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TRC Reference No. 115058

November 19, 2013

Michele Paul
Environmental Planner
Department of Environmental Stewardship
City of New Bedford
133 William Street
New Bedford, Massachusetts 02740

RE: Sampling Results for the Keith Middle School Foundation Vent Stack and Indoor Air for Polychlorinated Biphenyls August 2013 Monitoring Round. Report Dated November 2013

Dear Ms. Paul:

Enclosed herein is a copy of the above referenced report prepared by TRC. An electronic Portable Document Format (PDF) version has also been provided that is suitable for posting on the City of New Bedford's website.

We appreciate the opportunity to serve the City on this important project. If you have any questions or comments, please do not hesitate to contact me at 978-656-3565.

Sincerely,

David M. Sullivan

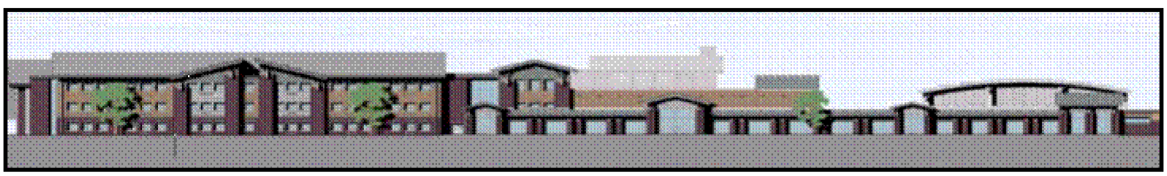
David M. Sullivan, LSP, CHMM
Senior Project Manager

Enclosure

cc. K. Tisa – United States Environmental Protection Agency
M. Cote – Massachusetts Department of Environmental Protection
Project File – TRC

Sampling Results for the Keith Middle School Foundation Vent Stack and Indoor Air for Polychlorinated Biphenyls

August 2013 Monitoring Round



Prepared for:

Department of Environmental Stewardship
City of New Bedford
133 William Street
New Bedford, Massachusetts 02740

Prepared by:

TRC Environmental Corporation
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L2013-405

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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) at the Keith Middle School (KMS) in New Bedford, Massachusetts. This report documents the indoor air and vent stack sampling performed by TRC during August 2013.

The sampling and analysis of vent stack and indoor air for the KMS is described in the *Revised Long-Term Monitoring and Maintenance Implementation Plan* (LTMMIP), revision 5.5, dated August 2012. The indoor air PCB sampling program involved the collection of one indoor air 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 sampling, air sampling of the sub-slab foundation ventilation system for PCBs was performed from four selected rooftop vent stacks, including VS-1 which vents building Section A west side (near the front of the school), VS-4 which vents building Section A east side (near the front of the school), VS-9 which vents Section B (near the auditorium), and VS-12 which vents Section C (the gymnasium). The passive sub-slab ventilation system was installed to allow sub-slab soil vapors to migrate from beneath the vapor barrier to the vent stacks, installed through the school building roof. An air sample was also collected immediately outside of the school during this round to provide comparative background results.

The samples were analyzed for PCBs according to EPA Method 680 (PCB homologues) by Pace Analytical Services of Schenectady, New York. This PCB method reliably quantifies total PCB concentrations, making analytical results directly comparable to total PCB concentration data for indoor air at New Bedford High School.

During the August 2013 sampling round, PCBs were detected at the three indoor air sampling locations. However, PCBs were not detected in any of the vent stack air samples or the corresponding outdoor air background sample.

Detected concentrations for PCBs in indoor air samples were generally consistent with urban ambient air background levels. PCB concentrations in indoor air have fluctuated slightly between August 2006 and August 2013, consistent with background conditions, but all detected concentrations are below indoor air concentrations that would be of concern for the health of building occupants.

PCB indoor air concentrations 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^3), which is 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^3), indicative of the maximum acceptable air concentration that should not be exceeded for an extended time period. PCB indoor air concentrations were also compared to EPA's Public Health Level (PHL) (USEPA, 2009; 0.45 ug/m^3) developed to be protective of indoor school air exposures for adult employees and 12 to <15 year-old students. Indoor air PCB concentrations were lower than RBACs and EPA's PHL.

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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) at the Keith Middle School (KMS) in New Bedford, Massachusetts. This report documents the indoor air and vent stack sampling performed by TRC during August 2013.

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, volatile organic compounds (VOCs) were also detected in the 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 and analysis of vent stack and indoor air was performed between July 2007 and April 2012 as part of United States Environmental Protection Agency (EPA) approved *Long-Term Monitoring and Maintenance Implementation 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. Following the July/August 2007 sampling event, monitoring was reduced to once every four months, consistent with the 2006 LTMMIP. Monitoring from September 2006 through February 2007 was conducted by BETA and is reported elsewhere.

The sampling program described in the 2006 LTMMIP consisted of the collection of indoor air quality and vent stack samples for the analysis of PCBs and VOCs. Sampling of indoor air quality and vent stack air for PCBs and VOCs has been conducted for 29 monitoring events between July 2007 and April 2012 to confirm the proper functioning of the passive ventilation system. Between 2007 and 2012, 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 lower, in general, than those observed in vent stack air samples. 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.

Based on the sampling data collected between 2007 and 2012, VOCs were determined to be 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 outdoor air samples collected simultaneously. Levels of VOCs detected in indoor air fluctuated and demonstrated noticeable decreasing trends over time.

Although PCBs and VOCs were measured in indoor air and vent stack air samples, the concentrations detected were determined to not pose a significant risk to human health, based on the comparison of concentrations to both background concentrations and applicable risk-based criteria (TRC, 2008a, 2008b, 2008c, 2008d, 2009a, 2009b, 2009c, 2010a, 2010b, 2011a, 2011b, 2011c, 2011d, 2012a and 2012b).

In 2011, the City proposed modifying the 2006 LTMMIP to reflect the detailed understanding of the site conceptual model (e.g., impacts from indoor use of commercially available cleaners, paints, adhesives, etc.), the relationship between vent measurements and historical soil gas measurements that illustrate the proper functioning of the passive sub-slab ventilation system, and long-term downward trends for indoor air and passive vent system concentrations of VOCs originating from building materials.

On August 27, 2012, USEPA approved the City's proposed revision to the LTMMIP, revision 5.5. This report presents monitoring data collected during August 2013, the third round of air sampling data collected under the 2012 LTMMIP. The results for the first and second rounds of air sampling data collected under the 2012 LTMMIP are presented in TRC, 2012d and TRC, 2013. The 2012 LTMMIP differs from the 2006 LTMMIP in a number of ways that are reflected in this report:

1. Analysis of indoor air and vent stack air samples for VOCs has been eliminated because VOCs are not the principal contaminants in soil and fill, and air monitoring conducted to date indicates that the remedy implemented for the KMS site is functioning as intended.

2. Indoor air and vent stack air sampling frequency has been reduced from three times per year to two times per year because air monitoring conducted to date demonstrates that the remedy implemented for the KMS site is preventing airborne release of PCBs that remain in the soil to the building.

3. The number of background air samples has been reduced from two samples to one sample because the single sample is sufficient to determine outdoor air concentrations of PCBs.

4. PCB analysis of indoor air and vent stack air samples includes quantification of homologue groups, but not Aroclors or individual congeners, because the homologue groups provide a sufficient and accurate measure of total PCB concentrations in air.

5. The comparison of vent stack air samples to health-based air concentrations has been eliminated because vent samples are not representative of the air that people breathe.

Therefore, vent stack air concentrations are not comparable to the health-based air concentrations.

1.2 Scope of Work

Sampling and analysis of vent stack and indoor air is performed as part of United States Environmental Protection Agency (EPA) approved *Long-Term Monitoring and Maintenance Implementation Plan* (LTMMIP), revision 5.5, dated August 2012 and approved by EPA on August 27, 2012.

The August 2013 sampling occurred during a weekend. Details concerning the sample collection procedures and analytical methods are described in Appendix A. Sampling data sheets are provided in Appendix B and the reduced data are presented in Appendix C. The calibration certifications can be found in Appendix D. Laboratory analytical results are presented in Appendix E.

Field sampling data were validated by the Field Team Leader and/or the Field Quality Control Coordinator based on their review of adherence to each approved sampling protocol and written sample collection procedure. Details concerning quality assurance procedures are described in Appendix A. The laboratory data validation memoranda can be found in Appendix F.

The following sections describe those features of the field sampling program, quality assurance/quality control (QA/QC) program, and data analysis that are specific to the August 2013 event. Generic information on the sampling and QA/QC programs and data analysis procedures can be found in Appendices A and G, respectively.

2.0 SAMPLING LOCATIONS

2.1 Indoor Air Quality Sample Locations

During the sampling event, one indoor air PCB 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. A duplicate sample was collected from the Building A sampling location. The Building B sampling location is located in the school cafeteria. The Building C sampling location is in the hallway between the auditorium and community room. These indoor air sampling locations have remained consistent throughout TRC's sampling program, with the exception of the December 2007 Building B sample which was collected in the school cafeteria at the request of the City. An outdoor air sample and a duplicate sample were collected from near the flagpole area immediately outside of the school to provide comparative background results.

Figure 2-1 presents the approximate locations of indoor air sampling. Table 2-1 summarizes the indoor air samples collected during the August 2013 sampling event. These samples were assigned sample identification numbers that include (1) the letter A, B, or C to identify the building section from which the sample was collected; and (2) a unique sample identification suffix indicating the sampling event number (e.g., A-32).

2.2 Foundation Vent Air Monitoring Sample Locations

The KMS 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 to cover the remaining collection zones. PCB concentrations in vent stack air were compared to the outdoor air samples described in Section 2.1 that define background conditions.

Figure 2-2 presents the approximate locations of the vent stack sample locations. Table 2-1 summarizes the vent stack samples collected during the August 2013 sampling event. Vent stack samples collected during the August 2013 sampling event were designated with the vent stack number (e.g., VS-4) and a unique sample identification suffix indicating the sampling event number (e.g., VS-4-32).

3.0 QUALITY ASSURANCE

This section highlights the results of the QA/QC review for the August 2013 sampling event. Please refer to Appendix A for additional QA/QC details.

3.1 Data Validation Summary

Limited (Tier II) validation was performed on the data for 10 air samples and two trip blank samples collected at the Keith Middle School in New Bedford, Massachusetts. The samples were collected on August 30, 2013 and submitted to Pace Analytical Services (Pace) 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 indoor and background outdoor 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. Pace reported the results under job number 13090035.

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. Appendix F contains the complete Laboratory Data Validation Memoranda.

