UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
EDISON, NEW JERSEY 08837

DEC - 7 2012

CERTIFIED MAIL – RETURN RECEIPT REQUESTED
Article Number: 70110470000237286567

Mr. Alex Lempert
Director of Industrial and Environmental Hygiene
Environmental and Regulatory Compliance
New York City School Construction Authority
30-30 Thompson Avenue
Long Island City, New York 11101

Re: **Final Remedial Investigation Report**

Dear Mr. Lempert:

This letter serves as a follow-up to the October 17, 2012 technical meeting between the United States Environmental Protection Agency (EPA) and the New York City School Construction Authority (SCA) regarding the August 21, 2012 Final Remedial Investigation (RI) Report. As discussed during that meeting, the EPA has completed its review of the RI Report. Based on our review of the document, we believe that the SCA has satisfied the work requirements specified in the July 9, 2010 RI Plan and its Addendum No.1 (and subsequent modification dated November 23, 2010). This letter is issued in accordance with the terms of the January 25, 2012 letter from Mr. Castagnola addressed to me (the "January 25, 2012 letter"). However, EPA has the following concerns which should be addressed before the Agency can concur with the preferred remedy presented in the RI Report. These concerns are discussed below.

The preferred remedy recommends further evaluation of procedures for removal, replacement and encapsulation of caulk, prior to implementation of PCB caulk removal. We do not believe this recommendation encompasses essential elements of dealing with PCB caulk. EPA's research has shown that caulk containing high levels of PCBs (on the order of thousands of parts per million) is a significant source of PCBs into the indoor air, as well as being an unauthorized use under the Toxic Substances Control Act. Active management of PCB caulk (through procedures that are developed in consultation with the Agency) should therefore be a major component of the preferred remedy.

EPA also believes that the preferred remedy should include provisions for improved ventilation. We have seen that air exchange rates within the individual classrooms at P.S. 199M improve substantially when the windows are slightly opened. Improved ventilation is a necessary component of any strategy to address PCBs in the indoor air.

SCA is not recommending any long-term air testing within the pilot schools. In order to evaluate the effectiveness of any of the remedies that are implemented, we recommend that testing be performed twice a year (i.e., summer and winter) for at least 5 years after attainment of the Agency's benchmark levels for PCBs in the indoor air. This recommendation is consistent with the statement in the January 25, 2012 letter that a long term monitoring plan may be utilized after EPA issues a letter stating that Work Plan requirements have been satisfied. In accordance with the terms of the January 25, 2012 letter, the Summary Report, described in paragraph III. A. of the Work Plan, which shall include a Preferred Citywide Remedy, shall be submitted to EPA within 135 days following your receipt of this letter.

I would like to remind the SCA of the importance of informing the Agency whenever additional work is to be performed within the pilot schools. We are frequently contacted by parents regarding pilot study activities. It is important that EPA be aware of any such work prior to its implementation.

As to different topics we have discussed, I would also at this time repeat and emphasize our request that New York City have written procedures for reoccupying locations within schools where there has been a catastrophic failure of PCB ballasts. During the September 20, 2012 meeting between EPA and New York City, the Agency specifically requested these procedures. To date, we have not yet received this information. Please note that EPA also requested inventories of ballasts removed from City schools where catastrophic ballast failures have occurred (e.g. P.S. 41R), and we have not yet received this information as well.

We are also awaiting submittal of New York City's detailed prioritization of schools that are scheduled for light fixture replacement. At the September 20, 2012 meeting, New York City committed to providing EPA with a list of prioritized schools and their anticipated completion dates.

Should you have any questions concerning the issues presented in this letter, please contact Mr. James Haklar at (732) 906-6817 or at haklar.james@epa.gov.

Sincerely yours,

John Gorman, Chief
Pesticides & Toxic Substances Branch

cc: Ross Holden, New York City School Construction Authority

FINAL REMEDIAL INVESTIGATION REPORT
FOR THE

NEW YORK CITY SCHOOL CONSTRUCTION AUTHORITY
PILOT STUDY TO
ADDRESS PCB CAULK IN NEW YORK CITY SCHOOL BUILDINGS

USEPA CONSENT AGREEMENT AND FINAL ORDER
DOCKET NUMBER: TSCA-02-2010-9201

SCA LLW NO.: 060390
SCA CONTRACT NO.: C000011517
SCA JOB NO.: 34425

TRC ENGINEERS, INC. PROJECT NO.: 166423-0000-0025

August 21, 2012

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TABLE OF CONTENTS

LIST OF TABLES (WITHIN TEXT)

LIST OF FIGURES (WITHIN TEXT)

LIST OF APPENDICES

* - Due to file size, web posting is not feasible – information may be viewed at NYC Public Library near school. Click here for library locations – go to page 8 of the CPP, Section 4.3 – Document Repositories.

