) sample.

\* PCBs in vent stack air are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC), as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-9. Comparison of PCB Vent Stack Air Sample Results to Risk-Based Air Concentrations - June 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	Comparison Values	
		VS-9-13	VS-9-13 Dup	VS-1-13	VS-7-13	VS-4-13	VS-BG-13	Trip Blank-VS	AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )	Total PCBs	< 0.020	< 0.021	< 0.021	< 0.020	< 0.022	< 0.021	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for vent stack air are compared to contemporary outdoor air (background) sample.

\* PCBs in vent stack air are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC), as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 7-10. Comparison of PCB Vent Stack Air Sample Results to Risk-Based Air Concentrations - July/August 2007  
Keith Middle School  
New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	Comparison Values	
		VS-14-14	VS-14-14 Dup	VS-1-14	VS-16-14	VS-4-14	VS-BG-14	Trip Blank-VS	AL*	ALTAEC*
PCBs (ug/m <sup>3</sup> )										
	Total PCBs	< 0.021	< 0.022	<b>0.01</b>	< 0.021	<b>0.028</b>	< 0.020	< 0.025 ug	0.05	0.3

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

PCBs - polychlorinated biphenyls

PCB results for vent stack air are compared to contemporary outdoor air (background) sample.

\* PCBs in vent stack air are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC), as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

**Table 8-1. Comparison of VOC Indoor Air Quality Sample Results to Comparison Criteria - March 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC	MassDEP	Comparison Values		
		A-10	B-10	C-10	BG-10	BG-10 Dup	Trip Blank	Background	TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	<2.33	<2.33	<2.33	<2.33	<2.33	<2.33	--	--	--	146 (b)
	2-butanone	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	42.18	200	10	1020 (a)
	acetone <sup>(1)</sup>	<b>12 J</b>	<b>7.33 J</b>	<b>9.54 J</b>	<b>5.51 J</b>	<4.75	<4.75	27.04	160.54	160.54	660 (a)
	benzene	<1.60	<1.60	<1.60	<1.60	<1.60	<1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	--	0.1	0.1	146 (a)
	chloroform	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44	3.36	132.76	0.04	0.077 (a)
	chloromethane	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	--	--	--	19 (a)
	cyclohexane	<1.72	<1.72	<b>2.2</b>	<1.72	<1.72	<1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	<b>46.4</b>	<b>9.77</b>	<b>13.7</b>	<3.76	<3.76	<3.76	--	51.24	51.24	--
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	<b>11.2</b>	<1.23	<b>4.3</b>	<1.23	<1.23	<1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	<3.47	<b>4.13</b>	<3.47	<b>6.8</b>	<3.47	<3.47	600	9.45	<b>0.24</b>	<b>3.8 (a)</b>
	methyl tert butyl ether	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	--	--	--	1.6 (a)
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	<2.17	<2.17	<2.17	<2.17	<2.17	<2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	<2.05	<2.05	<2.05	<2.05	<2.05	<2.05	--	--	--	146 (d)
	n-hexane	<3.52	<3.52	<3.52	<3.52	<3.52	<3.52	--	--	--	146 (a)
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	2.79	200	2	200 (a)
tetrachloroethene	<3.39	<3.39	<3.39	<3.39	<3.39	<3.39	11.01	922.18	0.02	0.31 (a)	
tetrahydrofuran	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	--	160.35	80.18	0.92 (a)	
toluene	<b>2.64</b>	<b>1.92</b>	<b>3.01</b>	<1.88	<1.88	<1.88	28.65	80	20	1020 (a)	
trichloroethene	<2.68	<2.68	<2.68	<2.68	<2.68	<2.68	4.49	36.52	0.61	0.016 (a)	
trichlorofluoromethane	<2.81	<2.81	<2.81	<2.81	<2.81	<2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

**Table 8-2. Comparison of VOC Indoor Air Quality Sample Results to Comparison Criteria - April 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank	MassDEP Background	Comparison Values		
		A-11	B-11	C-11	BG-11	BG-11 Dup			TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	12.2	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33	--	--	--	146 (b)
	2-butanone	23.6	< 1.47	< 1.47	< 1.47	< 1.47	< 1.47	42.18	200	10	1020 (a)
	acetone <sup>(1)</sup>	60.3	13.3	21.4	15.7	19.5	< 4.75	27.04	160.54	160.54	660 (a)
	benzene	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56	--	0.1	0.1	146 (a)
	chloroform	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44	3.36	132.76	0.04	0.077 (a)
	chloromethane	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	--	--	--	19 (a)
	cyclohexane	< 1.72	< 1.72	< 1.72	< 1.72	< 1.72	< 1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	160	7.89	4.16	5.76	< 3.76	< 3.76	--	51.24	51.24	--
	ethylbenzene	9.94	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	< 1.23	< 1.23	< 1.23	< 1.23	< 1.23	< 1.23	--	--	--	41.22 (c )
	methylene chloride <sup>(1)</sup>	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47	600	9.45	0.24	3.8 (a)
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80	--	--	--	1.6 (a)
	p/m-xylene	37.4	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	13.4	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	16.5	< 2.05	< 2.05	< 2.05	< 2.05	< 2.05	--	--	--	146 (d)
	n-hexane	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52	--	--	--	146 (a)
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	2.79	200	2	200 (a)
	tetrachloroethene	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39	11.01	922.18	0.02	0.31 (a)
	tetrahydrofuran	< 1.47	< 1.47	< 1.47	< 1.47	2.42	< 1.47	--	160.35	80.18	0.92 (a)
	toluene	33.1	2.07	2.45	< 1.88	< 1.88	< 1.88	28.65	80	20	1020 (a)
trichloroethene	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	4.49	36.52	0.61	0.016 (a)	
trichlorofluoromethane	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.  
 µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

Table 8-3. Comparison of VOC Indoor Air Quality Sample Results to Comparison Criteria - May 2007

Keith Middle School  
New Bedford, Massachusetts

Analysis	Analyte	Sample Locations			Background Locations		QA/QC	MassDEP	Comparison Values		
		A-12	B-12	C-12	BG-12	BG-12 Dup	Trip Blank	Background	TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	11.7	< 3.71	< 3.71	< 3.71	< 13.4	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 8.87	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 2.33	< 8.43	< 2.33	--	--	--	146 (b)
	2-butanone	< 1.47	< 1.47	2.09	< 1.47	< 5.32	< 1.47	42.18	200	10	1020 (a)
	acetone <sup>(1)</sup>	7.45	17.5	11.5	< 4.75	< 17.2	< 4.75	27.04	160.54	160.54	660 (a)
	benzene	< 1.60	< 1.60	< 1.60	< 1.60	< 5.77	< 1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 1.56	< 5.62	< 1.56	--	0.1	0.1	146 (a)
	chloroform	< 2.44	< 2.44	< 2.44	< 2.44	< 8.81	< 2.44	3.36	132.76	0.04	0.077 (a)
	chloromethane	< 1.03	< 1.03	< 1.03	1.13	< 3.73	< 1.03	--	--	--	19 (a)
	cyclohexane	< 1.72	< 1.72	< 1.72	< 1.72	< 6.21	< 1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	9.19	27.4	17.6	< 3.76	< 13.6	< 3.76	--	51.24	51.24	--
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 7.84	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	< 1.23	7.96	< 1.23	< 1.23	6.77	< 1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	< 3.47	3.48	4.06	< 3.47	14.8	< 3.47	600	9.45	0.24	3.8 (a)
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 1.80	< 6.51	< 1.80	--	--	--	1.6 (a)
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 15.7	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	< 2.17	< 2.17	< 2.17	< 2.17	< 7.84	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	< 2.05	< 2.05	< 2.05	< 2.05	< 7.40	< 2.05	--	--	--	146 (d)
	n-hexane	< 3.52	< 3.52	< 3.52	< 3.52	< 12.7	< 3.52	--	--	--	146 (a)
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 7.69	< 2.13	2.79	200	2	200 (a)
	tetrachloroethene	< 3.39	< 3.39	< 3.39	< 3.39	< 12.2	< 3.39	11.01	922.18	0.02	0.31 (a)
	tetrahydrofuran	< 1.47	< 1.47	< 1.47	< 1.47	< 5.32	< 1.47	--	160.35	80.18	0.92 (a)
toluene	< 1.88	2.14	< 1.88	< 1.88	< 6.80	< 1.88	28.65	80	20	1020 (a)	
trichloroethene	< 2.68	< 2.68	< 2.68	< 2.68	< 9.70	< 2.68	4.49	36.52	0.61	0.016 (a)	
trichlorofluoromethane	< 2.81	< 2.81	< 2.81	< 2.81	< 10.1	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELEs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

**Table 8-4. Comparison of VOC Indoor Air Quality Sample Results to Comparison Criteria - June 2007**  
 Keith Middle School  
 New Bedford, Massachusetts

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank	MassDEP Background	Comparison Values		
		A-13	B-13	C-13	BG-13	BG-13 Dup			TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 2.46	< 2.46	4.85	< 2.46	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33	< 2.33	--	--	--	146 (b)
	2-butanone	5.33	3.3	11.5	2.24	2.39	< 1.47	42.18	200	10	1020 (a)
	acetone <sup>(1)</sup>	134	31.5	78.6	24.2	24.2	< 4.75	27.04	160.54	160.54	660 (a)
	benzene	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60	< 1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56	< 1.56	--	0.1	0.1	146 (a)
	chloroform	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44	< 2.44	3.36	132.76	0.04	0.077 (a)
	chloromethane	4.01	4.11	15	1.68	1.72	< 1.03	--	--	--	19 (a)
	cyclohexane	< 1.72	< 1.72	7.36	< 1.72	< 1.72	< 1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	24.1	6.98	12.6	5.12	9.95	< 3.76	--	51.24	51.24	--
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	7.9	< 1.23	1.47	< 1.23	< 1.23	< 1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47	< 3.47	600	9.45	0.24	3.8 (a)
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80	< 1.80	--	--	--	1.6 (a)
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	< 2.05	< 2.05	< 2.05	< 2.05	< 2.05	< 2.05	--	--	--	146 (d)
	n-hexane	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52	< 3.52	--	--	--	146 (a)
	styrene	3.63	< 2.13	4.69	< 2.13	< 2.13	< 2.13	2.79	200	2	200 (a)
	tetrachloroethene	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39	< 3.39	11.01	922.18	0.02	0.31 (a)
	tetrahydrofuran	7.05	< 1.47	< 1.47	< 1.47	< 1.47	< 1.47	--	160.35	80.18	0.92 (a)
	toluene	3.59	2.88	10.6	< 1.88	< 1.88	< 1.88	28.65	80	20	1020 (a)
trichloroethene	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	< 2.68	4.49	36.52	0.61	0.016 (a)	
trichlorofluoromethane	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELS) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

**Table 8-5. Comparison of VOC Indoor Air Quality Sample Results to Comparison Criteria - July/August 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations			Background Locations		QA/QC Trip Blank	MassDEP Background	Comparison Values		
		A-14	B-14	C-14	BG-14	BG-14 Dup			TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 6.10	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 2.46	< 2.46	2.46	< 4.04	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 2.33	< 3.84	< 2.33	< 2.33	--	--	--	146 (b)
	2-butanone	4.82	5.8	12.4	< 2.42	< 1.47	< 1.47	42.18	200	10	1020 (a)
	acetone <sup>(1)</sup>	58.5	31.6	50.6	15.6	14.9	< 4.75	27.04	160.54	160.54	660 (a)
	benzene	< 1.60	< 1.60	< 1.60	< 2.62	< 1.60	< 1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	< 1.56	< 1.56	< 1.56	< 2.56	< 1.56	< 1.56	--	0.1	0.1	146 (a)
	chloroform	< 2.44	< 2.44	< 2.44	< 4.01	< 2.44	< 2.44	3.36	132.76	0.04	0.077 (a)
	chloromethane	< 1.03	< 1.03	< 1.03	1.74	1.74	< 1.03	--	--	--	19 (a)
	cyclohexane	< 1.72	< 1.72	3.6	< 2.83	< 1.72	< 1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	41	23.8	61.5	< 6.19	6.57	< 3.76	--	51.24	51.24	--
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 3.57	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	13.4	6.67	11.3	3.44	2.68	< 1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	17	19.3	318	18.8	21.2	7.48	600	9.45	0.24	3.8 (a)
	methyl tert butyl ether	< 1.80	< 1.80	< 1.80	< 2.96	< 1.80	< 1.80	--	--	--	1.6 (a)
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 7.13	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	< 2.17	< 2.17	< 2.17	< 3.57	< 2.17	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	< 2.05	< 2.05	< 2.05	< 3.37	< 2.05	< 2.05	--	--	--	146 (d)
	n-hexane	4.82	4.09	145	< 5.79	7.89	< 3.52	--	--	--	146 (a)
	styrene	7.26	3.52	3.05	< 3.50	< 2.13	< 2.13	2.79	200	2	200 (a)
	tetrachloroethene	< 3.39	< 3.39	< 3.39	< 5.57	< 3.39	< 3.39	11.01	922.18	0.02	0.31 (a)
	tetrahydrofuran	< 1.47	4.52	< 1.47	< 2.42	< 1.47	< 1.47	--	160.35	80.18	0.92 (a)
	toluene	5.93	3.65	10.7	< 3.10	< 1.88	< 1.88	28.65	80	20	1020 (a)
trichloroethene	< 2.68	< 2.68	< 2.68	< 4.41	< 2.68	< 2.68	4.49	36.52	0.61	0.016 (a)	
trichlorofluoromethane	< 2.81	< 2.81	3.08	< 4.61	< 2.81	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.  
 µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELS) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

**Table 8-6. Comparison of VOC Vent Stack Air Sample Results to Comparison Criteria - March 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	MassDEP	Comparison Values		
		VS-14-10	VS-14-10 Dup	VS-1-10	VS-7-10	VS-4-10	VS-BG-10	Trip Blank-VS	Background	TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	<b>13.6</b>	<b>13.5</b>	<2.33	<2.33	<2.33	<2.33	<2.33	--	--	--	146 (b)
	2-butanone	<b>110 J</b>	<b>139 J</b>	<b>114 J</b>	<b>33.3 J</b>	<b>109 J</b>	<1.47	<1.47	42.18	200	<b>10</b>	1020 (a)
	acetone <sup>(1)</sup>	<4.75	<4.75	<b>44.1 J</b>	<b>42.6 J</b>	<b>60.3 J</b>	<4.75	<4.75	27.04	160.54	160.54	660 (a)
	benzene	<b>5.74</b>	<b>6</b>	<1.60	<1.60	<1.60	<1.60	<1.60	21	<b>1.74</b>	<b>0.12</b>	<b>0.23 (a)</b>
	carbon disulfide	<1.56	<1.56	<b>2.24</b>	<1.56	<1.56	<1.56	<1.56	--	<b>0.1</b>	<b>0.1</b>	146 (a)
	chloroform	<2.44	<b>2.49</b>	<b>4.15</b>	<b>4.78</b>	<2.44	<2.44	<2.44	3.36	132.76	<b>0.04</b>	<b>0.077 (a)</b>
	chloromethane	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	< 1.03	--	--	--	19 (a)
	cyclohexane	<b>47.3</b>	<b>49.9</b>	<b>1.99</b>	<b>7.12</b>	<1.72	<1.72	<1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	<b>32.3</b>	<b>32.5</b>	<b>22</b>	<b>11.3</b>	<b>56.1</b>	<3.76	<3.76	--	<b>51.24</b>	<b>51.24</b>	--
	ethylbenzene	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	<1.23	<1.23	<b>8.2</b>	<1.23	<b>14.2</b>	<1.23	<1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	<b>4.1</b>	<3.47	<b>4.16</b>	<3.47	<3.47	<3.47	<3.47	600	9.45	<b>0.24</b>	<b>3.8 (a)</b>
	methyl tert butyl ether	<b>213</b>	<b>225</b>	<1.80	<b>2.3</b>	<1.80	<1.80	<1.80	--	--	--	<b>1.6 (a)</b>
	p/m-xylene	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	<b>2.56</b>	<b>2.91</b>	<2.17	<2.17	<2.17	<2.17	<2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	<b>8.19</b>	<b>8.35</b>	<b>5.28</b>	<2.05	<b>8.56</b>	<2.05	<2.05	--	--	--	146 (d)
	n-hexane	<b>205</b>	<b>223</b>	<3.52	<b>5.28</b>	<3.52	<3.52	<3.52	--	--	--	<b>146 (a)</b>
	styrene	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	< 2.13	2.79	200	2	200 (a)
	tetrachloroethene	<3.39	<3.39	<b>5.56</b>	<3.39	<b>4.88</b>	<3.39	<3.39	11.01	922.18	<b>0.02</b>	<b>0.31 (a)</b>
	tetrahydrofuran	<b>96.7</b>	<b>118</b>	<b>73.2</b>	<b>51.3</b>	<b>72.3</b>	<1.47	<1.47	--	160.35	<b>80.18</b>	<b>0.92 (a)</b>
	toluene	<b>13.9</b>	<b>14.4</b>	<1.88	<1.88	<1.88	<1.88	<1.88	28.65	80	20	1020 (a)
trichloroethene	<2.68	<b>2.79</b>	<b>4.94</b>	<b>3.92</b>	<2.68	<2.68	<2.68	4.49	36.52	<b>0.61</b>	<b>0.016 (a)</b>	
trichlorofluoromethane	<2.81	<2.81	<2.81	<b>3.76</b>	<2.81	<2.81	<2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELEs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

VOCs in vent stack air were compared to comparison criteria, as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

**Table 8-7. Comparison of VOC Vent Stack Air Sample Results to Comparison Criteria - April 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	MassDEP	Comparison Values		
		VS-10-11	VS-16-11	VS-16-11 Dup	VS-1-11	VS-4-11	VS-BG-11	Trip Blank-VS	Background	TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	x	< 3.71	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 2.46	< 2.46	x	< 2.46	< 2.46	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	< 2.33	< 2.33	x	< 2.33	< 2.33	< 2.33	< 2.33	--	--	--	146 (b)
	2-butanone	< 1.47	<b>7.72</b>	x	<b>4.8</b>	< 1.47	< 1.47	< 1.47	42.18	200	10	1020 (a)
	acetone <sup>(1)</sup>	<b>64.4</b>	<b>49.3</b>	x	<b>55.4</b>	<b>15.4</b>	<b>7.07</b>	< 4.75	27.04	160.54	160.54	660 (a)
	benzene	< 1.60	< 1.60	x	< 1.60	< 1.60	< 1.60	< 1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	<b>4.6</b>	<b>4.45</b>	x	<b>4.98</b>	<b>5.57</b>	<b>4.45</b>	< 1.56	--	<b>0.1</b>	<b>0.1</b>	146 (a)
	chloroform	< 2.44	< 2.44	x	<b>2.88</b>	< 2.44	< 2.44	< 2.44	3.36	132.76	<b>0.04</b>	<b>0.077 (a)</b>
	chloromethane	< 1.03	< 1.03	x	< 1.03	< 1.03	< 1.03	< 1.03	--	--	--	19 (a)
	cyclohexane	< 1.72	< 1.72	x	< 1.72	< 1.72	< 1.72	< 1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	< 3.76	<b>8.19</b>	x	<b>6.63</b>	<b>15.7</b>	< 3.76	< 3.76	--	51.24	51.24	--
	ethylbenzene	< 2.17	< 2.17	x	< 2.17	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	< 1.23	< 1.23	x	<b>15.8</b>	<b>2.8</b>	< 1.23	< 1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	< 3.47	< 3.47	x	< 3.47	< 3.47	< 3.47	< 3.47	600	9.45	0.24	3.8 (a)
	methyl tert butyl ether	< 1.80	< 1.80	x	< 1.80	< 1.80	< 1.80	< 1.80	--	--	--	1.6 (a)
	p/m-xylene	< 4.34	< 4.34	x	< 4.34	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	< 2.17	< 2.17	x	< 2.17	< 2.17	< 2.17	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	< 2.05	< 2.05	x	< 2.05	< 2.05	< 2.05	< 2.05	--	--	--	146 (d)
	n-hexane	<b>7.22</b>	<b>5.78</b>	x	<b>6.27</b>	< 3.52	< 3.52	< 3.52	--	--	--	146 (a)
	styrene	< 2.13	< 2.13	x	< 2.13	< 2.13	< 2.13	< 2.13	2.79	200	2	200 (a)
	tetrachloroethene	< 3.39	< 3.39	x	< 3.39	< 3.39	< 3.39	< 3.39	11.01	922.18	0.02	0.31 (a)
	tetrahydrofuran	<b>3.71</b>	<b>28.6</b>	x	<b>24.8</b>	<b>5.63</b>	< 1.47	< 1.47	--	160.35	80.18	<b>0.92 (a)</b>
	toluene	< 1.88	<b>2.48</b>	x	< 1.88	< 1.88	< 1.88	< 1.88	28.65	80	20	1020 (a)
trichloroethene	< 2.68	< 2.68	x	< 2.68	< 2.68	< 2.68	< 2.68	4.49	36.52	0.61	0.016 (a)	
trichlorofluoromethane	< 2.81	< 2.81	x	< 2.81	< 2.81	< 2.81	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

VOCs in vent stack air were compared to comparison criteria, as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

x - this sample not analyzed due to a flow controller malfunction

**Table 8-8. Comparison of VOC Vent Stack Air Sample Results to Comparison Criteria - May 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	MassDEP	Comparison Values		
		VS-11-12	VS-8-12	Dup	VS-1-12	VS-4-12	VS-BG-12	Trip Blank-VS	Background	TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 3.71	< 3.71	< 7.93	< 3.71	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	<b>3.55</b>	< 2.46	< 5.25	< 2.46	< 2.46	< 2.46	< 2.46	--	--	--	<b>1.46 (a)</b>
	2,2,4-trimethylpentane	< 2.33	< 2.33	< 4.99	< 2.33	< 2.33	< 2.33	< 2.33	--	--	--	146 (b)
	2-butanone	<b>25.1</b>	<b>25.3</b>	<b>14.6</b>	<b>9.94</b>	<b>3.2</b>	<b>1.51</b>	< 1.47	42.18	200	<b>10</b>	1020 (a)
	acetone <sup>(1)</sup>	< 4.75	<b>41.1</b>	<b>57</b>	<b>16.5</b>	<b>42.6</b>	< 4.75	< 4.75	27.04	160.54	160.54	660 (a)
	benzene	< 1.60	< 1.60	< 3.41	< 1.60	< 1.60	< 1.60	< 1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	< 1.56	< 1.56	< 3.33	< 1.56	< 1.56	<b>1.62</b>	< 1.56	--	<b>0.1</b>	<b>0.1</b>	146 (a)
	chloroform	< 2.44	< 2.44	< 5.22	<b>3.47</b>	< 2.44	< 2.44	< 2.44	3.36	132.76	<b>0.04</b>	<b>0.077 (a)</b>
	chloromethane	< 1.03	< 1.03	< 2.20	< 1.03	< 1.03	<b>1.44</b>	< 1.03	--	--	--	19 (a)
	cyclohexane	<b>3.44</b>	<b>3.3</b>	< 3.68	< 1.72	< 1.72	< 1.72	< 1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	<b>5.4</b>	<b>10.3</b>	<b>13.1</b>	<b>10.5</b>	<b>27.2</b>	< 3.76	< 3.76	--	51.24	51.24	--
	ethylbenzene	<b>12.9</b>	< 2.17	< 4.64	< 2.17	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	< 1.23	< 1.23	<b>17.8</b>	<b>2.55</b>	<b>16.8</b>	< 1.23	< 1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	< 3.47	<b>4.45</b>	<b>17.3</b>	< 3.47	< 3.47	< 3.47	< 3.47	600	<b>9.45</b>	<b>0.24</b>	<b>3.8 (a)</b>
	methyl tert butyl ether	<b>93.9</b>	<b>4.53</b>	< 3.85	< 1.80	< 1.80	< 1.80	< 1.80	--	--	--	<b>1.6 (a)</b>
	p/m-xylene	<b>5.28</b>	< 4.34	< 9.28	< 4.34	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	<b>2.73</b>	< 2.17	< 4.64	< 2.17	< 2.17	< 2.17	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	< 2.05	< 2.05	< 4.38	< 2.05	< 2.05	< 2.05	< 2.05	--	--	--	146 (d)
	n-hexane	<b>8.02</b>	< 3.52	< 7.53	< 3.52	< 3.52	< 3.52	< 3.52	--	--	--	146 (a)
	styrene	<b>10.6</b>	< 2.13	< 4.55	< 2.13	< 2.13	< 2.13	< 2.13	2.79	200	<b>2</b>	200 (a)
tetrachloroethene	< 3.39	< 3.39	< 7.24	< 3.39	< 3.39	< 3.39	< 3.39	11.01	922.18	0.02	0.31 (a)	
tetrahydrofuran	<b>24.2</b>	<b>27.1</b>	<b>23.9</b>	<b>18.9</b>	<b>3</b>	< 1.47	< 1.47	--	160.35	80.18	<b>0.92 (a)</b>	
toluene	<b>5.97</b>	< 1.88	< 4.02	< 1.88	< 1.88	< 1.88	< 1.88	28.65	80	20	1020 (a)	
trichloroethene	< 2.68	<b>4.54</b>	< 5.74	< 2.68	< 2.68	< 2.68	< 2.68	4.49	36.52	<b>0.61</b>	<b>0.016 (a)</b>	
trichlorofluoromethane	<b>8.76</b>	<b>4.76</b>	< 6.00	<b>3.48</b>	< 2.81	< 2.81	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELEs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

VOCs in vent stack air were compared to comparison criteria, as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

**Table 8-9. Comparison of VOC Vent Stack Air Sample Results to Comparison Criteria - June 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	MassDEP	Comparison Values		
		VS-9-13	VS-9-13 Dup	VS-1-13	VS-7-13	VS-4-13	VS-BG-13	Trip Blank-VS	Background	TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 74.2	< 74.2	< 3.71	< 74.2	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 49.1	< 49.1	< 2.46	< 49.1	< 2.46	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	<b>89.3</b>	<b>94.9</b>	< 2.33	< 46.7	< 2.33	< 2.33	< 2.33	--	--	--	146 (b)
	2-butanone	<b>52.6</b>	<b>85.3</b>	<b>26.1</b>	<b>44.6</b>	<b>30</b>	<b>1.71</b>	< 1.47	42.18	200	<b>10</b>	1020 (a)
	acetone <sup>(1)</sup>	< 94.9	< 94.9	<b>84.3</b>	< 94.9	<b>114</b>	<b>17.6</b>	< 4.75	27.04	160.54	160.54	660 (a)
	benzene	< 31.9	< 31.9	< 1.60	< 31.9	< 1.60	< 1.60	< 1.60	21	1.74	0.12	0.23 (a)
	carbon disulfide	< 31.1	< 31.1	< 1.56	< 31.1	< 1.56	< 1.56	< 1.56	--	0.1	0.1	146 (a)
	chloroform	< 48.8	< 48.8	< 2.44	< 48.8	< 2.44	< 2.44	< 2.44	3.36	132.76	0.04	0.077 (a)
	chloromethane	< 20.6	< 20.6	< 1.03	< 20.6	<b>4.21</b>	<b>1.57</b>	< 1.03	--	--	--	19 (a)
	cyclohexane	<b>92.4</b>	<b>106</b>	< 1.72	< 34.4	< 1.72	< 1.72	< 1.72	--	280.82	280.82	3600 (a)
	ethanol <sup>(1)</sup>	< 75.3	<b>93.1</b>	<b>98.5</b>	< 75.3	<b>5.4</b>	< 3.76	< 3.76	--	<b>51.24</b>	<b>51.24</b>	--
	ethylbenzene	< 43.4	< 43.4	< 2.17	< 43.4	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	< 24.6	< 24.6	<b>6.71</b>	< 24.6	<b>2.38</b>	< 1.23	< 1.23	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	< 69.4	< 69.4	< 3.47	< 69.4	<b>3.8</b>	< 3.47	< 3.47	600	9.45	<b>0.24</b>	3.8 (a)
	methyl tert butyl ether	<b>149</b>	<b>172</b>	< 1.80	< 36.0	< 1.80	< 1.80	< 1.80	--	--	--	<b>1.6 (a)</b>
	p/m-xylene	< 86.8	< 86.8	< 4.34	< 86.8	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	< 43.4	< 43.4	< 2.17	< 43.4	< 2.17	< 2.17	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	< 41.0	< 41.0	<b>2.31</b>	< 41.0	< 2.05	< 2.05	< 2.05	--	--	--	146 (d)
	n-hexane	< 70.4	<b>110</b>	< 3.52	< 70.4	< 3.52	< 3.52	< 3.52	--	--	--	146 (a)
	styrene	< 42.6	< 42.6	< 2.13	< 42.6	2.13	< 2.13	< 2.13	2.79	200	2	200 (a)
tetrachloroethene	< 67.8	< 67.8	< 3.39	< 67.8	3.39	< 3.39	< 3.39	11.01	922.18	0.02	0.31 (a)	
tetrahydrofuran	< 29.5	< 29.5	<b>6.42</b>	< 29.5	<b>3.85</b>	< 1.47	< 1.47	--	160.35	80.18	<b>0.92 (a)</b>	
toluene	< 37.6	< 37.6	<b>1.88</b>	< 37.6	<b>2.03</b>	< 1.88	< 1.88	28.65	80	20	1020 (a)	
trichloroethene	< 53.7	< 53.7	< 2.68	< 53.7	< 2.68	<b>3.61</b>	< 2.68	4.49	36.52	<b>0.61</b>	<b>0.016 (a)</b>	
trichlorofluoromethane	< 56.1	< 56.1	< 2.81	< 56.1	< 2.81	< 2.81	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

VOCs in vent stack air were compared to comparison criteria, as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

**Table 8-10. Comparison of VOC Vent Stack Air Sample Results to Comparison Criteria - July/August 2007**  
**Keith Middle School**  
**New Bedford, Massachusetts**

Analysis	Analyte	Sample Locations					Background	QA/QC	MassDEP	Comparison Values		
		VS-14-14	VS-14-14 Dup	VS-1-14	VS-16-14	VS-4-14	VS-BG-14	Trip Blank-VS	Background	TEL*	AAL*	Alternate Value
VOCs (ug/m <sup>3</sup> )	1,2,4-trichlorobenzene	< 148	< 148	< 14.8	< 14.8	< 3.71	< 3.71	< 3.71	0.59	--	--	7.4 (a)
	1,2,4-trimethylbenzene	< 98.2	< 98.2	< 9.82	< 9.82	< 2.46	< 2.46	< 2.46	--	--	--	1.46 (a)
	2,2,4-trimethylpentane	<b>122</b>	<b>165</b>	< 9.34	< 9.34	< 2.33	< 2.33	< 2.33	--	--	--	<b>146 (b)</b>
	2-butanone	< 58.9	< 58.9	<b>46.1</b>	<b>42.2</b>	<b>42.7</b>	<b>1.59</b>	< 1.47	42.18	200	<b>10</b>	1020 (a)
	acetone <sup>(1)</sup>	< 190	< 190	<b>57.4</b>	<b>54.5</b>	<b>75</b>	<b>15.3</b>	<b>5.97</b>	27.04	160.54	160.54	660 (a)
	benzene	< 63.8	< 63.8	< 6.38	< 6.38	<b>1.81</b>	< 1.60	< 1.60	21	<b>1.74</b>	<b>0.12</b>	<b>0.23 (a)</b>
	carbon disulfide	< 62.2	< 62.2	< 6.22	< 6.22	<b>2.67</b>	< 1.56	< 1.56	--	<b>0.1</b>	<b>0.1</b>	146 (a)
	chloroform	< 97.6	< 97.6	< 9.76	< 9.76	< 2.44	< 2.44	< 2.44	3.36	132.76	0.04	0.077 (a)
	chloromethane	< 41.3	< 41.3	< 4.13	< 4.13	< 1.03	<b>1.67</b>	< 1.03	--	--	--	19 (a)
	cyclohexane	<b>256</b>	<b>347</b>	< 6.88	< 6.88	< 1.72	< 1.72	< 1.72	--	<b>280.82</b>	<b>280.82</b>	3600 (a)
	ethanol <sup>(1)</sup>	< 151	< 151	<b>15.9</b>	< 15.1	<b>94</b>	<b>5.67</b>	< 3.76	--	<b>51.24</b>	<b>51.24</b>	--
	ethylbenzene	< 86.8	< 86.8	< 8.68	< 8.68	< 2.17	< 2.17	< 2.17	9.62	300	300	220 (a)
	isopropanol <sup>(1)</sup>	< 49.1	< 49.1	<b>7.79</b>	< 4.91	<b>15.7</b>	< 1.23	<b>8.76</b>	--	--	--	41.22 (c)
	methylene chloride <sup>(1)</sup>	< 139	< 139	<b>19.1</b>	<b>17.5</b>	<b>37.6</b>	<b>15.6</b>	<b>19</b>	600	<b>9.45</b>	<b>0.24</b>	<b>3.8 (a)</b>
	methyl tert butyl ether	<b>563</b>	<b>708</b>	< 7.20	< 7.20	< 1.80	< 1.80	< 1.80	--	--	--	<b>1.6 (a)</b>
	p/m-xylene	< 174	< 174	< 17.4	< 17.4	< 4.34	< 4.34	< 4.34	72.41**	11.8**	11.8**	22** (a)
	o-xylene	< 86.8	< 86.8	< 8.68	< 8.68	< 2.17	< 2.17	< 2.17	72.41**	11.8**	11.8**	22** (a)
	n-heptane	< 81.9	< 81.9	< 8.19	< 8.19	<b>3.19</b>	< 2.05	< 2.05	--	--	--	146 (d)
	n-hexane	<b>651</b>	<b>857</b>	< 14.1	< 14.1	<b>8.58</b>	<b>4.23</b>	<b>4.46</b>	--	--	--	<b>146 (a)</b>
	styrene	< 85.1	< 85.1	< 8.51	< 8.51	< 2.13	< 2.13	< 2.13	2.79	200	2	200 (a)
tetrachloroethene	< 136	< 136	< 13.6	< 13.6	< 3.39	< 3.39	< 3.39	11.01	922.18	0.02	0.31 (a)	
tetrahydrofuran	< 58.9	< 58.9	<b>13.8</b>	<b>130</b>	<b>21.2</b>	< 1.47	< 1.47	--	160.35	<b>80.18</b>	<b>0.92 (a)</b>	
toluene	< 75.3	< 75.3	< 7.53	< 7.53	< 1.88	< 1.88	< 1.88	28.65	80	20	1020 (a)	
trichloroethene	< 107	< 107	< 10.7	< 10.7	< 2.68	< 2.68	< 2.68	4.49	36.52	0.61	0.016 (a)	
trichlorofluoromethane	< 112	< 112	< 11.2	< 11.2	< 2.81	< 2.81	< 2.81	--	--	--	146 (a)	

**Notes:**

J - Concentration should be considered estimated.

µg/m<sup>3</sup> - micrograms per cubic meter

VOCs - volatile organic compounds

RBC - Risk-Based Concentration for Ambient Air (USEPA, 2007)

<sup>(1)</sup> Compound is a common laboratory contaminant and detects may be associated with laboratory contamination, as discussed in Section 5.

VOC results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.

\* Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for ambient air currently in effect (December, 1995).

Alternate Value: (a) Region III RBC (ELCR of 1E-06 for carcinogens; hazard of 0.2 for noncarcinogens)

(b) RBC for n-hexane used as surrogate for 2,2,4-trimethylpentane

(c) AAL/TEL for isobutyl alcohol used as surrogate for isopropanol

(d) RBC for n-hexane used as surrogate for n-heptane

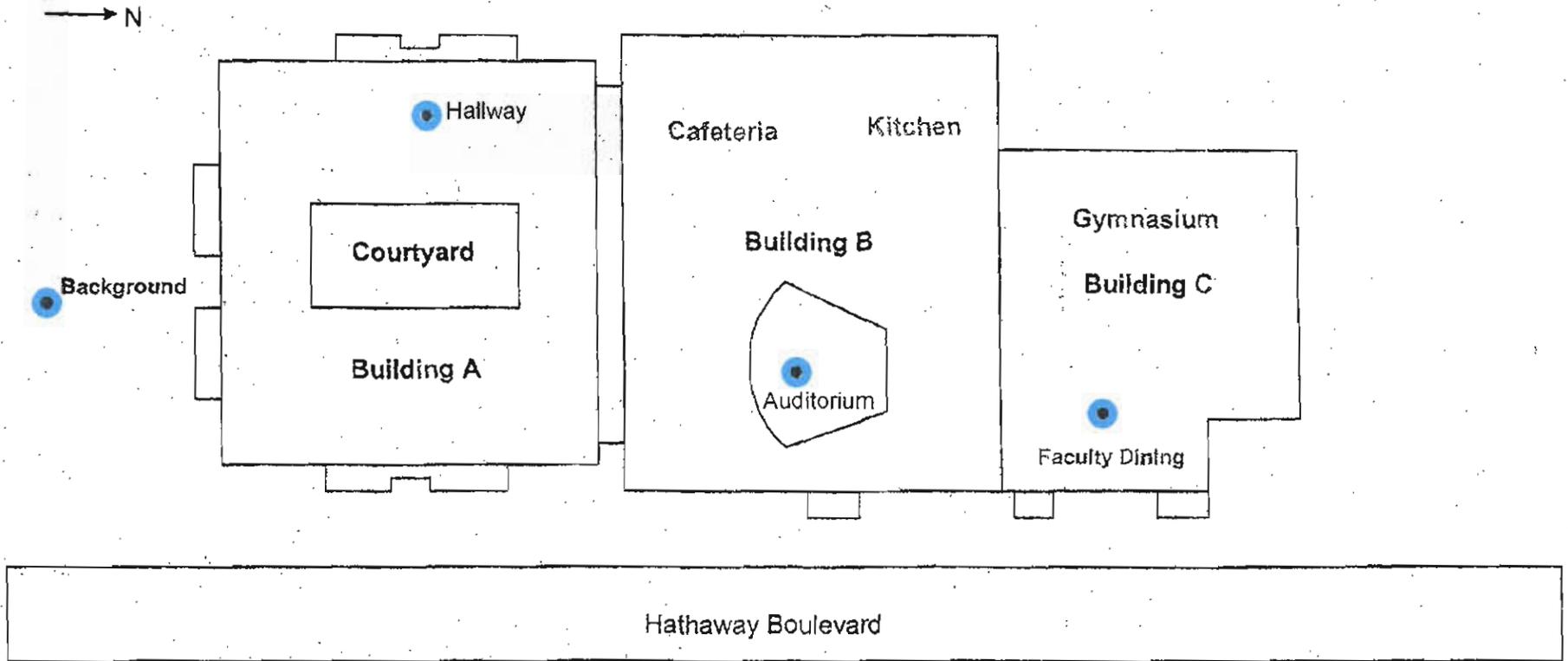
VOCs in vent stack air were compared to comparison criteria, as required by the LTMMIP, even though little, if any exposure is occurring to air within the vent stack system.