3.2 Collocated Sampler Precision

Samples BG-32/BG-32 DUP and VS-9-32/VS-9-32 DUP were submitted as the field duplicate (collocated) pairs with this sample set. PCBs were not detected in samples BG-32, BG-32 DUP, VS-9-32 and VS-9-32 DUP. Tables 3-1 and 3-2 summarize the relative percent differences (RPDs) of the detected analytes in sample pairs BG-32/BG-32 DUP and VS-9-32/VS-9-32 DUP, respectively. As shown in Tables 3-1 and 3-2, RPDs could not be calculated because of non-detect results in both of the collocated sample pairs. All results are usable for project objectives.

4.0 SUMMARY OF RESULTS

Table 2-1 provides a summary of the types, numbers, and locations of the samples collected. Appendices E and F contain the laboratory data reports and data validation memoranda, respectively. Along with the samples, TO-4A and TO-10A trip blanks were analyzed as a quality assurance measure to check for shipping and laboratory-related sources of contamination.

All results represent "total PCB" concentrations. PCBs were not detected in the indoor air quality or vent stack air trip blanks. Low level fluctuations of PCB concentrations in indoor air are generally consistent with urban indoor background levels. Sporadic detected concentrations of PCBs in vent stack air are expected, and indicate that the passive ventilation system is performing as designed.

4.1 Indoor Air Quality Results

On August 30, 2013, TRC collected three indoor and one outdoor background (plus one duplicate) 24-hour TO-4A air samples at the KMS. Table 4-1 provides a summary of PCB indoor air results. Table 4-3 provides a complete list of total PCB indoor air results from August 2006 thru August 2013.

PCBs were detected in the three indoor air samples. PCBs were not detected in the background outdoor air sample or in the duplicate sample. PCB concentrations in the indoor air samples ranged from 0.0066 ug/m^3 in the Building C sample to 0.00452 ug/m^3 in the Building A sample. The PCB concentration in the Building C sample is consistent with the maximum concentrations reported in the April 2009, August 2010, April 2011, August 2012, and January 2013 sampling rounds.

4.2 Vent Stack Air Results

On August 30, 2013, TRC collected four (plus one duplicate) vent stack 4-hour TO-10A samples at the KMS. Table 4-2 provides a summary of results for the vent stack samples, and the results of the outdoor background 24-hour TO-4A air sample and its duplicate sample.

PCBs were not detected in the vent stack samples. As previously stated in Section 4.1, PCBs were not detected in the background outdoor air samples.

5.0 COMPARISON OF INDOOR AIR PCB RESULTS TO RISK-BASED AIR CONCENTRATIONS

This section of the report compares PCB concentrations in indoor air to outdoor air and risk-based air concentrations (RBACs). These concentrations are presented in Table 5-1. PCB concentrations that exceed the RBACs are highlighted on this table.

A detailed discussion of the RBACs can be found in Appendix G. Two PCB RBACs have been developed for the KMS. The first RBAC is the Action Level (AL; 0.05 ug/m^3) 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^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. In September 2009, EPA published Public Health Levels (PHLs) which are indoor air concentrations that EPA believes protect building occupants (USEPA, 2009). PHLs were calculated for all ages of children from toddlers in day care to adolescents in high school as well as for adult school employees. In this report, indoor air PCB concentrations are compared to the PHL for adult school employees and children 12 to <15 years old, representative of the middle school age range.

Indoor air sampling results, outdoor air background results, and RBACs are presented in Table 5-1. As noted in Section 4.1, PCBs were detected at all three of the indoor air sampling locations (Buildings A, B, and C), but not in the outdoor air background samples. The highest indoor air PCB concentration (Building C sample) was approximately 8-fold lower than the PCB AL and roughly 45-fold lower than the ALTAEC; the Building A and Building B samples displayed concentrations of PCBs up to 11-fold lower than the AL and 66-fold lower than the ALTAEC. Because the PCB AL is used as an initial indicator that PCB air concentrations above background levels for indoor air have been detected and the detected concentrations of PCBs are significantly less than the AL, concentrations of PCBs in indoor air are consistent with levels associated with ambient conditions. The indoor air samples were also between 68- and 100-fold lower than the EPA PHL. Because there are no indoor air PCB concentrations in excess of the RBACs, no specific follow-up actions are recommended at this time.

Temporal trends for PCB indoor air concentrations at the sampling locations in Building A (classrooms), Building B (auditorium), and Building C (faculty dining area) are shown in Figure 5-1. Figure 5-1 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 2013. The highest indoor air PCB concentration was detected during the April 2009 sampling event when the school was likely experiencing lower than normal air exchange (school vacation) and the potential for volatilization of PCBs from outdoor ambient sources is greater due to the warmer weather. The lowest indoor air PCB concentration was detected during the November 2006 sampling event.

No clear trends are noted for 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 outdoor ambient sources is greatest due to warmer weather. The low level PCB indoor air concentrations are generally consistent with urban ambient background conditions. Based on the PCB indoor air results collected between August 2006 and August 2013, it appears that there is variability in indoor air concentrations and the slightly higher concentrations sporadically detected are not part of a trend.

6.0 CONCLUSIONS

Indoor air quality and vent stack air sampling was conducted at the KMS during August 2013 for PCBs. Indoor and vent stack air data were evaluated for quality and reliability, and indoor air concentrations were compared to risk-based air concentrations and analyzed for concentration trends over the period August 2006 to August 2013. The following summarizes the conclusions of the air sampling data evaluation.

In general, all TO-4A and TO-10A data collected during August 2013 were determined to be valid as reported and usable for decision-making purposes.

PCBs were detected in the three indoor air samples, but not in the outdoor air background sample or its duplicate sample. The detected PCB concentrations for the indoor air samples were below risk-based action levels. The low level fluctuations of PCB indoor air concentrations are generally consistent with concentrations found in urban ambient air background.

PCBs were not detected in the four vent stack air samples. The sporadic presence of PCBs in vent stack air is expected, and indicates that the passive ventilation system is performing as designed.

January 2014 is the date for the next sampling event.

7.0 REFERENCES

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TABLES

Table 2-1. August 2013 Sample Summary
Keith Middle School
New Bedford, Massachusetts

Sample ID	Sample Location	Sample Collected	Sample Type
A	Building A, center of west hallway	X	IAQ
B	Building B, Auditorium	X	IAQ
C	Building C, Community room	X	IAQ
BG	Background, flagpole area outside main entrance to Building A	XX	IAQ
VS-1	Building A, vent stack 1	X	Vent Stack
VS-4	Building A, vent stack 4	X	Vent Stack
VS-5	Building B, vent stack 5		Vent Stack
VS-7	Building B, vent stack 7		Vent Stack
VS-8	Building B, vent stack 8		Vent Stack
VS-9	Building B, vent stack 9	XX	Vent Stack
VS-10	Building B, vent stack 10		Vent Stack
VS-11	Gymnasium , vent stack 11		Vent Stack
VS-12	Gymnasium, vent stack 12	X	Vent Stack
VS-13	Gymnasium, vent stack 13		Vent Stack
VS-14	Gymnasium, vent stack 14		Vent Stack
VS-16	Building A , vent stack 16		Vent Stack
VS-BG	On the ground at main entrance to Building A		Vent Stack

X - Sample collected at this location during this sampling round.
XX - Sample and duplicate collected at this location during this sampling round.

Table 3-1. Comparison of PCB Indoor Air Sample Results - Collocated Sampler Precision
Keith Middle School
New Bedford, Massachusetts

Analysis	Analyte	Aug-13		
		BG-32	**BG-32 Dup**	**RPD (%)**
PCBs				
(µg/m3)	monochlorobiphenyl	< 0.0000150	< 0.0000140	NC
	dichlorobiphenyl	< 0.0000150	< 0.0000140	NC
	trichlorobiphenyl	< 0.0000150	< 0.0000140	NC
	tetrachlorobiphenyl	< 0.0000290	< 0.0000290	NC
	pentachlorobiphenyl	< 0.0000290	< 0.0000290	NC
	hexachlorobiphenyl	< 0.0000290	< 0.0000290	NC
	heptachlorobiphenyl	< 0.0000440	< 0.0000430	NC
	octachlorobiphenyl	< 0.0000440	< 0.0000430	NC
	nonachlorobiphenyl	< 0.0000730	< 0.0000710	NC
	decachlorobiphenyl	< 0.0000730	< 0.0000710	NC
(µg/m^3)	Total PCBs	< 0.0000150	< 0.0000140	NC

Notes:

RPD - Relative Percent Difference = ABS(Dup-Sample)/((Dup+Sample)/2)*100

NC - Not Calculated; RPD could not be calculated due to a non-detect in one or both of the collocated samples

Detected values are shown in bold

Table 3-2. Comparison of PCB Vent Stack Air Sample Results - Collocated Sampler Precision
Keith Middle School
New Bedford, Massachusetts

		Aug-13		
Analysis	**Analyte**	**VS-9-32**	**VS-9-32 DUP**	**RPD (%)**
PCBs				
(µg/m3)	monochlorobiphenyl	< 0.00410	< 0.00403	NC
	dichlorobiphenyl	< 0.00410	< 0.00403	NC
	trichlorobiphenyl	< 0.00410	< 0.00403	NC
	tetrachlorobiphenyl	< 0.00820	< 0.00807	NC
	pentachlorobiphenyl	< 0.00820	< 0.00807	NC
	hexachlorobiphenyl	< 0.00820	< 0.00807	NC
	heptachlorobiphenyl	< 0.0123	< 0.0121	NC
	octachlorobiphenyl	< 0.0123	< 0.0121	NC
	nonachlorobiphenyl	< 0.0205	< 0.0202	NC
	decachlorobiphenyl	< 0.0205	< 0.0202	NC
(µg/m^3)	Total PCBs	< 0.00410	< 0.00403	NC

Notes:
RPD - Relative Percent Difference = ABS(Dup-Sample)/((Dup+Sample)/2)*100
NC - Not Calculated; RPD could not be calculated due to a non-detect in one or both of the collocated samples
Detected values are shown in bold

Table 4-1. Indoor Air Quality Sample Results - August 2013
Keith Middle School
New Bedford, Massachusetts