LIST OF TABLES (APPENDIX A)

LIST OF FIGURES (APPENDIX B)

EXECUTIVE SUMMARY

On January 19, 2010, The City of New York (the City) and the New York City School Construction Authority (SCA) reached an agreement regarding the assessment and remediation of PCB Caulk in public school buildings with the United States Environmental Protection Agency (USEPA), Region 2 (Consent Agreement and Final Order (CAFO), Docket Number TSCA-02-2010-9201). As a result of the agreement, the City has undertaken a comprehensive Pilot Study to evaluate the possible presence of PCB Caulk and preferred remedial remedies. Pursuant to the terms and conditions of the CAFO, the Pilot Study also evaluated non-caulk sources of PCBs, such as light ballasts. The ultimate goal of the CAFO is to develop a Citywide PCB Management Plan for the relevant schools (built between 1950 and 1978). The agreement required the City to select five Pilot School Buildings from the list of relevant schools. The five approved Pilot School Buildings are P.S. 178X/176, P.S. 199M, P.S. 309K, P.S. 3R and P.S. 183Q.

A Pilot Study was developed and conducted to test and assess selected remedial strategies in these Pilot School Buildings, in accordance with the July 9, 2010 Remedial Investigation (RI) Plan and the following modifications:

- Addendum No.1 to the RI Plan dated July 19, 2010, as approved by USEPA on August 12, 2010;
- RI Plan modification request dated November 23, 2010, as approved by USEPA on November 29, 2010; and,
- The recommendations presented in TRC's Interim Remedial Investigation Report (IRIR) dated June 15, 2011, as approved by USEPA on October 20, 2011.

The purpose of this study (as amended) was to assist in identifying a Pilot Preferred Remedy (which may include more than one remedy) for PCB Caulk and PCB light ballasts in Pilot School Buildings.

The Pilot Study was implemented in two primary phases. In the first phase, conducted from June, 2010, through November, 2010, the SCA implemented a remedial investigation of three of the five Pilot School Buildings (P.S. 178X/176, P.S. 199M, and P.S. 309K) in accordance with the CAFO and the RI Plan. The scope, results, findings and recommendations of these initial remedial investigations are presented in the IRIR dated June 15, 2011, Addendum No. 1 to the Report dated October 5, 2011, and the USEPA approval letter dated October 20, 2011.

In the second phase, conducted from April 2011, through October 2011, the SCA implemented remedial activities at each of the five Pilot School Buildings in accordance with the CAFO and RI Plan. The scope of those activities is summarized below:

- Performed additional caulk surveys, as required;
- Collected pre-remedial air and wipe samples in a representative number of areas in the five Pilot School Buildings;
- Collected soil samples from a representative number of areas on the exterior of P.S. 183Q and P.S. 3R, where soil was present. In addition, exterior caulk samples were collected and analyzed wherever soil sample results exceeded their comparison criteria;

- Applied building-wide remedial alternatives for managing PCB Caulk in three Pilot School Buildings: 1) Encapsulation (in P.S. 309K); 2) Patch and repair (in P.S. 178X/176); 3) Caulk removal and replacement (in P.S. 199M);

- Performed window removal and replacement in select Pilot Study areas at one Pilot School Building (P.S. 183Q);

- Performed light fixture ballast removal and replacement throughout one Pilot School Building (P.S. 3R);

- Evaluated current Best Management Practices for managing PCB caulk at all five Pilot School Buildings;

- Remediated PCB contaminated soils and associated exterior PCB Caulk previously identified around P.S. 178X/176, P.S. 199M, and P.S. 309K;

- Collected post-remedial air and wipe samples from the same locations as the pre-remedial samples to gauge the effects of each of the remedial alternatives;

- Conducted various post-pilot activities and collected additional samples in response to findings of post-remedial air samples;

- Evaluated the ventilation systems at P.S. 199M and P.S. 309K; and,

- Prepared a Remedial Investigation Report presenting and evaluating all data and analytical results of samples collected to date, the various remedial alternatives, and associated costs.