\*\* - Value for total xylenes (m-, o-, p- isomers)

-- - No corresponding comparison criterion

# FIGURES

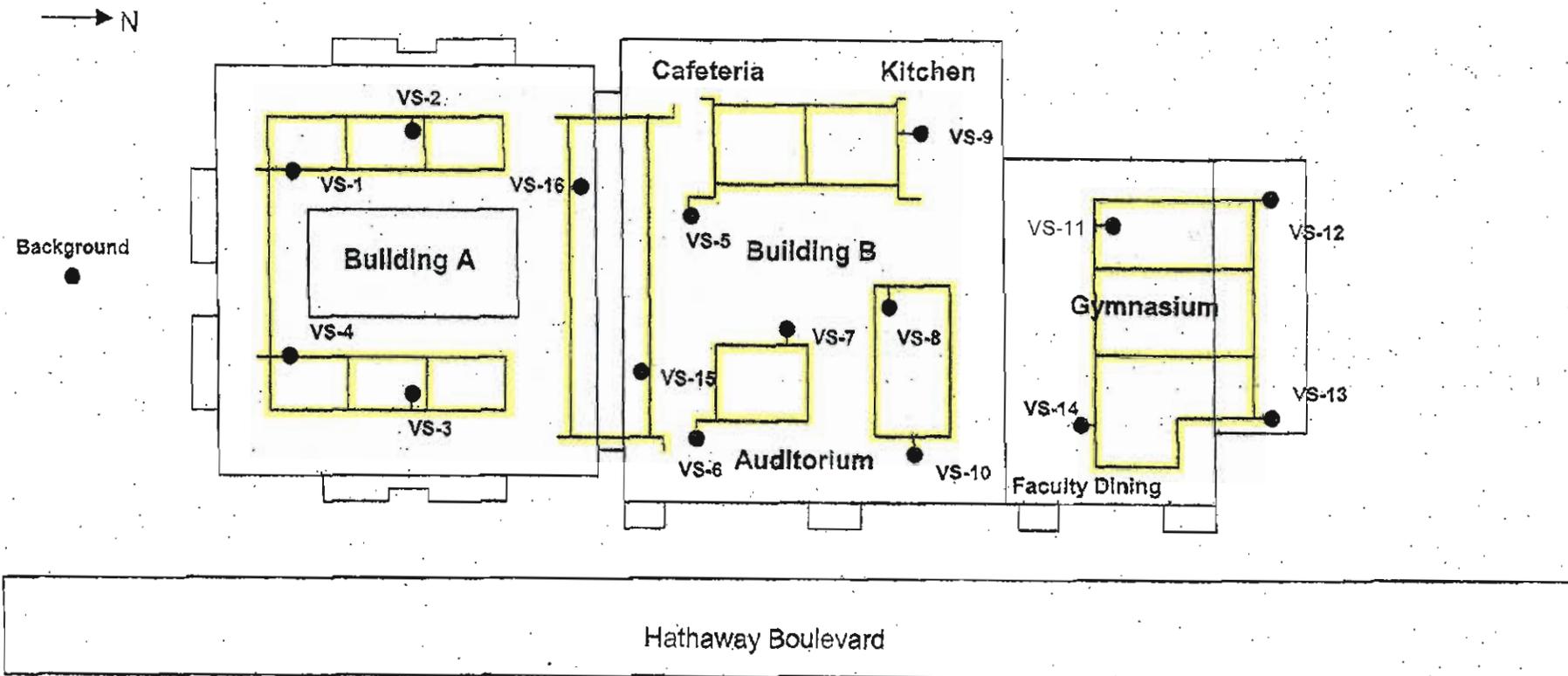
# Keith Middle School Indoor Air Sampling Locations



- = Indoor Air Sampling Point
- = Sample Locations

<b>KEITH MIDDLE SCHOOL NEW BEDFORD, MASSACHUSETTS</b>	
<b>INDOOR AIR SAMPLING LOCATIONS</b>	
	Wannalancit Mills 650 Suffolk Street Lowell, MA 01854 (978) 970-5600
DRAWN BY: --- CHECKED BY: DMS	DATE: MAY 2008
<b>FIGURE 2-1</b>	

# Keith Middle School Foundation Venting System

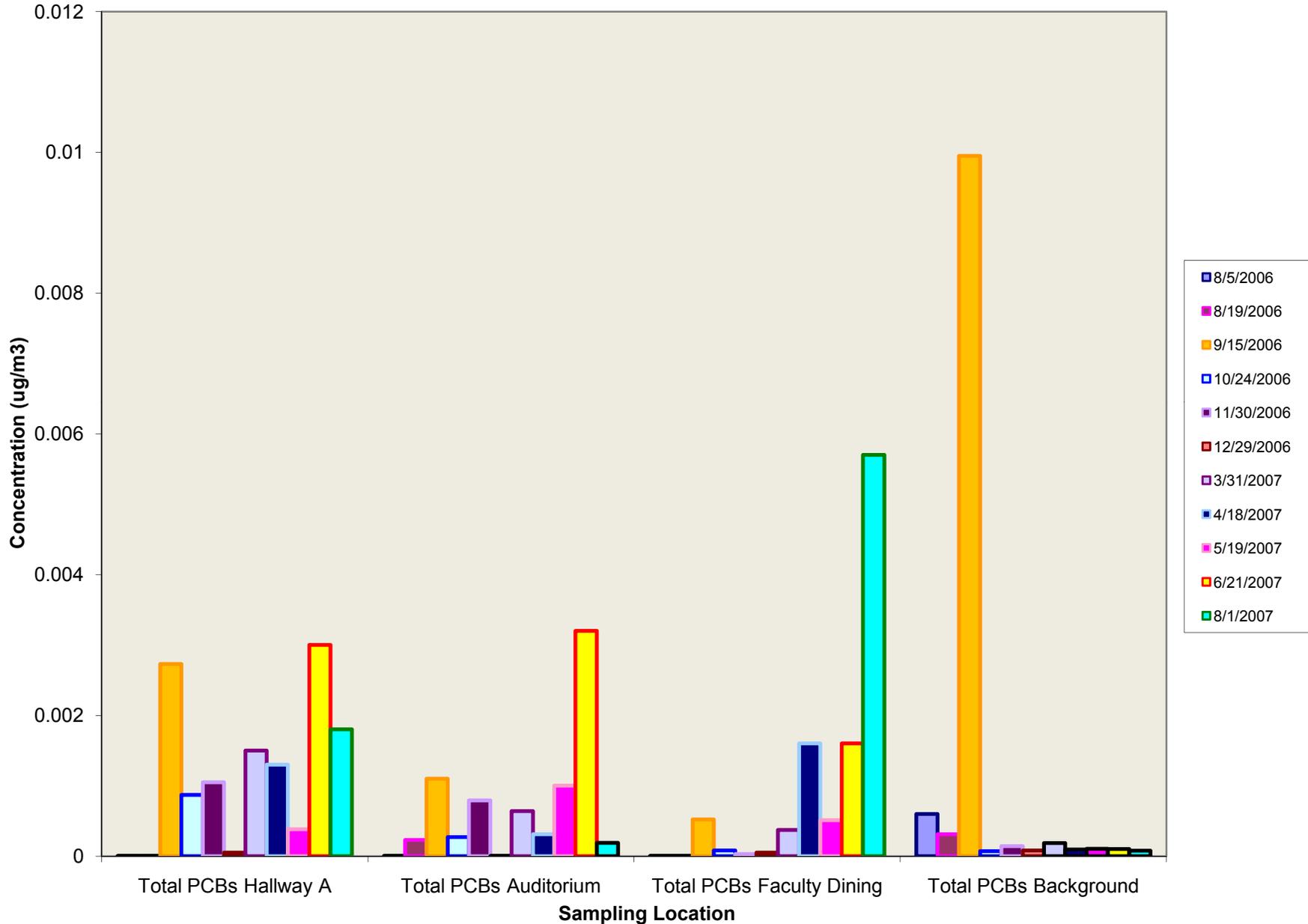


- = Vent Riser / Vent Stack Sampling location
- = Passive Venting and Collection System

<b>KEITH MIDDLE SCHOOL NEW BEDFORD, MASSACHUSETTS</b>	
<b>VENT STACK SAMPLE LOCATIONS</b>	
	Wannolancit Mills 650 Suffolk Street Lowell, MA 01854 (978) 970-5600
DRAWN BY: —	DATE:
CHECKED BY: DMS	MAY 2008
<b>FIGURE 2-2</b>	

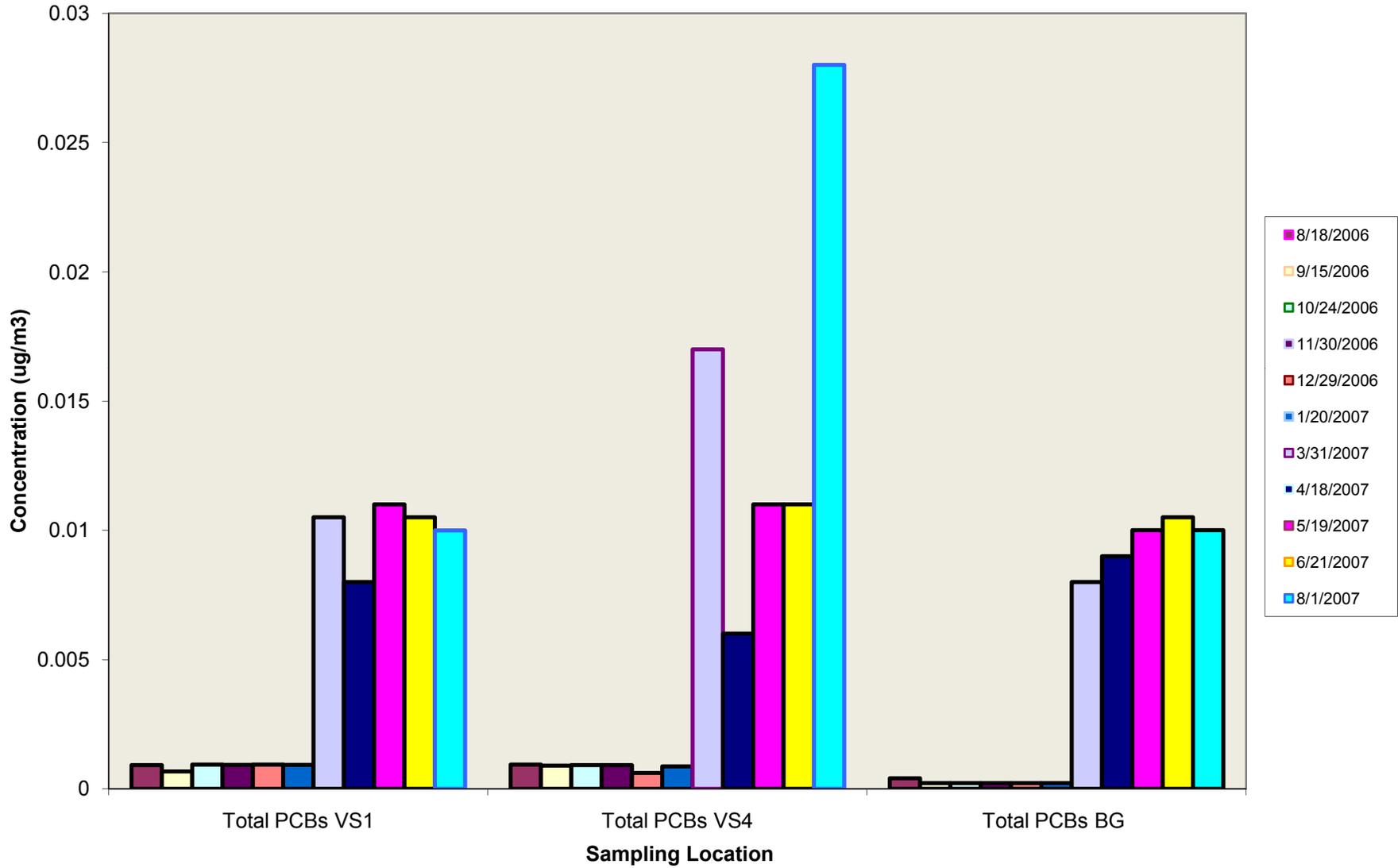
FILE: T:\E\_CAD\115058\ventsys1A.dwg

Figure 7-1. Total PCB Trends in KMS Indoor Air Quality (IAQ) Samples - August 2006 through August 2007



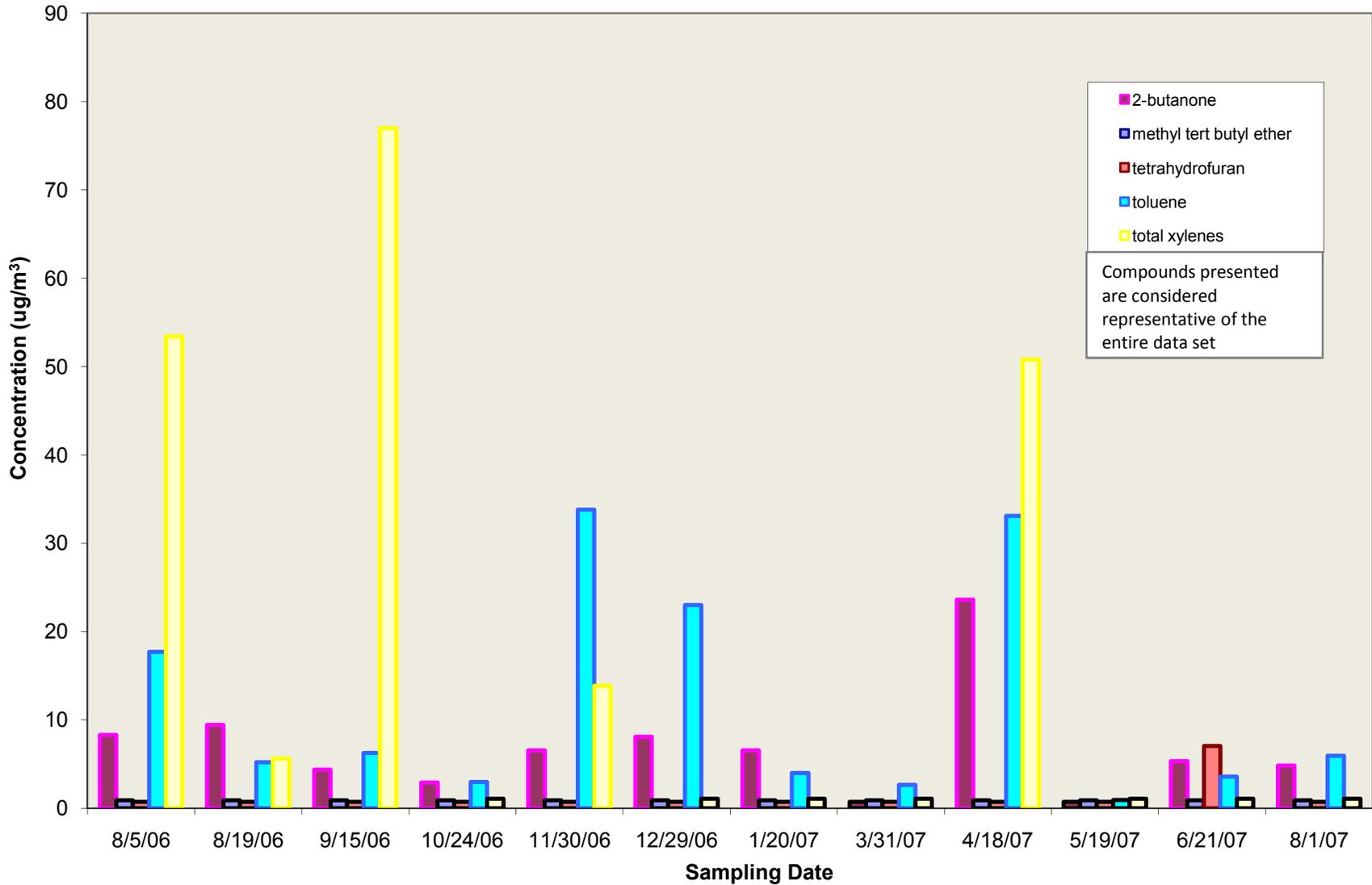
Each bar represents a single measurement. Bars outlined in black represent values reported by the laboratory as nondetect. For charting purposes these nondetect values are plotted as one half the reporting limit.

**Figure 7-2. KMS Vent Stack PCB Trends - August 2006 through August 2007**



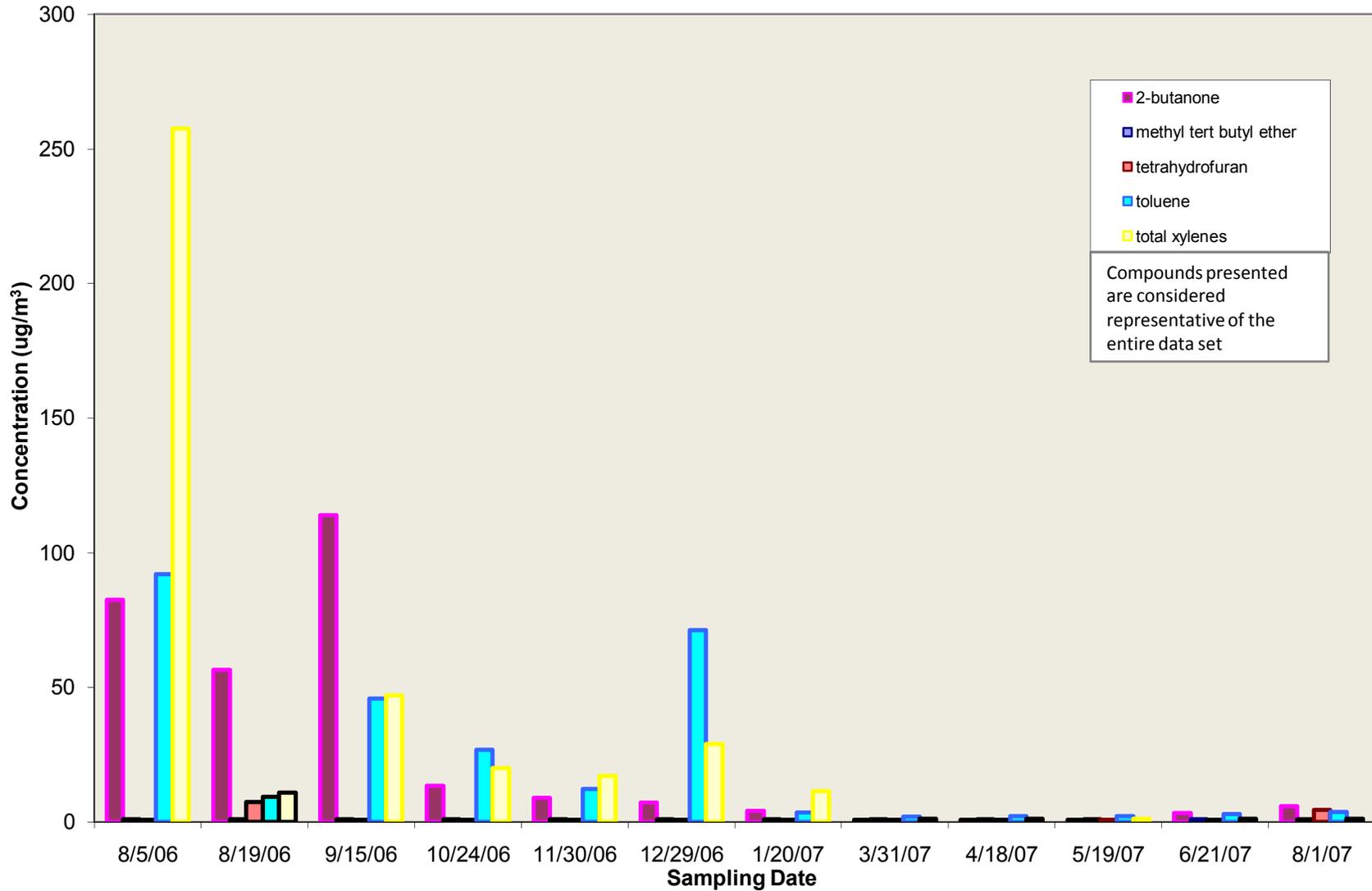
Each bar represents a single measurement. Bars outlined in black represent values reported by the laboratory as nondetect. For charting purposes these nondetect values are plotted as one half the reporting limit.

Figure 8-1. VOC Trends in KMS Building A (IAQ) - August 2006 through August 2007



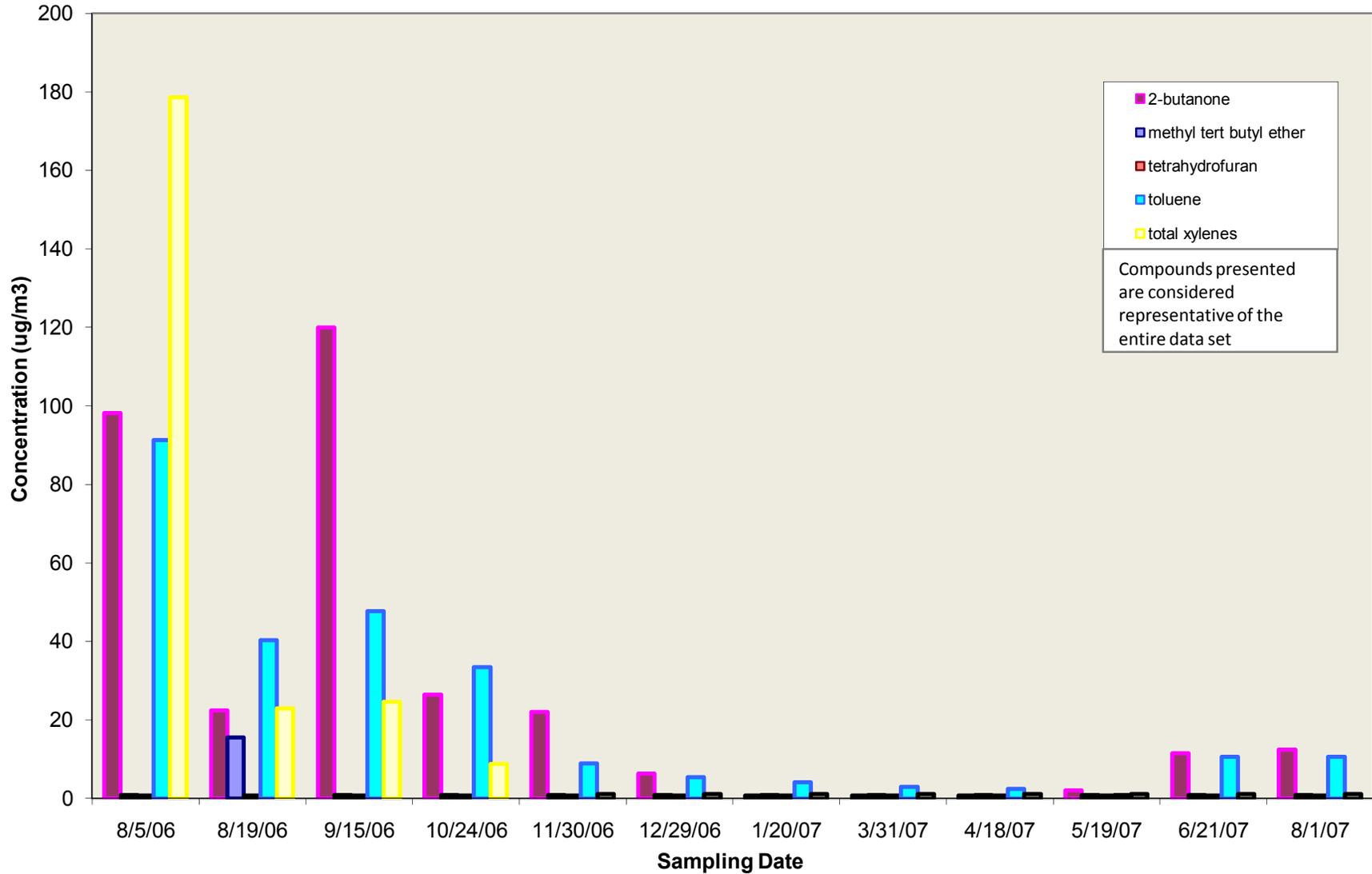
Each bar represents a single measurement. Bars outlined in black represent values reported by the laboratory as nondetect. For charting purposes these nondetect values are plotted as one half the reporting limit.

**Figure 8-2. VOC Trends in KMS Building B (IAQ) - August 2006 through August 2007**



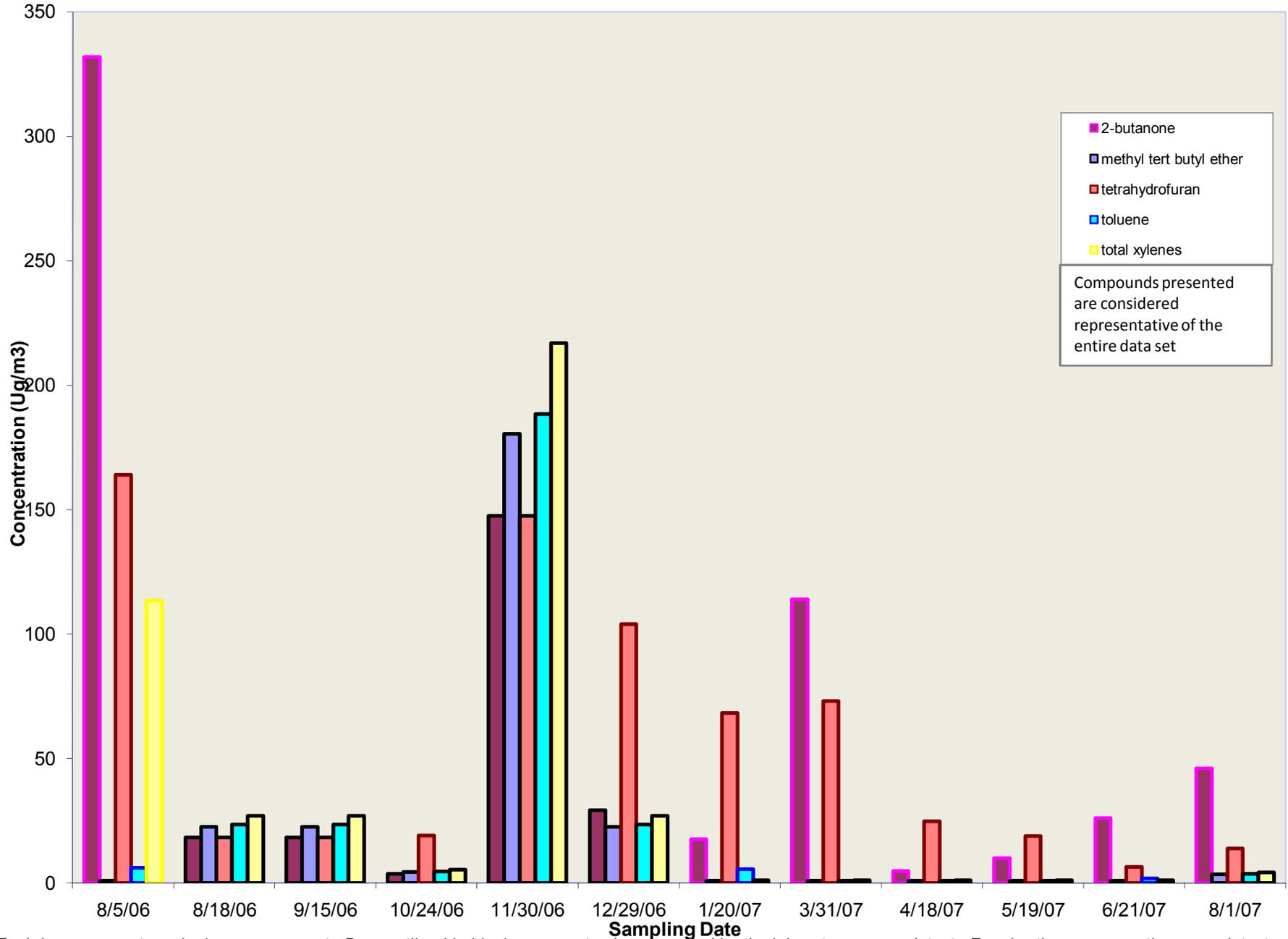
Each bar represents a single measurement. Bars outlined in black represent values reported by the laboratory as nondetect. For charting purposes these nondetect values are plotted as one half the reporting limit.

Figure 8-3. VOC Trends in KMS Building C (IAQ) - August 2006 through August 2007



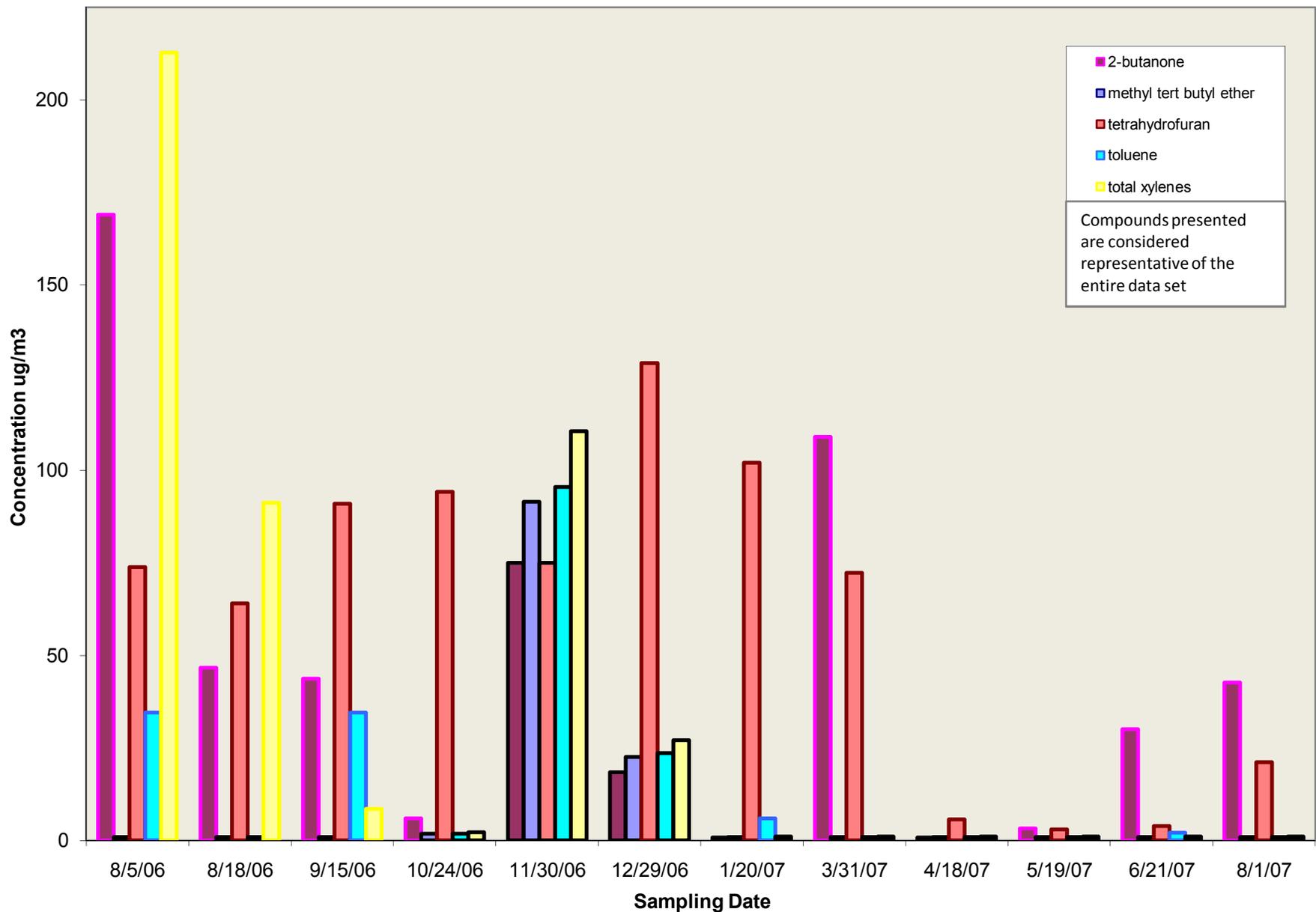
Each bar represents a single measurement. Bars outlined in black represent values reported by the laboratory as nondetect. For charting purposes these nondetect values are plotted as one half the reporting limit.

Figure 8-4. VOC Trends in KMS Vent Stack VS-1 - August 2006 through August 2007



Each bar represents a single measurement. Bars outlined in black represent values reported by the laboratory as nondetect. For charting purposes these nondetect values are plotted as one half the reporting limit.

Figure 8-5. VOC Trends in KMS Vent Stack VS-4 - August 2006 through August 2007



Each bar represents a single measurement. Bars outlined in black represent values reported by the laboratory as nondetect. For charting purposes these nondetect values are plotted as one half the reporting limit.

**APPENDIX A**

**FIELD SAMPLING DATA SHEETS**

## RAW DATA

**TO4A , TO10A, & TO15A DATA SHEETS**

**SAMPLING ROUND 10 – MARCH 2007**

## Keith Middle School Sampling Data Sheet Ambient Air Sampling

Setup Date: 3/30/07  
Recovery Date: 3/31/07

Sampler(s): Ed MacKinnon Dave Gill  
Sampler(s): Ed MacKinnon Dave Gill

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA Serial No.:	Flow Controller Serial No.:
	Start	Stop	Start	Finish		
A-10	1640	1644	-29.5	-6.0	2979	FC2
B-10	1643	1650	-28.5	-3.0	2980	FC64
C-10	1647	1656	-29.5	-3.0	2978	FC116
B6-10	1637	1637	-29.5	-5.0	2993	FC96
B6-10Dup	1636	1636	-30.0	-2.0	2977	FC252

TO-4A							
Location	Time		Sampler				
			Serial Number	Counter (Hrs)		Flow Rate (Mag Reading)	
	Start	Stop		Start	Finish	Initial	Final
A-10	1640	1644	821	100.44	124.49	54	54
B-10	1643	1650	825	99.09	123.19	50	48
C-10	1647	1656	820	90.33	114.48	54	53
B6-10	1637	1637	822	99.85	123.74	46	52
B6-10-Dup	1636	1636	823	99.83	123.94	48	54

## Keith Middle School Sampling Data Sheet Ambient Air Sampling

Setup Date: 3/31/07  
Recovery Date: 3/31/07

Sampler(s): Ed MacKinnon Dave Gill  
Sampler(s): Ed MacKinnon Dave Gill

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA Serial No.:	Flow Controller Serial No.:
	Start	Stop	Start	Finish		
VS-14-10	0957	1349	-28.5	-4	374	FC203
VS-14-10-Dup	0957	1349	-30	-4	508	FC186
VS-1-10	1024	1421	>-30	-5.5	103	FC202
VS-7-10	1009	1405	>-3	-4	516	FC211
VS-4-10	1036	1435	-29	-5	212	FC208
VS-B6-10	1052	1453	>-30	-1	495	FC210

TO-10A				
Location	Time		Flow Rate (LPM)	
	Start	Stop	Start	Finish
VS-14-10	0957	1349	5.1	5.1
VS-14-10-Dup	0957	1349	5.1	5.1
VS-1-10	1024	1421	5.0	5.0
VS-7-10	1009	1405	5.0	5.1
VS-4-10	1036	1435	5.1	5.0
VS-B6-10	1052	1453	5.1	5.1

**SAMPLING ROUND 11 - APRIL 2007**

## Keith Middle School Sampling Data Sheet Ambient Air Sampling

Setup Date: 4/17/07  
Recovery Date: 4/18/07

Sampler(s): E. MacKinnon (M. Hiezi)  
Sampler(s): M. Hiezi

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA	Flow Controller
	Start	Stop	Start	Finish	Serial No.:	Serial No.:
B6	1218	12 <sup>20</sup>	-28.5	-15	4002	0132
B6-Dup	1218	12 <sup>20</sup>	-30	-5	7273	0086
A-11	1222	12 <sup>28</sup>	-29.5	-5	7124	0171
B-11	1227	12 <sup>29</sup>	-30	-4.5	2998	0242
C-11	1234	1235	-28.3	-0.8	2986	0116
TB	—	—	—	—	2998	—

TO-4A								
Location	Time		PUF	Sampler				
				Serial	Counter (Hrs)		Flow Rate (Mag Reading)	
	Start	Stop	Number	Number	Start	Finish	Initial	Final
B6	1218	12 <sup>19</sup>	3	823	124.08	148.16	58.5	55
B6-Dup	1218	12 <sup>19</sup>	1	821	124.64	148.66	46	45
A-11	1222	12 <sup>24</sup>	5	822	123.85	147.90	62	62
B-11	1227	12 <sup>29</sup>	2	825	123.28	147.37	54	50
C-11	1234	1234	4	820	114.57	138.57	54	49



# Keith Middle School Sampling Data Sheet

## Vent Air Sampling

Setup Date: 4/18/07  
 Recovery Date: 4/18/07

Sampler(s): EMacKinnon / M. Lihers  
 Sampler(s): EMacK

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA	Flow Controller
	Start	Stop	Start	Finish	Serial No.:	Serial No.:
VS-10	8:20	12:20	-29	-3	1066	247
VS-16	8:36	12:36	-27.5	-5	488	016
VS-16 dup	8:36	12:36	-29	-28*	138	209
VS-1	8:45	12:45	-28.5	-5	257	208
VS-4	8:53	12:55	-29.5	-7.5	449	168
BG	9:05	13:05	-28	-3.5	511	203

Controller plugged?