Analysis	Analyte	Sample Locations A-32	Sample Locations B-32	Sample Locations C-32	Background BG-32	Background BG-32 Dup	QA/QC Trip Blank
PCBs							
(μg/m3)	monochlorobiphenyl	< 0.0000280	< 0.0000290	< 0.0000290	< 0.000015	< 0.000014	< 0.005 ug
	dichlorobiphenyl	**0.000985**	**0.000179**	**0.000132**	< 0.000015	< 0.000014	< 0.005 ug
	trichlorobiphenyl	**0.00335**	**0.00519**	**0.00406**	< 0.000015	< 0.000014	< 0.005 ug
	tetrachlorobiphenyl	**0.000177**	< 0.0000580	**0.00235**	< 0.000029	< 0.000029	< 0.01 ug
	pentachlorobiphenyl	< 0.0000550	< 0.0000580	< 0.0000580	< 0.000029	< 0.000029	< 0.01 ug
	hexachlorobiphenyl	< 0.0000550	< 0.0000580	< 0.0000580	< 0.000029	< 0.000029	< 0.01 ug
	heptachlorobiphenyl	< 0.0000830	< 0.0000870	< 0.0000860	< 0.000044	< 0.000043	< 0.015 ug
	octachlorobiphenyl	< 0.0000830	< 0.0000870	< 0.0000860	< 0.000044	< 0.000043	< 0.015 ug
	nonachlorobiphenyl	< 0.000138	< 0.000145	< 0.000144	< 0.000073	< 0.000071	< 0.025 ug
	decachlorobiphenyl	< 0.000138	< 0.000145	< 0.000144	< 0.000073	< 0.000071	< 0.025 ug
($\mu g/m^3$)	Total PCBs	**0.00452**	**0.00537**	**0.0066**	< 0.000015	< 0.000014	< 0.025 ug

Notes:

$\mu g/m^3$ - micrograms per cubic meter
PCBs - polychlorinated biphenyls
μg - micrograms; trip blank results are presented in micrograms (μg) due to no air volume being collected during analysis.
Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.
Values in **Bold** indicate the compound was detected.
< - less than laboratory reporting limit
J - Detected result reported is estimated
UJ - Non-Detect result reported is estimated

Table 4-2. Vent Stack Sample Results - August 2013
Keith Middle School
New Bedford, Massachusetts

Analysis	Analyte	Sample Locations					Background		QA/QC
		VS-1-32	**VS-4-32**	**VS-12-32**	**VS-9-32**	**VS-9-32-DUP**	**BG-32**	**BG-32 Dup**	**Trip Blank-VS**
PCBs									
(µg/m3)	monochlorobiphenyl	< 0.00407	< 0.00413	< 0.00410	< 0.00410	< 0.00403	< 0.000015	< 0.000014	< 0.005 ug
	dichlorobiphenyl	< 0.00407	< 0.00413	< 0.00410	< 0.00410	< 0.00403	< 0.000015	< 0.000014	< 0.005 ug
	trichlorobiphenyl	< 0.00407	< 0.00413	< 0.00410	< 0.00410	< 0.00403	< 0.000015	< 0.000014	< 0.005 ug
	tetrachlorobiphenyl	< 0.00813	< 0.00825	< 0.00820	< 0.00820	< 0.00807	< 0.000029	< 0.000029	< 0.01 ug
	pentachlorobiphenyl	< 0.00813	< 0.00825	< 0.00820	< 0.00820	< 0.00807	< 0.000029	< 0.000029	< 0.01 ug
	hexachlorobiphenyl	< 0.00813	< 0.00825	< 0.00820	< 0.00820	< 0.00807	< 0.000029	< 0.000029	< 0.01 ug
	heptachlorobiphenyl	< 0.0122	< 0.0124	< 0.0123	< 0.0123	< 0.0121	< 0.000044	< 0.000043	< 0.015 ug
	octachlorobiphenyl	< 0.0122	< 0.0124	< 0.0123	< 0.0123	< 0.0121	< 0.000044	< 0.000043	< 0.015 ug
	nonachlorobiphenyl	< 0.0203	< 0.0206	< 0.0205	< 0.0205	< 0.0202	< 0.000073	< 0.000071	< 0.025 ug
	decachlorobiphenyl	< 0.0203	< 0.0206	< 0.0205	< 0.0205	< 0.0202	< 0.000073	< 0.000071	< 0.025 ug
(µg/m^3)	Total PCBs	< 0.00407	< 0.00413	< 0.00410	< 0.00410	< 0.00403	< 0.000015	< 0.000014	< 0.025 ug

Notes:

µg/m^3 - micrograms per cubic meter

PCBs - polychlorinated biphenyls

µg - micrograms; trip blank results are presented in micrograms (µg) due to no air volume being collected during analysis.

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

Values in **Bold** indicate the compound was detected.

< - less than laboratory reporting limit

J - Detected result reported is estimated

UJ - Non-Detect result reported is estimated

Table 4-3. Total PCB Results in KMS Indoor Air Quality (IAQ) Samples August 2006 through August 2013 (24hr Sample, Method TO-4A [ug/m^3])

Sampling Date	Hallway Building A	Auditorium Building B	Faculty Dining Building C	Background Outside	Background Outside (DUP)
AL	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
ALTAEC	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*
8/5/2006	< 0.0000007	< 0.0000007	< 0.0000007	**0.0006**	NS
8/19/2006	< 0.0000007	**0.00023**	< 0.0000007	**0.00031**	NS
9/15/2006	**0.00273**	**0.0011**	**0.00052**	**0.00989**	**0.00995**
10/24/2006	**0.00087**	**0.00027**	**0.00008**	**0.00007**	NS
11/30/2006	**0.00105**	**0.00079**	**0.00003**	**0.00014**	**0.00014**
12/29/2006	**0.00005**	< 0.0000007 [2]	**0.00005**	**0.00008**	**0.00004**
1/20/2007	NS	NS	NS	NS	NS
3/31/2007	**0.0015**	**0.00064**	**0.00037**	< 0.0001850	< 0.0001900
4/18/2007	**0.0013**	**0.00031**	**0.0016**	< 0.0000950	< 0.0000950
5/19/2007	**0.00038**	**0.001**	**0.00051** [3]	< 0.0001050	< 0.0001000
6/21/2007	**0.003**	**0.0032**	**0.0016**	< 0.0001000	< 0.0001000
8/1/2007	**0.0018**	< 0.0001900	**0.0057**	< 0.0000750	< 0.0000750
12/27/2007	**0.003**	**0.00094** [2]	**0.0011**	< 0.0001850	**0.000035**
4/25/2008	< 0.0000700	< 0.0000360	< 0.0000355	< 0.0000355	< 0.0000355
7/16/2008	**0.0018**	**0.0075**	**0.0017**	< 0.0000700	< 0.0000370
12/29/2008	NS	NS	NS	NS	NS
2/19/2009	< 0.0001900	< 0.0001900	< 0.0000750	< 0.0000400	< 0.0000390
4/23/2009	**0.013**	**0.0034**	**0.0095**	< 0.0000400	< 0.0000400
8/20/2009	**0.00875** [1]	**0.00577**	**0.00366** [3]	**0.000759**	**0.00072**
12/29/2009	**0.00288**	**0.00165**	**0.00616**	< 0.0000389	NS
4/20/2010	**0.006163**	**0.000384**	**0.000882**	**0.0000614**	**0.000226**
8/24/2010	**0.0064**	**0.0049**	**0.0114**	**0.0029**	**0.0029**
12/29/2010	**0.0012**	**0.0027**	**0.0135**	< 0.0000500	NS
4/21/2011	**0.0036**	**0.0040**	**0.0115**	< 0.0000380	**0.0002**
8/24/2011	**0.0062**	**0.0090**	**0.0085**	< 0.0000425	**0.0005**
12/29/2011	**0.0036**	**0.0057**	**0.0054**	< 0.0000340	< 0.0000330
4/18/2012	**0.00499**	**0.0130**	**0.00578**	**0.000832**	< 0.0000330
8/30/2012	**0.00452**	**0.0061**	**0.01090**	**0.00158**	< 0.0000395
1/28/2013	**0.00333**	**0.0039** [2]	**0.00414** [3]	< 0.0000780	NS
8/30/2013	**0.00452**	**0.0054**	**0.00655**	< 0.0000730	< 0.0000710

AL = Action Level = 0.05 ug/m^3

ALTAEC = Acceptable Long-Term Average Exposure = 0.3 ug/m^3

NS = Not Sampled

BOLD = Positive Detection

1. Sampler moved to Front lobby Due to work in halls
2. Sampler moved to Cafferiteria due to auditoriom in use
3. Sampler moved to hall way outside of Community room due to room in use.

Table 5-1. Comparison of PCB Indoor Air Quality Sample Results to Risk-Based Air Concentrations - August 2013
Keith Middle School
New Bedford, Massachusetts

Analysis	Analyte	Sample Locations			Background Location		QA/QC	Comparison Values		
		A-32	B-32	C-32	BG-32	BG-32 Dup	Trip Blank			
PCBs								AL*	ALTAEC*	PHL**
(μg/m³)	Total PCBs	**0.00452**	**0.0054**	**0.0066**	<0.000015	<0.000014	< 0.025 ug	0.05	0.3	0.45

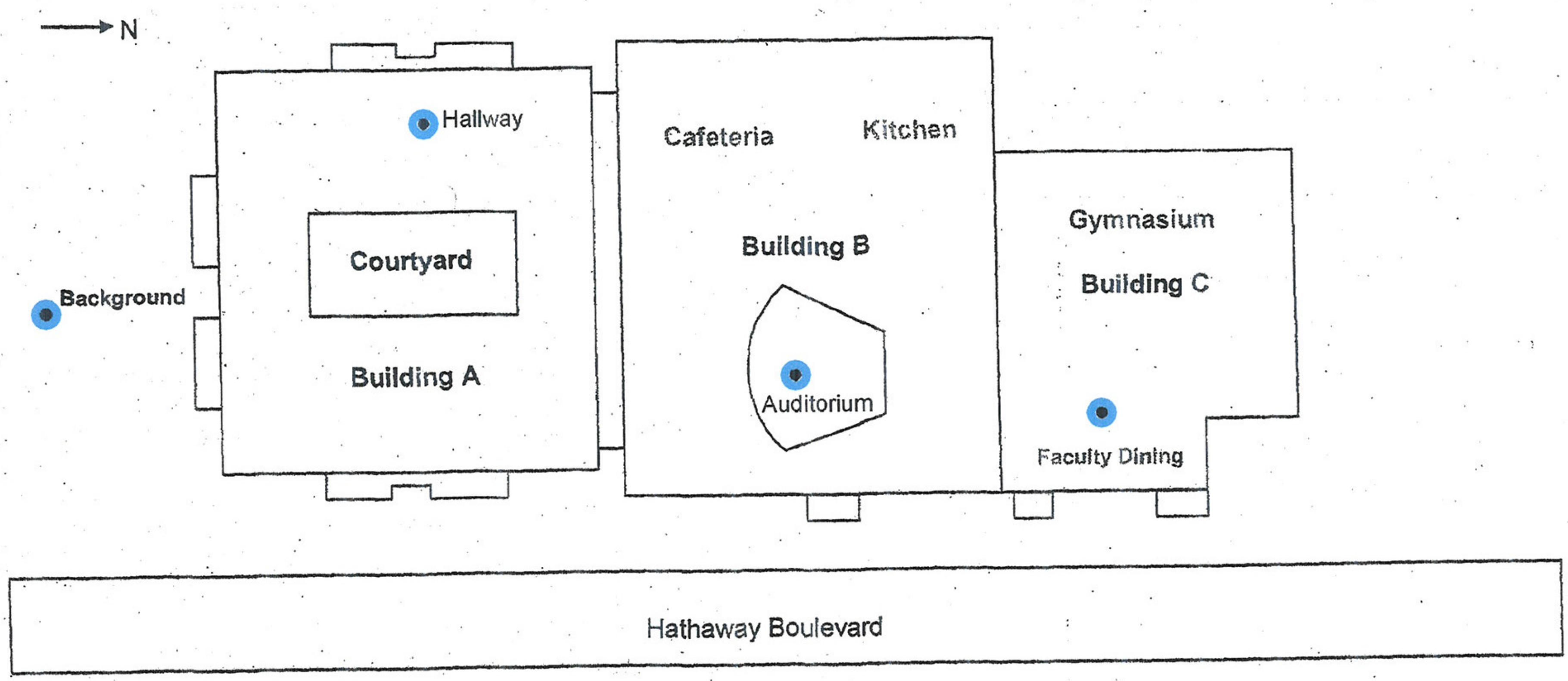
Notes:

μg/m³ - micrograms per cubic meter
PCBs - polychlorinated biphenyls
ug - micrograms; trip blank results are presented in micrograms (ug) since no air volume is collected for the trip blank

PCB results for indoor air are compared to contemporary outdoor air (background) sample and MassDEP indoor air background values.
* PCBs are compared to the EPA site specific Action Level (AL) and the Acceptable Long-Term Average Exposure Concentration (ALTAEC).
** PCBs are compared to the lowest of the EPA Public Health Level for PCBs in School Indoor Air (September 2009) for adult employees and children 12-<15 year olds (http://www.epa.gov/pcbsincaulk/)
Reporting Limit for Total PCBs is the highest individual homolog PQL (practical quantitation limit) per sample.

FIGURES

Keith Middle School
Indoor Air Sampling Locations



● = Indoor Air Sampling Point

● = Sample Locations

KEITH MIDDLE SCHOOL
NEW BEDFORD, MASSACHUSETTS

INDOOR AIR SAMPLING LOCATIONS

TRC Wannalancit Mills
650 Suffolk Street
Lowell, MA 01854
(978) 970-5600

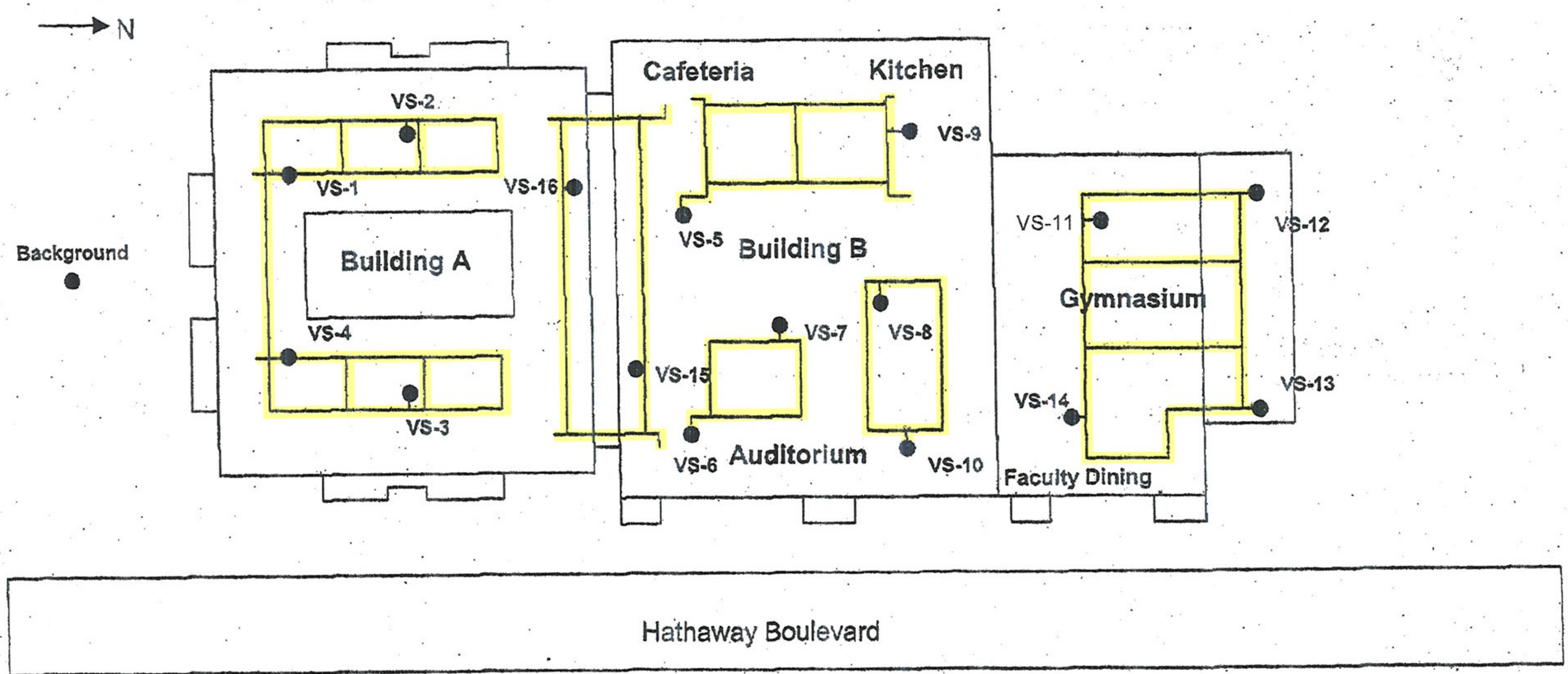
FIGURE 2-1

DRAWN BY: ---
CHECKED BY: DMS

DATE: MAY 2008

FILE: T:\E_CAD\115058\indoorventsys1.dwg

Keith Middle School
Foundation Venting System



● = Vent Riser / Vent Stack Sampling location

= Passive Venting and Collection System

KEITH MIDDLE SCHOOL
NEW BEDFORD, MASSACHUSETTS

VENT STACK SAMPLE LOCATIONS

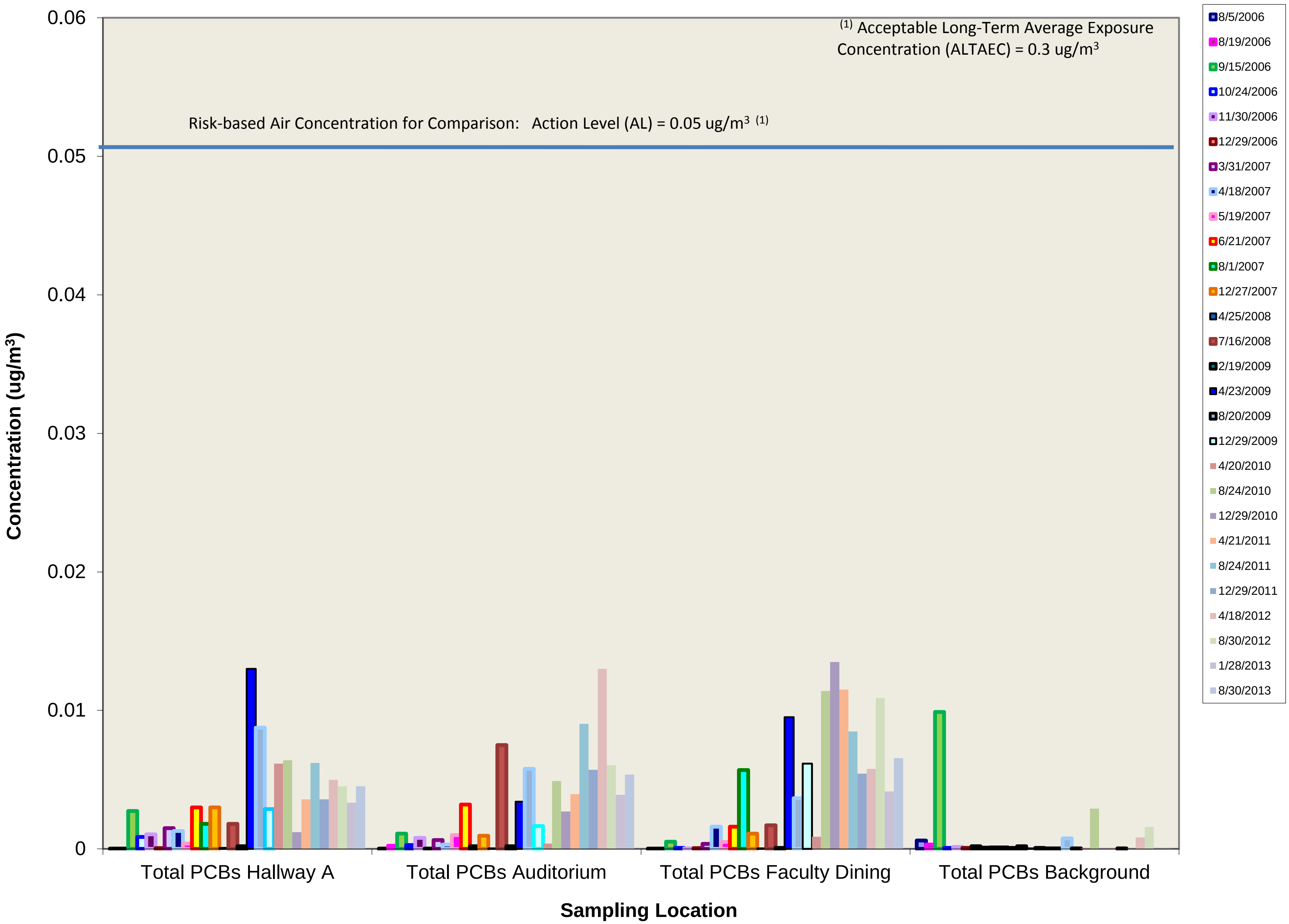
TRC
Wannalancit Mills
650 Suffolk Street
Lowell, MA 01854
(978) 970-5600

FIGURE 2-2

DRAWN BY: ---
CHECKED BY: DMS
DATE: MAY 2008

FILE: T:\E_CAD\115058\ventsys1A.dwg

Figure 5-1. Total PCB Trends in KMS Indoor Air Quality (IAQ) Samples - August 2006 through August 2013



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

SUMMARY OF FIELD SAMPLING PROGRAM, ANALYTICAL PROGRAM, AND QUALITY ASSURANCE

1.0 FIELD SAMPLING PROGRAM

1.1 Overview

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

1.2 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.