Following submission of the Remedial Investigation Report, from January through April 2012, the SCA implemented additional activities at three of the five Pilot School Buildings in accordance with the CAFO and RI Plan. The scope of those activities is summarized below:

- Performed long-term monitoring wipe sampling of encapsulated caulk at P.S. 309K;

- Performed long-term monitoring bulk caulk sampling of replacement caulk at P.S. 178X and P.S. 199M;

- Performed a pollutant pathway study at P.S. 199M;

- Performed a comparative analysis of air sampling results from P.S. 199M and P.S. 309K;

- Performed air sampling in two classrooms in P.S. 199M following encapsulation of various identified PCB-containing materials and coatings;

- Performed minor repairs and a follow-up evaluation of the exhaust ventilation system at P.S. 309K;

- Performed additional indoor temperature studies, by recording and evaluating indoor air temperatures on multiple floors over several weeks, at P.S. 199M;

- Performed carbon air filter media bulk sampling prior to filter replacement;

- Performed a comparative analysis of pre- and post-carbon filtration air sampling data;

- Performed post-carbon air filter replacement air sampling at P.S. 199M;and,

- Prepared this revised Remedial Investigation/Feasibility Study Report presenting and evaluating all data and analytical results of samples collected to date, the various remedial alternatives, and associated costs.

Based on the results of the pilot activities to-date, the following is a summary of the overall findings of the Pilot Study:

- Pre- and post-remediation wipe samples in all five (5) Pilot School Buildings were consistently below the USEPA guidance value of 10 µg/100 cm^2. Based on those results, surface exposure through ingestion or dermal contact with PCB-laden dust has not been identified as a concern and current housekeeping/cleaning methods employed by the schools adequately address this issue. Therefore, future pre- and post-remediation low and high contact surface wipe sampling should be discontinued.

- Aroclor 1254 was, by far, the most common contributor to the reported total PCB concentrations in air and wipe samples, with a much smaller portion being attributed to Aroclor 1248. No other Aroclors were identified in any of the air or wipe samples collected in the Pilot School Buildings.

- There was not a statistically significant change in airborne PCB concentrations between pre- and post-remedial air sample results at the four (4) Pilot School Buildings in locations where interior PCB Caulk remediation occurred in the summer, 2011. At P.S. 309K, there was a statistically significant increase in airborne PCB concentrations between the pre and post-remediation samples in the Primary Exposure Areas. However, no remedial activities were performed in those locations and it is therefore not believed that the remedial activities caused the increase in airborne PCB concentrations in those locations. Rather, the increases are believed to be attributable to temporal and spatial variations typical of airborne PCB concentrations, as well as variabilities associated with the sampling and analytical methodologies. Based on those results, the various remedial alternatives to address PCB caulk did not either improve or make worse the PCB air concentrations in the areas where they were implemented and, therefore, the remedial methodologies utilized were effective at controlling PCB releases during the remedial process.

- Mean airborne PCB concentrations in Transitory Areas appear greater than in Primary Exposure Areas within P.S. 199M, P.S. 3R and P.S. 183Q for the 2011 Pilot Study, which may be due to the general absence of exhaust ventilation in hallways and stairwells.

- At P.S. 183Q, an additional, detailed, and fine cleaning of the physical spaces subject to the window removal and replacement work by a qualified environmental contractor resulted in subsequent air sampling results meeting the applicable acceptance criteria. Future window replacement project procedures should be modified to incorporate such a detailed and fine cleaning following the replacement work and prior to re-occupancy.

- Soil contamination was identified at all five schools studied. Soil contamination encountered at P.S. 199M, P.S. 178X/176, and P.S. 309K was successfully mitigated through the process of delineation, excavation, and off-site disposal. Soil contamination at P.S. 3R and P.S. 183Q has been isolated pending implementation of soil excavation and disposal.

- PCB Caulk was identified on the building exterior of four out of the five Pilot School Buildings.