TO-10A				
Location	Time		Flow Rate (LPM)	
	Start	Stop	Start	Finish
VS-10	8:20	12:20	5.2	5.2
VS-16	8:36	12:36	4.9	4.2
VS-16 dup	8:36	12:36	5.2	4.4
SV-1	8:45	12:45	5.0	4.8
SV-4	8:53	12:55	5.0	4.4
BG	9:05	13:05	5.0	5.0



**SAMPLING ROUND 12 – MAY 2007**

## Keith Middle School Sampling Data Sheet Ambient Air Sampling

A-12 = Room 119  
 B-12 = Cafeteria  
 C-12 = Faculty Dining  
 BG-12 } Background  
 BG-DUP-12 } (Flag pole)

Setup Date: 5/18/07  
 Recovery Date: 5/19/07

Sampler(s): SM  
 Sampler(s): CM DT

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA	Flow Controller
	Start	Stop	Start	Finish	Serial No.:	Serial No.:
BG-DUP-12	1622	1630	-29	-23	7280	0010
C-12	1614	1616	-30	-2.5	7266	0185
A-12	1618	1652	-29.5	-2.0	4002	0113
B-12	16:11	1609	-30	-2.5	2350	0170001
BG-12	1622	1456	-29.5	-2.0	6872	0080

TO-4A								
Location	Time		PUF	Serial	Sampler		Flow Rate (Mag Reading)	
					Counter (Hrs)		Flow Rate (Mag Reading)	
	Start	Stop	Number	Number	Start	Finish	Initial	Final
B-12	16:11	1611	5	0820	138.71	162.69	50	44
C-12	1614	1616	1	0825	147.44	171.48	49	44
A-12	1618	1623	4	0822	148.01	172.10	62	54
BG-12	1622	1630	2	0821	148.88	173.00	46	42
BG-DUP-12	1622	1630	3	0823	148.32	172.44	58	51

# Keith Middle School Sampling Data Sheet

## Vent Air Sampling

Setup Date: 5/19/07  
 Recovery Date: 5/19/07

Sampler(s): SM  
 Sampler(s): GM DT

### TO-15

307  
5-19-07

Location	Time		Vacuum (in Hg)		SUMMA Serial No.:	Flow Controller Serial No.:
	Start	Stop	Start	Finish		
<del>VS-8-12</del>	1013	1405	-29.5	-3.0	0409	0204
VS-8-DUP-12	1002	1401	-28.5	-18.0	0178	0203
VS-BG-12	1050	1455	> -30	-3.0	0236	0205
VS-4-12	1029	1427	> -30	-3.5	0464	0240
VS8-12	1002	1401	-29.5	-7.5	0375	0247
VS-1-12	1034	1320	> -30	-3.0	0362	0210
<del>VS-BG-12</del>						

### TO-10A

Location	Time		Flow Rate (LPM)	
	Start	Stop	Start	Finish
VS-8-12	1002	1400	4.8	4.4
VS-8-DUP-12	1002	1400	5.0	3.9
VS-11-12	1013	1413	5.1	2.4
VS-4-12	1029	1428	4.9	4.6
VS-1-12	1034	1432	5.0	4.0
VS-BG-12	1050	1455	5.1	5.1



**SAMPLING ROUND 13 – JUNE 2007**

## Keith Middle School Sampling Data Sheet Ambient Air Sampling

Setup Date: 6/26/07  
Recovery Date: 6/27/07

Sampler(s): EM LM  
Sampler(s): EM LM

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA Serial No.:	Flow Controller Serial No.:
	Start	Stop	Start	Finish		
B-13	<del>1454</del> <sup>1447</sup>	1444	>30	-3.5	2876	0001
B6-13-Dup	1456	1457	>30	-4	7282	0123
A-13	1453	1453	>30	-4.0	7130	0086
C-13	<del>1459</del> <sup>1447</sup>	1204	-27	-3.2	7275	0019
B6-13	1456	1457	>30	-2.0	6907	0118
FB	N/A		-29.5		4463	0257

TO-4A								
Location	Time		PUF Number	Serial Number	Sampler Counter (Hrs)		Flow Rate (Mag Reading)	
	Start	Stop			Start	Finish	Initial	Final
B-13	1447	1445	3	0825	162.76	186.71	48	42.5
C-13	1450	1449	4	0820	171.56	195.53	48	42.5
B6-13	1456	1457	2	0823	172.56	196.57	46	45
B6-13-Dup	1456	1457	5	0821	173.13	197.14	48	44
A-13	1453	1453	1	0822	172.16	196.15	66	59



## Keith Middle School Sampling Data Sheet Vent Air Sampling

Setup Date: 6/27/07  
Recovery Date: 6/27/07

Sampler(s): EM LM  
Sampler(s): EM LM

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA Serial No.:	Flow Controller Serial No.:
	Start	Stop	Start	Finish		
B6-13	0952	1351	-29.5	-2	0131	0247
VS1-13	0929	1322	7-30	-7	0532	0245
VS9-13	0904	1258	-29.5	<del>0-2.3</del>	0393	0229
VS7-13	0916	1314	-27	-5	0322	0236
VS4-13	0938	1329	7-30	-2.5	0262	0232
VS9-DUP	0904	1258	7-30	-3.3	0183	0205

TO-10A				
Location	Time		Flow Rate (LPM)	
	Start	Stop	Start	Finish
VS9-13-DUP	0904	1258	5.00	5.25
VS9-13	0904	1258	5.15	5.30
VS7-13	0916	1314	5.05	5.60
VS1-13	0929	1322	5.13	5.03
VS4-13	0938	1329	5.12	4.94
B6-13	0952	1351	4.98	4.80



**SAMPLING ROUND 14 – AUGUST 2007**

## Keith Middle School Sampling Data Sheet Ambient Air Sampling

Setup Date: 8-1-07  
Recovery Date: 8/2/07

Sampler(s): SM LM  
Sampler(s): air SS

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA Serial No.:	Flow Controller Serial No.:
	Start	Stop	Start	Finish		
C (Faculty)	14:36	1436	-30	-15.8	4001	0112
B (caf)	14:39	1439	-29	-14.2	4032	0090
B6	14:45	1446	-28	-16	4457	0125
A (Rm 119)	14:42	1443	-30	-17	4027	0212
B6-DUP	14:45	1446	-30	-17	4036	0139

TO-4A								
Location	Time		PUF Number	Serial Number	Sampler		Flow Rate (Mag Reading)	
					Counter (Hrs)		Initial	Final
	Start	Stop	Start	Finish	Start	Finish	Initial	Final
C	14:36	1436	4	820	186.85	210.85	53	53
B	14:39	1439	3	825	195.66	219.65	44	43
A	14:42	1443	1	821	197.24	221.24	65	58
B6	14:45	1446	2	822	196.30	220.33	50	48
B6-Dup	14:45	1446	5	823	196.73	220.76	49	46



# Keith Middle School Sampling Data Sheet

## Vent Air Sampling

Setup Date: 8-1-07  
 Recovery Date: \_\_\_\_\_

Sampler(s): GM 55  
 Sampler(s): \_\_\_\_\_

TO-15						
Location	Time		Vacuum (in Hg)		SUMMA Serial No.:	Flow Controller Serial No.:
	Start	Stop	Start	Finish		
VS-1	0950	<del>1335</del> 1345	-26.5	<del>-2.55</del>	366	236
VS-14-Dup	0935	1335	-30	-4	542	226
VS-14	0935	1335	-30	-6.2	221	245
VS4	0955	1350	-29.5	-4	194	244
VS-B6	1006	1407	-28.5	-3.2	253	203
VS-16	0942	1342	-28.8	-3.6	175	241

TO-10A				
Location	Time		Flow Rate (LPM)	
	Start	Stop	Start	Finish
VS-14-Dup	0935	1335	4.8	4.98
VS-14	0935	1335	4.9	4.66
VS-16	0942	1342	4.98	5.06
VS-1	0950	1345	5.12	5.40
VS-4	0955	1358	5.05	4.95
VS-B6	1006	1407	4.98	5.33



**APPENDIX B**

**FIELD REDUCED DATA**

## **REDUCED FIELD DATA**

**TO4A & TO10A SAMPLE VOLUMES**

**SAMPLING ROUND 10 – MARCH 2007**

Average Temp (aF/K): 43.0 278.1

Average Baro. Press (°Hg / mmHg): 30.20 767.1

Saturday, March 31, 2007

Location	Serial #	m <sub>a</sub>	b <sub>a</sub>	Start Reading (°H <sub>2</sub> O)	Start Reading (µpm)	Stop Reading (°H <sub>2</sub> O)	Stop Reading (µpm)	Avg. Reading (°H <sub>2</sub> O)	RPD of Start and Stop Readings	Avg. Flow (µpm)	Start time (hr)	Start time (clock)	Stop Time (hr)	Stop Time (clock)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
VS-14-10	TO-10A	-	-	-	5.1	-	5.1	-	0.00	5.1	-	9:57	-	13:49	232	1.18
VS-14-10-DUP	TO-10A	-	-	-	5.1	-	5.1	-	0.00	5.1	-	9:57	-	13:49	232	1.18
VS-1-10	TO-10A	-	-	-	5	-	5	-	0.00	5	-	10:24	-	14:21	237	1.19
VS-7-10	TO-10A	-	-	-	5	-	5.1	-	1.98	5.05	-	10:09	-	14:05	236	1.19
VS-4-10	TO-10A	-	-	-	5.1	-	5	-	1.98	5.05	-	10:36	-	14:35	238	1.21
VS-BG-10	TO-10A	-	-	-	5.1	-	5.1	-	0.00	5.1	-	10:52	-	15:53	301	1.54
	TO-10A	-	-	-	-	-	-	-	#DIV/0!	0	-	-	-	-	0	0.00

Location	Serial #	m <sub>a</sub>	b <sub>a</sub>	Start Reading (°H <sub>2</sub> O)	Start Reading (µpm)	Stop Reading (°H <sub>2</sub> O)	Stop Reading (µpm)	Avg. Reading (°H <sub>2</sub> O)	RPD of Start and Stop Readings	Avg. Flow (µpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
A-10	TO-10A	821	-1.19162	54	54	54	54	54	0.00	241	100:44	124:49	1443	347.4
B-10	TO-10A	825	-0.84222	50	48	49	48	49	4.08	238	98:09	123:19	1448	344.2
C-10	TO-10A	820	-1.18238	54	53	53.5	53	53.5	1.97	240	90:33	114:48	1448	347.0
BG-10	TO-10A	822	-1.98722	46	52	49	52	49	12.24	232	98:55	123:54	1445	334.7
BG-10-DUP	TO-10A	823	-1.48151	48	54	51	54	51	11.76	229	98:53	123:74	1435	328.9

**SAMPLING ROUND 11 – APRIL 2007**

Average Temp (oF/K): 85.1 291.4

Average Baro. Press (°Hg / mmHg): 29.48 748.8

Wednesday, April 18, 2007

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (°H2O)	Start Reading (µpm)	Stop Reading (°H2O)	Stop Reading (µpm)	Avg. Reading (°H2O)	RPD of Start and Stop Readings	Avg. Flow (µpm)	Start time (hr)	Start time (clock)	Stop Time (hr)	Stop Time (clock)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
VS-10-11	TO-10A	-	-	-	5.2	-	5.2	-	0.00	5.2	-	8:20	-	13:49	329	1.71
VS-10-11	TO-10A	-	-	-	4.8	-	4.2	-	15.38	4.55	-	8:36	-	13:49	313	1.42
VS-18-11-Dup	TO-10A	-	-	-	5.2	-	4.4	-	18.67	4.8	-	8:36	-	14:21	345	1.66
VS-1-11	TO-10A	-	-	-	5	-	4.8	-	4.08	4.9	-	8:45	-	14:05	320	1.57
VS-4-11	TO-10A	-	-	-	5	-	4.4	-	12.77	4.7	-	8:53	-	14:35	342	1.61
VS-BG-11	TO-10A	-	-	-	5	-	5	-	0.00	5	-	9:05	-	15:53	406	2.04
	TO-10A	-	-	-	-	-	-	-	-	0	-	-	-	-	0	0.00

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (°H2O)	Start Reading (µpm)	Stop Reading (°H2O)	Stop Reading (µpm)	Avg. Reading (°H2O)	RPD of Start and Stop Readings	Avg. Flow (µpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
A-11	TO-10A	0.037	-1.57823	82	54	54	54	58	13.79	247	123.85	147.9	1443	358.9
B-11	TO-10A	0.036	-1.33868	64	46	46	46	51	11.75	234	123.28	147.37	1445	338.9
C-11	TO-10A	0.035	-0.98821	54	53	53	53	53.5	1.87	236	144.57	138.57	1440	340.1

Average Temp (oF/ K): 40.2 277.6

Average Baro. Press (Hg / mmHg): 28.48 746.8

Wednesday, April 18, 2007

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (°H2O)	Start Reading (µm)	Stop Reading (°H2O)	Stop Reading (µm)	Avg. Reading (°H2O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
BG-11	TO-10A 823	0.038	-1.60958	52.5		52		56.25	11.76	232	124.08	148.1	1441	334.7
BG-11-DUP	TO-10A 820	0.039	-2.05998	48		54		50	16.00	228	124.84	148.66	1441	326.0

**SAMPLING ROUND 12 – MAY 2007**

**OUTDOOR SAMPLING LOCATIONS**

Average Temp (oF/K): 43.0      279.1

Average Baro. Press (\*Hg / mmHg): 29.86      761.0

**Saturday, May 19, 2007**

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (*H2O)	Start Reading (ppm)	Stop Reading (*H2O)	Stop Reading (ppm)	Avg. Reading (*H2O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Start time (clock)	Stop Time (hr)	Stop Time (clock)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
VS-11-12	TO-10A	-	-	-	5.1	-	2.4	-	72.00	3.75	-	10:13	-	14:13	240	0.90
VS-6-12	TO-10A	-	-	-	4.8	-	4.4	-	8.70	4.8	-	10:02	-	14:00	236	1.09
VS-6-12-Dup	TO-10A	-	-	-	5	-	3.9	-	24.72	4.45	-	10:02	-	14:00	236	1.06
VS-1-12	TO-10A	-	-	-	5	-	4	-	22.22	4.5	-	10:34	-	14:32	236	1.07
VS-4-12	TO-10A	-	-	-	4.9	-	4.8	-	8.32	4.75	-	10:29	-	14:26	239	1.14
VS-BG-12	TO-10A	-	-	-	5.1	-	5.1	-	0.08	5.1	-	10:50	-	14:55	245	1.25
	TO-10A	-	-	-	-	-	-	-	-	0	-	-	-	-	0	0.00

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (*H2O)	Start Reading (ppm)	Stop Reading (*H2O)	Stop Reading (ppm)	Avg. Reading (*H2O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
BG-12	TO-10A	821	0.037	-1.44767	49	42	44	9.09	9.09	210	148.88	173	1447	303.9
BG-12-DUP	TO-10A	823	0.039	-1.56326	58	51	54.5	12.84	12.84	221	148.32	172.44	1447	319.2

**INDOOR SAMPLING LOCATIONS**

Average Temp (oF/ K): 68.3      293.2

Average Baro. Press (\*Hg / mmHg): 29.92      760.0

**Saturday, May 19, 2007**

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (*H2O)	Start Reading (ppm)	Stop Reading (*H2O)	Stop Reading (ppm)	Avg. Reading (*H2O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
A-12	TO-10A 822	0.038	-1.22239	62		54		58	13.78	243	148.01	172.1	1445	351.6
B-12	TO-10A 825	0.034	-1.00726	50		44		47	12.77	229	138.71	162.69	1439	329.7
C-12	TO-10A 820	0.034	-0.77412	49		44		46.5	10.75	221	147.44	171.48	1442	319.2

**SAMPLING ROUND 13 – JUNE 2007**

### OUTDOOR SAMPLING LOCATIONS

Average Temp (oF/ K): 79.5      299.4

Average Baro. Press (\*Hg / mmHg): 29.96      761.0

Wednesday, June 27, 2007

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (*H <sub>2</sub> O)	Start Reading (ppm)	Stop Reading (*H <sub>2</sub> O)	Stop Reading (ppm)	Avg. Reading (*H <sub>2</sub> O)	RPD of Start and Stop Readings	Avg. Flow (ppm)	Start time (hr)	Start time (clock)	Stop Time (hr)	Stop Time (clock)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
VS-7-13	TO-10A	-	-		5.05		5.5		10.33	5.325		9:16		13:14	238	1.27
VS-9-13	TO-10A	-	-		5.16		5.3		2.87	5.225		9:04		12:58	234	1.22
VS-9-13-Dup	TO-10A	-	-		5		5.25		4.88	5.125		9:04		12:58	234	1.20
VS-1-13	TO-10A	-	-		5.13		5.63		1.97	5.08		9:29		13:22	233	1.18
VS-4-13	TO-10A	-	-		5.12		4.94		3.58	5.03		9:38		13:28	231	1.16
VS-BG-13	TO-10A	-	-		4.88		4.5		3.58	4.89		9:52		13:51	238	1.17
	TO-10A	-	-							0					0	0.00

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading (*H <sub>2</sub> O)	Start Reading (ppm)	Stop Reading (*H <sub>2</sub> O)	Stop Reading (ppm)	Avg. Reading (*H <sub>2</sub> O)	RPD of Start and Stop Readings	Avg. Flow (ppm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
BG-13	TO-4A	821	0.037	-1.37533	46	45	45	45.5	2.20	222	172.58	196.57	1441	319.3
BG-13-DUP	TO-4A	823	0.038	-1.65730	48	44	44	46	8.70	225	173.13	197.14	1441	324.3

### INDOOR SAMPLING LOCATIONS

Average Temp (oF/ K): 79.5 / 299.4

Average Baro. Press ("Hg / mmHg): 29.98 / 761.0

Wednesday, June 27, 2007

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading ("H2O)	Start Reading (lpm)	Stop Reading ("H2O)	Stop Reading (lpm)	Avg. Reading ("H2O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
A-13	TO-4A	B22	0.035	-1.16715	66	59	59	62.5	11.20	257	172.16	186.15	1439	370.5
B-13	TO-4A	B25	0.034	-0.94590	48	42.5	42.5	45.25	12.15	228	162.76	186.71	1437	328.3
C-13	TO-4A	B20	0.035	-0.94609	48	42.5	42.5	45.25	12.15	221	171.56	195.53	1438	318.0

**SAMPLING ROUND 14 – AUGUST 2007**

### OUTDOOR SAMPLING LOCATIONS

Average Temp (cF/ K): 76.3    297.5

Average Baro. Press ("Hg / mmHg): 29.92    760.0

Thursday, August 02, 2007

Location	Serial #	m <sub>a</sub>	b <sub>a</sub>	Start Reading ("H <sub>2</sub> O)	Start Reading (ppm)	Stop Reading ("H <sub>2</sub> O)	Stop Reading (ppm)	Avg. Reading ("H <sub>2</sub> O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Start time (clock)	Stop Time (hr)	Stop Time (clock)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
VS-14-14	TO-10A	-	-	-	4.8	-	4.98	-	3.68	4.89	-	9:35	-	13:35	240	1.17
VS-14-14-DUP	TO-10A	-	-	-	4.8	-	4.68	-	5.02	4.73	-	9:35	-	13:35	240	1.15
VS-16-14	TO-10A	-	-	-	4.88	-	5.06	-	1.59	5.02	-	9:42	-	13:42	240	1.20
VS-1-14	TO-10A	-	-	-	5.12	-	5.4	-	5.32	5.26	-	9:50	-	13:45	235	1.24
VS-4-14	TO-10A	-	-	-	5.85	-	4.95	-	2.00	5	-	9:55	-	13:50	235	1.18
VS-BG-14	TO-10A	-	-	-	4.88	-	5.33	-	6.79	5.155	-	10:06	-	14:07	241	1.24
	TO-10A	-	-	-	-	-	-	-	-	0	-	-	-	-	0	0.00

Location	Serial #	m <sub>a</sub>	b <sub>a</sub>	Start Reading ("H <sub>2</sub> O)	Start Reading (ppm)	Stop Reading ("H <sub>2</sub> O)	Stop Reading (ppm)	Avg. Reading ("H <sub>2</sub> O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
BG-14	TO-4A	822	0.037	-1.53280	50	48	48	49	4.06	228	196.3	220.33	1442	328.4
BG-14-DUP	TO-4A	823	0.036	-1.21497	48	48	48	47.5	6.32	225	198.79	220.76	1442	324.6

**INDOOR SAMPLING LOCATIONS**

Average Temp (oF/ K): 78.0 298.6

Average Baro. Press ("Hg / mmHg): 29.92 760.0

**Thursday, August 02, 2007**

Location	Serial #	m <sub>s</sub>	b <sub>s</sub>	Start Reading ("H2O)	Start Reading (lpm)	Stop Reading ("H2O)	Stop Reading (lpm)	Avg. Reading ("H2O)	RPD of Start and Stop Readings	Avg. Flow (lpm)	Start time (hr)	Stop Time (hr)	Total Sample Time (min)	Total Actual Sample Volume (m <sup>3</sup> )
A-14	TO-4A 821	0.037	-1.39700	65		58		61.5	11.38	252	197.24	221.26	1441	363.1
B-14	TO-4A 825	0.032	-0.59827	44		43		43.5	2.30	227	195.66	218.85	1439	326.1
C-14	TO-4A 820	0.037	-1.57348	53		53		53	0.00	238	186.85	210.85	1440	343.3

**APPENDIX C**

**EQUIPMENT CALIBRATION SHEETS**

## **PS1 CALIBRATIONS AND POST-SAMPLING AUDITS**

**SAMPLING ROUND 10 – MARCH 2007**

# PS1 Calibration Data Sheet

Network: New Bedford

Site: Kieth Middle School

Serial #: 821

Station # A

Technician: DG

Date: 3/30/07

Calibration Orifice  
S/N: 1125

Orif. Cal. Data: 11/27/07

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 20.7

Bar. press (in Hg): 30.20

Thermometer Serial #: 1247

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
4.0	4.0	8.0	80.00
3.6	3.6	7.2	70.00
3.2	3.15	6.35	60.00
2.7	2.7	5.4	50.00
2.2	2.15	4.35	40.00

Set @  
52

Post cal check

Bar 30.32

Mag

$\Delta H$

Temp 18.6

50

5.4

# PS1 Calibration Data Sheet

Network: New Bedford  
 Technician: DG

Site: Kieth Middle School  
 Date: 3/30/07

Serial #: 825  
 Calibration Orifice S/N: 1125  
 Station # B  
 Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 20.3

Bar. press (in Hg): 30.20

Thermometer Serial #: 1247

$\Delta H_0$  ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
4.3	4.15	8.45	80.00
3.8	3.8	7.6	70.00
3.4	3.3	6.7	60.00
2.8	2.9	5.7	50.00
2.3	2.2	4.5	40.00

set @  
50

Post cal check

Bar 30.32      mag 50      ΔH 5.8  
 Temp 15

# PS1 Calibration Data Sheet

Network: New Bedford      Site: Kieth Middle School      Serial #: 820      Station #: C  
 Technician: DG      Date: 3/30      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):      New Instrument      Brush Change      Motor Change      Quarterly Recal

Amb. Temp, T1 (°C): 20.3      Bar. press (in Hg): 30.20  
 Thermometer Serial #: 1247

$\Delta H_0$  ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
4.1	4.0	8.1	80.00
3.6	3.6	7.2	70.00
3.2	3.2	6.4	60.00
2.7	2.7	5.4	50.00
2.2	2.2	4.4	40.00

Set e  
 52

Post cal check  
 BARO 30.32      MAG 50      DA 5.4  
 Temp 18.8

# PS1 Calibration Data Sheet

Network: New Bedford

Site: Kieth Middle School

Serial #: 822

Station # B67

Technician: DG

Date: 3/30/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 20.7 18.8 <sup>DSO</sup> <sub>3/26/07</sub>

Bar. press (in Hg): 30.20

Thermometer Serial #: 1247

$\Delta H_0$  ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
3.8	3.8	7.6	80.00
3.5	3.5	7.0	70.00
3.2	3.2	6.4	60.00
2.6	2.7	5.3	50.00
2.2	2.2	4.4	40.00

Set @  
52

Post cal check

Bar 30.32

MAG  
50

$\Delta H$   
5.2

Temp 18.1°C

# PS1 Calibration Data Sheet

Network: New Bedford      Site: Kieth Middle School      Serial #: 823      Station # BG-Dup  
 Technician: DG      Date: 3/30/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):      New Instrument      Brush Change      Motor Change      Quarterly Recal

Amb. Temp, T1 (°C): 18.8      Bar. press (in Hg): 30.20  
 Thermometer Serial #: 1247

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.8	3.8	7.6	80.00
3.5	3.5	7.0	70.00
3.0	3.0	6.0	60.00
2.7	2.7	5.4	50.00
2.1	2.1	4.2	40.00

Set @  
54

Post cal check  
 Bar 30.32      mas 50       $\Delta H$  53  
 Temp - 17.1 °C

**SAMPLING ROUND 11 – APRIL 2007**

# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 0820

Station # KT C11

Technician: en

Date: 4/17/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

move

Amb. Temp, T1 (°C): 16.4

Bar. press (in Hg): 29.9

Thermometer Serial #: T2585

$\Delta H_0$  ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
3.55	3.6	7.15	80.00
3.2	3.3	6.5	70.00
2.8	2.85	5.65	60.00
2.4	2.4	4.8	50.00
1.95	1.9	3.85	40.00

# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 821

Station # BG-Dup

Technician: cm

Date: 4/17/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 9.9

Bar.press (in Hg): 29.4

Thermometer Serial #: T2585

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.4	3.6	7.0	80.00
3.1	3.2	6.3	70.00
2.8	2.9	5.7	60.00
2.4	2.5	4.9	50.00
2.0	2.0	4.0	40.00

# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 822

Station # A71

Technician: cm

Date: 4/17/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

None

Amb. Temp, T1 (°C): 21.6

Bar.press (in Hg): 29.4

Thermometer Serial #: T2585

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.6	3.5	7.1	80.00
3.25	3.15	6.40	70.00
2.9	2.7	5.6	60.00
2.5	2.4	4.9	50.00
2.05	1.9	3.95	40.00

# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 823

Station # B6

Technician: Car

Date: 4/17/07

Calibration Orifice S/N: 1125

Orif. Cal. Data: 112710

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 9.9

Bar.press (in Hg): 29.4

Thermometer Serial #: T2585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.5	3.6	7.1	80.00
3.1	3.2	6.3	70.00
2.7	2.8	5.5	60.00
2.4	2.5	4.9	50.00
1.95	2.0	3.95	40.00

## PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 0825

Station #: B-7<sup>th</sup> B-11

Technician: EM

Date: 4/17/07

Calibration Orifice  
S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

move

Amb. Temp, T1 (°C): 17.6

Bar.press (in Hg): 29.4

Thermometer Serial #: T2585

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.7	3.8	7.5	80.00
3.3	3.4	6.7	70.00
2.9	3.0	5.9	60.00
2.5	2.6	5.1	50.00
2.0	2.1	4.1	40.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 820

Station # C-11

Technician: GM/ML

Date: 4/18/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 16.7

Bar. press (In Hg): 29.7

Thermometer Serial #: T2585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.4	2.38	4.78	50.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 821

Station # B6-11-Dup

Technician: SM/ML

Date: 4/18/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 10.7

Bar.press (in Hg): 29.7

Thermometer Serial #: T2585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.5	2.4	4.9	50.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 822

Station # A-11

Technician: JM/ML

Date: 4/18/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 21.2

Bar.press (in Hg): 29.7

Thermometer Serial #: T2585

$\Delta H_0$  ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
2.5	2.4	4.9	50.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 823

Station # B6-11

Technician: SM/ML

Date: 4/18/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 10.7

Bar. press (in Hg): 29.7

Thermometer Serial #: T2585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.5	2.35	4.85	50.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 825

Station # B-11

Technician: Am/ML

Date: 4/18/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 16.8

Bar.press (in Hg): 29.7

Thermometer Serial #: T2585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.4	2.6	5.0	50.00

**SAMPLING ROUND 12 – MAY 2007**

# PS1 Calibration Data Sheet

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 0820      Station # B-12  
 Technician: SM, PP      Date: 5/18/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):     New Instrument     Brush Change     Motor Change     Quarterly Recal

Amb. Temp, T1 (°C): 20.3      Bar. press (in Hg): 30.0  
 Thermometer Serial #: T2585

ΔH<sub>o</sub> ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
3.7	3.5	7.2	80.00
3.3	3.2	6.5	70.00
2.9	2.7	5.6	60.00
2.5	2.3	4.8	50.00
2.0	1.8	3.8	40.00

# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 821

Station #: B6-12

Technician: GM PP

Date: 5/18/07

Calibration Orifice  
S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 8.3

Bar.press (in Hg): 30

Thermometer Serial #: 12585

$\Delta H_o$  ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelec
3.6	3.5	7.1	80.00
3.7	3.2	6.5	70.00
5.55	2.7	5.55	60.00
2.45	2.4	4.85	50.00
2.0	1.95	3.95	40.00

# PS1 Calibration Data Sheet

Network: Kelth Middle School  
 Technician: GM PP

Site: New Bedford, MA  
 Date: 5/18/07

Serial #: 0822  
 Calibration Orifice S/N: 1125

Station # A-12 Rm 119  
 Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):     New Instrument     Brush Change     Motor Change     Quarterly Recal

Amb. Temp, T1 (°C): 19.9                      Bar.press (in Hg): 30.0  
 Thermometer Serial #: T2585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.65	3.6	7.25	80.00
3.4	3.3	4.7	70.00
2.8	2.8	5.6	60.00
2.5	2.45	4.95	50.00
2.0	2.0	4.0	40.00

## PS1 Calibration Data Sheet

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 823      Station # BG-DUP-12  
 Technician: EM PP      Date: 5/18/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):       New Instrument       Brush Change       Motor Change       Quarterly Recal

Amb. Temp, T1 (°C): 6.2      Bar.press (in Hg): 30.0  
 Thermometer Serial #: 72585

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnaheic
3.5	3.4	6.9	80.00
3.2	3.1	6.3	70.00
2.8	2.7	5.5	60.00
2.4	2.35	4.75	50.00
2.0	1.85	3.85	40.00

## PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 0825

Station # C-12

Technician: GM PP

Date: 5/18/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 19.6

Bar. press (in Hg): 30.0

Thermometer Serial #: 12585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.9	3.8	7.7	80.00
3.5	3.4	6.9	70.00
3.1	3.0	6.1	60.00
2.4	2.5	5.1	50.00
2.1	2.05	4.15	40.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 820

Station # B12

Technician: EM

Date: 5-19-07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 21.0

Bar. press (in Hg): 29.84

Thermometer Serial #: T2585

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.4	2.4	4.8	50.00



# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 821

Station # B612

Technician: EM

Date: 5-19-07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 12.5

Bar.press (in Hg): 29.84

Thermometer Serial #: T2589

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.5	2.4	4.9	50.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 822

Station # A12

Technician: EM

Date: 5-19-07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 21.8

Bar. press (In Hg): 29.84

Thermometer Serial #: T2585

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.5	2.4	4.9	50.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 823

Station # B6DUP12

Technician: EM

Date: 5-19-07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

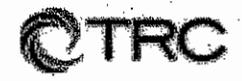
Amb. Temp, T1 (°C): <sup>20.7</sup>  
~~12.5~~ 12.2

Bar. press (in Hg): 29.84

Thermometer Serial #: T2585

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.5	2.4	4.9	50.00



# PS1 Post-Sampling Flow Audit

Network: Keith Middle School  
Technician: EM

Site: New Bedford, MA  
Date: 5.19.07

Serial #: 825  
Calibration Orifice  
S/N: 1125

Station # C12  
Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 18.5  
Thermometer Serial #: T2585

Bar. press (in Hg): 29.84

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.6	2.4	5.0	50.00



**SAMPLING ROUND 13 – JUNE 2007**

# PS1 Calibration Data Sheet

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 0820      Station #: B-13  
 Technician: EMM      Date: 6/26/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):       New Instrument       Brush Change       Motor Change       Quarterly Recal

Amb. Temp, T1 (°C): 36.5      Bar.press (in Hg): 30.1  
 Thermometer Serial #: LC01246

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelec
3.6	3.7	7.3	80.00
3.2	3.25	6.45	70.00
2.85	2.8	5.65	60.00
2.35	2.45	4.8	50.00
1.95	1.95	3.90	40.00

6/27/07 Temp °C 27.9      BP 29.24

Post      left      Right      Total      mag  
          2.82      2.8      5.62      60"



# PS1 Calibration Data Sheet

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 0821      Station #: BG 73 Dup  
 Technician: CM, LM      Date: 6/26/07      Calibration Orifice S/N: 025      Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):       New Instrument       Brush Change       Motor Change       Quarterly Recal

Amb. Temp, T1 (°C): 35.4      Bar.press (in Hg): 30.1  
 Thermometer Serial #: 4001246

ΔH<sub>o</sub> ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
3.5	3.5	7.0	80.00
3.2	3.25	6.45	70.00
2.8	2.9	5.7	60.00
2.4	2.4	4.8	50.00
1.95	1.95	3.90	40.00

6/27/07      Temp °C 35.3      BB 29.96  
 Post      Left      Right      Total      mag  
             2.65      2.95      5.60      60



# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 0822

Station # A-13 (Rm 112)

Technician: CM LM

Date: 6/26/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 27.6

Bar. press (in Hg): 30.1

Thermometer Serial #: 2001246

$\Delta H_0$  ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
3.65	3.65	7.30	80.00
3.3	3.3	6.6	70.00
2.9	2.9	5.8	60.00
2.5	2.5	5.0	50.00
2.0	1.95	3.95	40.00

6/27/07

Post

Temp °C 27.5      BP 29.96

left	Right	Total	Mag.
<u>2.85</u>	<u>2.89</u>	<u>5.74</u>	<u>60"</u>



# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 0823

Station # B6-13

Technician: GM, LM

Date: 6/26/07

Calibration Orifice  
S/N: 1125

Orif. Cal. Data: 7/12/02

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 35.4

Bar. press (in Hg): 30.1

Thermometer Serial #: 6001246

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.55	3.65	7.20	80.00
3.2	3.3	6.5	70.00
2.8	2.8	5.6	60.00
2.45	2.5	4.95	50.00
2.0	2.05	4.05	40.00

6/27/07 Temp °C 35.3 BP 29.96

POST Left Right Total Mag.