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

1.3 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. 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.

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 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 Bios Defender™ 520 primary gas flow calibrator. 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 B and the reduced data can be found in Appendix C. The calibration certifications of the Bios Defender™ 520 primary gas flow calibrator can be found in Appendix D.

2.0 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 Homologue distribution. The homologue analytical method is a reliable method to quantify total PCBs to levels below the EPA Action Level (0.05 $\mu g/m^3$) and Acceptable Long-Term Average Exposure Concentration (0.3 $\mu g/m^3$) described in Section 5 and Appendix G. 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.

Laboratory analytical results are presented in Appendix E.

3.0 QUALITY ASSURANCE

3.1 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 during this sampling and analysis program.

3.2 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 placed in 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 D. All instrument calibrations met the performance criteria defined in 40 CFR 50 Appendix B.

3.3 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.

3.3.1 Field Data Reduction

Appendix B 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.

3.3.2 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 an "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 adherence to each 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 F. All data are reported in standard units depending on the measurement and the ultimate use of the data.

3.4 Collocated Sampler Precision

Single collocated sampler pairs were included for both indoor and vent stack air 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 collection 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:

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

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

APPENDIX B

SAMPLING DATA

Keith Middle School Sampling Data Sheet
Ambient / Vent Air Sampling

Setup Date: 8/29/13 **Sampler(s):** DG / SB

Recovery Date: 8/30/13 **Sampler(s):** DG / SB

TO-4A (Ambient)							
Location	Time (clock)		Sampler				
			Serial Number	Counter (Hrs)		Flow Rate (Mag Reading)	
	Start	Stop		Start	Finish	Initial	Final
A	1409	1411	1-825	557.47	557.47	50	45
B-Aud	1404	1403	3-823	635.51	659.46	50	46
C	1402	1358	5-821	635.74	659.67	50	46
BG	1413	1418	4-822	657.63	681.72	50	47
BG-Dup	1413	1418	2-820	238.94	263.03	50	47

Sample Date: 8/30/13 **Sampler(s):** DG/SB

TO-10A (Vent)				
Location	Time (clock)		Flow Rate (LPM)	
	Start	Stop	Start	Finish
VB-1	930	1331	5.07	5.11
VB-4	933	1335	5.08	5.01
VB-9	944	1346	5.01	5.11
VB-9 Dup	944	1346	5.09	5.13
VB-12	949	1350	5.02	5.12

Round 32

TRC

APPENDIX C

FIELD REDUCED DATA

OUTDOOR SAMPLING LOCATIONS

Average Temp (oF/ K): 63.0 290 2

Average Baro Press ("Hg / mmHg): 30.00 762 0

Friday, August 30, 2013

Location		Serial #	m_s	b_s	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)	Start time (clock)	Stop Time (hr)	Stop Time (clock)	Total Sample Time (min)	Total Actual Sample Volume (m^3)
BG-32	TO-4A	4-822	0.031	-0.51901	50		47		48.5	6 19	238	657.63	14:13	681.72	14:18	1445	343.5
BG-32-Dup	TO-4A	2-820	0.031	-0.68021	50		47		48.5	6 19	243	238.94	14 13	263.03	14 18	1445	350.8
VS-1-32	TO-10A					5.07		5.11		0.79	5 09		9:30		13:31	241	1.23
VS-4-32	TO-10A					5.08		5.01		1.39	5 05		9:33		13:35	242	1.22
VS-9-32	TO-10A					5.01		5.11		1.98	5.06		9:44		13:46	242	1.22
VS-9-32-DUP	TO-10A					5.08		5.13		0 98	5 11		9:44		13:48	242	1.24
VS-12-32	TO-10A					5.02		5.12		1 97	5 07		9:49		13:50	241	1.22

✓ SMM 9-3-13

INDOOR SAMPLING LOCATIONS

Average Temp (oF/ K): 81.0 300 2

Average Baro Press ("Hg / mmHg): 30.00 762 0

Friday, August 30, 2013

Location		Serial #	m_s	b_s	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)	Start time (clock)	Stop Time (hr)	Stop Time (clock)	Total Sample Time (min)	Total Actual Sample Volume (m^3)
A-32 Hallway	TO-4A	1-825	0.031	-0.85759	50		45		47.5	10.53	251	557.47	14:09	557.47	14:11	1442	361.4
B-32 Aud	TO-4A	3-823	0.033	-0.97778	50		46		48	8.33	240	635.51	14:04	659.46	14:03	1437	345.2
C-32 Lounge hallway	TO-4A	5-821	0.031	-0.55413	50		46		48	8.33	242	635.74	14:02	659.67	13:58	1436	347.4

Note:

✓ Ewn 9-3-13

APPENDIX D

EQUIPMENT CALIBRATION SHEETS

Keith Middle School PS1 Calibration Data Sheet

Sampler ID: 1
Sampler Location: A

Initial Calibration
Date: 8/29/13 Time: 1056

Magnehelic Reading	Manometer Left	Right	total
70	2.55	10.3	7.75
60	3.1	9.75	6.65
50	3.55	9.25	5.70
40	4.05	8.75	4.70
30	4.6	8.2	3.60

Post Calibration
Date: 8/30/13 Time: 1412

Magnahelic Reading	Manometer Left	Right	total
50	3.6	9.3	5.7

Sampler ID: 5
Sampler Location: C

Initial Calibration
Date: 8/29/13 Time: 1109

Magnehelic Reading	Manometer Left	Right	total
70	2.8	10.0	7.2
60	3.25	9.55	6.3
50	3.75	9.1	5.35
40	4.25	8.6	4.35
30	4.8	8.05	3.25

Post Calibration
Date: 8/30/13 Time: 1400

Magnahelic Reading	Manometer Left	Right	total
50	3.7	9.2	5.5

Sampler ID: 3
Sampler Location: B-Aud

Initial Calibration
Date: 8/29/13 Time: 1115

Magnehelic Reading	Manometer Left	Right	total
70	2.75	10.05	7.3
60	3.2	9.6	6.4
50	3.75	9.1	5.35
40	4.15	8.65	4.5
30	4.7	8.15	3.45

Post Calibration
Date: 8/30/13 Time: 1404

Magnahelic Reading	Manometer Left	Right	total
50	3.75	9.05	5.3

Sampler ID: 4
Sampler Location: BG

Initial Calibration
Date: 8/29/13 Time: 1118

Magnehelic Reading	Manometer Left	Right	total
70	2.8	10.1	7.3
60	3.2	9.65	6.45
50	3.7	9.2	5.5
40	4.25	8.65	4.4
30	4.8	8.1	3.3

Post Calibration
Date: 8/30/13 Time: 1420

Magnahelic Reading	Manometer Left	Right	total
50	3.8	9.25	5.45

ROUND 32

Sampler ID: 2
Sampler Location: B6-Dup

Initial Calibration
Date: 8/29/13 Time: ~~1118~~ 1122

Magnehelic Reading	Manometer Left	Right	total
70	~~2.8~~ 2.7	10.15	~~[illegible]~~ 7.45
60	3.25	9.7	~~7.79~~ 6.45
50	3.65	9.15	5.5
40	4.2	8.7	4.5
30	4.75	8.15	3.4

Post Calibration
Date: 8/30/13 Time: 1420

Magnahelic Reading	Manometer Left	Right	total
50	3.8	9.3	5.5

Orifice ID: 1125 Cal. Date: 8/22/13
Initial Cal Temp (in/out): 25.6 / 68°F F / (C)
Initial Cal Press: 30.02 (inHg) / mmHg
Post Cal Temp (in/out): 81 F / 75 (F) / C
Post Cal Press: 29.90 (inHg) / mmHg

TRC

Network: **New Bedford** Site: **Keith Middle** Serial #: **1-825** Station #: **A**

Technician: **SB/DG** Date: **8/29/2013** OrificeS/N: **946** Orif. Cal. Date: **22-Aug-13**

Reason for Puff Sampler Calibration: *Monthly Recal*

Amb. Temp, Ta (°C)	25.6	Bar. Press., Pa (in Hg)	**30.02**
Amb. Temp, Ta (K)	298.6	Bar. Press., Pa (mmHg)	762.5

Orifice Data

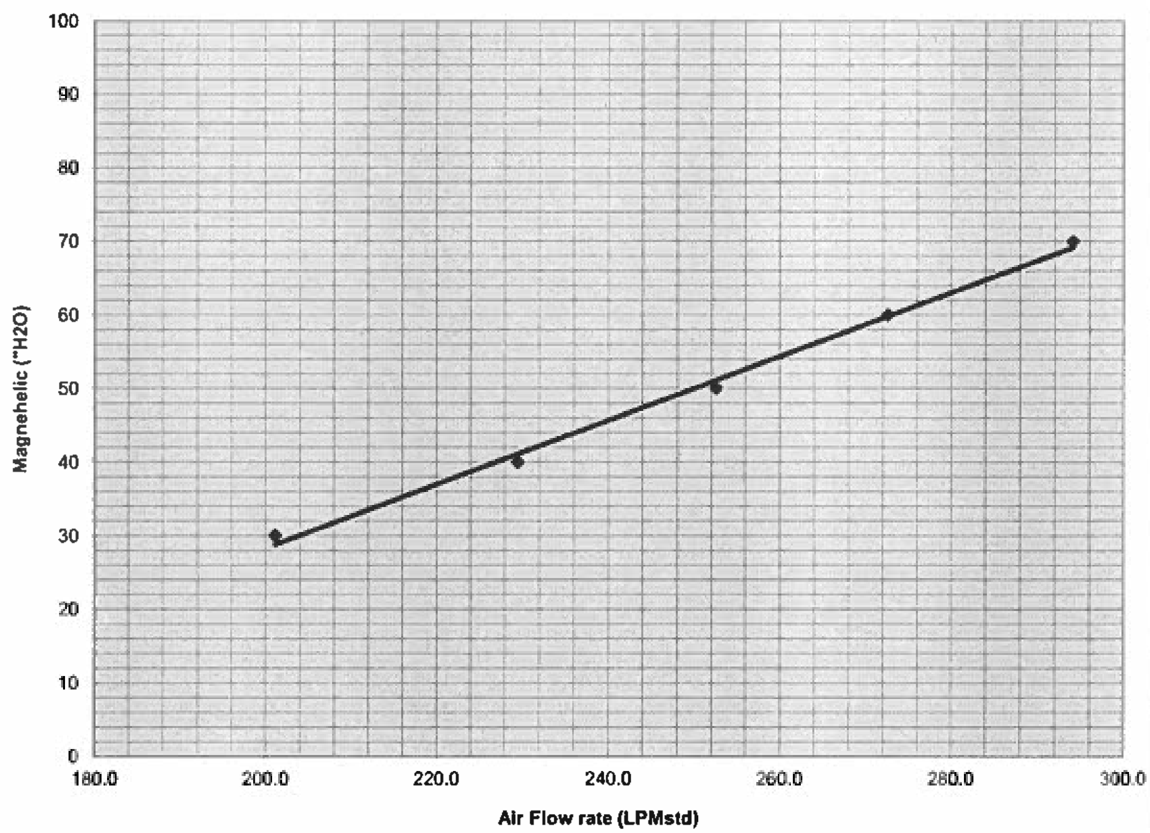
Qstd (m_o) = **9.54224** Qstd (b_o) = **-0.02082** Qstd (r_o) = **0.99997**