- As reported in the IRIR, removal and replacement of the PCB light ballasts and associated fixtures had the most pronounced effect in terms of lowering PCB levels in air in the three Pilot School Buildings in which more than one remedy was implemented (i.e., P.S. 199M, P.S. 178X/176, and P.S. 309K). The major source of airborne PCB in these schools appears to have been leaking light fixture ballasts, rather than caulk. In P.S. 199M, other non-ballast and non-caulk PCB sources appear to be contributing factors as well. In P.S. 3R, concentrations in air were on average lower in Primary Exposure Areas following light fixture removal; however the difference was not statistically significant.

- School-wide mean airborne PCB concentrations at P.S. 199M and P.S. 309K were higher in the warmer summer months and lower in cooler fall and winter months. Evaluation suggests there is a positive relationship at both schools between indoor air PCB concentration and outdoor temperatures.

- At both P.S. 199M and P.S. 309K, on a floor-by-floor basis, mean PCB air concentrations in classrooms were highest on the third floor and lowest on the first floor.

- An evaluation of the ventilation systems at P.S. 199M and P.S. 309K indicated that designed and measured exhaust ventilation rates were variable between classrooms. With one or two windows partially opened, measured air exhaust rates in select classrooms at P.S. 199M increased by an average of 68%, and air exchange rates increased by an average of 76%. Similarly, at P.S. 309K measured air exhaust rates in select classrooms increased by an average of approximately 45% when one or two windows were opened slightly versus when they were closed.

- An evaluation of the total normalized Relative Source Strength (RSS) of PCB-containing materials for select classrooms at P.S. 199M indicated that the average RSS was more than two times higher than the average RSS for comparable select classrooms at P.S. 309K. Although no correlation between the RSS and airborne PCB concentration in either school was identified, the higher normalized RSS in P.S. 199M as compared to P.S 309K, which is similar to P.S. 199M in both construction type and date, as well as ventilation configuration, suggests that the other interior PCB-containing materials may be contributing to the higher mean airborne PCB concentration associated with post-remediation samples at P.S. 199M.

- Based on air sample results at P.S. 178X, which is mechanically ventilated, an increase in the amount of fresh air introduced into the building via the ventilation system helped reduce indoor air PCB concentrations. Conversely, based on a simple trend analysis of the air sample results from P.S. 199M, which has a mechanical exhaust system that relies on operable windows for make-up air, there was no correlation between air exhaust rates and indoor air PCB concentrations.

- The limited pollutant pathway study at P.S. 199M revealed that, when the classroom windows were closed, a majority of the tracer gas (approximately 95%) was removed from the room via the exhaust ventilation system, and when the windows were slightly opened, a majority of the tracer gas (approximately 57%) migrated to the adjacent hallway while approximately 42% was removed via the exhaust ventilation system. Only trace amounts of tracer gas migrated from the 1st floor classroom to the upper floor classrooms, most likely via the pipe risers for the perimeter radiators.

- Long-term monitoring results of wipe samples collected January 2012, from surfaces of PCB caulk that were encapsulated at P.S. 309K in July 2010, indicate that PCBs from the caulk appear to have penetrated and migrated through the encapsulant. These results suggest that encapsulation of PCB caulk using the currently available encapsulants and methodologies employed in the pilot study is of limited benefit as a remedial alternative.

- Long-term monitoring results of bulk samples collected in February and April 2012 from replacement caulk that was installed in P.S. 178X and P.S. 199M in July 2010 and July/August 2011, indicate that PCBs from the original caulk appear to have contaminated the underlying substrates (i.e., masonry mortar, block, etc.) and that those PCBs have, in turn, penetrated and contaminated the new non-PCB caulk. These results suggest that removal and replacement of PCB caulk, without additional actions to isolate the underlying substrate prior to installing the new caulk, is of limited benefit as a remedial alternative.

- Despite the relative ineffectiveness of the various caulk remedial alternatives, as evidenced by the long term monitoring results, the majority of post–remediation air sampling results were found to be below the applicable guidance criteria. In addition, there was not a statistically significant change in airborne PCB concentrations between pre- and post-remedial air sample results, suggesting that PCB caulk is not a major contributor to indoor PCB air concentrations at the schools that were evaluated.

On the basis of the work performed and summarized in the Interim Remedial Investigation Report and this Final Remedial Investigation Report, the following proposed supplemental actions are recommended:

(1) <u>Supplemental Actions Related to P.S. 199M</u>

- For future air sampling events, data log temperature in representative areas throughout each sampling event.