2.72    2.98    5.70    60"

# PS1 Calibration Data Sheet

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 0825      Station # C-13  
 Technician: GWM LM      Date: 6/26/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 1/12/06

Reason for Calibration (Circle One):       New Instrument       Brush Change       Motor Change       Quarterly Recal

Amb. Temp, T1 (°C): 28.7      Bar. press (in Hg): 30.10  
 Thermometer Serial #: 6001246

ΔH<sub>0</sub> ("H<sub>2</sub>O) Calibration Orifice

Left	Right	Total	I ("H <sub>2</sub> O) Magnahelic
3.9	3.9	7.8	80.00
3.5	3.45	6.95	70.00
3.0	3.0	6.0	60.00
2.5	2.6	5.1	50.00
2.1	2.1	4.2	40.00

6/27/07      Temp 29.3°C      BP 29.96  
 Post      left      Right      Total      Mag.  
           3.09      3.0      6.09      60"



**SAMPLING ROUND 14 – AUGUST 2007**

# PS1 Calibration Data Sheet

Network: Keith Middle School  
 Technician: Jim LM

Site: New Bedford, MA  
 Date: 8/1/07

Serial #: 820  
 Calibration Orifice S/N: 1125

Station # C-14  
 Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):      New Instrument      Brush Change      Motor Change      Quarterly Recal

Amb. Temp, T1 (°C): 25.5  
 Thermometer Serial #: 2525

Bar. press (in Hg): 29.92

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.6	3.5	7.10	80.00
3.25	3.3	6.55	70.00
2.85	2.9	5.75	60.00
2.39	2.4	4.79	50.00
2.05	2.0	4.05	40.00



# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 821

Station # A (Rm 112) - 14

Technician: AM LM

Date: 8/1/07

Calibration Orifice S/N: 11/25

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 26.7

Bar. press (in Hg): 29.92

Thermometer Serial #: 2595

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.58	3.50	7.08	80.00
3.25	3.2	6.45	70.00
2.90	2.75	5.65	60.00
2.42	2.35	4.77	50.00
2.0	1.95	3.95	40.00

# PS1 Calibration Data Sheet

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 822

Station # B6-14

Technician: EM LM

Date: 8/1/07

Calibration Orifice  
S/N: 1125

Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):

New Instrument

Brush Change

Motor Change

Quarterly Recal

Amb. Temp, T1 (°C): 32.7

Bar. press (in Hg): 29.72

Thermometer Serial #: 2595

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.5	3.6	7.10	80.00
3.25	3.1	6.35	70.00
2.75	2.8	5.55	60.00
2.42	2.3	4.72	50.00
1.9	2.1	4.0	40.00

# PS1 Calibration Data Sheet

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 823      Station # BG-Dup-14  
 Technician: EM LM      Date: 8/1/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):      New Instrument      Brush Change      Motor Change      Quarterly Recal

Amb. Temp, T1 (°C): 32.6      Bar. press (in Hg): 29.92  
 Thermometer Serial #: \_\_\_\_\_

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
3.62	3.5	7.12	80.00
3.3	3.2	4.5	70.00
<del>2.85</del>	2.75	5.6	60.00
2.5	2.35	4.85	50.00
2.0	1.9	3.90	40.00

# PS1 Calibration Data Sheet

Network: Keith Middle School  
 Technician: AM/LM

Site: New Bedford, MA  
 Date: 8/1/07

Serial #: 0825  
 Calibration Orifice S/N: 1125

Station # B-14 (ref.)  
 Orif. Cal. Data: 11/27/06

Reason for Calibration (Circle One):     New Instrument     Brush Change     Motor Change     Quarterly Recal

Amb. Temp, T1 (°C): 26.8 27.3  
 Thermometer Serial #: 2595

Bar. press (in Hg): 29.92

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelec
3.9	4.3	8.2	80.00
3.0	3.45	7.05	70.00
5.25	3.1	6.35	60.00
2.70	2.45	5.15	50.00
2.20	2.10	4.3	40.00



# PS1 Post-Sampling Flow Audit

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 820      Station # C-14  
 Technician: en      Date: 8/2/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 22.7      Bar.press (in Hg): 29.95  
 Thermometer Serial #: 2525      30.00

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.3	2.5	4.80	50.00



# PS1 Post-Sampling Flow Audit

Network: Keith Middle School  
Technician:     

Site: New Bedford, MA  
Date: 8/2/07

Serial #: 821  
Calibration Orifice S/N: 1125

Station # A-14  
Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 23.6  
Thermometer Serial #: 2525

Bar.press (in Hg): 29.98

$\Delta H_o$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.4	2.45	4.85	50.00



# PS1 Post-Sampling Flow Audit

Network: Keith Middle School      Site: New Bedford, MA      Serial #: 822      Station # B6-14  
 Technician: cm      Date: 8/2/07      Calibration Orifice S/N: 1125      Orif. Cal. Data: 11/21/06

Amb. Temp, T1 (°C): 23.4      Bar.press (in Hg): 30.00 <sup>29.98</sup>  
 Thermometer Serial #: 2525

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.35	2.4	4.75	50.00



# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 823

Station # BGRup-14

Technician: an

Date: 8/2/07

Calibration Orifice

S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 23.6

Bar. press (in Hg): 29.98  
~~30.00~~ 2

Thermometer Serial #: 2525

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.3	2.4	4.70	50.00

# PS1 Post-Sampling Flow Audit

Network: Keith Middle School

Site: New Bedford, MA

Serial #: 825

Station # B-14

Technician: AM

Date: 8/2/07

Calibration Orifice  
S/N: 1125

Orif. Cal. Data: 11/27/06

Amb. Temp, T1 (°C): 27.5

Bar. press (in Hg): 29.98  
~~30.00~~ in

Thermometer Serial #: 2525

$\Delta H_0$  ("H2O) Calibration Orifice

Left	Right	Total	I ("H2O) Magnahelic
2.5	2.6	5.1	50.00

## **PS1 CALIBRATIONS AND POST-SAMPLING AUDITS**

**SAMPLING ROUND 10 – MARCH 2007**

Network: New Bedford Site: Keith Middle Serial #: 821 Station #: A  
 Technician: D.G./E.M. Date: 3/30/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 20.3 Bar. Press., Pa (in Hg) 30.20  
 Amb. Temp, Ta (K) 293.3 Bar. Press., Pa (mmHg) 767.1

Orifice Data

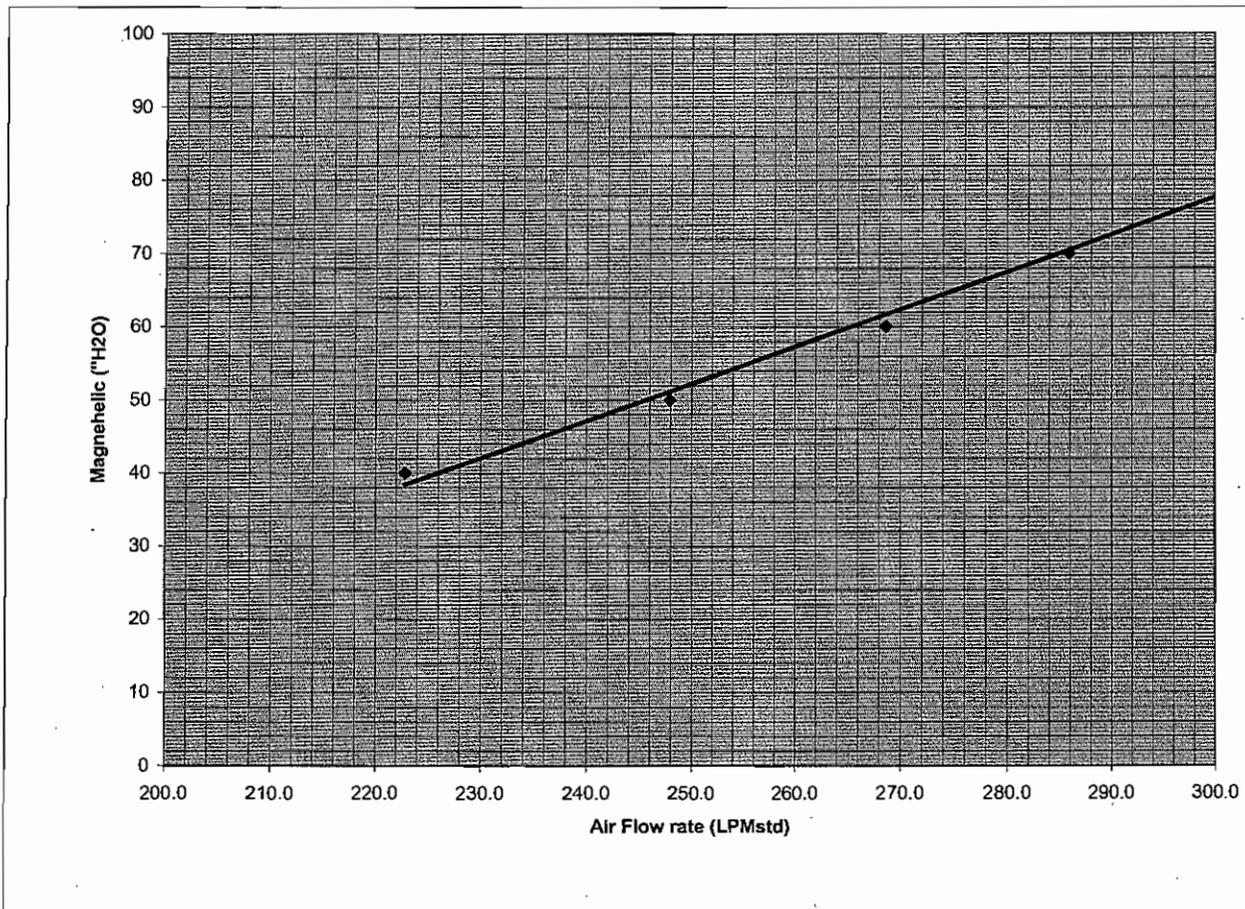
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	I	I <sub>c</sub>
8.00	301.176	80	9.06
7.20	285.871	70	8.47
6.35	268.647	60	7.84
5.40	247.967	50	7.16
4.35	222.859	40	6.40

$I_c = \sqrt{I \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o}\} \times 1000$

m<sub>s</sub> = 0.034 b<sub>s</sub> = -1.19162 r<sub>s</sub> = 0.99875



Desired Flow Rate (lpm): 250 Sampler Setting: 52.2

m<sub>mag</sub> = 0.509 b<sub>mag</sub> = -74.99790 r<sub>mag</sub> = 0.99494

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 825 Station #: B  
 Technician: D.G./ E.M. Date: 3/30/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 20.3 Bar. Press., Pa (in Hg) 30.20  
 Amb. Temp, Ta (K) 293.3 Bar. Press., Pa (mmHg) 767.1

Orifice Data

Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
8.45	309.449	80	9.06
7.60	293.624	70	8.47
6.70	275.871	60	7.84
5.70	254.681	50	7.16
4.50	226.618	40	6.40

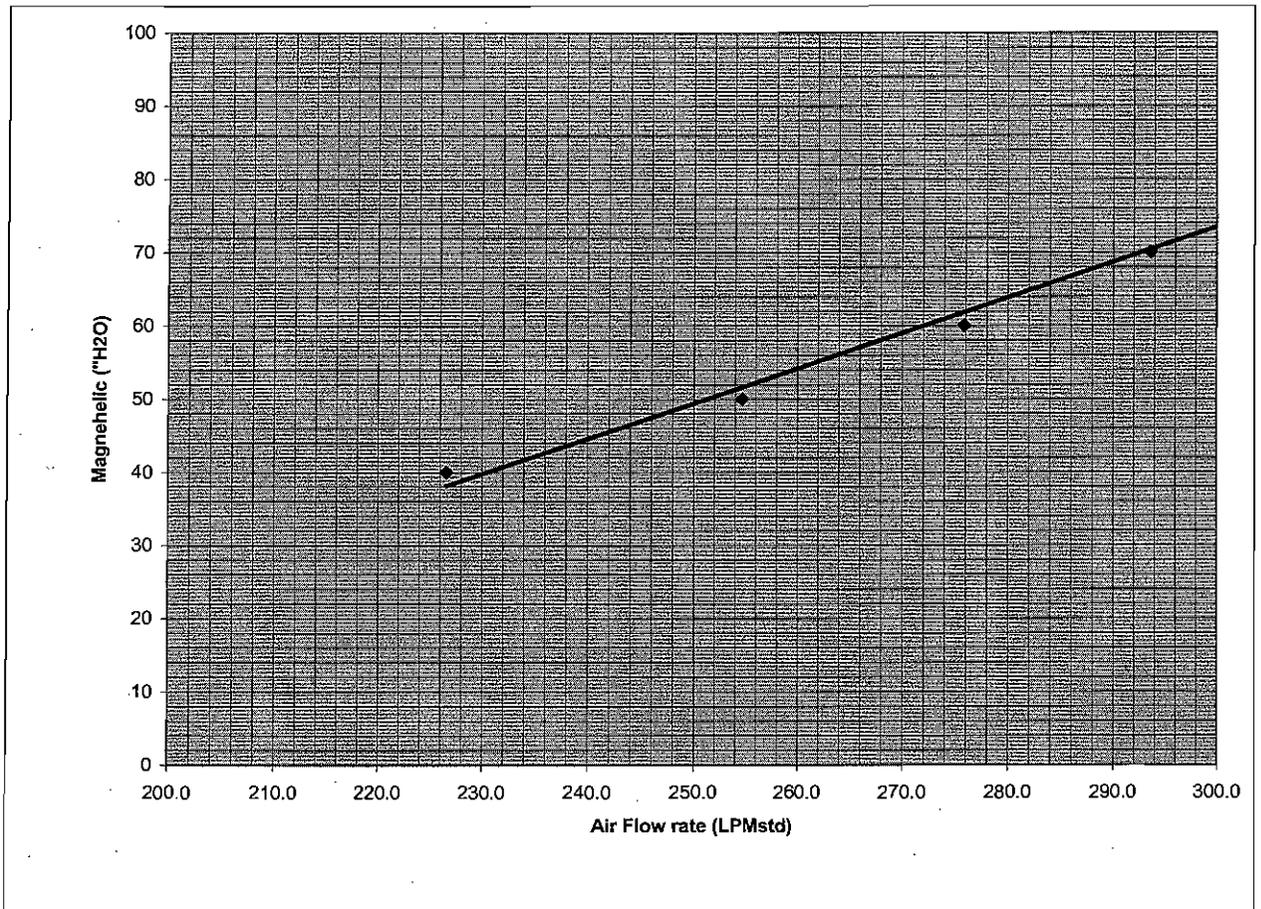
$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta)} - b_o\} \times 1000$

m<sub>s</sub> = 0.032

b<sub>s</sub> = -0.94222

r<sub>s</sub> = .099775



Desired Flow Rate (lpm): 250

Sampler Setting: 49.4

m<sub>mag</sub> = 0.482

b<sub>mag</sub> = -71.14141

r<sub>mag</sub> = 0.99313

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 820 Station #: C  
 Technician: D.G./E.M. Date: 3/30/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 20.3 Bar. Press., Pa (in Hg) 30.20  
 Amb. Temp, Ta (K) 293.3 Bar. Press., Pa (mmHg) 767.1

Orifice Data

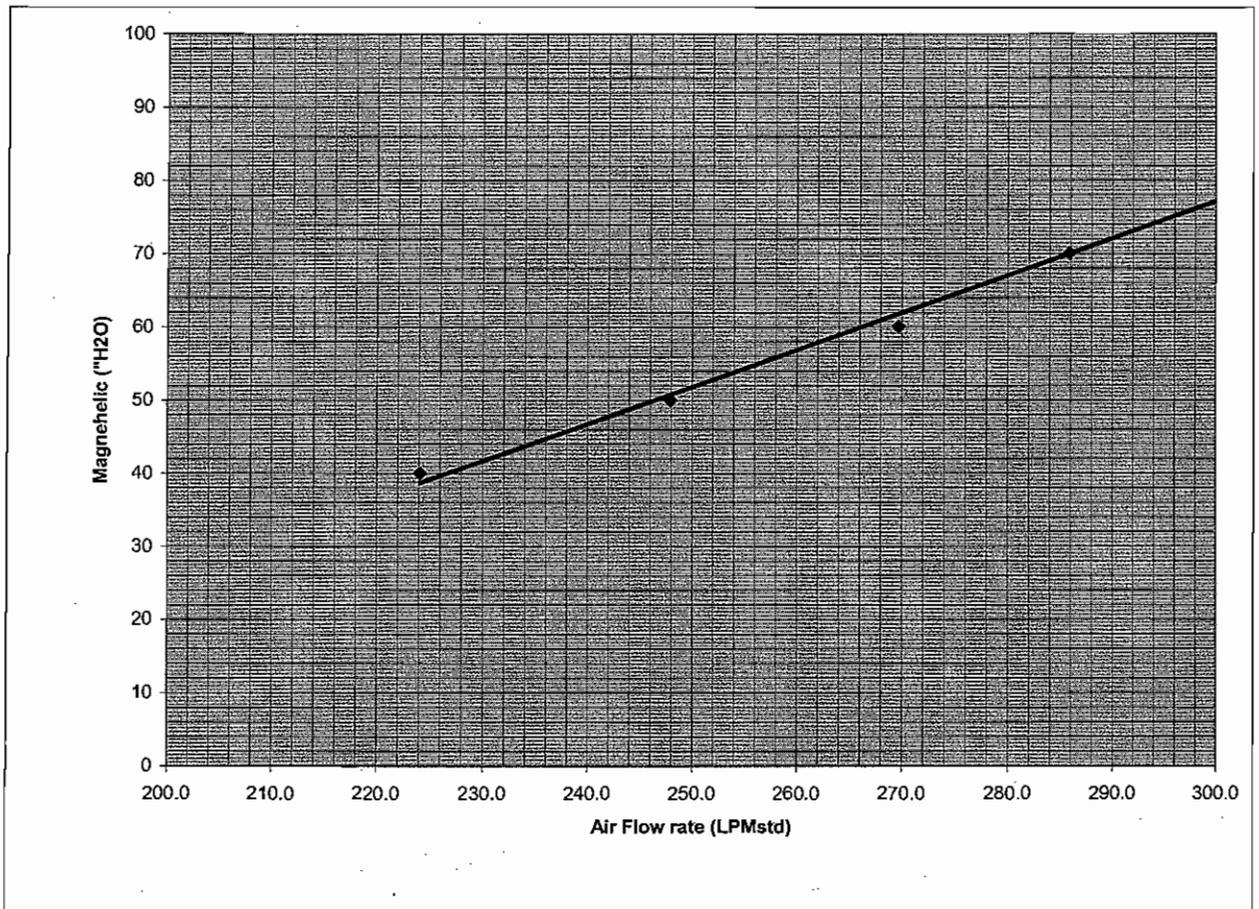
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
8.10	303.034	80	9.06
7.20	285.871	70	8.47
6.40	269.691	60	7.84
5.40	247.967	50	7.16
4.40	224.119	40	6.40

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o}\} \times 1000$

m<sub>s</sub> = 0.034 b<sub>s</sub> = -1.18236 r<sub>s</sub> = 0.99927



Desired Flow Rate (lpm): 250 Sampler Setting: 51.8

m<sub>mag</sub> = 0.507 b<sub>mag</sub> = -74.98382 r<sub>mag</sub> = 0.99637

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 822 Station #: BG  
 Technician: D.G./ E.M. Date: 3/30/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 18.8 Bar. Press., Pa (in Hg) 30.20  
 Amb. Temp, Ta (K) 291.8 Bar. Press., Pa (mmHg) 767.1

Orifice Data

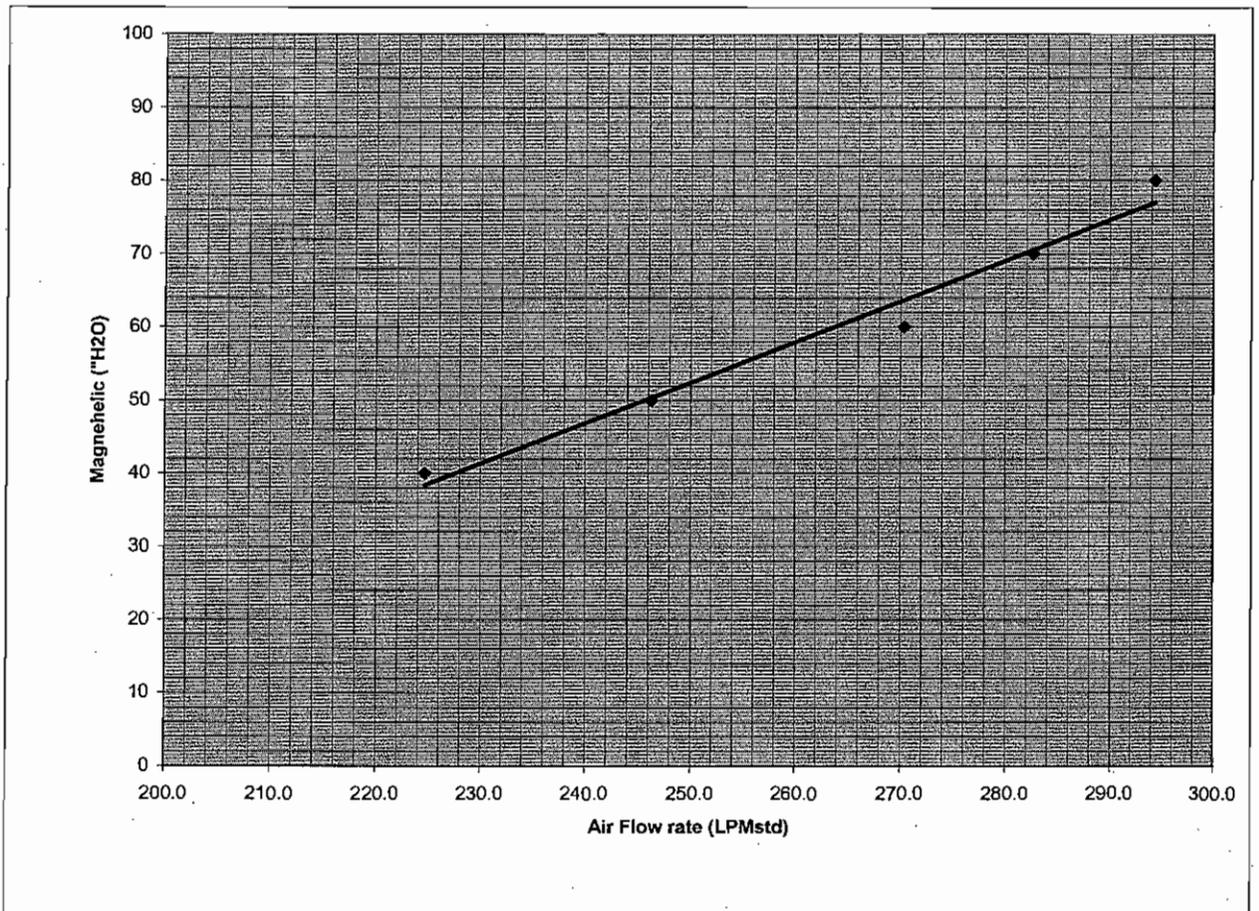
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
7.60	294.370	80	9.08
7.00	282.630	70	8.49
6.40	270.375	60	7.86
5.30	246.310	50	7.18
4.40	224.687	40	6.42

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o]}\} \times 1000$

m<sub>s</sub> = 0.037 b<sub>s</sub> = -1.96722 r<sub>s</sub> = 0.99329



Desired Flow Rate (lpm): 250

Sampler Setting: 52.4

m<sub>mag</sub> = 0.555

b<sub>mag</sub> = -86.22432

r<sub>mag</sub> = 0.98707

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 823 Station #: BG-dup  
 Technician: D.G./ E.M. Date: 3/30/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 18.8 Bar. Press., Pa (in Hg) 30.20  
 Amb. Temp, Ta (K) 291.8 Bar. Press., Pa (mmHg) 767.1

Orifice Data

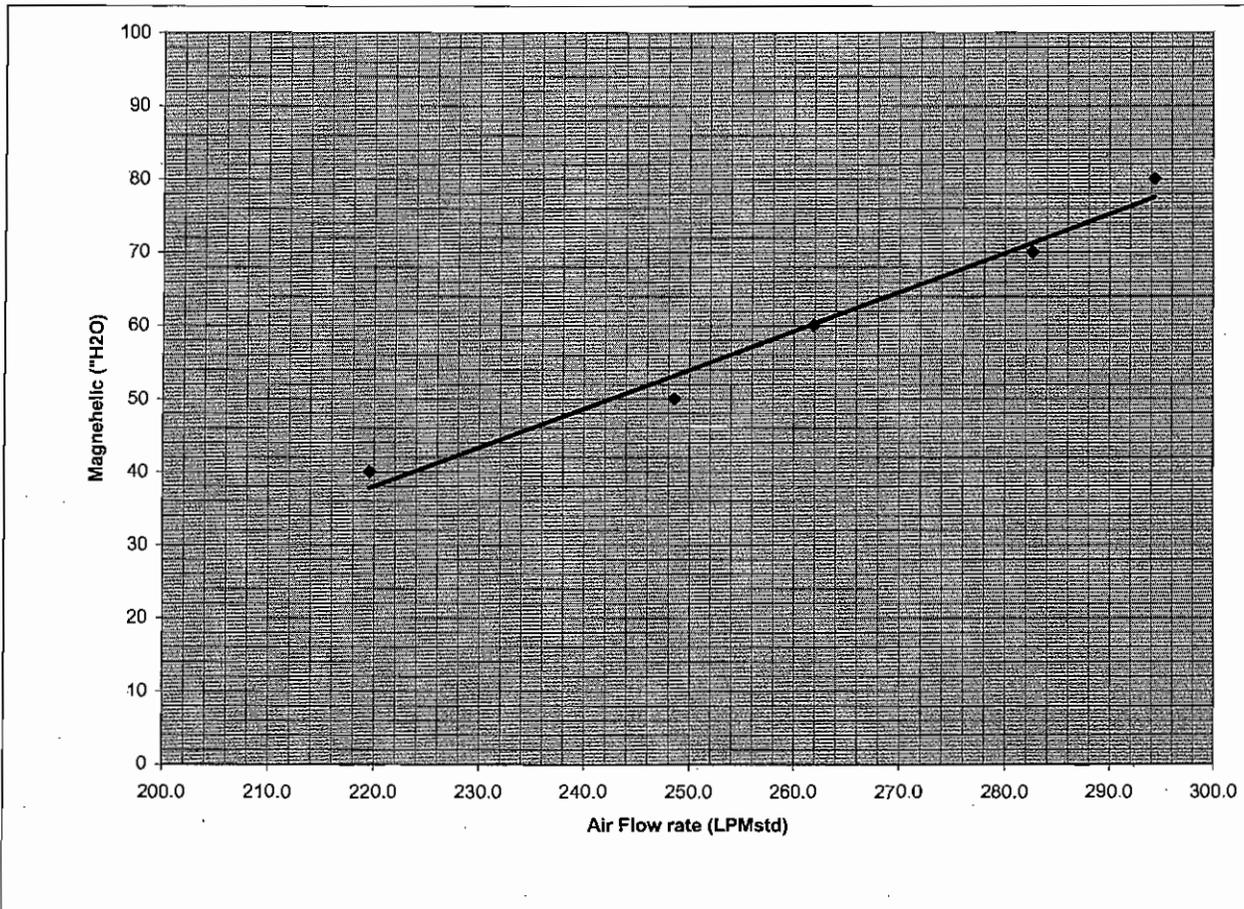
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	$Q_{std}$	$l$	$l_c$
7.60	294.370	80	9.08
7.00	282.630	70	8.49
6.00	261.883	60	7.86
5.40	248.596	50	7.18
4.20	219.588	40	6.42

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{ \{ 1/m_o \} \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o} \} \times 1000$

$m_s =$  0.036  $b_s =$  -1.48151  $r_s =$  0.99358



Desired Flow Rate (lpm): 250 Sampler Setting: 53.9

$m_{mag} =$  0.532  $b_{mag} =$  -79.10972  $r_{mag} =$  0.98844

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

## PS-1 Post-Sampling Flow Audit

$$\text{Qstd Orifice (m}^3\text{/min)} = (1/m_o) * (\text{SQRT}(H_o * (\text{Tstd}/\text{Pstd})) - b_o)$$

$$\text{Qstd Sampler (m}^3\text{/min)} = (1/m_s) * (\text{SQRT}(H_s * (\text{Tstd}/\text{Pstd})) - b_s) / 1000$$

$$\% \text{ Difference} = ((\text{Qact Orifice} - \text{Qact Sampler}) / \text{Qact Orifice}) * 100$$

3/31/2007		Temp (°F): 18.6		Temp - T <sub>s</sub> (K): 265.6		Press ("Hg): 30.32		Press - P <sub>s</sub> (mmHg): 770.1				
		Sampler Reading - H <sub>s</sub> ("h20)	Orifice Reading - H <sub>o</sub> ("h20)	Orifice #	Orifice Slope - m <sub>o</sub>	Orifice Intercept - b <sub>o</sub>	Qstd Orifice	Sampler #	Sampler Slope - m <sub>s</sub>	Sampler Intercept - b <sub>s</sub>	Qstd Sampler	% Difference
A-10	821	50	5.40	1125	9.59093	-0.02825	0.261	821	0.034	-1.91620	0.278	-6.44
B-10	825	50	5.80	1125	9.59093	-0.02825	0.271	825	0.032	-0.94222	0.265	2.08
C-10	820	50	5.40	1125	9.59093	-0.02825	0.261	820	0.034	-1.18236	0.257	1.82
BG-10	822	50	5.20	1125	9.59093	-0.02825	0.256	822	0.037	-1.96722	0.257	-0.19
BG-10-DUP	823	50	5.30	1125	9.59093	-0.02825	0.259	823	0.036	-1.48151	0.251	3.21

821	3/30/2007	m <sub>s</sub> =	0.034	b <sub>s</sub> =	-1.91620
825	3/30/2007	m <sub>s</sub> =	0.032	b <sub>s</sub> =	-0.94222
820	3/30/2007	m <sub>s</sub> =	0.034	b <sub>s</sub> =	-1.18236
822	3/30/2007	m <sub>s</sub> =	0.037	b <sub>s</sub> =	-1.96722
823	3/30/2007	m <sub>s</sub> =	0.036	b <sub>s</sub> =	-1.48151

Acceptance Limit <= 10% Difference

**SAMPLING ROUND 11 – APRIL 2007**

Network: New Bedford Site: Keith Middle Serial #: 820 Station #: C  
 Technician: E.M./M.L. Date: 4/17/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 16.4 Bar. Press., Pa (in Hg) 29.40  
 Amb. Temp, Ta (K) 289.4 Bar. Press., Pa (mmHg) 746.8

Orifice Data

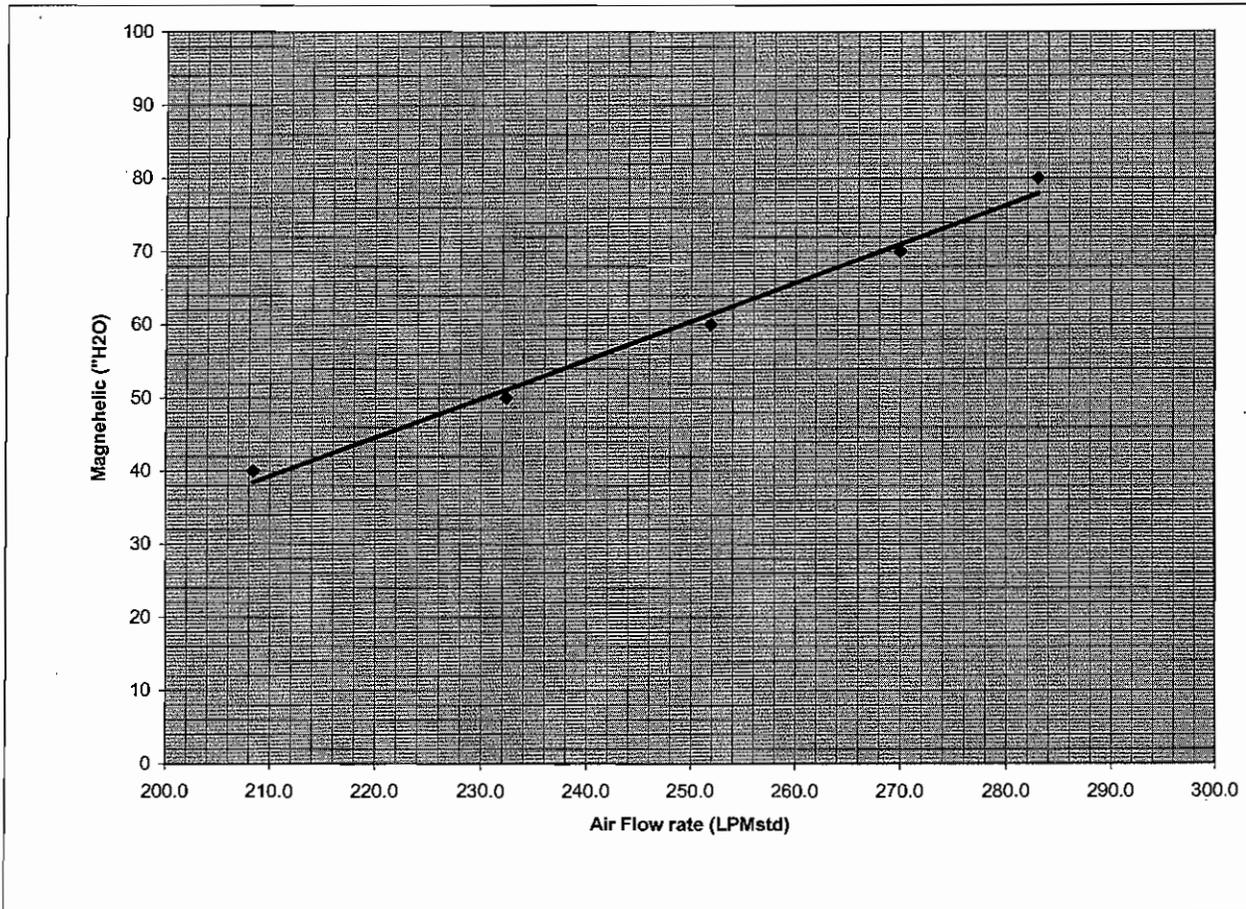
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.15	282.996	80	9.00
6.50	269.963	70	8.41
5.65	251.893	60	7.79
4.80	232.404	50	7.11
3.85	208.446	40	6.36

$l_c = \text{sqrt}[l \times 0.392 \times (Pa/Ta)]$

$Q_{std} = \{(1/m_o) \times \text{sqrt}[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o]\} \times 1000$

m<sub>s</sub> = 0.035 b<sub>s</sub> = -0.98621 r<sub>s</sub> = 0.99841



Desired Flow Rate (lpm): 250 Sampler Setting: 60.5

m<sub>mag</sub> = 0.530 b<sub>mag</sub> = -71.98371 r<sub>mag</sub> = 0.99440

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 821 Station #: BG-dup  
 Technician: E.M./M.L. Date: 4/17/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 9.9 Bar. Press., Pa (in Hg) 29.40  
 Amb. Temp, Ta (K) 282.9 Bar. Press., Pa (mmHg) 746.8

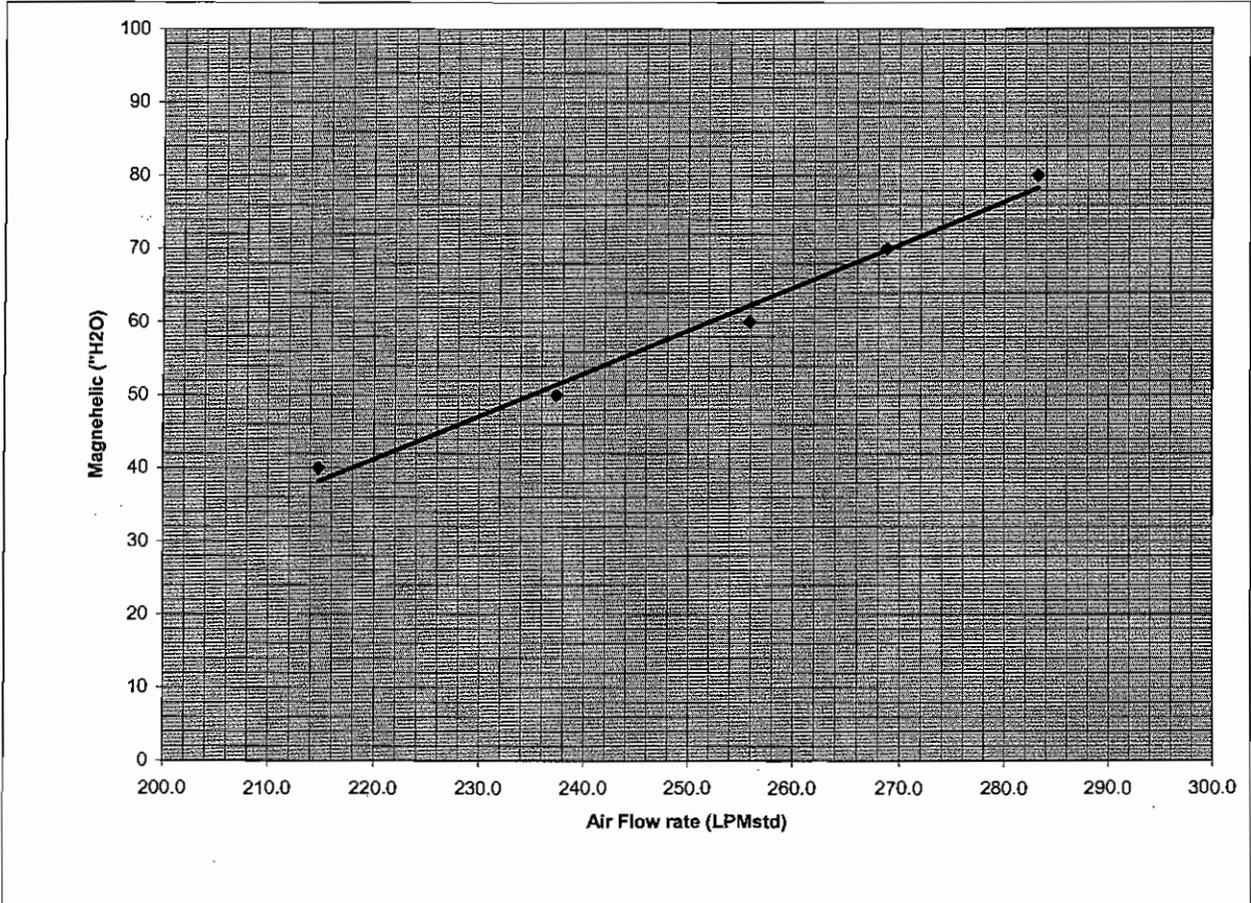
Orifice Data

Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.00	283.208	80	9.10
6.30	268.826	70	8.51
5.70	255.848	60	7.88
4.90	237.430	50	7.19
4.00	214.804	40	6.43

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$   $Q_{std} = \{(1/m_o) \times \sqrt{[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o]}\} \times 1000$

m<sub>s</sub> = 0.039 b<sub>s</sub> = -2.05996 r<sub>s</sub> = 0.99767



Desired Flow Rate (lpm): 250 Sampler Setting: 58.8

m<sub>mag</sub> = 0.587 b<sub>mag</sub> = -87.82422 r<sub>mag</sub> = 0.99328

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 822 Station #: A  
 Technician: E.M./M.L. Date: 4/17/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 21.6 Bar. Press., Pa (in Hg) 29.40  
 Amb. Temp, Ta (K) 294.6 Bar. Press., Pa (mmHg) 746.8

Orifice Data

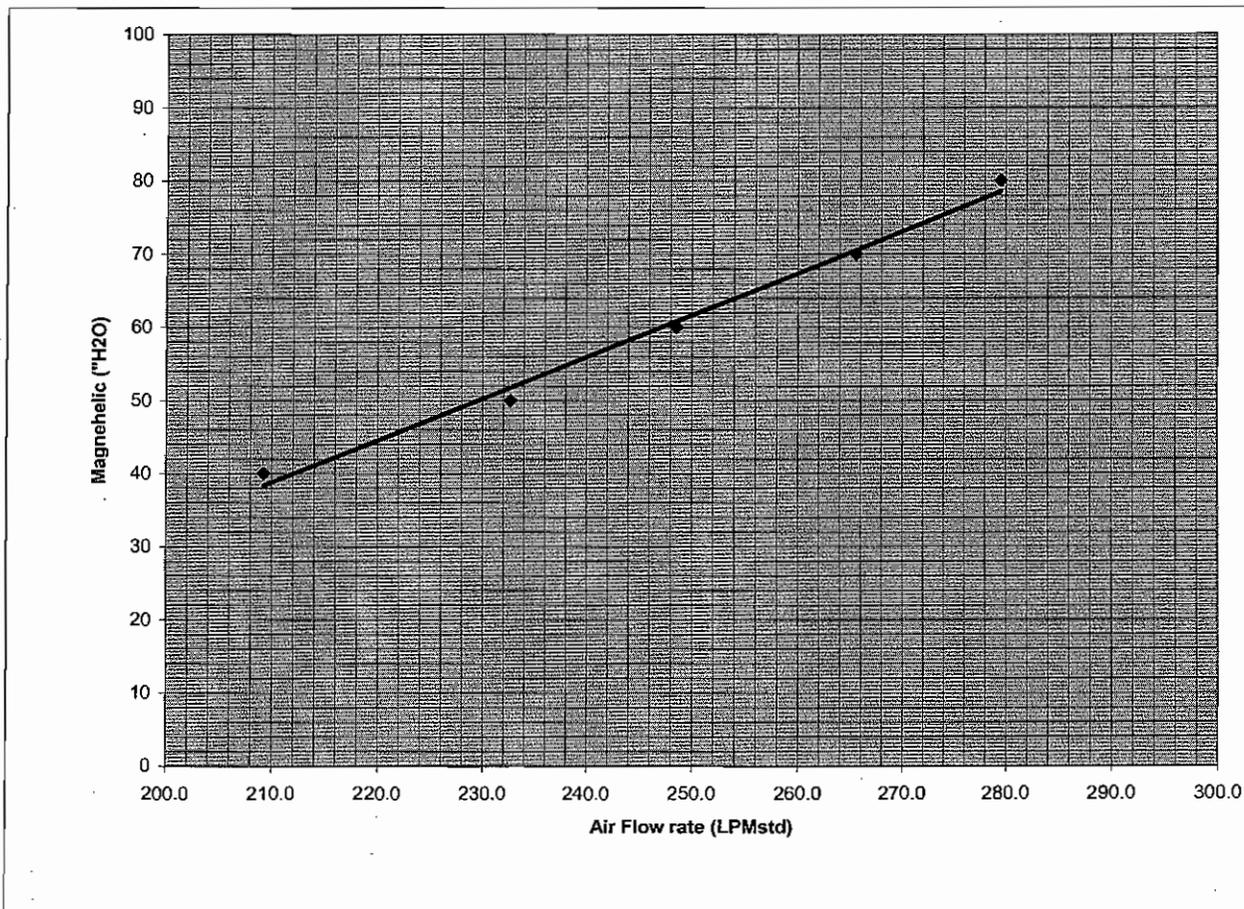
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.10	279.541	80	8.92
6.40	265.553	70	8.34
5.60	248.592	60	7.72
4.90	232.727	50	7.05
3.95	209.253	40	6.30