ΔH	Q_{std}	I	I_c
7.75	294.112	**70**	8.37
6.65	272.602	**60**	7.75
5.70	252.542	**50**	7.07
4.70	229.523	**40**	6.33
3.60	201.148	**30**	5.48

I_c = sqrt[I x 0.392 x (Pa/Ta)]

Qstd = {(1/mo) x sqrt[DH x (Pa/760) x (298/Ta) - bo]} x 1000

m_s = 0.031 b_s = -0.85759 r_s = 0.99972



Desired Flow Rate (lpm): 250 Sampler Setting: 50.0

m_{mag} = 0.435 b_{mag} = -58.65114 r_{mag} = 0.99766

✓ SMM 9-3-13

Network: **New Bedford** | Site: **Keith Middle** | Serial #: **3-823** | Station #: **B-Aud**

Technician: **SB/DG** | Date: **8/29/2013** | OrificeS/N: **946** | Orif. Cal. Date: **22-Aug-13**

Reason for Puff Sampler Calibration: *Monthly Recal*

Amb. Temp, Ta (°C)	25.6	Bar. Press., Pa (in Hg)	**30.02**
Amb. Temp, Ta (K)	298.6	Bar. Press., Pa (mmHg)	762.5

Orifice Data

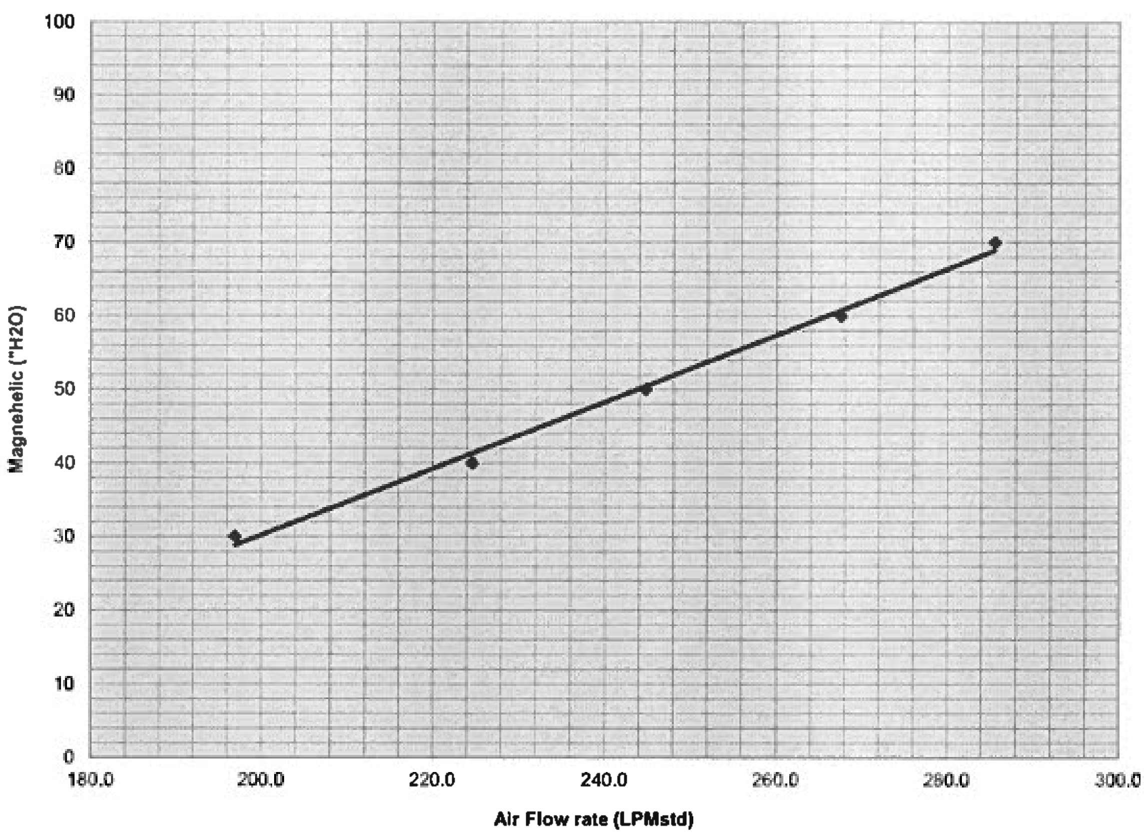
Qstd (m_o) = **9.54224** Qstd (b_o) = **-0.02082** Qstd (r_o) = **0.99997**

ΔH	Q_{std}	I	I_c
7.30	285.510	**70**	8.37
6.40	267.470	**60**	7.75
5.35	244.734	**50**	7.07
4.50	224.633	**40**	6.33
3.45	196.959	**30**	5.48

I_c = sqrt[I x 0.392 x (Pa/Ta)]

Qstd = {(1/mo) x sqrt[DH x (Pa/760) x (298/Ta) - bo]} x 1000

m_s = 0.033 b_s = -0.97778 r_s = 0.99954



Desired Flow Rate (lpm): 250 Sampler Setting: 52.8

m_{mag} = 0.452 b_{mag} = -60.30681 r_{mag} = 0.99743

✓ EM 9-3-13

Network: **New Bedford** Site: **Keith Middle** Serial #: **5-821** Station #: **C**

Technician: **SB/DG** Date: **8/29/2013** OrificeS/N: **946** Orif. Cal. Date: **22-Aug-13**

Reason for Puff Sampler Calibration: *Monthly Recal*

Amb. Temp, Ta (°C)	25.6	Bar. Press., Pa (in Hg)	**30.02**
Amb. Temp, Ta (K)	298.6	Bar. Press., Pa (mmHg)	762.5

Orifice Data

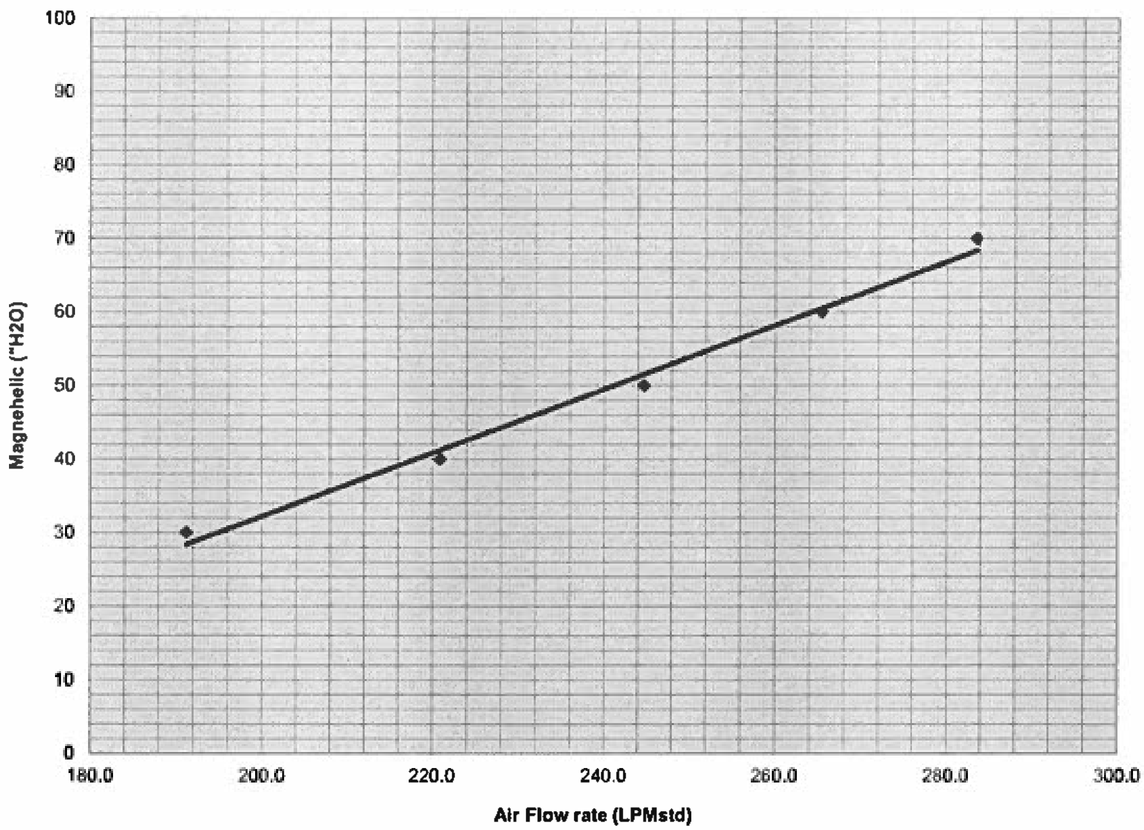
Qstd (m_o) = **9.54224** Qstd (b_o) = **-0.02082** Qstd (r_o) = **0.99997**

ΔH	Q_{std}	I	I_c
7.20	283.563	**70**	8.37
6.30	265.390	**60**	7.75
5.35	244.734	**50**	7.07
4.35	220.894	**40**	6.33
3.25	191.229	**30**	5.48

I_c = sqrt[I x 0.392 x (Pa/Ta)]

Qstd = {(1/mo) x sqrt[DH x (Pa/760) x (298/Ta) - bo]} x 1000

m_s = 0.031 b_s = -0.55413 r_s = 0.99936



Desired Flow Rate (lpm): 250 Sampler Setting: 53.8

m_{mag} = 0.432 b_{mag} = -54.24177 r_{mag} = 0.99527

✓ SM 9-3-13

Network:	**New Bedford**	Site:	**Keith Middle**	Serial #:	**4-822**	Station #:	**BG**
Technician:	**SB/DG**	Date:	**8/29/2013**	OrificeS/N:	**946**	Orif. Cal. Date:	**22-Aug-13**