- Subsequent to publication of the EPA's research report on their evaluation of PCB encapsulants, and depending upon the effectiveness of the various products tested, encapsulate other PCB-containing materials within a representative number of interior spaces and conduct a minimum of two rounds of air sampling and analysis in these same spaces, following encapsulation, to evaluate the impact, if any, on the concentration of PCBs in air.

(2) <u>Supplemental Actions Related to P.S. 178X/176</u>

- Other than continuing to implement the Long-Term Monitoring Plan, no further post-pilot investigation or remediation actions are recommended at this time.

(3) <u>Supplemental Actions Related to P.S. 309K</u>

- Due to the relatively low air exhaust rates measured in specific areas at P.S. 309K, engage a ventilation contractor and/or engineer to evaluate the building exhaust system and make recommendations for repairs and/or upgrades as may be necessary.

(4) <u>Supplemental Actions Related to P.S. 183Q</u>

- Continue to isolate surface soil documented to contain PCB concentrations above one part per million (ppm) as an interim measure pending implementation of soil excavation and disposal. A construction fence associated with a capital improvement project is currently in place. When construction is completed and the construction fence is removed, cover the contaminated soil areas with geotextile fabric and a 3" to 4" top layer of cedar mulch and maintain it. Encapsulate exterior PCB Caulk in areas immediately adjacent to soils to be remediated in accordance with the SCA's commitment to USEPA prior to soil remediation. Remediate soils above 1 ppm by excavation and off-site disposal, and obtain confirmatory post-excavation soil results. Backfill with clean fill and reestablish surface features.

- Remove and replace ballasts and light fixtures as part of the on-going light fixture replacement program due to evidence of historic ballast leakage.

(5) Supplemental Actions Related to P.S. 3R

- Continue to isolate surface soil documented to contain PCB concentrations above 1 ppm as an interim measure pending implementation of soil excavation and disposal. Maintain the existing geotextile fabric and cedar mulch. Encapsulate exterior PCB Caulk in areas immediately adjacent to soils to be remediated in accordance with the SCA's commitment to USEPA prior to soil remediation. Remediate soils above 1 ppm by excavation and off-site disposal, and obtain confirmatory post-excavation soil results. Backfill with clean fill and reestablish surface features.

(6) Supplemental Actions Related to All Pilot School Buildings

- Continue to perform bulk and wipe sampling in the four Pilot Schools where PCB Caulk work was performed, as defined in the USEPA-approved Remedial Investigation Work Plan.

The status of the proposed Pilot Preferred Remedy, as supported by the companion Feasibility Study, is as follows:

- The Pilot Study evaluated five (5) remedial alternatives with respect to interior caulk: 1) Patch and repair of caulk at P.S. 178X/176; 2) Encapsulation of caulk at P.S. 309K; 3) Removal of all caulk and replacement with new non PCB-containing caulk at P.S. 199M; 4) Window frame and caulk removal and replacement with new window frames and non PCB-containing caulk at P.S. 183Q; and, 5) Best Management Practices at all Pilot School Buildings. Based on the current data, with the exception of the Best Management Practices, each of these alternative remedial approaches, as designed and implemented in this Pilot Study, have been shown to be relatively ineffective over the long term as lone remedies. Best Management Practices have been shown to be effective at reducing surface dust levels below USEPA criteria. Long-term monitoring results, however, suggest that removal and replacement of PCB caulk, without additional actions to isolate the underlying substrate prior to installing the new caulk, is of limited benefit as a remedial alternative over the long term. Additionally, results suggest that encapsulation of PCB caulk, using the various coatings and methodology employed in the Pilot Study, is also of limited benefit as a remedial alternative to isolate PCB caulk over the long term. Accordingly, additional and/or revised remedial approaches should be explored and evaluated prior to identifying a preferred remedy for PCB caulk and Best Management Practices should be included as part of the final Pilot Preferred Remedy.

- The Pilot Study determined that the replacement of PCB light ballasts and associated fixtures is a successful remedial measure for lowering PCB levels in indoor air where concentrations exceed the USEPA air guidance values. Light fixture replacements were implemented at P.S.309K, P.S. 178X/176, and P.S. 199M as supplemental remedial measures, and at P.S. 3R as the primary remedial measure. Light fixture replacement is effective where a supplemental remedy is necessary, and also as a primary remedial measure. Accordingly, the Pilot Preferred Remedy includes light fixture replacement at the Pilot School Buildings. Light fixture replacement will be implemented at P.S. 183Q in accordance with the Greener, Healthier Schools for 21st Century and Energy Savings Performance Contracting (ESPC) program.