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o}\} \times 1000$

m<sub>s</sub> = 0.037 b<sub>s</sub> = -1.57623 r<sub>s</sub> = 0.99872



Desired Flow Rate (lpm): 250 Sampler Setting: 61.6

m<sub>mag</sub> = 0.572 b<sub>mag</sub> = -81.23748 r<sub>mag</sub> = 0.99549

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 823 Station #: BG  
 Technician: E.M./M.L. Date: 4/17/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 9.9 Bar. Press., Pa (in Hg) 29.40  
 Amb. Temp, Ta (K) 282.9 Bar. Press., Pa (mmHg) 746.8

Orifice Data

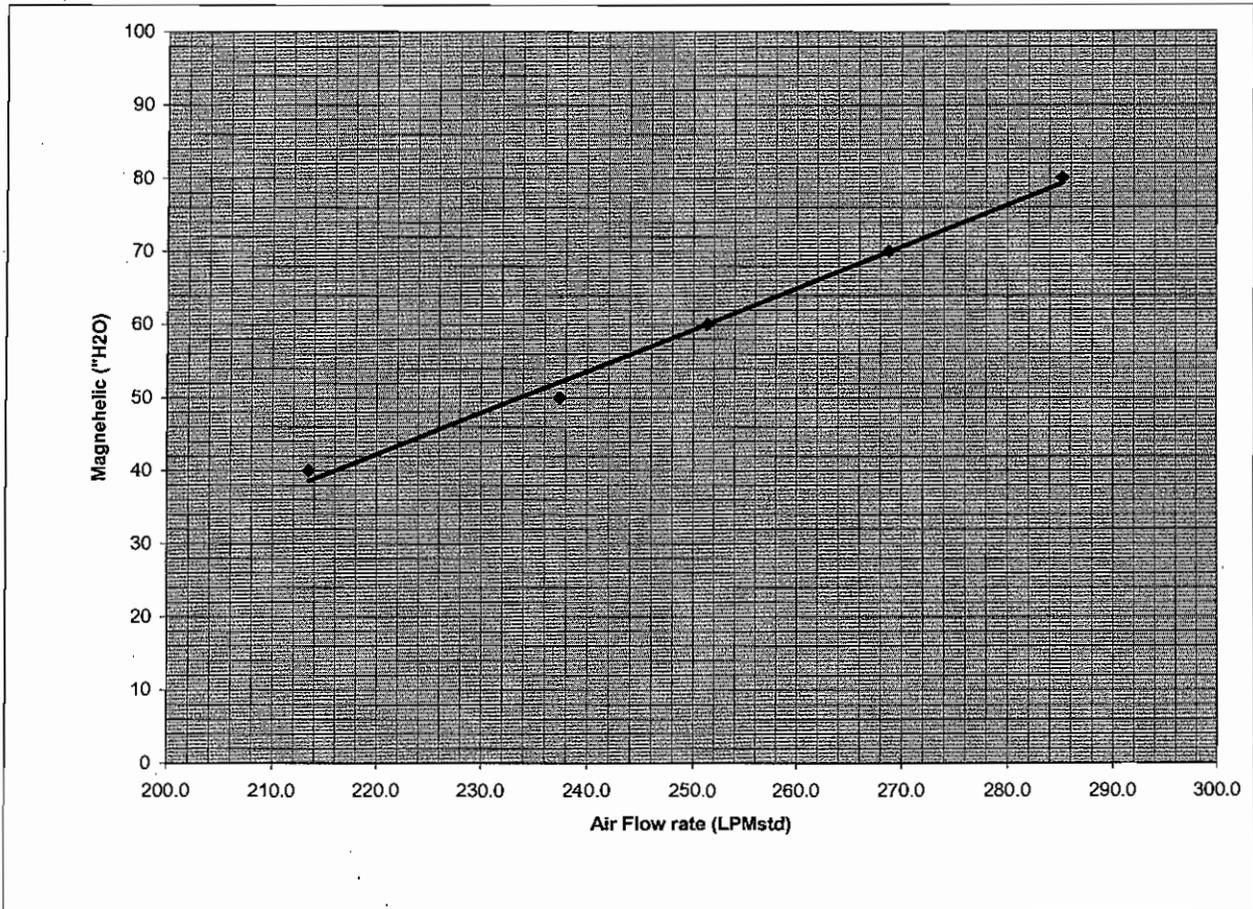
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.10	285.203	80	9.10
6.30	268.826	70	8.51
5.50	251.372	60	7.88
4.90	237.430	50	7.19
3.95	213.476	40	6.43

$l_c = \text{sqrt}[l \times 0.392 \times (Pa/Ta)]$

$Q_{std} = \{(1/m_o) \times \text{sqrt}[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o]\} \times 1000$

m<sub>s</sub> = 0.038 b<sub>s</sub> = -1.68958 r<sub>s</sub> = 0.99815



Desired Flow Rate (lpm): 250 Sampler Setting: 59.3

m<sub>mag</sub> = 0.568 b<sub>mag</sub> = -82.65800 r<sub>mag</sub> = 0.99636

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

Network: New Bedford Site: Keith Middle Serial #: 825 Station #: B  
 Technician: E.M./M.L. Date: 4/17/2007 Orifice S/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 17.6 Bar. Press., Pa (in Hg) 29.40  
 Amb. Temp, Ta (K) 290.6 Bar. Press., Pa (mmHg) 746.8

Orifice Data

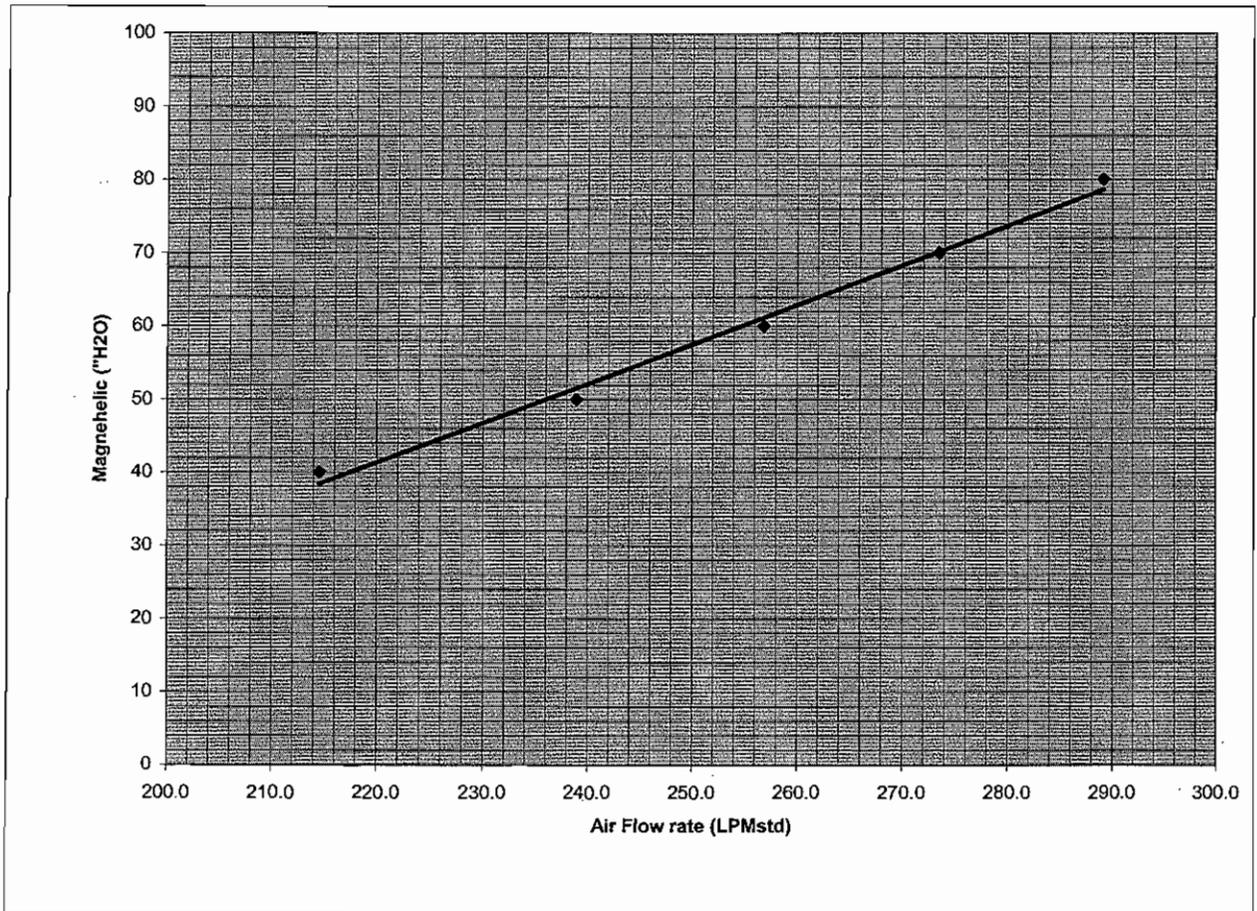
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.50	289.176	80	8.98
6.70	273.480	70	8.40
5.90	256.815	60	7.77
5.10	238.977	50	7.10
4.10	214.575	40	6.35

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o}\} \times 1000$

m<sub>s</sub> = 0.036 b<sub>s</sub> = -1.33668 r<sub>s</sub> = 0.99901



Desired Flow Rate (lpm): 250

Sampler Setting: 57.5

m<sub>mag</sub> = 0.540

b<sub>mag</sub> = -77.44729

r<sub>mag</sub> = 0.99585

Data Entry Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Curve Verified by: \_\_\_\_\_ Date: \_\_\_\_\_  
 New Curve Entered into Summary Sheet by: \_\_\_\_\_ Date: \_\_\_\_\_

## PS-1 Post-Sampling Flow Audit

$$\text{Qstd Orifice (m}^3\text{/min)} = (1/m_o) * (\text{SQRT}(H_o * (\text{Tstd}/\text{Pstd})) - b_o)$$

$$\text{Qstd Sampler (m}^3\text{/min)} = (1/m_s) * (\text{SQRT}(H_s * (\text{Tstd}/\text{Pstd})) - b_s) / 1000$$

$$\% \text{ Difference} = ((\text{Qact Orifice} - \text{Qact Sampler}) / \text{Qact Orifice}) * 100$$

4/18/2007			Temp (°F): 40.2		Temp - T <sub>a</sub> (K): 277.6		Press (°Hg): 29.48		Press - P <sub>a</sub> (mmHg): 748.8					
	Temp (°C):	Temp - T <sub>a</sub> (K):	Sampler Serial #	Sampler Reading - H <sub>s</sub> ("h20)	Orifice Reading - H <sub>o</sub> ("h20)	Orifice #	Orifice Slope - m <sub>o</sub>	Orifice Intercept - b <sub>o</sub>	Qstd Orifice	Sampler #	Sampler Slope - m <sub>s</sub>	Sampler Intercept - b <sub>s</sub>	Qstd Sampler	% Difference
A-11	21.2	294.2	822	50	4.90	1125	9.59093	-0.02825	0.234	822	0.037	-1.57623	0.234	0.00
B-11	16.8	289.8	825	50	5.80	1125	9.59093	-0.02825	0.256	825	0.036	-1.33668	0.235	8.16
C-11	16.7	289.7	820	50	4.78	1125	9.59093	-0.02825	0.232	820	0.035	-0.98821	0.232	0.37
BG-11	10.7	283.7	823	50	4.85	1125	9.59093	-0.02825	0.237	823	0.038	-1.68958	0.234	1.17
BG-11-DUP	10.7	283.7	821	50	4.90	1125	9.59093	-0.02825	0.238	821	0.039	-2.05996	0.237	0.20

822	4/17/2007	m <sub>s</sub> =	0.037	b <sub>s</sub> =	-1.57623
825	4/17/2007	m <sub>s</sub> =	0.036	b <sub>s</sub> =	-1.33668
820	4/17/2007	m <sub>s</sub> =	0.035	b <sub>s</sub> =	-0.98821
823	4/17/2007	m <sub>s</sub> =	0.038	b <sub>s</sub> =	-1.68958
821	4/17/2007	m <sub>s</sub> =	0.039	b <sub>s</sub> =	-2.05996

Acceptance Limit <= 10% Difference

**SAMPLING ROUND 12 – MAY 2007**

Network: New Bedford Site: Keith Middle Serial #: 820 Station #: B-12  
 Technician: E.M. Date: 5/18/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 20.3 Bar. Press., Pa (in Hg) 30.00  
 Amb. Temp, Ta (K) 293.3 Bar. Press., Pa (mmHg) 762.0

Orifice Data

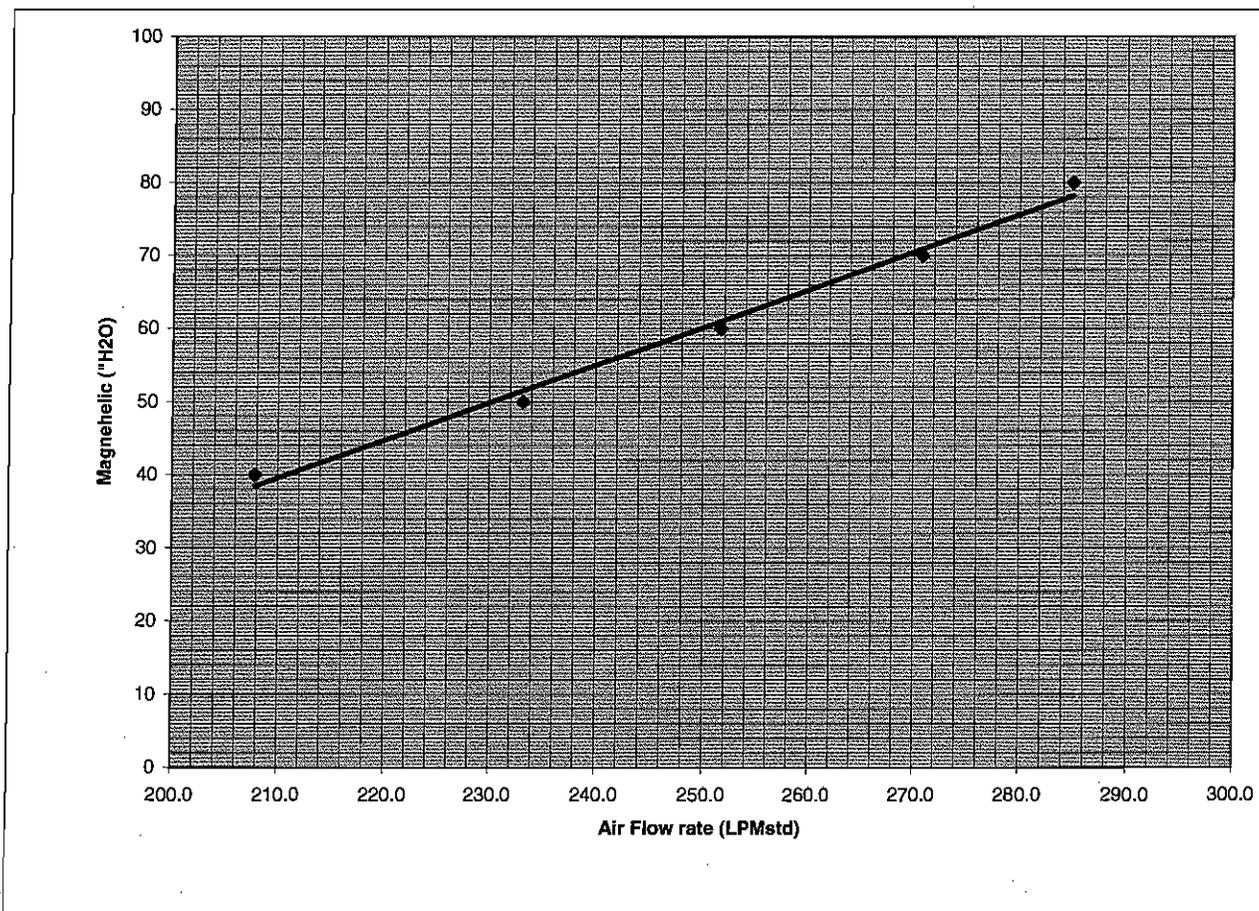
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
7.20	284.933	80	9.03
6.50	270.875	70	8.44
5.60	251.635	60	7.82
4.80	233.187	50	7.14
3.80	207.805	40	6.38

$l_c = \text{sqrt}[l \times 0.392 \times (Pa/Ta)]$

$Q_{std} = \{(1/m_o) \times \text{sqrt}[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o]\} \times 1000$

m<sub>s</sub> = 0.034 b<sub>s</sub> = -0.77412 r<sub>s</sub> = 0.99861



Desired Flow Rate (lpm): 250 Sampler Setting: 60.2

m<sub>mag</sub> = 0.516 b<sub>mag</sub> = -68.78583 r<sub>mag</sub> = 0.99500

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Network: New Bedford      Site: Keith Middle      Serial #: 821      Station #: BG-12  
 Technician: E.M.      Date: 5/18/2007      OrificeS/N: 1125      Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C)      8.3      Bar. Press., Pa (in Hg)      30.00  
 Amb. Temp, Ta (K)      281.3      Bar. Press., Pa (mmHg)      762.0

Orifice Data

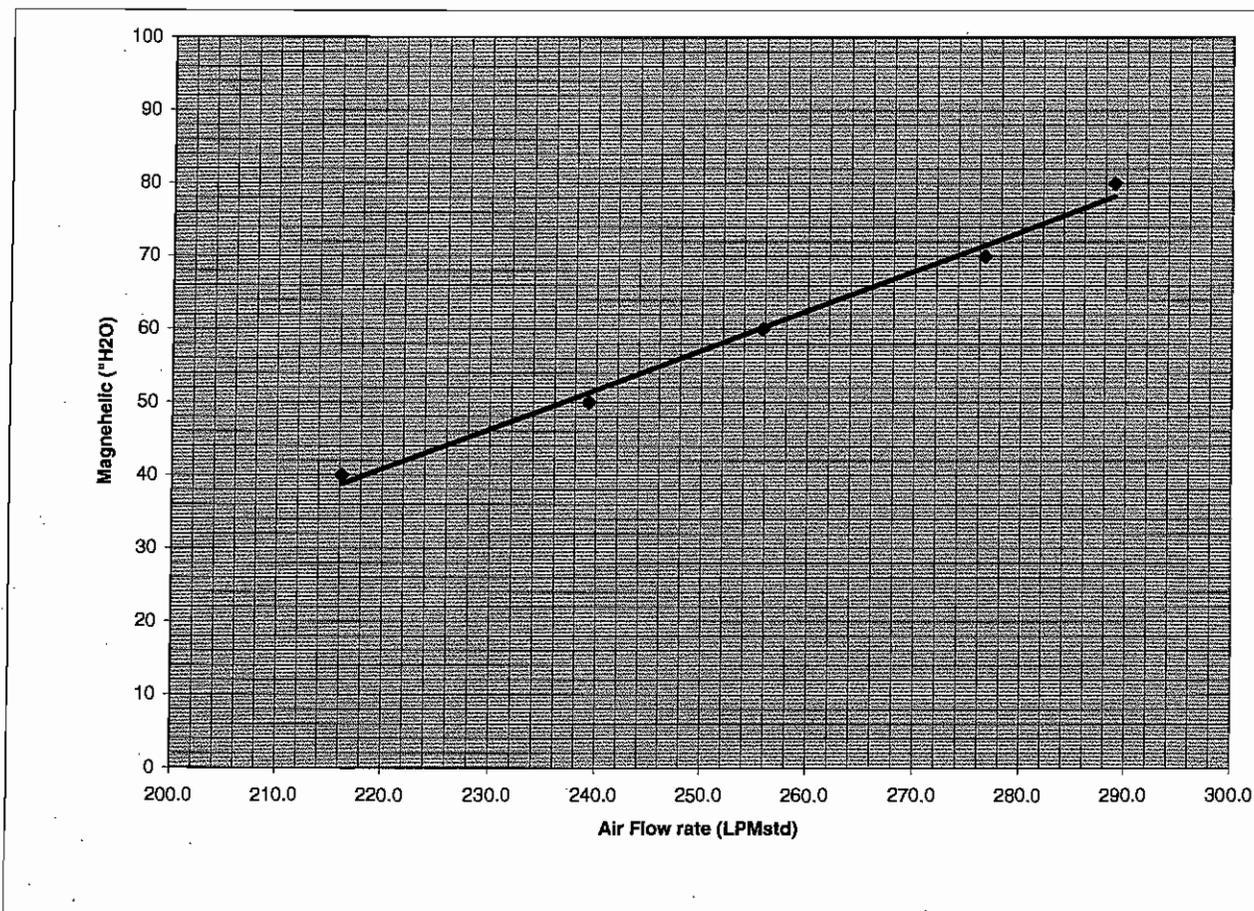
Qstd (m<sub>o</sub>) = 9.59093      Qstd (b<sub>o</sub>) = -0.02825      Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	I	I <sub>c</sub>
7.10	288.878	80	9.22
6.50	276.530	70	8.62
5.55	255.748	60	7.98
4.85	239.268	50	7.29
3.95	216.217	40	6.52

$I_c = \text{sqrt}[I \times 0.392 \times (\text{Pa}/T_a)]$

$Q_{\text{std}} = \{ (1/m_o) \times \text{sqrt}[\Delta H \times (\text{Pa}/760) \times (297.18/T_a) - b_o] \} \times 1000$

m<sub>s</sub> = 0.037      b<sub>s</sub> = -1.44767      r<sub>s</sub> = 0.99833



Desired Flow Rate (lpm): 250      Sampler Setting: 57.1

m<sub>mag</sub> = 0.543      b<sub>mag</sub> = -78.62735      r<sub>mag</sub> = 0.99565

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Network: New Bedford      Site: Keith Middle      Serial #: 822      Station #: A-12  
 Technician: E.M.      Date: 5/18/2007      OrificeS/N: 1125      Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C)      19.9      Bar. Press., Pa (in Hg)      30.00  
 Amb. Temp, Ta (K)      292.9      Bar. Press., Pa (mmHg)      762.0

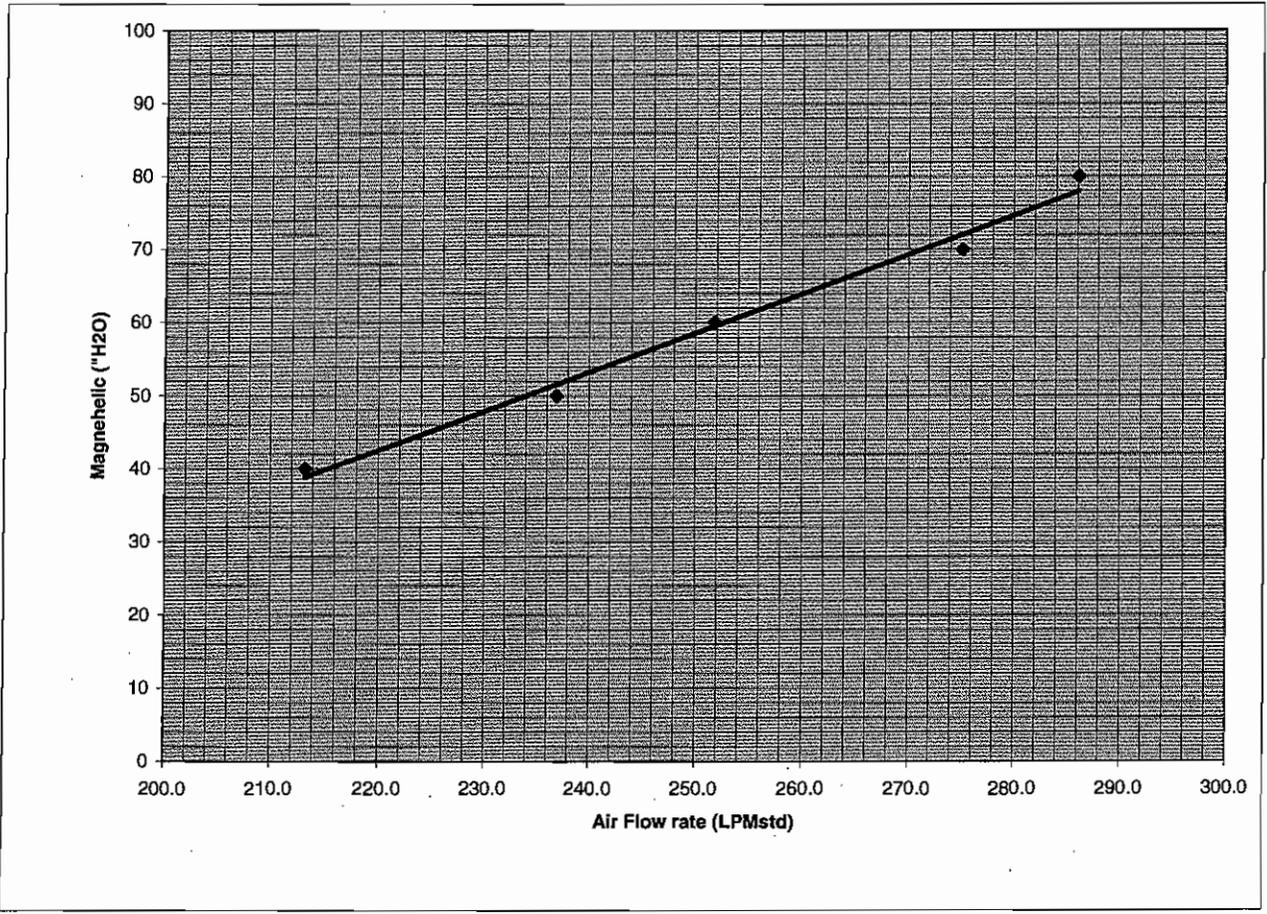
Orifice Data

Qstd (m<sub>o</sub>) = 9.59093      Qstd (b<sub>o</sub>) = -0.02825      Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.25	286.104	80	9.03
6.70	275.151	70	8.45
5.60	251.805	60	7.82
4.95	236.917	50	7.14
4.00	213.270	40	6.39

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$        $Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o}\} \times 1000$

m<sub>s</sub> = 0.036      b<sub>s</sub> = -1.22239      r<sub>s</sub> = 0.99635



Desired Flow Rate (lpm): 250      Sampler Setting: 58.6

m<sub>mag</sub> = 0.537      b<sub>mag</sub> = -75.67786      r<sub>mag</sub> = 0.99378

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Network: New Bedford Site: Keith Middle Serial #: 823 Station #: BG-DUP-12  
 Technician: E.M. Date: 5/18/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 8.2 Bar. Press., Pa (in Hg) 30.00  
 Amb. Temp, Ta (K) 281.2 Bar. Press., Pa (mmHg) 762.0

Orifice Data

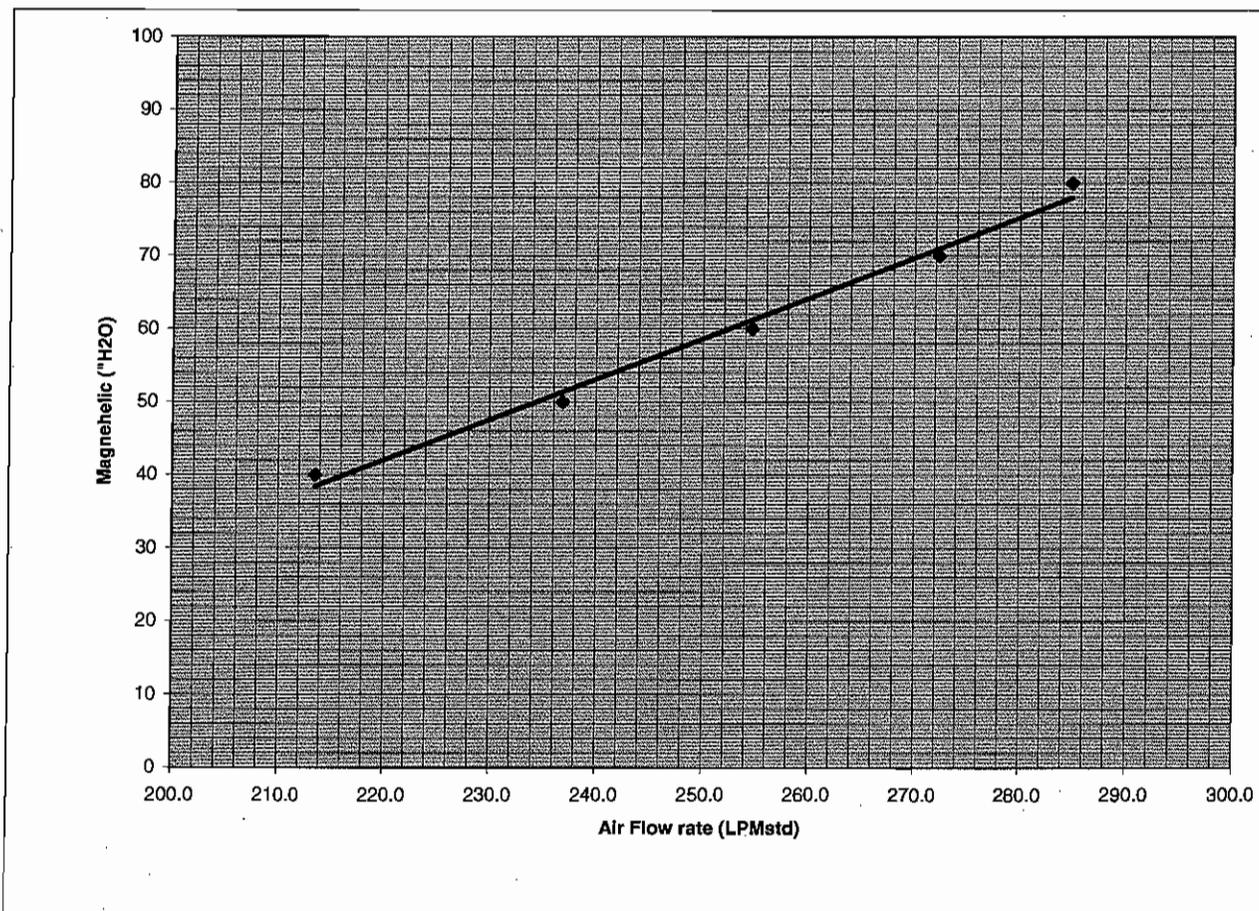
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
6.90	284.872	80	9.22
6.30	272.336	70	8.62
5.50	254.651	60	7.98
4.75	236.861	50	7.29
3.85	213.538	40	6.52

$l_c = \text{sqrt}[l \times 0.392 \times (\text{Pa}/\text{Ta})]$

$Q_{std} = \{(1/m_o) \times \text{sqrt}[\Delta H \times (\text{Pa}/760) \times (297.18/\text{Ta}) - b_o]\} \times 1000$

m<sub>s</sub> = 0.038 b<sub>s</sub> = -1.56328 r<sub>s</sub> = 0.99842



Desired Flow Rate (lpm): 250 Sampler Setting: 58.6

m<sub>mag</sub> = 0.555 b<sub>mag</sub> = -80.15931 r<sub>mag</sub> = 0.99451

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Network: New Bedford      Site: Keith Middle      Serial #: 825      Station #: C-12  
 Technician: E.M.      Date: 5/18/2007      OrificeS/N: 1125      Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C)      19.6      Bar. Press., Pa (in Hg)      30.00  
 Amb. Temp, Ta (K)      292.6      Bar. Press., Pa (mmHg)      762.0

Orifice Data

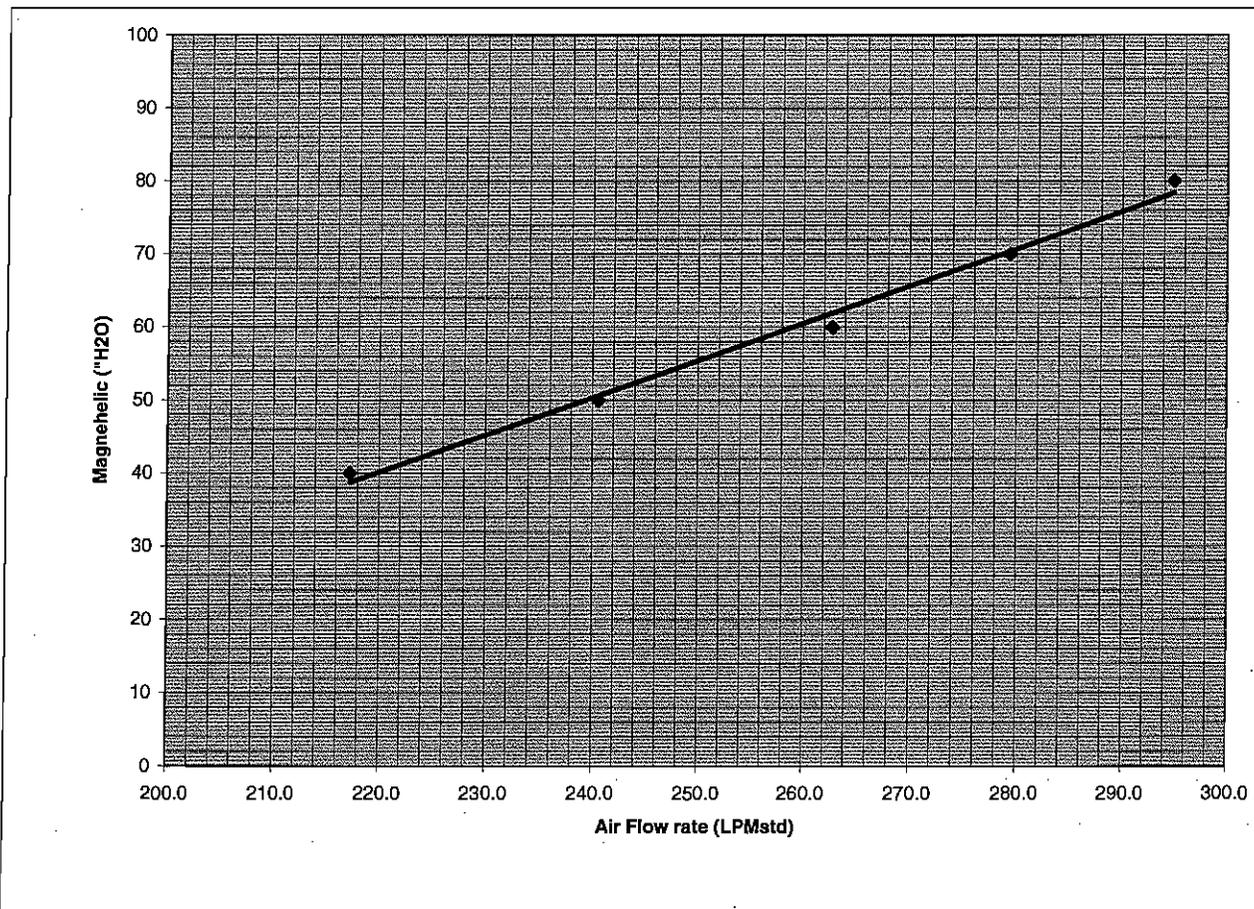
Qstd (m<sub>o</sub>) = 9.59093      Qstd (b<sub>o</sub>) = -0.02825      Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
7.70	294.909	80	9.04
6.90	279.326	70	8.45
6.10	262.810	60	7.83
5.10	240.557	50	7.14
4.15	217.287	40	6.39

$l_c = \text{sqrt}[l \times 0.392 \times (Pa/Ta)]$

$Q_{std} = \{ (1/m_o) \times \text{sqrt}[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o] \} \times 1000$

m<sub>s</sub> = 0.034      b<sub>s</sub> = -1.00726      r<sub>s</sub> = 0.99897



Desired Flow Rate (lpm): 250

Sampler Setting: 55.4

m<sub>mag</sub> = 0.511

b<sub>mag</sub> = -72.32099

r<sub>mag</sub> = 0.99563

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## PS-1 Post-Sampling Flow Audit

$$Q_{std \text{ Orifice}} (m^3/min) = (1/m_o) * (SQRT(H_o * (T_{std}/P_{std}) - b_o))$$

$$Q_{std \text{ Sampler}} (m^3/min) = (1/m_s) * (SQRT(H_s * (T_{atd}/P_{std}) - b_s)) / 1000$$

$$\% \text{ Difference} = ((Q_{act \text{ Orifice}} - Q_{act \text{ Sampler}}) / Q_{act \text{ Orifice}}) * 100$$

5/19/2007									Press ("Hg): 29.84	Press - P <sub>a</sub> (mmHg): 757.9				
	Temp (°C):	Temp - T <sub>a</sub> (K):	Sampler Serial #	Sampler Reading - H <sub>s</sub> ("h20)	Orifice Reading - H <sub>o</sub> ("h20)	Orifice #	Orifice Slope - m <sub>o</sub>	Orifice Intercept - b <sub>o</sub>	Q <sub>std Orifice</sub>	Sampler #	Sampler Slope - m <sub>s</sub>	Sampler Intercept - b <sub>s</sub>	Q <sub>std Sampler</sub>	% Difference
A-12	21.8	294.8	822	50	4.90	1125	9.59093	-0.02825	0.235	821	0.035	-1.22239	0.234	0.33
C-12	18.5	291.5	825	50	5.00	1125	9.59093	-0.02825	0.238	825	0.034	-1.00725	0.240	-0.85
B-12	21	294.0	820	50	4.80	1125	9.59093	-0.02825	0.233	820	0.034	-0.77412	0.231	0.86
BG-1DUP-12	12.2	285.2	823	50	4.90	1125	9.59093	-0.02825	0.239	822	0.038	-1.58328	0.234	2.07
BG-12	12.5	285.5	821	50	4.90	1125	9.59093	-0.02825	0.238	823	0.037	-1.44767	0.236	1.03

822	5/18/2007	m <sub>s</sub> =	0.036	b <sub>s</sub> =	-1.22239
825	5/18/2007	m <sub>s</sub> =	0.034	b <sub>s</sub> =	-1.00728
820	5/18/2007	m <sub>s</sub> =	0.034	b <sub>s</sub> =	-0.77412
823	5/18/2007	m <sub>s</sub> =	0.038	b <sub>s</sub> =	-1.58328
821	5/18/2007	m <sub>s</sub> =	0.037	b <sub>s</sub> =	-1.44767

Acceptance Limit <= 10% Difference

**SAMPLING ROUND 13 – JUNE 2007**

Network: New Bedford Site: Keith Middle Serial #: 820 Station #: B-13  
 Technician: E.M. L.M. Date: 6/26/2007 Orifice S/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 26.5 Bar. Press., Pa (in Hg) 30.10  
 Amb. Temp, Ta (K) 299.5 Bar. Press., Pa (mmHg) 764.5