Reason for Puff Sampler Calibration: *Monthly Recal*

Amb. Temp, Ta (°C)	20.0	Bar. Press., Pa (in Hg)	**30.02**
Amb. Temp, Ta (K)	293.0	Bar. Press., Pa (mmHg)	762.5

Orifice Data

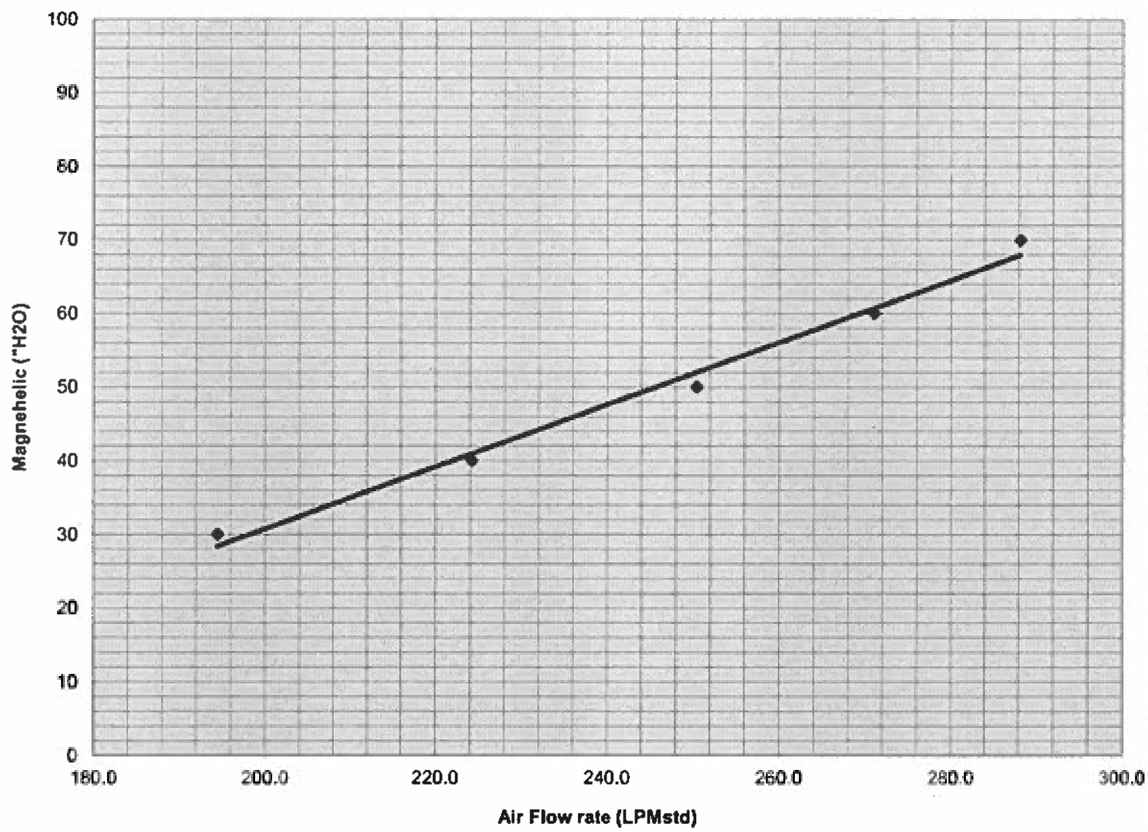
Qstd (m_o) = **9.54224** Qstd (b_o) = **-0.02082** Qstd (r_o) = **0.99997**

ΔH	Q_{std}	I	I_c
7.30	288.205	**70**	8.45
6.45	271.038	**60**	7.82
5.50	250.450	**50**	7.14
4.40	224.240	**40**	6.39
3.30	194.489	**30**	5.53

I_c = sqrt[I x 0.392 x (Pa/Ta)]

Qstd = {(1/mo) x sqrt[DH x (Pa/760) x (298/Ta) - bo]} x 1000

m_s = 0.031 b_s = -0.51901 r_s = 0.99875



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

m_{mag} = 0.422 b_{mag} = -53.60709 r_{mag} = 0.99386

✓ GM 9-3-13

Network: New Bedford | Site: Keith Middle | Serial #: 2-820 | Station #: BG-DUP

Technician: SB/DG | Date: 8/29/2013 | OrificeS/N: 946 | Orif. Cal. Date: 22-Aug-13

Reason for Puff Sampler Calibration: *Monthly Recal*

Amb. Temp, Ta (°C)	20.0	Bar. Press., Pa (in Hg)	30.02
Amb. Temp, Ta (K)	293.0	Bar. Press., Pa (mmHg)	762.5

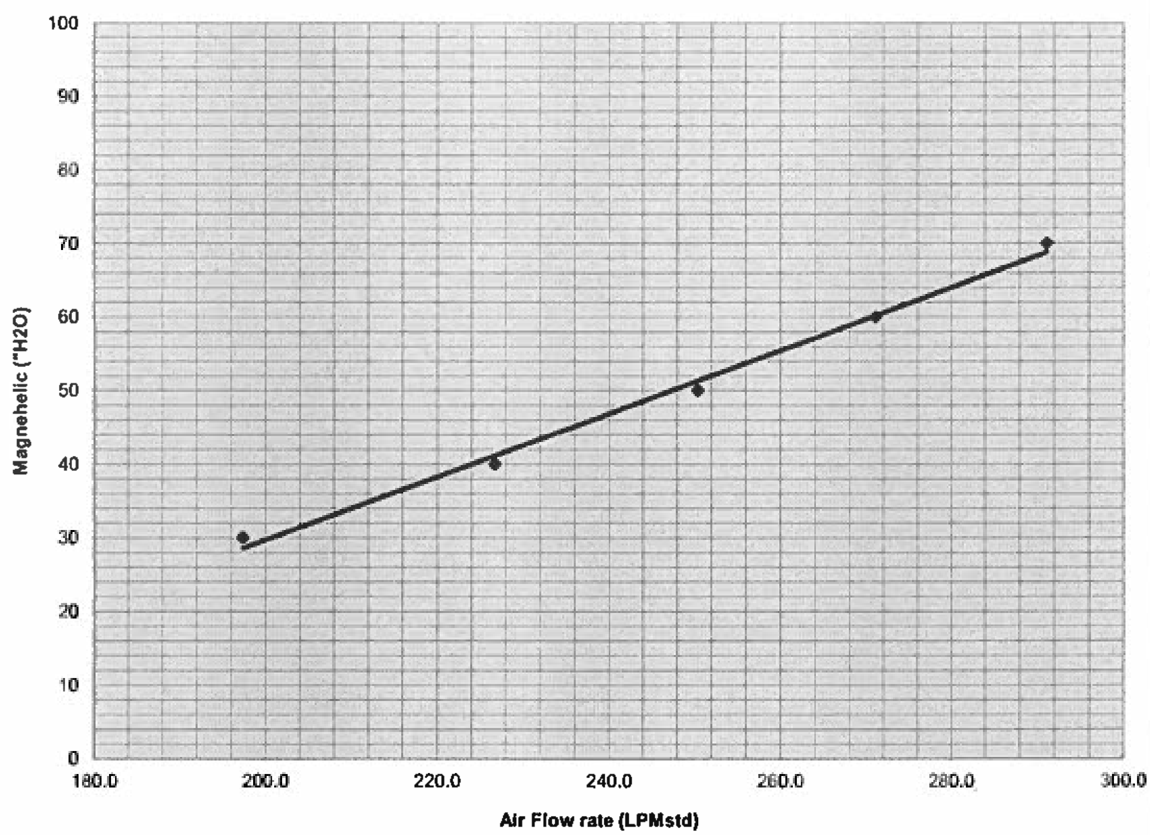
Orifice Data

Qstd (m_o) = 9.54224 Qstd (b_o) = -0.02082 Qstd (r_o) = 0.99997

ΔH	Q_{std}	I	I_c
7.45	291.128	70	8.45
6.45	271.038	60	7.82
5.50	250.450	50	7.14
4.50	226.749	40	6.39
3.40	197.381	30	5.53

I_c = sqrt[I x 0.392 x (Pa/Ta)] Qstd = {(1/mo) x sqrt[DH x (Pa/760) x (298/Ta) - bo]} x 1000

m_s = 0.031 b_s = -0.68021 r_s = 0.99973



Desired Flow Rate (lpm): 250 Sampler Setting: 51.1

m_{mag} = 0.429 b_{mag} = -56.00161 r_{mag} = 0.99665

✓ [initials] 9-3-13

PS-1 Post-Sampling Flow Audit

Qstd Orifice (m^3/min) = $(1/m_o)$*(SQRT(H_o*(Tstd/Pstd))-b_o))
Qstd Sampler (m^3/min) = $(1/m_s)$*(SQRT(H_s*(Tstd/Pstd))-b_s)/1000
% Difference = ((Qact Orifice - Qact Sampler) / Qact Orifice)*100

8/30/2013 Press ("Hg): **29.90** Press - P_a (mmHg): 759.5

	Temp (°C):	Temp - T_a (K):	Sampler Serial #	Sampler Reading - H_s ("h20)	Orifice Reading - H_o ("h20)	Orifice #	Orifice Slope - m_o	Orifice Intercept - b_o	**Qstd Orifice**	Sampler #	Sampler Slope - m_s	Sampler Intercept - b_s	**Qstd Sampler**	**% Difference**
A-32	20.0	293.0	1-825	50	5.70	1125	9.54224	-0.02082	0.254	1-825	0.031	-0.85759	0.258	-1.26
B-32	20.0	293.0	3-823	50	5.30	1125	9.54224	-0.02082	0.245	3-823	0.033	-0.97778	0.246	-0.10
C-32	20.0	293.0	5-821	50	5.50	1125	9.54224	-0.02082	0.250	5-821	0.031	-0.55413	0.248	0.85
BG-32	20.0	293.0	4-822	50	5.45	1125	9.54224	-0.02082	0.249	4-822	0.031	-0.51901	0.247	0.85
BG-DUP-32	20.0	293.0	2-820	50	5.50	1125	9.54224	-0.02082	0.250	2-820	0.031	-0.68021	0.252	-0.78