- PCB contamination of soil encountered in Outside Exposure Areas at P.S. 199M, P.S. 178X/176 and P.S. 309K was successfully mitigated through the process of delineation, excavation, and off-site disposal. The PCB contaminated soil identified in the outdoor exposure areas at P.S. 183Q and P.S. 3R should be excavated and disposed utilizing these same protocols. A Soil Remediation Plan should be created for USEPA approval and soils above 1 ppm should be remediated by excavation and off-site disposal, and confirmatory post-excavation soil results should be obtained. In addition, the soil should be backfilled with clean fill and surface features should be reestablished. Exterior caulk at the Pilot School Buildings should be periodically inspected and be repaired to the extent it becomes damaged or deteriorated.

This proposed Pilot Preferred Remedy – based on a detailed assessment of currently available remedial strategies and technologies – offers a reasoned approach meant to efficiently manage PCB Caulk, PCB light ballasts and associated fixtures, and contaminated surface soils in outside exposure areas, at the Pilot School Buildings. This proposed Pilot Preferred Remedy is subject to USEPA review and possible modification prior to approval.

1.0 INTRODUCTION

1.1 Purpose

At the request of the New York City School Construction Authority (SCA), TRC Engineers, Inc. (TRC) has prepared this Remedial Investigation (RI) Report for the PCB Pilot Study activities conducted in NYC school buildings. This report is part of the Consent Agreement and Final Order (CAFO) (Docket Number TSCA-02-2010-9201) between the City of New York and the USEPA Region 2. The City chose five Pilot School Buildings to evaluate various remedial remedies. The Pilot Study was implemented in two primary phases. In the first phase, from June 2010 through November 2010, the SCA implemented a remedial investigation of three of the five Pilot School Buildings (P.S. 178X/176, P.S. 199M, and P.S. 309K) in accordance with the CAFO and the RI Plan. The scope, results, findings and recommendations of these initial remedial investigations are presented in the Interim Remedial Investigation Report (IRIR) dated June 15, 2011, Addendum No. 1 to the Report dated October 5, 2011, and the USEPA approval letter dated October 20, 2011 (refer to Appendix J for both documents).

This Final RI Report (RIR) summarizes the Pilot Study remedial strategies and associated Pilot Study results of bulk caulk, air, wipe and soil sampling and analysis conducted in the second phase of remedial investigations, from April 2011 through October 2011, that evaluated whole school remedies in P.S. 199M, P.S. 178X, and P.S. 309K, light ballast replacement in P.S. 3R and window replacement in P.S. 183Q. This RIR also summarizes subsequent long-term monitoring sampling and additional activities performed from January 2012 through April 2012.

The purpose of the Pilot Remedial Investigation is to evaluate the possible presence of PCB Caulk located in primary, transitory and outside exposure areas (defined in the CAFO and Section 3.1 of the approved RI Plan), and evaluate preferred remedial strategies with consideration of: effectiveness of the remedy; logistics; disruption to educational activities; and overall costs. The Pilot Study also requires supplemental investigation and remedial work where post-remedial sampling indicates the potential presence of another non-caulk source. As a result of findings of the first phase conducted in 2010, the July 9, 2010 Remedial Investigation (RI) Plan was modified to evaluate PCB light ballast and fixture removal at P.S. 3R and the revised window replacement scope of work at P.S. 183Q through the November 23, 2010 modification approved by USEPA on November 29, 2010. This Final RIR presents the results of RI activities conducted over the summer of 2011 in Pilot School Buildings P.S. 178X/176, P.S. 199M, P.S. 309K, P.S. 183Q, and P.S. 3R, additional activities that were performed due to post-remedial air sample results elevated over USEPA guidance values, results of the first round of long-term monitoring performed at P.S. 178X/176, P.S. 199M and P.S. 309K, as well as supplemental activities undertaken in early 2012. This RIR provides a recommended pilot preferred remedial strategy for the Pilot School Buildings.