Orifice Data

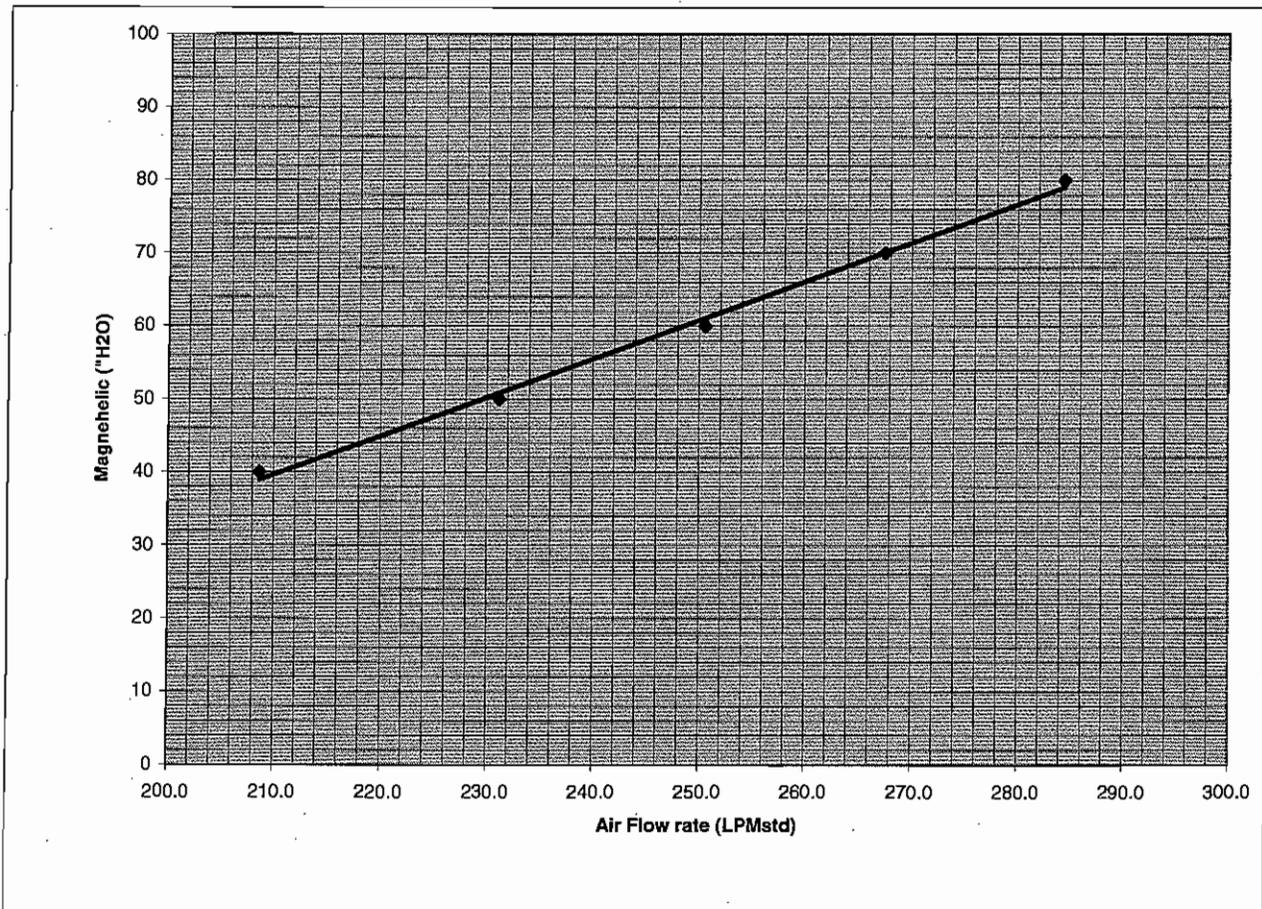
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
7.30	284.398	80	8.95
6.45	267.505	70	8.37
5.65	250.555	60	7.75
4.80	231.171	50	7.07
3.90	208.665	40	6.33

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{ (1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o} \} \times 1000$

m<sub>s</sub> = 0.035 b<sub>s</sub> = -0.94809 r<sub>s</sub> = 0.99986



Desired Flow Rate (lpm): 250 Sampler Setting: 60.8

m<sub>mag</sub> = 0.530 b<sub>mag</sub> = -71.76549 r<sub>mag</sub> = 0.99798

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Network: New Bedford Site: Keith Middle Serial #: 821 Station #: BG-13-DUP  
 Technician: E.M. L.M. Date: 6/26/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 35.4 Bar. Press., Pa (in Hg) 30.10  
 Amb. Temp, Ta (K) 308.4 Bar. Press., Pa (mmHg) 764.5

Orifice Data

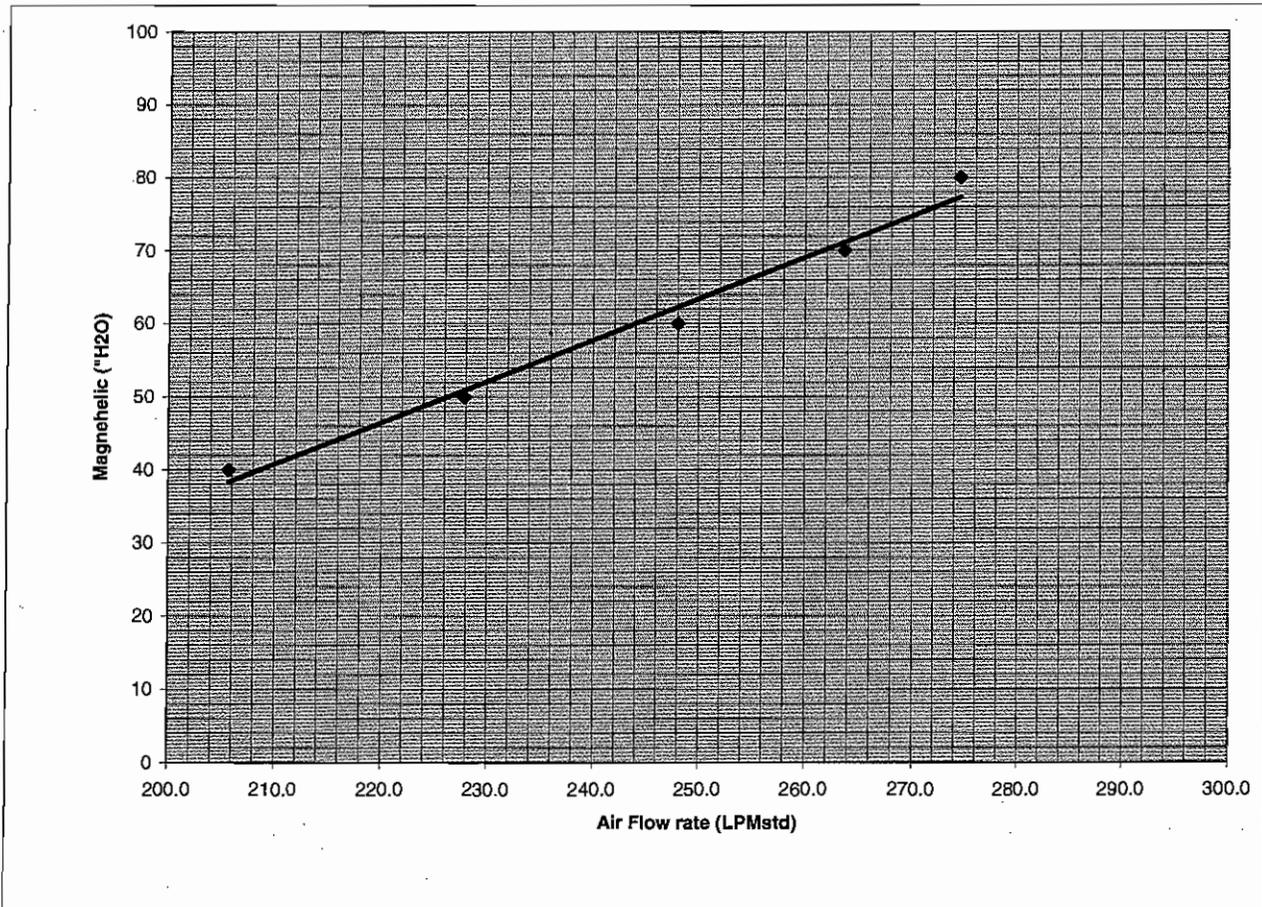
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	I	I <sub>c</sub>
7.00	274.548	80	8.82
6.45	263.660	70	8.25
5.70	248.034	60	7.64
4.80	227.854	50	6.97
3.90	205.675	40	6.23

$I_c = \sqrt{I \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta) - b_o}\} \times 1000$

m<sub>s</sub> = 0.037 b<sub>s</sub> = -1.37533 r<sub>s</sub> = 0.99653



Desired Flow Rate (lpm): 250

Sampler Setting: 63.4

m<sub>mag</sub> = 0.566

b<sub>mag</sub> = -78.11586

r<sub>mag</sub> = 0.99125

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Network: New Bedford Site: Keith Middle Serial #: 822 Station #: A-13  
 Technician: E.M. L.M. Date: 6/26/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 27.6 Bar. Press., Pa (in Hg) 30.10  
 Amb. Temp, Ta (K) 300.6 Bar. Press., Pa (mmHg) 764.5

Orifice Data

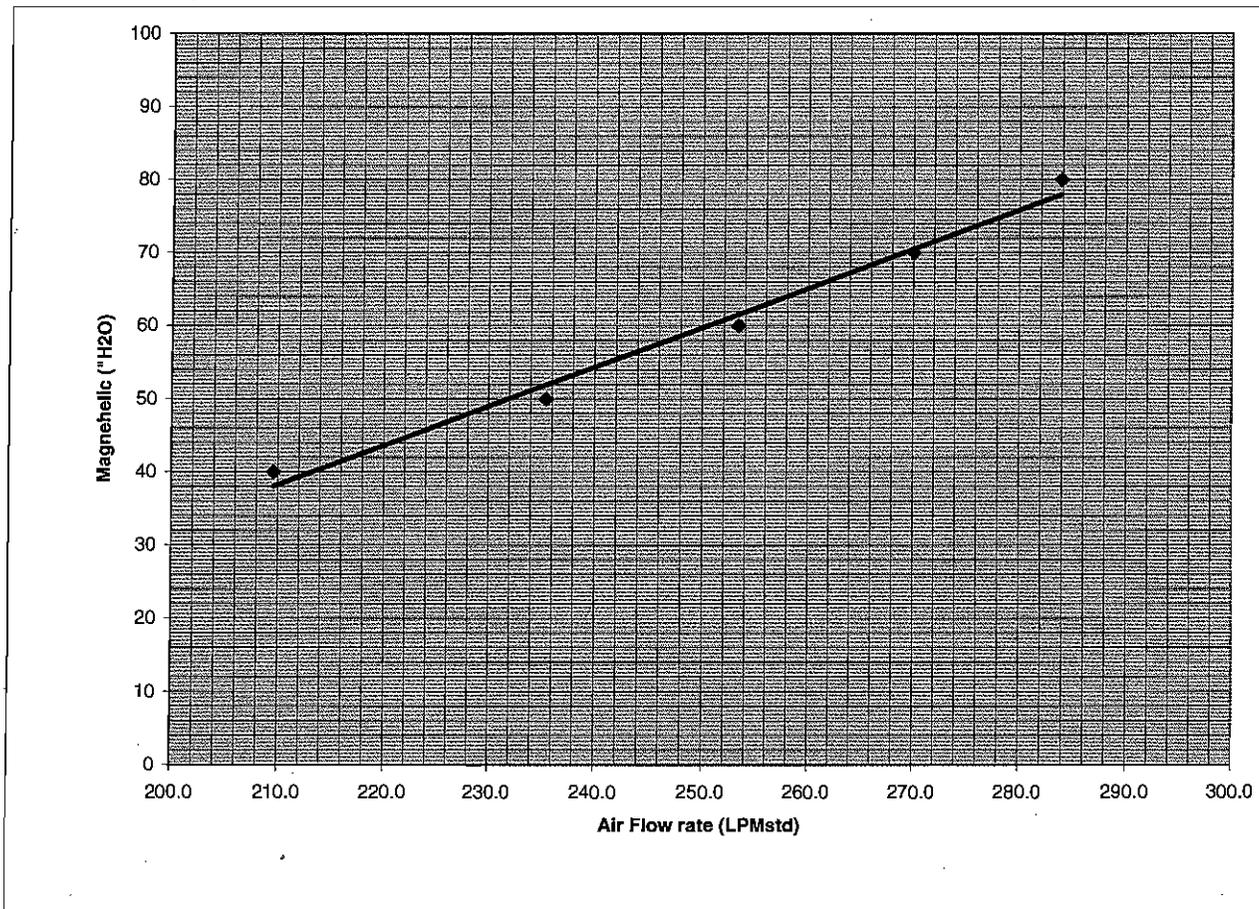
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
7.30	283.883	80	8.93
6.60	270.074	70	8.35
5.80	253.361	60	7.73
5.00	235.451	50	7.06
3.95	209.601	40	6.32

$l_c = \text{sqrt}[l \times 0.392 \times (\text{Pa}/\text{Ta})]$

$Q_{std} = \{ (1/m_o) \times \text{sqrt}[\Delta H \times (\text{Pa}/760) \times (297.18/\text{Ta}) - b_o] \} \times 1000$

m<sub>s</sub> = 0.035 b<sub>s</sub> = -1.16715 r<sub>s</sub> = 0.99745



Desired Flow Rate (lpm): 250 Sampler Setting: 59.7

m<sub>mag</sub> = 0.538 b<sub>mag</sub> = -74.75538 r<sub>mag</sub> = 0.99275

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Network: New Bedford Site: Keith Middle Serial #: 823 Station #: BG-13  
 Technician: E.M. L.M. Date: 6/26/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 35.4 Bar. Press., Pa (in Hg) 30.10  
 Amb. Temp, Ta (K) 308.4 Bar. Press., Pa (mmHg) 764.5

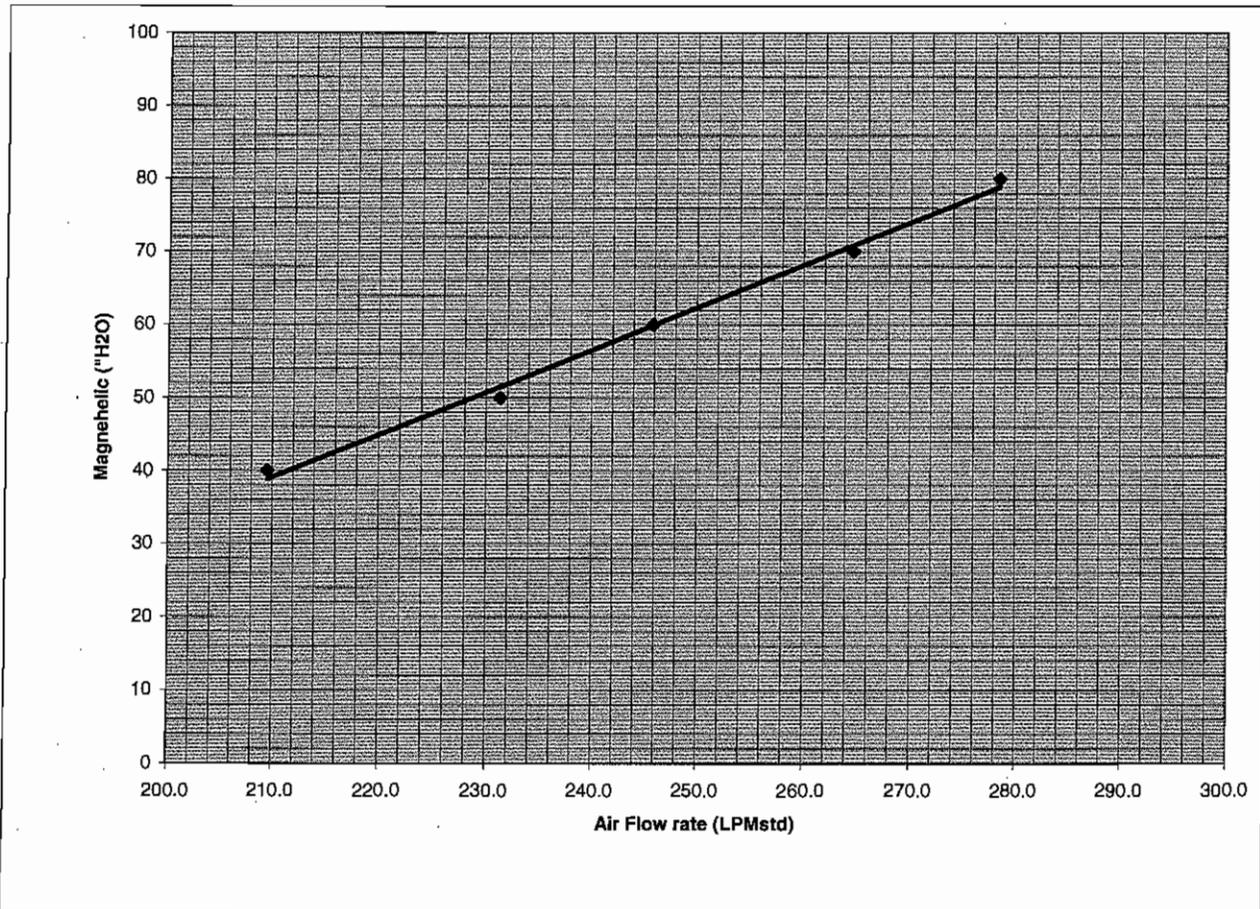
Orifice Data

Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
7.20	278.401	80	8.82
6.50	264.668	70	8.25
5.60	245.874	60	7.64
4.95	231.341	50	6.97
4.05	209.537	40	6.23

$l_c = \text{sqrt}[l \times 0.392 \times (Pa/Ta)]$        $Q_{std} = \{(1/m_o) \times \text{sqrt}[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o]\} \times 1000$

m<sub>s</sub> = 0.038      b<sub>s</sub> = -1.65730      r<sub>s</sub> = 0.99889



Desired Flow Rate (lpm): 250      Sampler Setting: 62.3

m<sub>mag</sub> = 0.581      b<sub>mag</sub> = -82.97232      r<sub>mag</sub> = 0.99714

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Network: New Bedford      Site: Keith Middle      Serial #: 825      Station #: C-13  
 Technician: E.M. L.M.      Date: 6/26/2007      OrificeS/N: 1125      Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C)      28.7      Bar. Press., Pa (in Hg)      30.10  
 Amb. Temp, Ta (K)      301.7      Bar. Press., Pa (mmHg)      764.5

Orifice Data

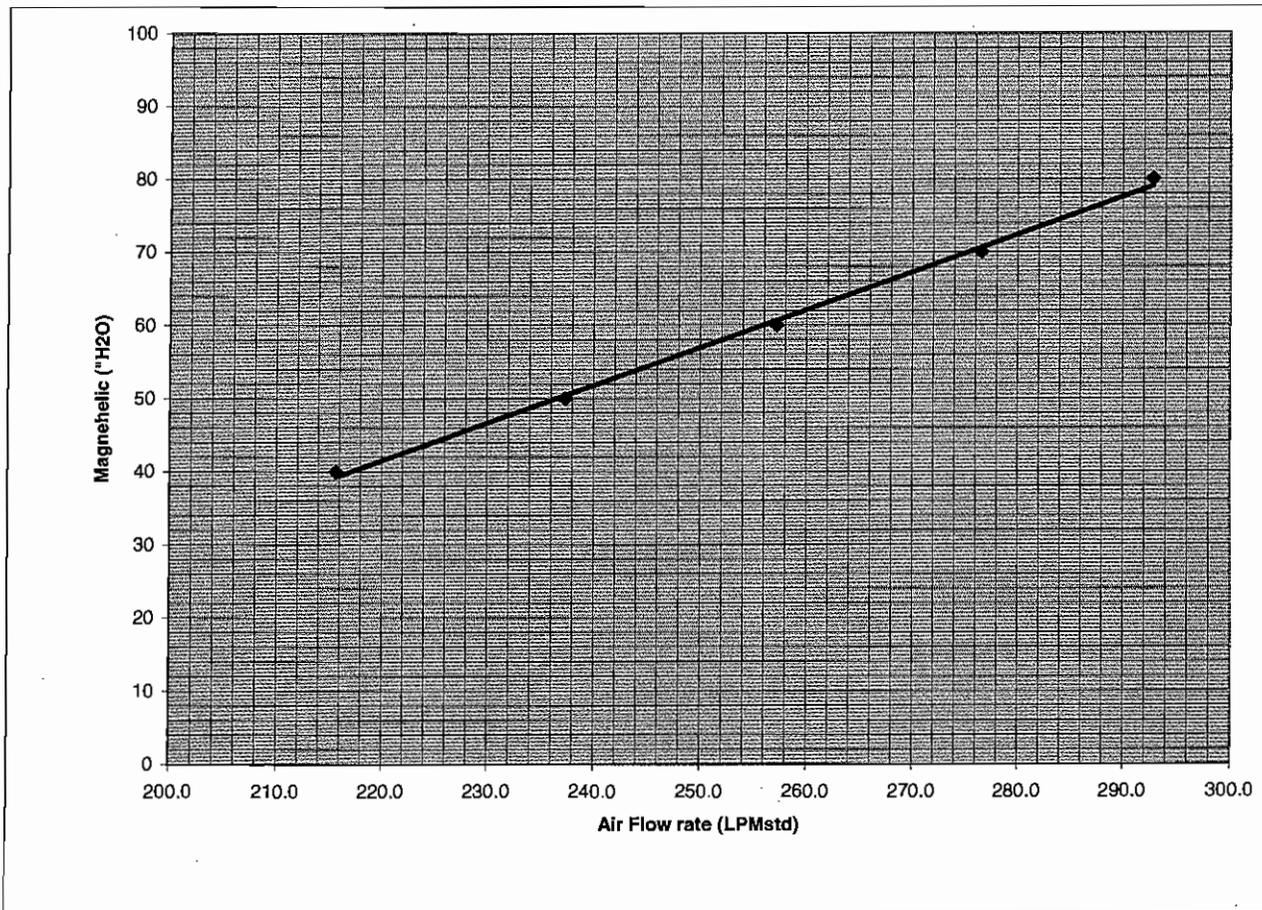
Qstd (m<sub>o</sub>) = 9.59093      Qstd (b<sub>o</sub>) = -0.02825      Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	l	l <sub>c</sub>
7.80	292.815	80	8.91
6.95	276.565	70	8.34
6.00	257.178	60	7.72
5.10	237.336	50	7.05
4.20	215.651	40	6.30

$l_c = \sqrt{l \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760) \times (297.18/Ta)} - b_o\} \times 1000$

m<sub>s</sub> = 0.034      b<sub>s</sub> = -0.94590      r<sub>s</sub> = 0.99991



Desired Flow Rate (lpm): 250

Sampler Setting: 57.0

m<sub>mag</sub> = 0.515

b<sub>mag</sub> = -71.87782

r<sub>mag</sub> = 0.99873

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## PS-1 Post-Sampling Flow Audit

$$Q_{std \text{ Orifice}} (m^3/min) = (1/m_o) * (\text{SQRT}(H_o * (T_{std}/P_{std})) - b_o)$$

$$Q_{std \text{ Sampler}} (m^3/min) = (1/m_s) * (\text{SQRT}(H_s * (T_{std}/P_{std})) - b_s) / 1000$$

$$\% \text{ Difference} = ((Q_{act \text{ Orifice}} - Q_{act \text{ Sampler}}) / Q_{act \text{ Orifice}}) * 100$$

6/27/2007			Press (*Hg): 29.84							Press - P <sub>s</sub> (mmHg): 757.9				
	Temp (°C):	Temp - T <sub>s</sub> (K):	Sampler Serial #	Sampler Reading - H <sub>s</sub> (*h20)	Orifice Reading - H <sub>o</sub> (*h20)	Orifice #	Orifice Slope - m <sub>o</sub>	Orifice Intercept - b <sub>o</sub>	Qstd Orifice	Sampler #	Sampler Slope - m <sub>s</sub>	Sampler Intercept - b <sub>s</sub>	Qstd Sampler	% Difference
A-13	21.8	294.8	822	50	5.74	1125	9.59093	-0.02825	0.254	822	0.035	-1.16715	0.234	7.76
C-13	18.5	291.5	825	50	6.09	1125	9.59093	-0.02825	0.263	825	0.034	-0.94590	0.240	6.54
B-13	21	294.0	820	50	5.62	1125	9.59093	-0.02825	0.251	820	0.035	-0.94809	0.232	7.67
BG-1DUP-13	12.2	285.2	823	50	5.70	1125	9.59093	-0.02825	0.257	823	0.038	-1.65730	0.236	8.07
BG-13	12.5	285.5	821	50	5.60	1125	9.59093	-0.02825	0.255	821	0.037	-1.37533	0.234	8.14

822	6/23/2007	m <sub>s</sub> =	0.035	b <sub>s</sub> =	-1.16715
825	6/26/2007	m <sub>s</sub> =	0.034	b <sub>s</sub> =	-0.94590
820	6/26/2007	m <sub>s</sub> =	0.035	b <sub>s</sub> =	-0.94809
823	6/26/2007	m <sub>s</sub> =	0.038	b <sub>s</sub> =	-1.65730
821	6/26/2007	m <sub>s</sub> =	0.037	b <sub>s</sub> =	-1.37533

Acceptance Limit <= 10% Difference

**SAMPLING ROUND 14 – AUGUST 2007**

Network: New Bedford Site: Keith Middle Serial #: 820 Station #: C-14  
 Technician: E.M. L.M. Date: 8/1/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: *Monthly Recal*

Amb. Temp, Ta (°C) 25.5 Bar. Press., Pa (in Hg) 29.92  
 Amb. Temp, Ta (K) 298.5 Bar. Press., Pa (mmHg) 760.0

Orifice Data

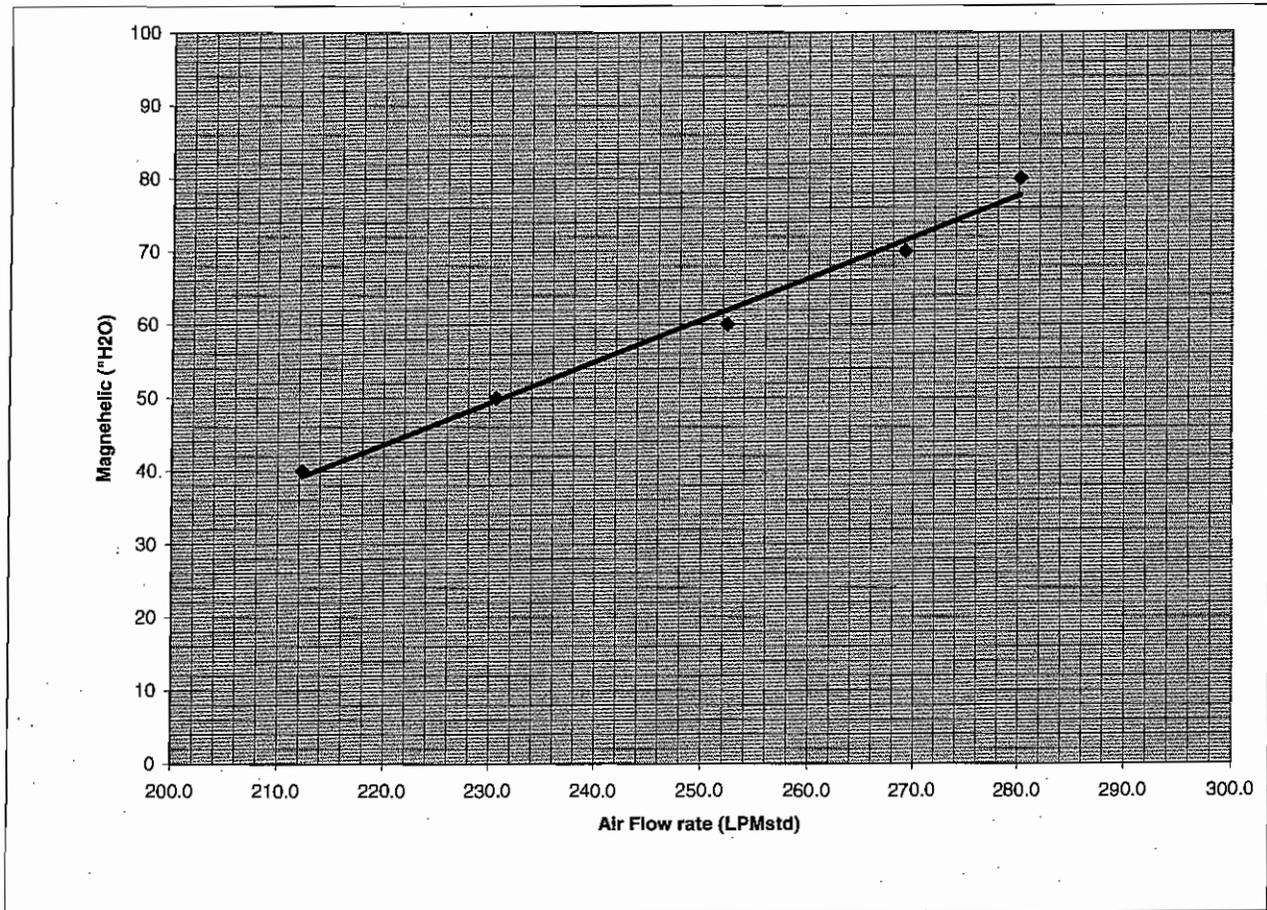
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

$\Delta H$	Q <sub>std</sub>	I	I <sub>c</sub>
7.10	280.148	80	8.94
6.55	269.195	70	8.36
5.75	252.406	60	7.74
4.79	230.631	50	7.06
4.05	212.306	40	6.32

$I_c = \sqrt{I \times 0.392 \times (Pa/Ta)}$

$Q_{std} = \{ (1/m_o) \times \sqrt{\Delta H \times (Pa/760)} \times (297.18/Ta) - b_o \} \times 1000$

m<sub>s</sub> = 0.037 b<sub>s</sub> = -1.57348 r<sub>s</sub> = 0.99722



Desired Flow Rate (lpm): 250

Sampler Setting: 60.6

m<sub>mag</sub> = 0.567

b<sub>mag</sub> = -81.13317

r<sub>mag</sub> = 0.99392

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Network: New Bedford      Site: Keith Middle      Serial #: 821      Station #: A-14  
 Technician: E.M. L.M.      Date: 8/1/2007      OrificeS/N: 1125      Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C)      26.7      Bar. Press., Pa (in Hg)      29.92  
 Amb. Temp, Ta (K)      299.7      Bar. Press., Pa (mmHg)      760.0

Orifice Data

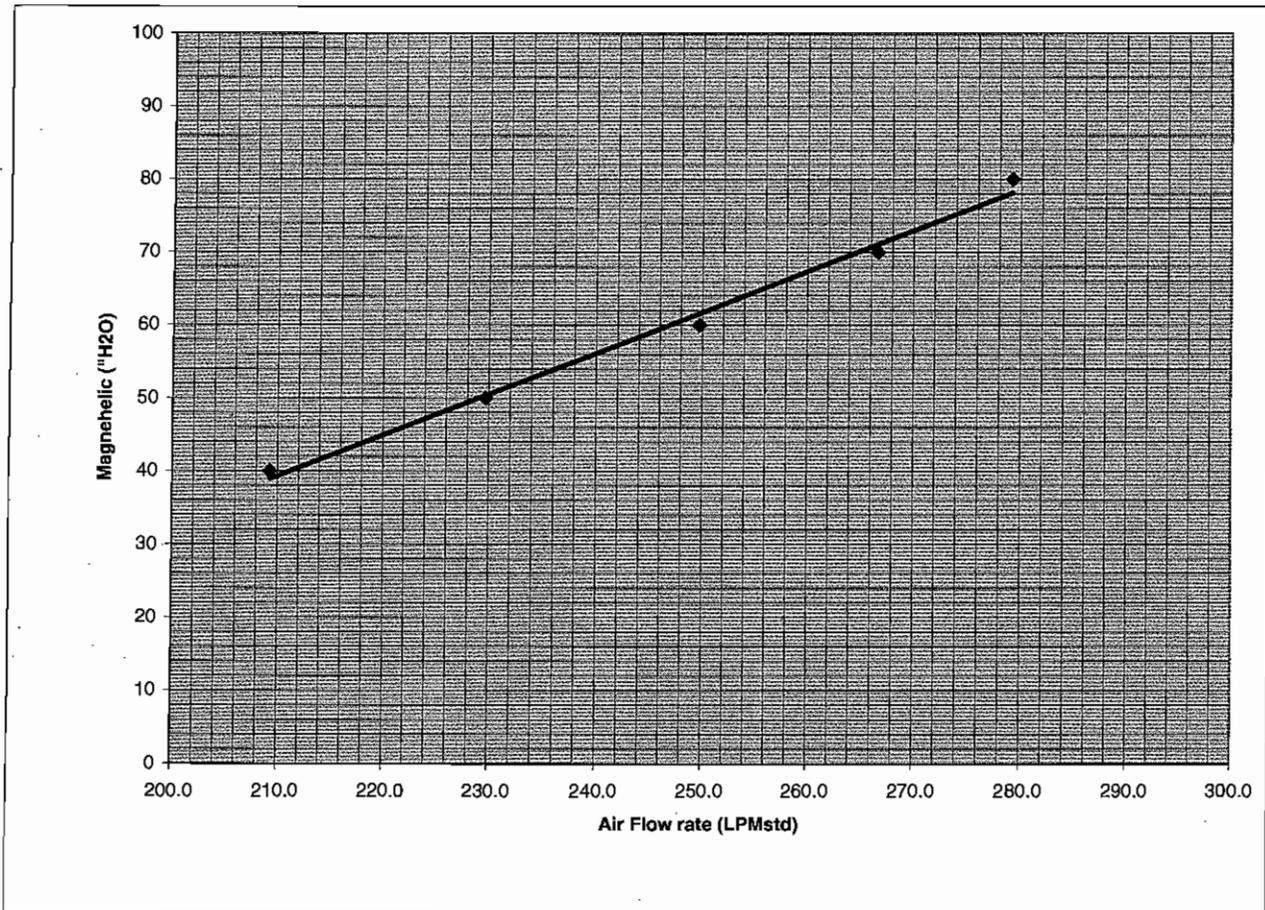
Qstd (m<sub>o</sub>) = 9.59093      Qstd (b<sub>o</sub>) = -0.02825      Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.08	279.202	80	8.92
6.45	266.625	70	8.34
5.65	249.732	60	7.72
4.77	229.700	50	7.05
3.95	209.291	40	6.31

$l_c = \text{sqrt}[l \times 0.392 \times (Pa/Ta)]$

$Q_{std} = \{(1/m_o) \times \text{sqrt}[\Delta H \times (Pa/760) \times (297.18/Ta) - b_o]\} \times 1000$

m<sub>s</sub> = 0.037      b<sub>s</sub> = -1.39700      r<sub>s</sub> = 0.99888



Desired Flow Rate (lpm): 250      Sampler Setting: 61.7

m<sub>mag</sub> = 0.561      b<sub>mag</sub> = -78.50633      r<sub>mag</sub> = 0.99573

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Network: New Bedford      Site: Keith Middle      Serial #: 822      Station #: A-14  
 Technician: E.M. L.M.      Date: 8/1/2007      OrificeS/N: 1125      Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C)      32.7      Bar. Press., Pa (in Hg)      29.92  
 Amb. Temp, Ta (K)      305.7      Bar. Press., Pa (mmHg)      760.0

Orifice Data

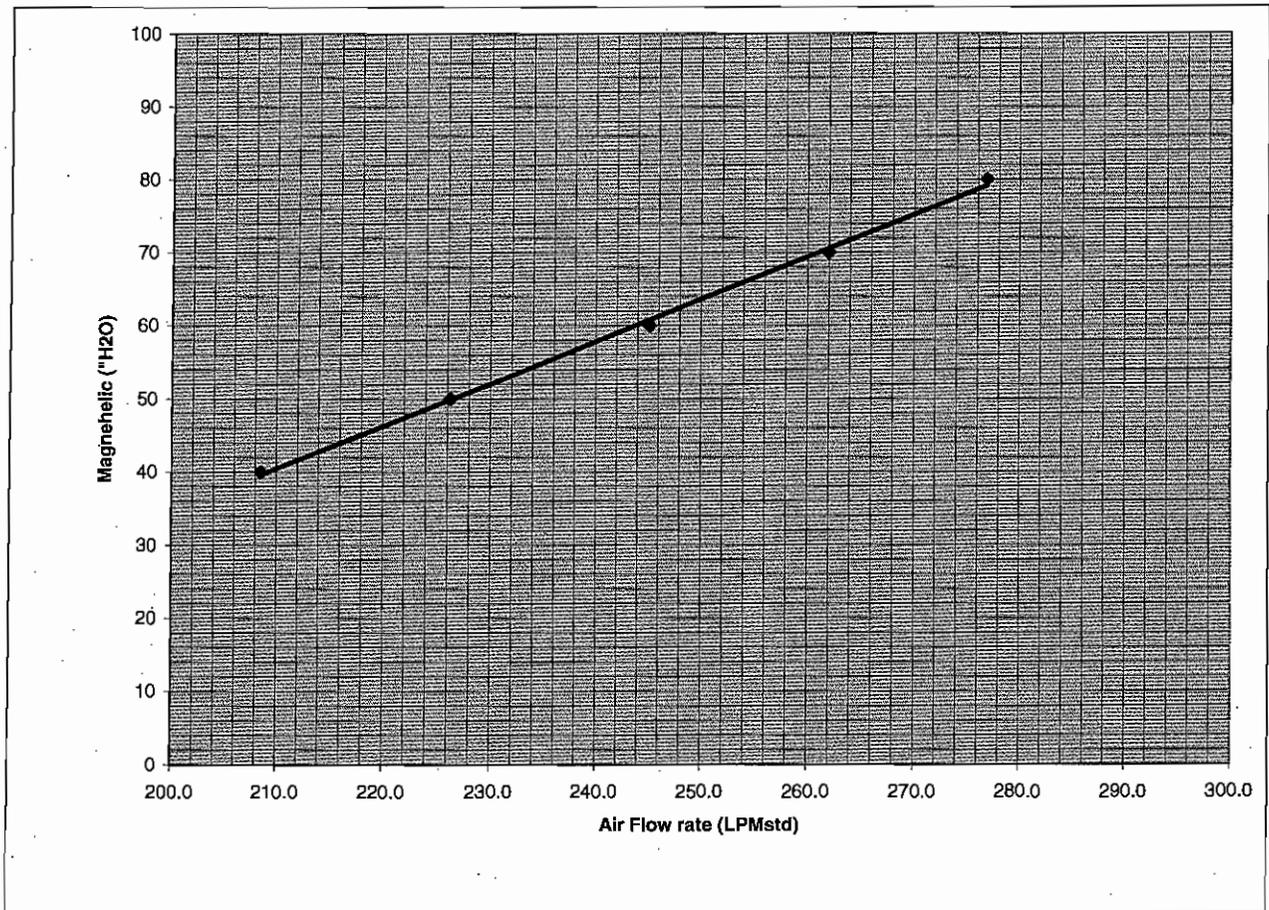
Qstd (m<sub>o</sub>) = 9.59093      Qstd (b<sub>o</sub>) = -0.02825      Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
7.10	276.864	80	8.83
6.35	261.993	70	8.26
5.55	245.126	60	7.65
4.72	226.284	50	6.98
4.00	208.545	40	6.24