Acceptance Limit </= 10% Difference

9-3-13

DATE	Time (est)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (°F) Air	Dwpt	6 hour Max.	6 hour Min.	Relative Humidity	Pressure altimeter (in.)	sea level (mb)	Precipitation (in.) 1 hr	3 hr	6 hr		
31	17:53	SW 14	9	Overcast	OVC007	73	70			90%	29.83	1010					
31	16:53	SW 12	8	Overcast	OVC007	73	70			90%	29.83	1010.2					
31	15:53	SW 15 G 22	10	Overcast	OVC009	74	69			85%	29.84	1010.3					
31	14:53	SW 16 G 22	10	Overcast	OVC011	75	69			82%	29.83	1010.1					
31	13:53	SW 9 G 17	9	Mostly Cloudy	BKN011	75	69	78	71	82%	29.84	1010.5					
31	12:53	SW 14	9	Mostly Cloudy	BKN011	75	69			82%	29.84	1010.6					
31	11:53	SW 14	9	Mostly Cloudy	BKN011	75	69			82%	29.85	1010.6					
31	10:53	SW 12	10	Mostly Cloudy	BKN011	76	70			82%	29.85	1010.8					
31	9:53	SW 7	8	Overcast	OVC007	73	69			87%	29.86	1011.1					
31	8:53	SW 7	6	Fog/Mist	OVC007	72	69			91%	29.85	1010.9					
31	7:53	SW 9	6	Fog/Mist	OVC007	71	69	71	69	94%	29.85	1010.6					
31	6:53	SW 9	6	Fog/Mist	OVC007	71	69			94%	29.84	1010.4					
31	5:53	SW 8	6	Fog/Mist	OVC005	71	69			94%	29.84	1010.4					
31	4:53	SW 8	6	Fog/Mist	OVC005	71	69			94%	29.84	1010.4					
31	3:53	SW 9	6	Fog/Mist	OVC005	70	69			97%	29.84	1010.3					
31	2:53	SW 10	6	Fog/Mist	OVC005	70	68			93%	29.83	1010.2					
31	1:53	SW 7	6	Fog/Mist	OVC005	69	68	69	67	96%	29.84	1010.6					
31	0:53	SW 6	7	Mostly Cloudy	BKN005	69	67			93%	29.85	1010.9					
30	23:53	SW 5	5	Fog/Mist	BKN005	68	66			93%	29.86	1011					
30	22:53	SW 5	7	Fair	CLR	68	66			93%	29.86	1011.1					
30	21:53	SW 5	8	Fair	CLR	68	66			93%	29.86	1011					
30	20:53	SW 5	9	Fair	CLR	68	67			96%	29.87	1011.4					
30	19:53	SW 8	10	Fair	CLR	69	66	78	69	90%	29.86	1011.3					
30	18:53	SW 7	10	Fair	CLR	71	67			87%	29.86	1011.2					
30	17:53	SW 10	10	Fair	CLR	75	67			76%	29.87	1011.3					
30	16:53	Vrbl 5	10	Partly Cloudy	SCT024	76	66			72%	29.86	1011.2					
30	15:53	W 12	10	Mostly Cloudy	BKN024	78	66			67%	29.87	1011.5					
30	14:53	SW 8	10	Overcast	OVC020	75	66			74%	29.88	1011.8					
30	13:53	W 10	10	Overcast	OVC020	75	65	75	62	71%	29.9	1012.4				*Post Cal Pressure*	
30	12:53	SW 9	10	Overcast	OVC018	73	63			71%	29.93	1013.3					
30	11:53	SW 6	10	Overcast	BKN016 OVC023	71	62			73%	29.94	1013.9					
30	10:53	W 5	10	Overcast	OVC014	67	61			81%	29.97	1014.7					
30	9:53	Vrbl 3	10	Overcast	BKN013 BKN021 OVC026	66	59			78%	29.97	1014.9					
30	8:53	W 9	10	Mostly Cloudy	BKN013 BKN017 BKN047	65	59			81%	29.98	1015.1					
30	7:53	W 5	10	Overcast	OVC014	62	59	62	57	90%	29.99	1015.5					
30	6:53	W 5	10	Overcast	OVC016	61	59			93%	30	1015.8					
30	5:53	Calm	10	Overcast	OVC016	60	58			93%	29.98	1015.3					
30	4:53	Calm	10	Overcast	OVC016	59	57			93%	29.98	1015.1					
30	3:53	Calm	10	Overcast	OVC020	58	57			97%	29.98	1015.1					
30	2:53	Calm	10	A Few Clouds	FEW017	57	56			96%	29.99	1015.6					
30	1:53	NW 3	10	A Few Clouds	FEW015	57	56	63	57	96%	30	1015.7	0.01		0.01		
30	0:53	NW 3	10	Fair	CLR	58	56			93%	30.01	1016.3					
29	23:53	Calm	10	Fair	CLR	57	56			96%	30.02	1016.4					
29	22:53	Calm	10	A Few Clouds	FEW023	58	57			97%	30.04	1017					
29	21:53	Calm	10	Partly Cloudy	SCT021	59	57			93%	30.03	1016.9					
29	20:53	N 5	10	Mostly Cloudy	BKN013	61	58			90%	30.04	1017.1					
29	19:53	N 5	10	Overcast	OVC013	63	59	68	63	87%	30.04	1017.1					
29	18:53	NE 7	6	Fog/Mist	OVC011	63	59			87%	30.04	1017.3					
29	17:53	NE 8 G 17	6	Fog/Mist	OVC011	64	60			87%	30.04	1017.1					
29	16:53	NE 8 G 17	6	Fog/Mist	OVC008	65	61			87%	30.03	1016.8					
29	15:53	N 9 G 17	8	Overcast	OVC008	66	63			90%	30.02	1016.4					
29	14:53	N 7	7	Overcast	OVC008	67	64			91%	30.01	1016.1					
29	13:53	N 5	3	Fog/Mist	BKN008 OVC010	67	65	69	66	93%	30.01	1016.3					
29	12:53	N 8	10	Overcast	OVC008	67	63			87%	30.02	1016.5				***Average Temp***	***Average Press***
29	11:53	NE 7	10	Overcast	OVC008	67	64			91%	30.03	1016.7				***63.0***	***30.00***
29	10:53	NE 7	10	Overcast	OVC008	68	64			87%	30.02	1016.4				*Pre Cal Pressure*	
29	9:53	N 7	10	Overcast	OVC008	67	64			91%	30.01	1016.3					
29	8:53	NE 9	10	Overcast	OVC008	66	64			93%	30	1016					
29	7:53	Vrbl 6	10	Overcast	OVC008	66	64	66	64	93%	29.99	1015.4			0.01		
29	6:53	NE 10	10	Overcast	BKN008 OVC019	66	64			93%	29.97	1014.9					
29	5:53	N 5	10	Overcast	OVC017	66	64			93%	29.96	1014.4					
29	4:53	N 3	10	Overcast	OVC010	65	64			97%	29.95	1014.1		0.01			
29	3:53	N 5	3	Fog/Mist	OVC004	65	64			97%	29.95	1014.1	0.01				
29	2:53	N 3	5	Fog/Mist	OVC004	65	64			97%	29.94	1013.9					
29	1:53	N 6	6	Fog/Mist	OVC002	64	64	70	64	100%	29.94	1013.8					
29	0:53	NE 7	2.5	Fog/Mist	OVC002	65	64			97%	29.95	1014.1					
28	23:53	NE 6	1.5	Fog/Mist	OVC002	67	66			97%	29.94	1013.7					
28	22:53	E 3	0.5	Fog	VV002	67	67			100%	29.93	1013.6					
28	21:53	E 3	4	Fog/Mist	OVC004	69	67			93%	29.92	1013.3					
28	20:53	Calm	4	Fog/Mist	OVC002	69	67			93%	29.92	1013.1					
28	19:53	Calm	7	Fair	CLR	70	67	83	70	90%	29.89	1012					
28	18:53	E 3	10	Fair	CLR	74	67			79%	29.89	1012.2					

APPENDIX E

LABORATORY DATA REPORTS (ON CD)

APPENDIX F

LABORATORY DATA VALIDATION MEMORANDA

Memo

To: David Sullivan

From: Lorie MacKinnon

CC:

Date: 11/07/13

Re: Data Validation Review: Air Samples: Keith Middle School/New Bedford, MA: SDG 13090035

SUMMARY

Limited (Tier II) validation was performed on the data for 10 air samples and two trip blank samples collected at the Keith Middle School in New Bedford, Massachusetts. The samples were collected on August 30, 2013 and submitted to Pace Analytical Services, Inc. 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. Pace reported the results under job number 13090035.

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.

The data appear to be valid as reported without qualification and may be used for decision-making purposes. All results are usable for project objectives.

SAMPLES

Samples included in this review are listed below:

VS-1-32	VS-4-32	VS-9-32
VS-9-32-DUP (1)	VS-12-32	VS-TB-32
A-32	B-32	C-32
BG-32	BG-32-DUP (2)	TB-32

(1) Field duplicate of VS-9-32
(2) Field duplicate of BG-32

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
- 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.

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 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 homologues used in the initial and continuing calibrations were within the acceptance criteria.

Blanks

Target compounds were not detected in the laboratory method blanks or trip blanks associated with the PCB homologue analyses.

Target compounds were not detected in the VER PUF sample (Lot #s 081213-0, 081213-1, and 081213-2) and VER Filter sample (Lot # 081213-4) which were analyzed and reported under job number 13080511.

Surrogate Spike Recoveries

All recovery criteria were met.

LCS Results

An LCS and LCSD was extracted and analyzed with each extraction batch. All recovery and precision criteria were met.

Internal Standard Performance

All internal standard criteria were met.

Field Duplicate Results

Samples VS-9-32/VS-9-32-DUP (PUF) and BG-32/BG-32-DUP (PUF/Filter) were submitted as the field duplicate (collocated) pairs with this sample set. PCBs were not detected in these samples.

Quantitation Limits and Sample Results

The quantitation limits met the requirements in the Sampling Plan for this program.

Due to sample matrix, two fold dilutions were performed on samples A-32, B-32, and C-32. Quantitation limits were elevated accordingly in these samples.

APPENDIX G

DISCUSSION OF RISK-BASED COMPARISON CRITERIA

DISCUSSION OF RISK-BASED COMPARISON CRITERIA

Two PCB risk-based air concentrations (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 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 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. PCB homologues have been quantified and summed to generate total PCB air concentrations. 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.

In September 2009, EPA published Public Health Levels (PHLs) for PCBs which are calculated indoor air concentrations that maintain PCB exposures below a level that EPA believes does not cause harm. PHLs were calculated for all ages of children from toddlers in day care to adolescents in high school as well as for adult school employees. In this report, indoor air PCB concentrations are compared to the PHL (0.45 ug/m^3) for adult school employees and children 12 to <15 years old, representative of the middle school age range. In calculating the PHL, EPA considered average PCB exposures from both school (e.g., school indoor and outdoor air, indoor dust and nearby outside soils) and non-school (e.g., diet, outside soils, indoor dust, and indoor and outdoor air) environments. EPA assumed that middle school children spend 6.5-hours per day at school (with 6 hours spent inside the school) for a 180-day school year.