$l_c = \text{sqrt}[l \times 0.392 \times (\text{Pa}/\text{Ta})]$

$Q_{\text{std}} = \{ (1/m_o) \times \text{sqrt}[\Delta H \times (\text{Pa}/760) \times (297.18/\text{Ta}) - b_o] \} \times 1000$

m<sub>s</sub> = 0.037      b<sub>s</sub> = -1.53280      r<sub>s</sub> = 0.99964



Desired Flow Rate (lpm): 250

Sampler Setting: 63.6

m<sub>mag</sub> = 0.579

b<sub>mag</sub> = -81.18320

r<sub>mag</sub> = 0.99910

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Network: New Bedford Site: Keith Middle Serial #: 823 Station #: BG-DUP-14  
 Technician: E.M. L.M. Date: 8/1/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 32.6 Bar. Press., Pa (in Hg) 29.92  
 Amb. Temp, Ta (K) 305.6 Bar. Press., Pa (mmHg) 760.0

Orifice Data

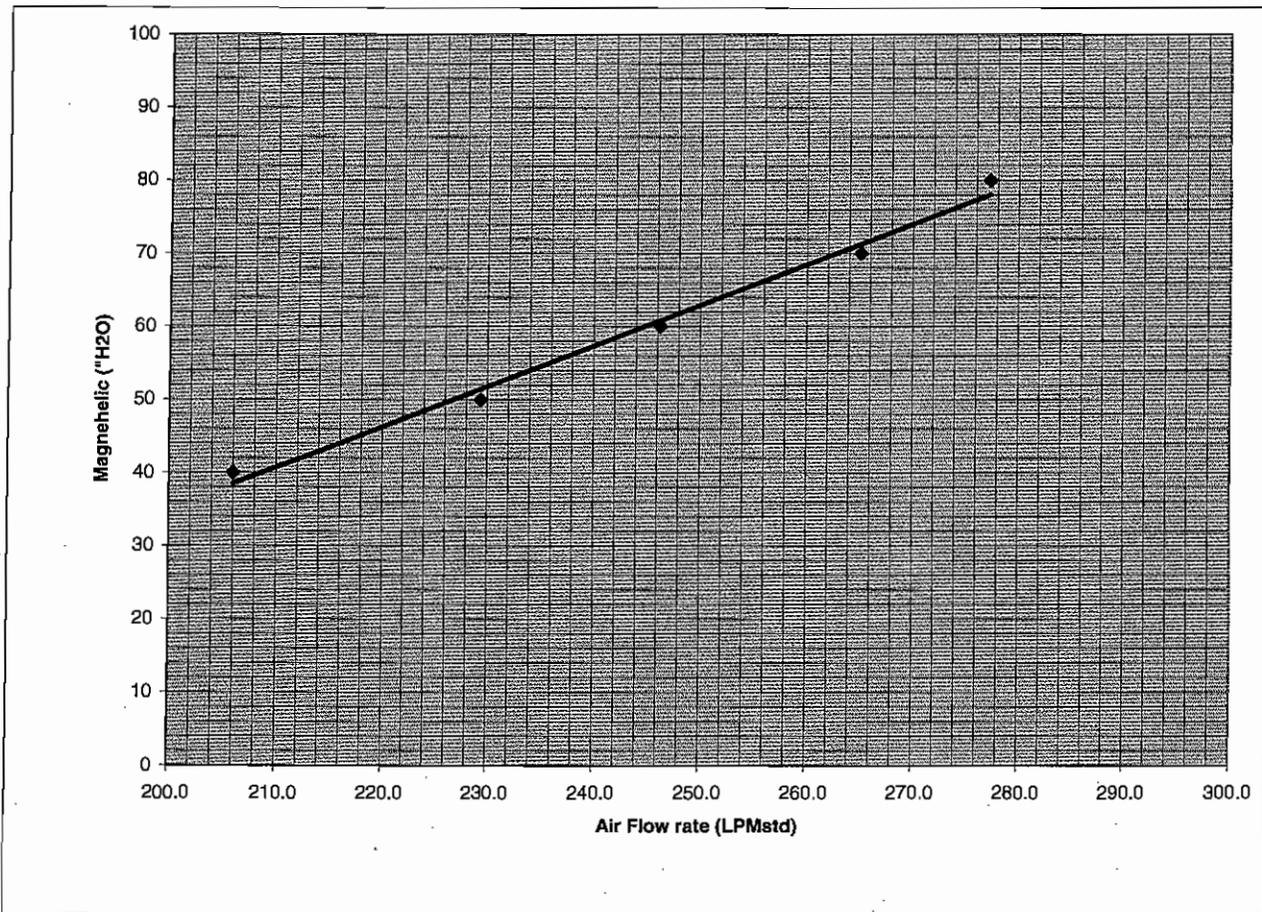
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	I	I <sub>c</sub>
7.12	277.294	80	8.83
6.50	265.077	70	8.26
5.60	246.254	60	7.65
4.85	229.376	50	6.98
3.90	205.992	40	6.24

$$I_c = \sqrt{I \times 0.392 \times (Pa/Ta)}$$

$$Q_{std} = \{(1/m_o) \times \sqrt{\Delta H \times (Pa/760)} \times (297.18/Ta) - b_o\} \times 1000$$

m<sub>s</sub> = 0.036 b<sub>s</sub> = -1.21497 r<sub>s</sub> = 0.99831



Desired Flow Rate (lpm): 250

Sampler Setting: 62.9

m<sub>mag</sub> = 0.555

b<sub>mag</sub> = -75.84572

r<sub>mag</sub> = 0.99472

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Network: New Bedford Site: Keith Middle Serial #: 825 Station #: B-13  
 Technician: E.M. L.M. Date: 8/1/2007 OrificeS/N: 1125 Orif. Cal. Date: 27-Nov-06

Reason for Puff Sampler Calibration: Monthly Recal

Amb. Temp, Ta (°C) 27.2 Bar. Press., Pa (in Hg) 29.92  
 Amb. Temp, Ta (K) 300.2 Bar. Press., Pa (mmHg) 760.0

Orifice Data

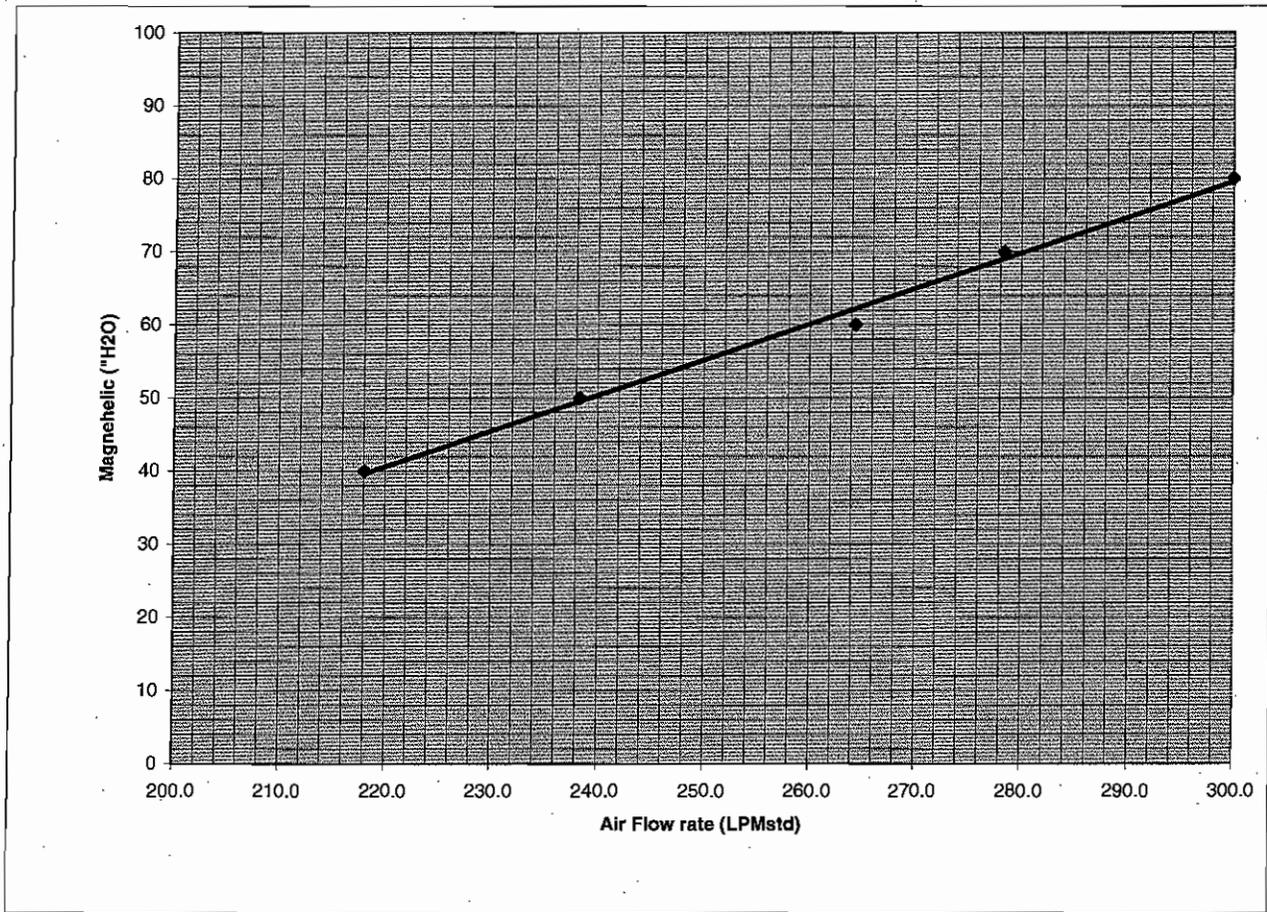
Qstd (m<sub>o</sub>) = 9.59093 Qstd (b<sub>o</sub>) = -0.02825 Qstd (r<sub>o</sub>) = 0.99998

ΔH	Q <sub>std</sub>	l	l <sub>c</sub>
8.20	300.004	80	8.91
7.05	278.387	70	8.33
6.35	264.355	60	7.72
5.15	238.363	50	7.04
4.30	218.060	40	6.30

$l_c = \text{sqrt}[l \times 0.392 \times (\text{Pa}/\text{Ta})]$

$Q_{\text{std}} = \{(1/m_o) \times \text{sqrt}[\Delta H \times (\text{Pa}/760) \times (297.18/\text{Ta}) - b_o]\} \times 1000$

m<sub>s</sub> = 0.032 b<sub>s</sub> = -0.59827 r<sub>s</sub> = 0.99753



Desired Flow Rate (lpm): 250 Sampler Setting: 55.2

m<sub>mag</sub> = 0.487 b<sub>mag</sub> = -66.62185 r<sub>mag</sub> = 0.99685

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## PS-1 Post-Sampling Flow Audit

$$Q_{std \text{ Orifice}} (m^3/min) = (1/m_o) * (\text{SQRT}(H_o * (T_{std}/P_{std})) - b_o)$$

$$Q_{std \text{ Sampler}} (m^3/min) = (1/m_s) * (\text{SQRT}(H_s * (T_{std}/P_{std})) - b_s) / 1000$$

$$\% \text{ Difference} = ((Q_{act \text{ Orifice}} - Q_{act \text{ Sampler}}) / Q_{act \text{ Orifice}}) * 100$$

8/2/2007		Press ("Hg): 29.98										Press - P <sub>s</sub> (mmHg): 761.5		
	Temp (°C):	Temp - T <sub>s</sub> (K):	Sampler Serial #	Sampler Reading - H <sub>s</sub> (h <sub>2</sub> O)	Orifice Reading - H <sub>o</sub> (h <sub>2</sub> O)	Orifice #	Orifice Slope - m <sub>o</sub>	Orifice Intercept - b <sub>o</sub>	Qstd Orifice	Sampler #	Sampler Slope - m <sub>s</sub>	Sampler Intercept - b <sub>s</sub>	Qstd Sampler	% Difference
A-14	23.6	296.6	821	50	4.85	1125	9.59093	-0.02825	0.233	821	0.037	-1.39700	0.230	1.64
BG-14	23.6	296.6	822	50	4.75	1125	9.59093	-0.02825	0.231	822	0.037	-1.53280	0.233	-0.97
BG-14- DUP	23.6	296.6	823	50	4.70	1125	9.59093	-0.02825	0.230	623	0.036	-1.21497	0.231	-0.47
B-14	27.5	300.5	625	50	5.10	1125	9.59093	-0.02825	0.238	625	0.032	-0.59827	0.239	-0.55
BG-14	22.7	295.7	620	50	4.80	1125	9.59093	-0.02825	0.232	620	0.037	-1.57346	0.235	-0.89

Acceptance Limit <= 10% Difference

**MISCELLANEOUS CALIBRATION RECORDS**



TISCH ENVIRONMENTAL, INC.  
 145 SOUTH MIAMI AVE.  
 VILLAGE OF CLEVELAND, OH 45002  
 513.467.9000  
 877.263.7610 TOLL FREE  
 513.467.9009 FAX  
 WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5040A

Date - Nov 27, 2006 Roots-meter S/N 9833620 Ta (K) - 295  
 Operator Jim Tisch Orifice I.D. - 1125 Pa (mm) - 758.19

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORIFICE DIFF H2O (in.)
1	NA	NA	1.00	6.6600	3.6	2.00
2	NA	NA	1.00	3.9950	10.0	5.50
3	NA	NA	1.00	3.2060	15.3	8.50
4	NA	NA	1.00	2.7340	20.7	11.50
5	NA	NA	1.00	2.4270	26.1	14.50
6	NA	NA	1.00	2.2620	29.7	16.50

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
1.0029	0.1505	1.4197	0.9951	0.1494	0.8821
0.9944	0.2489	2.3543	0.9868	0.2470	1.4629
0.9874	0.3079	2.9268	0.9798	0.3056	1.8186
0.9802	0.3585	3.4043	0.9726	0.3557	2.1153
0.9730	0.4009	3.8226	0.9655	0.3978	2.3752
0.9682	0.4280	4.0778	0.9608	0.4247	2.5338
Qstd slope (m) = 9.59093			Qa slope (m) = 6.00568		
intercept (b) = -0.02825			intercept (b) = -0.01755		
coefficient (r) = 0.99998			coefficient (r) = 0.99998		

y axis = SQRT[H2O (Pa/760) (298/Ta)]

y axis = SQRT[H2O (Ta/Pa)]

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)

Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]

Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m { [SQRT(H2O (Pa/760) (298/Ta))] - b }

Qa = 1/m { [SQRT H2O (Ta/Pa)] - b }

## CALIBRATOR SERVICE SHEET

RMA No: R53506  
 Model No: M-30  
 Serial No: 030306

Check Battery Date	: <u>7/05</u>	<b>AFTER CALIBRATION</b>	
Check Battery Voltage	: <u>5.60</u>	Empty Flow Cell	: <input checked="" type="checkbox"/>
Leak Check Flow Cell	: <input checked="" type="checkbox"/>	Install Nipple Covers	: <input checked="" type="checkbox"/>
Check Sensor Block Screws	: <input checked="" type="checkbox"/>	Install Calibration Label	: <input checked="" type="checkbox"/>
Flow Cell Has Serial Number	: <input checked="" type="checkbox"/>		
Clean Flow Cell & Unit	: <input checked="" type="checkbox"/>		

**Applicable Measurement Standards**

	Description	Initial	MFR.	Model	Serial #	N. I. S. T.
A	<input type="checkbox"/> 100ml Burette		Kimble	17027F-100		Special 17027F
B	<input checked="" type="checkbox"/> 1000ml Burette-1st check	<u>MO</u>	Kimble	17081	<u>1004</u>	ASTM E542
C	<input checked="" type="checkbox"/> 1000ml Burette-2nd check	<u>MI</u>	Kimble	17081	<u>1003</u>	ASTM E542
D	<input checked="" type="checkbox"/> Stopwatch-1st check	<u>MO</u>	Fisher	14-649-5	<u>51096701</u>	EL015
E	<input checked="" type="checkbox"/> Stopwatch-2nd check	<u>MI</u>	Fisher	14-649-5	<u>99051330</u>	EL015

Calibration Date :	<u>1-5-07</u>	<u>1-5-07</u>	<u>1-9-07</u>	
Calibrated By :	<u>MO</u>	<u>MO</u>	<u>MI</u>	
Measured With :	<u>BD</u>	<u>BD</u>	<u>CE</u>	
APB-1 Rev. 6.2	<u>As Received</u>	<u>1<sup>st</sup> Check</u>	<u>2<sup>nd</sup> Check</u>	<u>3<sup>rd</sup> Check</u>
Flow Rate				
M-1	<u>100.0 cc/m</u>	<u>100.0 cc/m</u>	<u>100.0 cc/m</u>	<u>100.0 cc/m</u>
M-5	<u>1000 cc/m</u>	<u>1000 cc/m</u>	<u>1000 cc/m</u>	<u>1000 cc/m</u>
M-30	<u>1.000 LPM</u>	<u>1.000 LPM</u>	<u>1.000 LPM</u>	<u>1.000 LPM</u>
Burette Reads	<u>1025</u>	<u>1025</u>	<u>1025</u>	
0.5 min on	<u>1030</u>	<u>1025</u>	<u>1027</u>	
1.0 min on	<u>1031</u>	<u>1024</u>	<u>1027</u>	
1.5 min on	<u>1029</u>	<u>1024</u>	<u>1026</u>	
2.0 min on	<u>1029</u>	<u>1024</u>	<u>1025</u>	
2.5 min on	<u>1028</u>	<u>1024</u>	<u>1026</u>	
3.0 min on	<u>1028</u>	<u>1023</u>	<u>1024</u>	
3.5 min on	<u>1028</u>	<u>1023</u>	<u>1023</u>	
4.0 min on	<u>1028</u>	<u>1022</u>	<u>1024</u>	
4.5 min on	<u>1026</u>	<u>1021</u>	<u>1023</u>	
5.0 min on	<u>1028</u>	<u>1022</u>	<u>1021</u>	

QC Stamp:

# Certificate of Calibration

A.P. BUCK, INC. mini-BUCK CALIBRATOR™

Serial No: 030306 Date Calibrated: 1-9-07 Next Calibration due date: 1-9-08

Model No:  M-1  M-5  M-30  M-30B

## Applicable Measurement Standards

Description	MFR.	Model	Serial #	N. I. S. T.
<input type="checkbox"/> 100ml Burette	Kimble	17027F-100	1220	SPECIAL 17027F
<input type="checkbox"/> 1000ml Burette	Kimble	17081	0002	ASTM E542
<input type="checkbox"/> 1000ml Burette	Kimble	17081	0003	ASTM E542
<input checked="" type="checkbox"/> 1000ml Burette	Kimble	17081	1003	ASTM E542
<input type="checkbox"/> 1000ml Burette	Kimble	17081	1004	ASTM E542
<input type="checkbox"/> 1000ml Burette	Kimble	17081	2087	ASTM E542
<input type="checkbox"/> Stopwatch	Fisher	14-649-5	51096691	EL015
<input checked="" type="checkbox"/> Stopwatch	Fisher	14-649-5	99051330	EL015
<input type="checkbox"/> Stopwatch	Fisher	14-649-5	51096701	EL015

AMBIENT CONDITIONS: Temperature  $74 \pm 3^{\circ}\text{F}$  Relative Humidity  $50 \pm 10\%$

This instrument as received on 1-5-07 at A.P. Buck,

- Unable to calibrate as received due to condition of unit.  
 Within specification of  $\pm 0.5\%$  of the display reading.  
 Not in specification by \_\_\_\_\_ % High, \_\_\_\_\_ % Low of the display

The instrument listed above has been adjusted to nominal, utilizing a burette, and an electronic digital stop watch, which are traceable to the National Institute of Standards & Technology (NIST). The accuracy of the instruments used to perform calibration is greater than 4 to 1. The A.P. Buck, Inc. Calibration system is in compliance with ANSI Z540-1 and IEC guide 25.

Calibration was conducted with A.P. Buck, Inc. Calibration Procedure APB-1 Rev. 6.2 with a constant flow pump using the Bubble-meter method. A.P. Buck, Inc. guarantees the accuracy and repeatability of  $\pm 0.5\%$  for any display reading as described under the instruction manual "Principles of Operation". Responsibilities shall in no event, nor for any cause whatsoever, exceed the price charged for the calibration represented by this certification.

QA APPROVAL BY: M. Brown

Information contained in this document should not be reproduced in any form without the written consent of A.P. Buck Inc. It is for reference only and cannot be used as a form of endorsement by any private or governmental regulatory body.

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**BUCK**  
A.P. BUCK, INC.

**APPENDIX D**

**LABORATORY DATA REPORTS**

**APPENDIX E**

**LABORATORY DATA VALIDATION**  
**MEMORANDA**

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 5/17/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG 07040010

---

## SUMMARY

Limited (Tier II) validation was performed on the data for 19 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on March 30, 2007 and submitted to Northeast Analytical, Inc. (NEA) in Schenectady, New York for analysis. All air vent samples were collected on polyurethane foam (PUF) cartridges in accordance with EPA method TO-10A; all ambient air samples were collected on particulate filters and PUF cartridges in accordance with EPA method TO-4A. The samples were analyzed for polychlorinated biphenyl (PCB) homologues using EPA method 680. NEA reported the results under job numbers 07040010A, 07040010B, and 07040010C.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. The Monochlorobiphenyl and Dichlorobiphenyl results for the air vent sample (TO-10A) should be considered estimated (J/UJ) due to low LCS/LCSD recoveries of the associated congener spikes.

## SAMPLES

Samples included in this review are listed below:

VS-14-10	B-10-PUF	BG-10-PF
VS-14-10-DUP (1)	A-10-PUF	BG-10-DUP-PF (3)
VS-1-10	BG-10-PUF	TRIP BLANK-PF
VS-7-10	BG-10-DUP-PUF (2)	
VS-4-10	TRIP BLANK-PUF	
VS-BG-10	B-10-PF	
TRIP BLANK	C-10-PF	
C-10-PUF	A-10-PF	

(1) Field duplicate of VS-14-10

- (2) Field duplicate of BG-10-PUF
- (3) Field duplicate of BG-10-PF

## **REVIEW ELEMENTS**

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- Surrogate spike recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## **DISCUSSION**

### **Agreement of Analyses Conducted with TRC Requests**

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### **Holding Times and Sample Preservation**

All samples were extracted and analyzed within the method-specified holding time. The cooler temperature was reported at 0.78°C upon receipt at the laboratory. The cooler temperature is below the recommended temperature of 4°C ± 2°C. It was the opinion of the validator that loss of PCBs would not occur due to the receipt temperature being lower than 2°C and therefore qualification of the data was not required.

### **GC/MS Tunes**

The frequency and abundance of all decafluorotriphenylphosphine (DFTPP) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the DFTPP tunes. Window defining mixtures were analyzed following each DFTPP tune.

### **Initial and Continuing Calibrations**

The %RSDs and %Ds of all PCB congeners used in the initial and continuing calibrations were within the acceptance criteria.

### **Method Blanks**

Target compounds were not detected in the laboratory method blanks or trip blanks associated with the PCB homologue analyses.

### **Surrogate Spike Recoveries**

Select samples exhibited recoveries of the surrogate tetrachloro-m-xylene (TCMX) which were outside the acceptance criteria of 60-140%. In all cases, recovery of the other surrogate (decachloro-C13

biphenyl [DCB]) was within the acceptance criteria with the exception of LCS AK02419L where the recovery of DCB was high at 150% recovery (see table below). The following table summarizes the surrogate recoveries in the affected samples.

Sample ID	SDG Package	TCMX	DCB
LCS (AK02419L)	07040010A	53%	150%
LCSD (AK02419S)	07040010A	57%	92%
VS-14-10-DUP	07040010A	53%	68%
Trip Blank	07040010A	50%	78%
LCSD (AK02426S)	07040010B	52%	98%
C-10-PUF	07040010B	390%	82%
A-10-PUF	07040010B	190%	85%
BG-10-DUP-PUF	07040010B	59%	76%
BG-10-PF	07040010C	52%	85%

The results of LCSD AK02426S were within the acceptance criteria for the PCB congener spikes even with slightly low recovery of TCMX; this implies that the associated sample data were not adversely affected by these slightly low recoveries. Therefore, it was the opinion of the validator that qualification of the data for SDG 07040010B and C was not required due to the recovery nonconformances listed above. The LCS and LCSD results associated with SDG 07040010A had low recoveries for 2-Chlorobiphenyl and 2,3-Dichlorobiphenyl (discussed below) and acceptable recoveries for the congener spikes. Therefore, it was the opinion of the validator that qualification of the data with the exception of Monochlorobiphenyl and Dichlorobiphenyl for SDG 07040010A was not required due to the recovery nonconformances listed above. Monochlorobiphenyl and Dichlorobiphenyl results require qualification as discussed below.

### LCS Results

An LCS and LCSD was extracted and analyzed with each extraction batch. The recoveries of the spiked congeners were within the acceptance criteria for all six LCS samples with the exception of LCS AK02419L for 2-chlorobiphenyl (39.4%) and 2,3-dichlorobiphenyl (51.8%) and LCSD AK02419S for 2-chlorobiphenyl (51.8%) and 2,3-dichlorobiphenyl (58.3%). Both of the effected LCS samples were associated with the preparation and analysis of the air vent samples (TO-10A). Based on the LCS results mentioned above, detected and non-detected TO-10A sample results for Monochlorobiphenyl and Dichlorobiphenyl should be considered estimated (J/UJ) with detected results (VS-4-10 Monochlorobephenyl @ 0.017 ug/m<sup>3</sup>) considered biased low.

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

### Field Duplicate Results

Samples VS-14-10/VS-14-10-DUP, BG-10-PUF/BG-10-PUF-DUP, and BG-10-PF/BG-10-PF-DUP were submitted as the field duplicate (collocated) pairs with this sample set. No PCBs were detected in any sample.

### Quantitation Limits and Sample Results

A dilution (2.5 fold) was required on the TO-4A PUF fractions due to chromatographic interferences, there were no dilutions performed on any other samples in this data set. The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 5/30/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDGs L0704308 and L0704494

---

## SUMMARY

Limited (Tier II) validation was performed on the data for 13 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on March 30, 2007 and submitted to Alpha Woods Hole Labs (Alpha) in Westborough, MA for analysis. All air vent samples were collected in 2 liter SUMMA® canisters in accordance with EPA method TO-15A; all ambient air samples were collected in 6 liter SUMMA® canisters in accordance with EPA method TO-15A. The samples were analyzed for volatile organic compounds using EPA method TO-15A. Alpha reported the results under job numbers L0704308 and L0704494.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. All positive acetone results should be considered estimated (J) due to initial calibration RSD exceedances. All positive 2-Butanone results in the vent stack samples should be considered estimated (J) due to lack of precision in the field duplicates.

## SAMPLES

Samples included in this review are listed below:

VS-14-10	VS-4-10	BG-10
VS-14-10-DUP (a)	VS-BG-10	B-10
VS-1-10	TRIP BLANK-VS	BG-10-DUP (b)
VS-7-10	A-10	TRIP BLANK

- a) Field duplicate of VS-14-10

b) Field duplicate of BG-10

## REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- System Monitoring Compound recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## DISCUSSION

### Agreement of Analyses Conducted with TRC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### Holding Times and Sample Preservation

All samples were extracted and analyzed within the method-specified holding time. The cooler temperature was at the proper temperature upon receipt at the laboratory.

### GC/MS Tunes

The frequency and abundance of all bromofluorobenzene (BFB) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the BFB tunes.

### Initial and Continuing Calibrations

The %RSDs of all target volatile organic compounds (VOCs) used in the initial calibration were within the acceptance criteria ( $\leq 30\%$ ) with the exception of the following;

Compound	% RSD
Acetone	30.73
Vinyl Acetate	40.38
2-Butanone	30.89
Cis-1,3-Dichloropropene	30.05
Styrene	40.59
Benzyl chloride	34.26

Positive results for these compounds should be considered estimated (J). Acetone was the only effected compound reported in detected quantities, all positive acetone results should be considered estimated (J).

The %Ds of all target volatile organic compounds (VOCs) used in the continuing calibrations were within the acceptance criteria.

### Method Blanks

Target compounds were not detected in the laboratory method blanks or field blanks associated with the volatile organic compound analyses.

### System Monitoring Compound Recoveries

All system monitoring compound recoveries were within the acceptance criteria of 70–30% with the exception of method blank WG275928-5 analyzed on 4/6/07 at 12:56. The system monitoring compound 1,2-dichloromethane-d4 had a recovery of 139.3%. No compounds were detected in the effected method blank. Therefore, it was the opinion of the validator that qualification of the data was not required due to the recovery nonconformance.

### LCS Results

An LCS was analyzed along with the field samples. The recoveries of the spiked target VOCs were within the acceptance criteria (70–130%) with the exception of 2-Hexanone (60%) and Benzyl chloride (54%). Benzyl chloride and 2-Hexanone were not detected in any of the field samples. Therefore, it was the opinion of the validator that qualification of the data was not required due to the recovery nonconformance.

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

### Field Duplicate Results

Samples VS-14-10/Vs-14-10-DUP and BG-10/BG-10-DUP were submitted as the field duplicate (collocated) pairs with this sample set. The following table summarizes the relative percent differences (RPDs) of the target VOCs detected in either sample.

VOCs	BG-10 ( $\mu\text{g}/\text{m}^3$ )	BG-10-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
Acetone	5.51	<4.75	< 2 x reporting limit
Methylene chloride	6.80	<3.47	<2 x reporting limit

VOCs	VS-14-10 ( $\mu\text{g}/\text{m}^3$ )	VS-14-10-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
2,2,4-Trimethylpentane	13.6	13.5	0.74
2-Butanone	110	139	23
Benzene	5.74	6.00	4.4
Chloroform	<2.44	2.49	< 2 x reporting limit
Cyclohexane	47.3	49.9	5.3
Ethanol	32.3	32.5	0.6

VOCs	VS-14-10 ( $\mu\text{g}/\text{m}^3$ )	VS-14-10-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
Methylene chloride	4.10	<3.47	< 2 x reporting limit
Methyl tert butyl ether	213	225	5.5
o-Xylene	2.56	2.91	13
n-Heptane	8.19	8.35	1.9
n-Hexane	205	223	8.4
Tetrahydrofuran	96.7	118	20
Toluene	13.9	14.4	3.5
Trichloroethane	<2.68	2.79	< 2 x reporting limit

All compounds met the duplicate acceptance criteria of 20%RPD or the difference of <2 times the reporting limit for compounds detected in one sample and not the other with the exception of 2-butanone (23% RPD) in the vent stack samples. All positive 2-Butanone results in the vent stack samples should be considered estimated(J).

#### Quantitation Limits and Sample Results

There were no dilutions performed on any samples in this data set. The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 9/18/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG 07040101

---

## SUMMARY

Limited (Tier II) validation was performed on the data for 19 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on April 17 & 18, 2007 and submitted to Northeast Analytical, Inc. (NEA) in Schenectady, New York for analysis. All air vent samples were collected on polyurethane foam (PUF) cartridges in accordance with EPA method TO-10A; all ambient air samples were collected on particulate filters and PUF cartridges in accordance with EPA method TO-4A. The samples were analyzed for polychlorinated biphenyl (PCB) homologues using EPA method 680. NEA reported the results under job numbers 07040101A, 07040101B, and 07040101C.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes.

## SAMPLES

Samples included in this review are listed below:

VS-16-11	B-11-PUF	BG-11-PF
VS-16-11-DUP (1)	A-11-PUF	BG-11-DUP-PF (3)
VS-10-11	BG-11-PUF	TRIP BLANK-PF
VS-1-11	BG-11-DUP-PUF (2)	
VS-4-11	TRIP BLANK-PUF	
VS-BG-11	B-11-PF	
TRIP BLANK	C-11-PF	
C-11-PUF	A-11-PF	

- (1) Field duplicate of VS-16-11
- (2) Field duplicate of BG-11-PUF
- (3) Field duplicate of BG-11-PF

## REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- Surrogate spike recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## DISCUSSION

### Agreement of Analyses Conducted with TRC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### Holding Times and Sample Preservation

All samples were extracted and analyzed within the method-specified holding time. The cooler temperature was reported at 2.4°C upon receipt at the laboratory. The cooler temperature met the recommended temperature of 4°C ± 2°C.

### GC/MS Tunes

The frequency and abundance of all decafluorotriphenylphosphine (DFTPP) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the DFTPP tunes. Window defining mixtures were analyzed following each DFTPP tune.

### Initial and Continuing Calibrations

The %RSDs and %Ds of all PCB congeners used in the initial and continuing calibrations were within the acceptance criteria.

### Method Blanks

Target compounds were not detected in the laboratory method blanks or trip blanks associated with the PCB homologue analyses.

### Surrogate Spike Recoveries

Select samples exhibited recoveries of the surrogate tetrachloro-m-xylene (TCMX) which were outside the acceptance criteria of 60-140%. In all cases, recovery of the other surrogate (decachloro-C13 biphenyl [DCB]) was within the acceptance criteria. The following table summarizes the surrogate recoveries in the affected samples.

Sample ID	SDG Package	TCMX	DCB
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Sample ID	SDG Package	TCMX	DCB
Method Blank (AK02901B)	07040101A	53%	84%
Trip Blank (AK02907)	07040101A	59%	81%
C-11-PUF (AK02908)	07040101B	180%	84%
B-11-PUF (AK02909)	07040101B	160%	92%
A-11-PUF (AK02910)	07040101B	170%	100%
Method Blank (AK02914B)	07040101C	55%	76%

With the DCB PCB congener spike recovery being within the acceptance criteria for the PCB congener spikes and no PCBs being detected in the effected samples, it was in the opinion of the validator that qualification of the data for SDG 07040010A, B and C was not required due to the recovery nonconformances listed above.

### LCS Results

An LCS and LCSD was extracted and analyzed with each extraction batch. The recoveries of the spiked congeners were within the acceptance criteria for all six LCS samples with the exception of LCSD AK02908S for 2-chlorobiphenyl (52%), 2,3-dichlorobiphenyl (53.9%), and 2,4,5-Trichlorobiphenyl (59.5%). The associated LCS (AK02908L) has acceptable recoveries for the spiked congeners mentioned above. The LCS samples were associated with the preparation and analysis of the ambient air PUF samples (TO-4A). Based on the LCS results mentioned above, it was in the opinion of the validator that qualification of the data for SDG 07040010B was not required due to the recovery nonconformances listed above.

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

### Field Duplicate Results

Samples VS-16-11/VS-16-11-DUP, BG-11-PUF/BG-11-PUF-DUP, and BG-11-PF/BG-11-PF-DUP were submitted as the field duplicate (collocated) pairs with this sample set. No PCBs were detected in any sample.

### Quantitation Limits and Sample Results

The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 5/31/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG L0705335

---

## SUMMARY

Limited (Tier II) validation was performed on the data for 13 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on April 18, 2007 and submitted to Alpha Woods Hole Labs (Alpha) in Westborough, MA for analysis. All air vent samples were collected in 2 liter SUMMA® canisters in accordance with EPA method TO-15A; all ambient air samples were collected in 6 liter SUMMA® canisters in accordance with EPA method TO-15A. The samples were analyzed for volatile organic compounds using EPA method TO-15A.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. All positive acetone and 2-butanona results should be considered estimated (J) due to initial calibration RSD nonconformance.

## SAMPLES

Samples included in this review are listed below:

VS-16-11	VS-4-11	BG-11
VS-16-11-DUP (a)	VS-BG-11	B-11
VS-10-11	VENT-TB	BG-11-DUP (b)
VS-1-11	A-11	TRIP BLANK

- a) Field duplicate of VS-16-11, no sample collected due to clogged flow controller, not analyzed.
- b) Field duplicate of BG-11

## REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- System Monitoring Compound recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## DISCUSSION

### Agreement of Analyses Conducted with TRC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### Holding Times and Sample Preservation

All samples were extracted and analyzed within the method-specified holding time.

### GC/MS Tunes

The frequency and abundance of all bromofluorobenzene (BFB) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the BFB tunes.

### Initial and Continuing Calibrations

The %RSDs of all target volatile organic compounds (VOCs) used in the initial calibration were within the acceptance criteria ( $\leq 30\%$ ) with the exception of the following;

Compound	% RSD
Acetone	30.73
Vinyl Acetate	49.88
2-Butanone	30.89
Cis-1,3-Dichloropropene	30.05
Styrene	40.59
Benzyl chloride	34.26

Positive results for these compounds should be considered estimated (J). Acetone and 2-Butanone were the only effected compounds reported in detected quantities, all positive Acetone and 2-Butanone results should be considered estimated (J).

The %Ds of all target volatile organic compounds (VOCs) used in the continuing calibrations were within the acceptance criteria.

## Method Blanks

Target compounds were not detected in the laboratory method blanks or field blanks associated with the volatile organic compound analyses.

## System Monitoring Compound Recoveries

Select samples exhibited recoveries of the system monitoring compound 1,2-dichloroethane-d4 which were outside the acceptance criteria of 70-130%. In all cases, recovery of the other system monitoring compounds (toluene-d8 and bromofluorobenzene [BFB]) were within the acceptance criteria (see table below). The following table summarizes the system monitoring compound recoveries in the affected samples.

Sample ID	1,2-dichloroethane-d4	Toluene-d8	BFB
VS-1-11	130.3%	111.2%	88.8%
BG-11-DUP	131.3%	121.5%	94.8%
Method Blank (WG277657-2)	131.8%	112.9%	85.8%
LCS (WG277657-1)	137.3%	101.8%	129.4%

The results of the LCS were within the acceptance criteria for the target VOC spikes (with the exception of 2-Hexanone [53%]) even with slightly high recovery of 1,2-dichloroethane-d4; this implies that the sample data were not adversely affected by these slightly high recoveries. Therefore, it was the opinion of the validator that qualification of the data was not required due to the recovery nonconformances listed above.

## LCS Results

An LCS was analyzed along with the field samples. The recoveries of the spiked target VOCs were within the acceptance criteria (70–130%) with the exception of 2-Hexanone (53%). 2-Hexanone was not detected in any of the field samples. Therefore, it was the opinion of the validator that qualification of the data was not required due to the recovery nonconformance.

## Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

## Field Duplicate Results

Samples BG-11/BG-11-DUP were submitted as the field duplicate (collocated) pairs with this sample set. The following table summarizes the relative percent differences (RPDs) of the target VOCs detected in either sample.

VOCs	BG-11 ( $\mu\text{g}/\text{m}^3$ )	BG-11-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
2-Butanone	<1.47	4.6	> 2 x reporting limit
Acetone	15.7	19.5	21.5
Ethanol	5.76	<3.76	< 2 x reporting limit
Tetrahydrofuran	<1.47	2.42	< 2 x reporting limit

Acetone and 2-butanone did not meet the duplicate acceptance criteria of 20%RPD or the difference of <2 times the reporting limit. Qualification of positive acetone and 2-butanone results are not required based on duplicate precision due to the fact that the results have been qualified due to initial calibration RSD nonconformance.

#### **Quantitation Limits and Sample Results**

There were no dilutions performed on any samples in this data set. The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 9/19/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG 07050109

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## SUMMARY

Limited (Tier II) validation was performed on the data for 19 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on May 18 & 19, 2007 and submitted to Northeast Analytical, Inc. (NEA) in Schenectady, New York for analysis. All air vent samples were collected on polyurethane foam (PUF) cartridges in accordance with EPA method TO-10A; all ambient air samples were collected on particulate filters and PUF cartridges in accordance with EPA method TO-4A. The samples were analyzed for polychlorinated biphenyl (PCB) homologues using EPA method 680. NEA reported the results under job numbers 07040101A, 07040101B, and 07040101C.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. Detected and non-detected results for sample B-12-PF should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery. Detected and non-detected TO-10A samples results for Monochlorobiphenyl, Dichlorobiphenyl, and Trichlorobiphenyl should be considered estimated (J/UJ) with detected results considered biased low.

## SAMPLES

Samples included in this review are listed below:

VS-8-12	B-12-PUF	BG-12-PF
VS-8-12-DUP (1)	A-12-PUF	BG-12-DUP-PF (3)
VS-11-12	BG-12-PUF	TRIP BLANK-PF
VS-1-12	BG-12-DUP-PUF (2)	A-12-PF
VS-4-12	TRIP BLANK-PUF	B-12-PF
VS-BG-12	C-12-PUF	C-12-PF
TRIP BLANK		

- (1) Field duplicate of VS-8-12
- (2) Field duplicate of BG-12-PUF
- (3) Field duplicate of BG-12-PF

## **REVIEW ELEMENTS**

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- Surrogate spike recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## **DISCUSSION**

### **Agreement of Analyses Conducted with TRC Requests**

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### **Holding Times and Sample Preservation**

All samples were extracted and analyzed within the method-specified holding time. The cooler temperature was reported at 2.4°C upon receipt at the laboratory. The cooler temperature met the recommended temperature of 4°C ± 2°C.

### **GC/MS Tunes**

The frequency and abundance of all decafluorotriphenylphosphine (DFTPP) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the DFTPP tunes. Window defining mixtures were analyzed following each DFTPP tune.

### **Initial and Continuing Calibrations**

The %RSDs and %Ds of all PCB congeners used in the initial and continuing calibrations were within the acceptance criteria.

### **Method Blanks**

Target compounds were not detected in the laboratory method blanks or trip blanks associated with the PCB homologue analyses.

### **Surrogate Spike Recoveries**

Select samples exhibited recoveries of the surrogate tetrachloro-m-xylene (TCMX) and/or surrogate (decachloro-C13 biphenyl [DCB]) which were outside the acceptance criteria of 60-140%. The

following table summarizes the surrogate recoveries in the affected samples. It should be noted that the laboratory re-analyzed the samples for surrogate compounds only on a new initial calibration. Due to the fact that the compounds of interest were quantified on the original initial calibration, only the surrogate recoveries from the calibration curve from which the samples were quantified will be evaluated.

Sample ID	SDG Package	TCMX	DCB
LCS (AK04002L)	07050109A	58%	88%
LCSD	07050109A	58%	79%
VS-11-12	07050109A	58%	62%
VS-BG-12	07050109A	53%	69%
C-12-PUF	07050109B	69%	57%
B-12-PUF	07050109B	93%	55%
A-12-PUF	07050109B	110%	58%
BG-12-DUP-PF	07050109B	68%	51%
C-12-PF	07050109C	56%	73%
B-12-PF	07050109C	51%	58%
A-12-PF	07050109C	49%	63%
BG-12-PF	07050109C	36%	63%
BG-12-DUP-PF	07050109C	70%	57%
TRIP BLANK-PF	07050109C	56%	76%

It is in the opinion of the validator that qualification of the data is not required due to the recovery nonconformances listed above when one of the two surrogate recoveries meet acceptance criteria. Detected and non-detected results for sample B-12-PF should be considered estimated (U/J) with detected results considered biased low due to poor surrogate recovery.

### LCS Results

An LCS and LCSD was extracted and analyzed with each extraction batch. The recoveries of the spiked congeners were within the acceptance criteria for all six LCS samples with the exception of LCS AK04002L and LCSD AK04002S from SDG 07050109A which are associated with the preparation and analysis of the vent samples (TO-10A). The following table summarizes the congener recoveries in the affected samples.

PCB Congener	LCS (AK04002L) % Rec.	LCSD (AK04002S) % Rec.
2-Chlorobiphenyl	55.1	54.5
2,3-Dichlorobiphenyl	58.9	59.4
2,4,5-Trichlorobiphenyl	57.5	59.0
2,2',4,6-Tetrachlorobiphenyl	59.1	61.3
2,2',3,4,5'-Pentachlorobiphenyl	59.4	62.2

Based on the LCS/LCSD results presented above, detected and non-detected TO-10A samples results for Monochlorobiphenyl, Dichlorobiphenyl, and Trichlorobiphenyl should be considered estimated (J/UJ) with detected results considered biased low.

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

**Field Duplicate Results**

Samples VS-16-11/VS-16-11-DUP, BG-11-PUF/BG-11-PUF-DUP, and BG-11-PF/BG-11-PF-DUP were submitted as the field duplicate (collocated) pairs with this sample set. No PCBs were detected in any sample.

**Quantitation Limits and Sample Results**

The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 9/18/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG L0707410

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## SUMMARY

Limited (Tier II) validation was performed on the data for 13 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on May 18 - 19, 2007 and submitted to Alpha Woods Hole Labs (Alpha) in Westborough, MA for analysis. All air vent samples were collected in 2 liter SUMMA® canisters in accordance with EPA method TO-15A; all ambient air samples were collected in 6 liter SUMMA® canisters in accordance with EPA method TO-15A. The samples were analyzed for volatile organic compounds using EPA method TO-15A.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. All positive 4-Methyl-2-pentanone should be considered estimated (J) due to initial calibration RSD nonconformance. Positive Methylene chloride results for both duplicate pairs (BG-12/BG-12-DUP and VS-8-12/VS-8-12-DUP) should be considered estimated (J) due to poor duplicate precision. Positive results for 2-Butanone, Acetone, Ethanol, and Isopropanol should be considered estimated (J) for duplicate pair VS-8-12/VS-8-12-DUP due to poor duplicate precision.

## SAMPLES

Samples included in this review are listed below:

VS-812	VS-4-12	BG-12
VS-8-12-DUP (a)	VS-BG-12	B-12
VS-1-12	VENT-TB	BG-11-DUP (b)
VS-11-12	A-12	TRIP BLANK

a) Field duplicate of VS-8-12

b) Field duplicate of BG-12

## REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- System Monitoring Compound recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## DISCUSSION

### Agreement of Analyses Conducted with TRC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### Holding Times and Sample Preservation

All samples were extracted and analyzed within the method-specified holding time.

### GC/MS Tunes

The frequency and abundance of all bromofluorobenzene (BFB) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the BFB tunes.

### Initial and Continuing Calibrations

The %RSDs of all target volatile organic compounds (VOCs) used in the initial calibration were within the acceptance criteria ( $\leq 30\%$ ) with the exception of the following;

Compound	% RSD
Bromoform	31.25
Vinyl Acetate	53.17
2-Hexanone	59.13
1,4-Dioxane	39.54
4-Methyl-2-pentanone	53.38
Trans-1,3-Dichloropropane	38.81
1,1,2,2-Tetrachloroethane	31.35
Benzyl chloride	47.06
1,2,4-Trichlorobenzene	39.09

Positive results for these compounds should be considered estimated (J). 4-Methyl-2-pentanone was the only effected compound reported in detected quantities in only two samples, VS-4-12 [4.19 ug/m<sup>3</sup> (J)] and B-12 [4.48 ug/m<sup>3</sup> (J)].

The %Ds of all target volatile organic compounds (VOCs) used in the continuing calibrations were within the acceptance criteria.

### Method Blanks

Target compounds were not detected in the laboratory method blanks or field blanks associated with the volatile organic compound analyses.

### System Monitoring Compound Recoveries

All samples exhibited recoveries of the system monitoring compound within target acceptance criteria.

### LCS Results

An LCS was analyzed along with the field samples. The recoveries of the spiked target VOCs were within the acceptance criteria (70–130%).

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

### Field Duplicate Results

Samples VS-8-12/VS-8-12-DUP and BG-12/BG-12-DUP were submitted as the field duplicate (collocated) pairs with this sample set. The following table summarizes the relative percent differences (RPDs) of the target VOCs detected in either sample.

VOCs	BG-12 ( $\mu\text{g}/\text{m}^3$ )	BG-12-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
Chloromethane	1.13	<3.73	< 2 x reporting limit
Isopropanol	1.23	6.77	> 2 x reporting limit
Methylene chloride	3.47	14.8	> 2 x reporting limit

VOCs	VS-8-12 ( $\mu\text{g}/\text{m}^3$ )	VS-8-12-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
1,2-Dichloroethane	3.61	<4.32	< 2 x reporting limit
2-butanone	25.3	14.6	53.6
Acetone	41.1	57.0	32.4
Cyclohexane	3.30	<3.68	< 2 x reporting limit
Ethanol	10.3	13.1	23.9
Isopropanol	<1.23	17.8	> 2 x reporting limit

VOCs	VS-8-12 ( $\mu\text{g}/\text{m}^3$ )	VS-8-12-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
Methylene chloride	4.45	17.3	118
Methyl tert butyl ether	4.53	<3.85	< 2 x reporting limit
Tetrahydrofuran	27.1	23.9	12.5
Trichloroethene	4.54	<5.74	< 2 x reporting limit
Trichlorofluoromethane	4.76	<6.00	< 2 x reporting limit

Methylene chloride did not meet the duplicate acceptance criteria of 20%RPD or the difference of <2 times the reporting limit for both duplicate pairs (BG-12/BG-12-DUP and VS-8-12/VS-8-12-DUP). 2-Butanone, Acetone, Ethanol, and Isopropanol did not meet the duplicate acceptance criteria of 20%RPD or the difference of <2 times the reporting limit for duplicate pair VS-8-12/VS-8-12-DUP. Qualify as estimated (J) of positive Methylene chloride results for both duplicate pairs (BG-12/BG-12-DUP and VS-8-12/VS-8-12-DUP) due to poor duplicate precision. Positive results for 2-Butanone, Acetone, Ethanol, and Isopropanol should be qualified estimated (J) for duplicate pair VS-8-12/VS-8-12-DUP due to poor duplicate precision.

#### Quantitation Limits and Sample Results

Samples VS-8-12-DUP and BG-12-DUP were pressurized with nitrogen due to limited sample volume collected and resulted in elevated quantitation limits for these samples. The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan

**From:** Edward MacKinnon

**CC:**

**Date:** 9/27/07

**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG 07060216

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## SUMMARY

Limited (Tier II) validation was performed on the data for 19 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on June 26 & 27, 2007 and submitted to Northeast Analytical, Inc. (NEA) in Schenectady, New York for analysis. All air vent samples were collected on polyurethane foam (PUF) cartridges in accordance with EPA method TO-10A; all ambient air samples were collected on particulate filters and PUF cartridges in accordance with EPA method TO-4A. The samples were analyzed for polychlorinated biphenyl (PCB) homologues using EPA method 680. NEA reported the results under job numbers 07060216A, 07060216B, and 07060216C.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. Detected and non-detected results for sample VS-9-13-DUP should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery. Detected and non-detected TO-10A samples results for Monochlorobiphenyl should be considered estimated (J/UJ) with detected results considered biased low.

## SAMPLES

Samples included in this review are listed below:

VS-9-13	B-13-PUF	BG-13-PF
VS-9-13-DUP (1)	A-13-PUF	BG-13-DUP-PF (3)
VS-1-13	BG-13-PUF	TRIP BLANK-PF
VS-4-13	BG-13-DUP-PUF (2)	A-13-PF
VS-7-13	TRIP BLANK-PUF	B-13-PF
VS-BG-13	C-13-PUF	C-13-PF
TRIP BLANK		

- (1) Field duplicate of VS-9-13
- (2) Field duplicate of BG-13-PUF
- (3) Field duplicate of BG-13-PF

## **REVIEW ELEMENTS**

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- Surrogate spike recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## **DISCUSSION**

### **Agreement of Analyses Conducted with TRC Requests**

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### **Holding Times and Sample Preservation**

All samples were extracted and analyzed within the method-specified holding time. The cooler temperature was reported at 3.9°C upon receipt at the laboratory. The cooler temperature met the recommended temperature of 4°C ± 2°C.

### **GC/MS Tunes**

The frequency and abundance of all decafluorotriphenylphosphine (DFTPP) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the DFTPP tunes. Window defining mixtures were analyzed following each DFTPP tune.

### **Initial and Continuing Calibrations**

The %RSDs and %Ds of all PCB congeners with the exception of octachlorobiphenyl used in the initial and continuing calibrations were within the acceptance criteria.

### **Method Blanks**

Target compounds were not detected in the laboratory method blanks or trip blanks associated with the PCB homologue analyses.

### Surrogate Spike Recoveries

Select samples exhibited recoveries of the surrogate tetrachloro-m-xylene (TCMX) and/or surrogate (decachloro-C13 biphenyl [DCB]) which were outside the acceptance criteria of 60-140%. The following table summarizes the surrogate recoveries in the affected samples.

Sample ID	SDG Package	TCMX	DCB
LCS (AK06553L)	07060216A	59%	77%
LCSD (AK06553S)	07060216A	57%	68%
VS-9-13-DUP	07060216A	59%	57%
VS-4-13	07060216A	63%	59%
VS-BG-13	07060216A	51%	61%
TRIP BLANK	07060216A	52%	67%
Method Blank (AK06560B)	07060216B	56%	70%
LCS (AK06560L)	07060216B	59%	89%
C-13-PUF	07060216B	160%	74%

It is in the opinion of the validator that qualification of the data is not required due to the recovery nonconformances listed above when one of the two surrogate recoveries meet acceptance criteria. Detected and non-detected results for sample VS-9-13-DUP should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery.

### LCS Results

An LCS and LCSD was extracted and analyzed with each extraction batch. The recoveries of the spiked congeners were within the acceptance criteria for all six LCS samples with the exception of LCS AK06553L and LCSD AK06553S from SDG 07060216A which are associated with the preparation and analysis of the vent samples (TO-10A). The following table summarizes the congener recoveries in the affected samples.

PCB Congener	LCS (AK06553L) % Rec.	LCSD (AK06553S) % Rec.
2-Chlorobiphenyl	58.5	57.4
2,2',4,6-Tetrachlorobiphenyl	62.1	59.9
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	58.4	68.7

Based on the LCS/LCSD results presented above, detected and non-detected TO-10A samples results for Monochlorobiphenyl should be considered estimated (J/UJ) with detected results considered biased low.

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses with the exception of Chrysene-d12 in LCSD AK06560S from SDG 07060216B. The Chrysene-d12 retention time was outside the retention time limit by 0.07 minutes. Qualification of field sample results were not required.

### Field Duplicate Results

Samples VS-16-11/VS-16-11-DUP, BG-11-PUF/BG-11-PUF-DUP, and BG-11-PF/BG-11-PF-DUP were submitted as the field duplicate (collocated) pairs with this sample set. No PCBs were detected in any sample.

### **Quantitation Limits and Sample Results**

The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 11/1/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG L0709306

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## **SUMMARY**

Limited (Tier II) validation was performed on the data for 13 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on June 26 & 27, 2007 and submitted to Alpha Woods Hole Labs (Alpha) in Westborough, MA for analysis. All air vent samples were collected in 2 liter SUMMA® canisters in accordance with EPA method TO-15A; all ambient air samples were collected in 6 liter SUMMA® canisters in accordance with EPA method TO-15A. The samples were analyzed for volatile organic compounds using EPA method TO-15A.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. Chloromethane results for field samples VS-4-13, VS-BG-13, VENT-TB, C-13, and B-13 should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected Benzyl chloride and Styrene results for samples VS-9-13, VS-9-13 DUP, and VS-1-13 should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery. Hexachlorobutadiene, 1,2,4-Trichlorobenzene, and Vinyl bromide results for field samples VS-7-13, A-13, BG-13, BG-13-DUP, and Trip Blank should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected Acetone and Methylene chloride results for field samples VS-7-13, A-13, BG-13, BG-13-DUP should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery

## **SAMPLES**

Samples included in this review are listed below:

VS-9-13	VS-4-13	BG-13
VS-9-13-DUP (a)	VS-BG-13	B-13
VS-1-13	VENT-TB	BG-13-DUP (b)

VS-7-13

A-13

TRIP BLANK

- a) Field duplicate of VS-9-13
- b) Field duplicate of BG-13

## REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- System Monitoring Compound recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## DISCUSSION

### Agreement of Analyses Conducted with TRC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### Holding Times and Sample Preservation

All samples were extracted and analyzed within the method-specified holding time.

### GC/MS Tunes

The frequency and abundance of all bromofluorobenzene (BFB) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the BFB tunes.

### Initial and Continuing Calibrations

The %RSDs of all target volatile organic compounds (VOCs) used in the initial calibration were within the acceptance criteria ( $\leq 30\%$ ).

The %Ds of all target volatile organic compounds (VOCs) used in the continuing calibrations were within the acceptance criteria.

### Method Blanks

Target compounds were not detected in the laboratory method blanks or field blanks associated with the volatile organic compound analyses.

### System Monitoring Compound Recoveries

System monitoring compounds were not introduced to these samples. Evaluation of the samples based on system monitoring compound recovery was not performed.

### LCS Results

An LCS (WG287162-4) was analyzed along with the field samples. The recoveries of the spiked target VOCs were within the acceptance criteria (70–130%) with the exception of the following:

Compound	Analysis Date	True Value (ppbv)	Found Concentration (ppbv)	% Recovery
Chloromethane	7/14/07	10	6.56	66
Benzyl chloride	7/16/07	10	13.6	136
Styrene	7/16/07	10	13.1	131
1,2,4-Trichlorobenzene	7/18/07	10	6.2	62
Acetone	7/18/07	10	13.8	138
Hexachlorobutadiene	7/18/07	10	5.87	59
Methylene chloride	7/18/07	10	14.6	146
Vinyl bromide	7/18/07	10	4.35	44

Chloromethane results for field samples VS-4-13, VS-BG-13, VENT-TB, C-13, and B-13 should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected Benzyl chloride and Styrene results for samples VS-9-13, VS-9-13 DUP, and VS-1-13 should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery. Hexachlorobutadiene, 1,2,4-Trichlorobenzene, and Vinyl bromide results for field samples VS-7-13, A-13, BG-13, BG-13-DUP, and Trip Blank should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected Acetone and Methylene chloride results for field samples VS-7-13, A-13, BG-13, BG-13-DUP should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery.

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

### Field Duplicate Results

Samples VS-9-13/VS-9-13-DUP and BG-13/BG-13-DUP were submitted as the field duplicate (collocated) pairs with this sample set. The following table summarizes the relative percent differences (RPDs) of the target VOCs detected in either sample.

VOCs	BG-13 ( $\mu\text{g}/\text{m}^3$ )	BG-13-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
2-Butanone	2.24	2.39	< 2 x reporting limit
Acetone	24.2	24.2	0
Chloromethane	1.68	1.72	< 2 x reporting limit
Ethanol	5.12	9.95	< 2 x reporting limit

VOCs	VS-9-13 ( $\mu\text{g}/\text{m}^3$ )	VS-9-13-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
2,2,4-Trimethylpentane	89.3	94.9	6.1
2-butanone	52.6	85.3	< 2 x reporting limit
Cyclohexane	92.4	106	14
Ethanol	<75.3	93.1	< 2 x reporting limit
Methyl tert butyl ether	149	172	14
n-Hexane	102	110	7.5
Propylene	87.1	114	< 2 x reporting limit

All compounds met the duplicate acceptance criteria of 20%RPD or the difference of <2 times the reporting limit for both duplicate pairs (BG-13/BG-13-DUP and VS-9-13/VS-9-13-DUP).

#### Quantitation Limits and Sample Results

The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 11/1/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG 07080018

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## **SUMMARY**

Limited (Tier II) validation was performed on the data for 19 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on August 1 & 2, 2007 and submitted to Northeast Analytical, Inc. (NEA) in Schenectady, New York for analysis. All air vent samples were collected on polyurethane foam (PUF) cartridges in accordance with EPA method TO-10A; all ambient air samples were collected on particulate filters and PUF cartridges in accordance with EPA method TO-4A. The samples were analyzed for polychlorinated biphenyl (PCB) homologues using EPA method 680. NEA reported the results under job numbers 07080018A, 07080018B, and 07080018C.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. Detected and non-detected Monochlorobiphenyl, Dichlorobiphenyl, Trichlorobiphenyl, and Tetra chlorobiphenyl results for all TO-10A and TO-4A (when both fractions are combined) samples should be considered estimated (J/UJ) with detected results considered biased low due to poor LCS/LCSD recoveries. Detected and non-detected Pentachlorobiphenyl TO-4A sample results should be considered estimated (J/UJ) with detected results considered biased low due to poor LCS/LCSD recoveries. Detected and non-detected results for sample BG-14-DUP should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery.

## **SAMPLES**

Samples included in this review are listed below:

VS-14-14  
VS-14-14-DUP (1)

B-14-PUF  
A-14-PUF

BG-14-PF  
BG-14-DUP-PF (3)

VS-1-14	BG-14-PUF	TRIP BLANK-PF
VS-4-14	BG-14-DUP-PUF (2)	A-14-PF
VS-16-14	TRIP BLANK-PUF	B-14-PF
VS-BG-14	C-14-PUF	C-14-PF
TRIP BLANK		

- (1) Field duplicate of VS-14-14
- (2) Field duplicate of BG-14-PUF
- (3) Field duplicate of BG-14-PF

## REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- Surrogate spike recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## DISCUSSION

### Agreement of Analyses Conducted with TRC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### Holding Times and Sample Preservation

All samples were extracted and analyzed within the method-specified holding time. The cooler temperature was reported at 2.4°C upon receipt at the laboratory. The cooler temperature met the recommended temperature of 4°C ± 2°C.

### GC/MS Tunes

The frequency and abundance of all decafluorotriphenylphosphine (DFTPP) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the DFTPP tunes. Window defining mixtures were analyzed following each DFTPP tune.

### Initial and Continuing Calibrations

The %RSDs and %Ds of all PCB congeners used in the initial and continuing calibrations were within the acceptance criteria.

### Method Blanks

Target compounds were not detected in the laboratory method blanks or trip blanks associated with the PCB homologue analyses.

## Surrogate Spike Recoveries

Select samples exhibited recoveries of the surrogate tetrachloro-m-xylene (TCMX) and/or surrogate (decachloro-C13 biphenyl [DCB]) which were outside the acceptance criteria of 60-140%. The following table summarizes the surrogate recoveries in the affected samples.

Sample ID	SDG Package	TCMX	DCB
Method Blank (AK08931B)	07080018A	57%	75%
LCS (AK08931L)	07080018A	47%	96%
LCSD (AK08931S)	07080018A	57%	86%
VS-14-14	0708018A	62%	70%
VS-14-14-DUP	07080018A	50%	73%
VS-1-14	0708018A	60%	66%
VS-16-14	07080018A	47%	74%
VS-BG-14	07080018A	48%	68%
TRIP BLANK	07080018A	56%	81%
Method Blank (AK08938B)	07080018B	51%	65%
LCS (AK08938L)	07080018B	49%	87%
LCSD (AK08938S)	07080018B	58%	82%
C-14-PUF	07080018B	200%	71%
B-14-PUF	07080018B	0%	64%
A-14-PUF	07080018B	0%	65%
BG-14-DUP-PUF	07080018B	58%	65%
Trip Blank-PUF	07080018B	37%	61%
LCS (AK08944L)	07080018C	47%	87%
LCSD (AK08944S)	07080018C	51%	89%
C-14-PF	07080018C	56%	54%
B-14-PF	07080018C	30%	68%
A-14-PF	07080018C	49%	61%
BG-14-PF	07080018C	32%	64%
BG-14-DUP-PF	07080018C	33%	47%
Trip Blank-PF	07080018C	48%	70%

It is in the opinion of the validator that qualification of the data is not required due to the recovery nonconformances listed above when one of the two surrogate recoveries meet acceptance criteria. Detected and non-detected results for sample BG-14-DUP-PF should be considered estimated (UJ/J) with detected results considered biased low due to poor surrogate recovery.

## LCS Results

An LCS and LCSD was extracted and analyzed with each extraction batch. The following table summarizes recoveries that were not with acceptance criteria.

PCB Congener	LCS (AK08931L) % Rec.	LCSD (AK08931S) % Rec.
2-Chlorobiphenyl	52.2	50.1
2,3-Dichlorobiphenyl	56.3	52.2
2,4,5-Trichlorobiphenyl	59.9	55.9
2,2',4,6-Tetrachlorobiphenyl	59.1	55.3
PCB Congener	LCS (AK08938L) % Rec.	LCSD (AK08938S) % Rec.
2-Chlorobiphenyl	46.3	49.7
2,3-Dichlorobiphenyl	49.8	51.7

2,4,5-Trichlorobiphenyl	52.8	55.1
2,2',4,6-Tetrachlorobiphenyl	53.3	55.2
2,2',3,4,5'-Pentachlorobiphenyl	58.8	59.3
<b>PCB Congener</b>	<b>LCS (AK08944L)</b>	<b>LCSD (AK08944S)</b>
	<b>% Rec.</b>	<b>% Rec.</b>
2-Chlorobiphenyl	51.1	49.9
2,3-Dichlorobiphenyl	55.1	52.6
2,4,5-Trichlorobiphenyl	61.7	56.5
2,2',4,6-Tetrachlorobiphenyl	61.2	56.8

Laboratory control samples AK08931L and AK08931S are associated with the preparation and analysis of TO-10A samples. Laboratory control samples AK08938L/AK08938S and AK08944L/AK08944S are associated with the preparation and analysis of PUF fraction and filter fraction of the TO-4A samples respectively.

Based on the LCS/LCSD results presented above, detected and non-detected Monochlorobiphenyl and Dichlorobiphenyl results for all TO-10A samples and both fractions of the TO-4A sample should be considered estimated (J/UJ) with detected results considered biased low. Detected and non-detected Trichlorobiphenyl and Tetrachlorobiphenyl results for all TO-10A samples and the PUF fractions of the TO-4A sample should be considered estimated (J/UJ) with detected results considered biased low. Pentachlorobiphenyl TO-4A PUF fraction Detected and non-detected results should be considered estimated (J/UJ) with detected results considered biased low.

#### **Internal Standard Performance**

Internal standards were within the acceptance criteria.

#### **Field Duplicate Results**

Samples VS-14-14/Vs-14-14-DUP, BG-14-PUF/BG-14-PUF-DUP, and BG-14-PF/BG-14-PF-DUP were submitted as the field duplicate (collocated) pairs with this sample set. No PCBs were detected in any sample.

#### **Quantitation Limits and Sample Results**

The quantitation limits met the requirements in the Sampling Plan for this program.

# Memo

**To:** David Sullivan  
**From:** Edward MacKinnon  
**CC:**  
**Date:** 11/1/07  
**Re:** Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG L0711230

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## SUMMARY

Limited (Tier II) validation was performed on the data for 13 air samples collected at the Keith Middle School, Massachusetts. The samples were collected on August 1 & 2, 2007 and submitted to Alpha Woods Hole Labs (Alpha) in Westborough, MA for analysis. All air vent samples were collected in 2 liter SUMMA® canisters in accordance with EPA method TO-15A; all ambient air samples were collected in 6 liter SUMMA® canisters in accordance with EPA method TO-15A. The samples were analyzed for volatile organic compounds using EPA method TO-15A.

The sample results were assessed using the *EPA New England Data Validation Functional Guidelines for Evaluating Environmental Analyses*, revised December 1996. Modification of these guidelines was performed to accommodate the non-CLP methodology.

In general, the data appear to be valid as reported and may be used for decision-making purposes. 1,1,2,2-Tetrachloroethane, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,4-Dichlorobenzene, and Hexachlorobutadiene results for field samples VS-14-14, VS-14-14-DUP, VS-1-14, VS-16-14, VS-4-14, VENT TB, B-14, and A-14 should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected Carbon disulfide results for samples previously mentioned should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery. Hexachlorobutadiene and 1,2,4-Trichlorobenzene results for field samples C-14, BG-14, BG-14-DUP, and Trip Blank should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected 1,1,1-Trichloroethane, Carbon disulfide, and Chloromethane results for field samples samples C-14, BG-14, BG-14-DUP, and Trip Blank should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery.

## SAMPLES

Samples included in this review are listed below:

VS-14-14

VS-4-14

BG-14

VS-14-14-DUP (a)  
VS-1-14  
VS-16-14

VS-BG-14  
VENT-TB  
A-14

B-14  
BG-14-DUP (b)  
TRIP BLANK

- a) Field duplicate of VS-14-14
- b) Field duplicate of BG-14

## REVIEW ELEMENTS

Sample data were reviewed for the following parameters:

- Agreement of analyses conducted with TRC requests
- Holding times and sample preservation
- Gas chromatography/mass spectrometry (GC/MS) tunes
- Initial and continuing calibrations
- Method blanks
- System Monitoring Compound recoveries
- Laboratory control sample (LCS) results
- Internal standard performance
- Field duplicate results
- Quantitation limits and sample results

## DISCUSSION

### Agreement of Analyses Conducted with TRC Requests

Sample reports were checked to verify that the results corresponded to analytical requests as designated on the chain-of-custody and any correspondence between TRC and the laboratory. There were no discrepancies noted.

### Holding Times and Sample Preservation

All samples were extracted and analyzed within the method-specified holding time.

### GC/MS Tunes

The frequency and abundance of all bromofluorobenzene (BFB) tunes were within the acceptance criteria. The samples were analyzed within 12 hours from the BFB tunes.

### Initial and Continuing Calibrations

The %RSDs of all target volatile organic compounds (VOCs) used in the initial calibration were within the acceptance criteria ( $\leq 30\%$ ).

The %Ds of all target volatile organic compounds (VOCs) used in the continuing calibrations were within the acceptance criteria.

### Method Blanks

Target compounds were not detected in the laboratory method blanks or field blanks associated with the volatile organic compound analyses.

### System Monitoring Compound Recoveries

System monitoring compounds were not introduced to these samples. Evaluation of the samples based on system monitoring compound recovery was not performed.

### LCS Results

A LCS (WG290964-4 analyzed on 8/16/07 and WG290964-6 analyzed on 8/17/07) was analyzed along with the field samples. The recoveries of the spiked target VOCs were within the acceptance criteria (70–130%) with the exception of the following:

Compound	Analysis Date	True Value (ppbv)	Found Concentration (ppbv)	% Recovery
1,1,2,2-Tetrachloroethane	8/16/07	5	3.43	69
1,2,4-Trichlorobenzene	8/16/07	5	2.06	41
1,2-Dichlorobenzene	8/16/07	5	3.2	64
1,4-Dichlorobenzene	8/16/07	5	3.4	68
Carbon disulfide	8/16/07	5	7.15	143
Hexachlorobutadiene	8/16/07	5	2.05	41
1,1,1-Trichloroethane	8/17/07	5	6.94	139
1,2,4-Trichlorobenzene	8/17/07	5	2.23	45
Carbon disulfide	8/17/07	5	7.61	152
Chloromethane	8/17/07	5	7.14	143
Hexachlorobutadiene	8/17/07	5	2.3	46

1,1,2,2-Tetrachloroethane, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,4-Dichlorobenzene, and Hexachlorobutadiene results for field samples VS-14-14, VS-14-14-DUP, VS-1-14, VS-16-14, VS-4-14, VENT TB, B-14, and A-14 should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected Carbon disulfide results for samples previously mentioned should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery. Hexachlorobutadiene and 1,2,4-Trichlorobenzene results for field samples C-14, BG-14, BG-14-DUP, and Trip Blank should be qualified as estimated (UJ/J) with detected results considered possibly biased low due to low LCS recovery. Detected 1,1,1-Trichloroethane, Carbon disulfide, and Chloromethane results for field samples samples C-14, BG-14, BG-14-DUP, and Trip Blank should be qualified as estimated (J) and considered possibly biased high due to high LCS recovery.

### Internal Standard Performance

Internal standards were within the acceptance criteria in all sample analyses.

### Field Duplicate Results

Samples VS-14-14/Vs-14-14-DUP and BG-14/BG-14-DUP were submitted as the field duplicate (collocated) pairs with this sample set. The following table summarizes the relative percent differences (RPDs) of the target VOCs detected in either sample.

VOCs	BG-14 ( $\mu\text{g}/\text{m}^3$ )	BG-14-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
Acetone	15.6	14.9	4.6
Chloromethane	1.74	1.74	0

VOCs	BG-14 ( $\mu\text{g}/\text{m}^3$ )	BG-14-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
Ethanol	<6.19	6.57	< 2 x reporting limit
Isopropanol	3.44	2.68	< 2 x reporting limit
Methylene chloride	18.8	21.2	12
n-Hexane	<5.79	7.89	< 2 x reporting limit

VOCs	VS-14-14 ( $\mu\text{g}/\text{m}^3$ )	VS-14-14-DUP ( $\mu\text{g}/\text{m}^3$ )	RPD (%)
2,2,4-Trimethylpentane	122	165	< 2 x reporting limit
Cyclohexane	256	347	< 2 x reporting limit
Methyl tert butyl ether	563	708	22.8
n-Heptane	<81.9	87.1	< 2 x reporting limit
n-Hexane	651	857	< 2 x reporting limit

All compounds met the duplicate acceptance criteria of 20%RPD or the difference of <2 times the reporting limit for both duplicate pairs (BG-13/BG-13-DUP and VS-9-13/VS-9-13-DUP).

#### Quantitation Limits and Sample Results

The quantitation limits met the requirements in the Sampling Plan for this program.

## **APPENDIX F**

# **INDOOR AIR RISK CALCULATION SPREADSHEET – COMMERCIAL WORKER**

**Table F-1  
Commercial Worker Risk Evaluation  
Inhalation of Air Exposure Pathway  
Keith Middle School  
New Bedford, MA**

Constituent	EPC	Estimated Dose		Toxicity Values		Risk Estimates	
	Indoor Air Concentration µg/m <sup>3</sup>	ADEcancer (Cancer) µg/m <sup>3</sup>	ADEnon-cancer (Non-cancer) µg/m <sup>3</sup>	Unit Risk µg/m <sup>3</sup>	Chronic Noncancer Reference Concentration µg/m <sup>3</sup>	Cancer Risk (--)	Hazard Quotient (--)
1,2,4-Trichlorobenzene	1.2E+01	1.0E+00	2.8E+00	NA	2.0E+02	NA	1.E-02
2-Butanone	2.4E+01	1.9E+00	5.4E+00	NA	5.0E+03	NA	1.E-03
Acetone	1.3E+02	1.1E+01	3.1E+01	NA	8.0E+02	NA	4.E-02
Chloromethane	1.5E+01	1.2E+00	3.5E+00	NA	9.0E+01	NA	4.E-02
Ethylbenzene	9.9E+00	8.2E-01	2.3E+00	NA	1.0E+03	NA	2.E-03
Methylene chloride	3.2E+02	2.6E+01	7.3E+01	4.7E-07	3.0E+03	1.E-05	2.E-02
Styrene	7.3E+00	6.0E-01	1.7E+00	5.7E-07	1.0E+03	3.E-07	2.E-03
Tetrahydrofuran	7.1E+00	5.8E-01	1.6E+00	1.9E-06	3.0E+02	1.E-06	5.E-03
Toluene	3.3E+01	2.7E+00	7.6E+00	NA	5.0E+03	NA	2.E-03
Trichlorofluoromethane	3.1E+00	2.5E-01	7.1E-01	NA	7.0E+02	NA	1.E-03
Xylenes	5.1E+01	4.2E+00	1.2E+01	NA	1.0E+02	NA	1.E-01
n-Hexane	1.5E+02	1.2E+01	3.3E+01	NA	2.0E+02	NA	2.E-01
n-Heptane	1.7E+01	1.4E+00	3.8E+00	NA	2.0E+02	NA	2.E-02
Cyclohexane	7.4E+00	6.0E-01	1.7E+00	NA	2.0E+02	NA	8.E-03
1,2,4-Trimethylbenzene	4.9E+00	4.0E-01	1.1E+00	NA	5.0E+01	NA	2.E-02
Ethanol	1.6E+02	1.3E+01	3.7E+01	NA	NA	NA	NA
Isopropanol	1.3E+01	1.1E+00	3.1E+00	NA	NA	NA	NA

Where:

LADecancer = IAC x EF x ED x EP/APcancer

ADEnon-cancer = IAC x EF x ED x EP / APnon-cancer

Cancer Risk = LADecancer x UR

Hazard Quotient = ADEnon-cancer / Inhalation Reference Concentration

LADE = Life Time Average Daily Exposure

ADE = Average Daily Exposure

EPC = Exposure Point Concentration

µg/m<sup>3</sup> = micrograms per cubic meter

And where:

Exposure Frequency (EF) =	250	days/year (5 days a week for 50 weeks of exposure)
Exposure Duration (ED) =	8	hrs/event [1]
Exposure Period (EP) =	25	yr [1]
Unit Conversion (UC) =	0.042	days/hr
Averaging Period (APcancer) =	25550	days [1]
Averaging Period (APnon-cancer) =	9125	days [1]

[1] MADEP, 2008

Risk and hazard for PCBs in indoor air was not quantified because concentrations are associated with background conditions and contribute negligibly to risk and hazard. Risk and hazard is overestimated since continuous worker exposure to the maximum detected VOC concentrations for 25 years is not expected due to downward trends in concentrations.

	Cancer Risk	Hazard Index
<b>TOTAL:</b>	1.E-05	5.E-01

**Bold** = Cancer Risk > 1.0E-05 or Hazard Quotient > 1.0E+01