1.2 Background

1.2.1 Description of the Issue

Although the manufacture and most uses of PCBs were banned in 1979, , buildings that were constructed or renovated from 1950 to 1978, including schools, may have PCBs in the caulk. Exposure to PCBs in caulk may occur as a result of their release from the caulk into the air, dust, surrounding surfaces and soil, and through direct contact. In September, 2009, the USEPA published a series of guidance materials pertaining to the management of PCB Caulk in older buildings. The guidance materials explained the current state of knowledge regarding PCB Caulk and set forth best management practices for addressing PCB Caulk. On January 19, 2010, the City, SCA, and USEPA reached an agreement to address the risks posed by PCBs in caulk by performing a Pilot Study to provide information to guide the development of a city-wide approach to assessing and reducing potential exposures to PCBs in caulk in New York City school buildings. If PCB levels in the air of the pilot schools still exceeded EPA guidance values, the CAFO then required the City and SCA to investigate and, if necessary, remediate other sources of PCBs as part of the study.

1.2.2 Description of PCB Caulk

The USEPA defines "PCB Caulk" as caulk that contains PCBs at concentrations of 50 parts per million (ppm) or greater. For purposes of the RI, caulk was defined as "any semi-drying or slow drying plastic material used to seal joints or fill crevices around window frames or panes, doors, or other building components; caulk does not include coatings, glazing varnishes or sealants that are or were applied as liquids" (U.S. EPA 2010a).

1.2.3 Description of Pilot School Buildings

The New York City Department of Education (DOE) and the SCA identified all school buildings that were constructed between 1950 and 1978. From this list, the SCA proposed five Pilot School Buildings for exploratory study. One school from each borough, with varying building age, PCB concentration and physical caulk condition, was selected to be in the Pilot Study. The five Pilot School Buildings proposed for the study and approved by the USEPA are:

Table 1.1 – Summary of Five Pilot School Buildings

NYC School ID	School Name	Address and Telephone No.	Current Student Education Levels
178X/176	Dr. Selman Waksman School/ P.S. 176@ P.S. 178X	850 Baychester Ave. Bronx, NY 10475 718-904-5570	Grades K-5/ Grades PK – 12
199M	Jessie Isador Straus School	270 West 70th Street Manhattan, NY 10023 212-799-1033	Grades K-5
309K	George E. Wibecan Preparatory Academy/Excellence Charter School for Girls	794 Monroe Street Brooklyn, NY 11221 718-574-2381	Grades PK – 5/ Grades K – 1
183Q	Dr. Richard R. Green School	2-45 Beach 79th Street Queens, NY 11693	Grades PK-8
3R	The Margaret Gioiosa School	80 South Goff Ave. Staten Island, NY 10309	Grades PK-5

K = Kindergarten
PK = Pre-Kindergarten

A brief summary of the relevant architectural and mechanical systems at the Pilot School Buildings follows:

- **P.S. 178X/176 -** This school is housed in a three-story brick and concrete building constructed in 1972. Five central heating, ventilation, and air conditioning (HVAC) units are located on the roof and one HVAC unit is located in the basement of the building. Each unit services a different zone inside the building. The zones are organized as North, South, East, West, and Center. There is central air conditioning (A/C) and perimeter radiant heat. Approximately seven window-mounted A/C units supplement the central HVAC system. Hot water is supplied to the building from an off-site location. The hot water is pumped to the rooftop and basement HVAC units for heating. The windows are double-paned with a membrane between the panes and have aluminum casing. Window glazing was recently replaced throughout the school.

- **P.S. 199M -** This school is housed in a three-story brick building constructed in 1962. The mechanical systems consist of a classroom and bathroom exhaust system, with perimeter heating units. Make-up air for this system is provided by operable windows. There are 19 rooftop exhaust fans that service the classrooms and bathrooms. The gymnasium and auditorium utilize forced air for heating and ventilation. The gym and auditorium are serviced by separate blower and exhaust fans located in mechanical rooms on the second and third floors. Outside air enters the gym and auditorium systems through louvers located in the third floor mechanical room. There are window mounted A/C units in the majority of the classrooms. Windows (including frames) were recently replaced in this school.

- **P.S. 309K -** This school is housed in a three-story brick building constructed in 1963. The mechanical systems consist of a classroom and bathroom exhaust system, with perimeter heating units. Make-up air for this system is provided by operable windows. There are a total of 15 exhaust fans, ten of which are located on the upper roof and five on the lower roof. Basement fans provide forced air heat and ventilation to the auditorium and gym. Outside air enters the gym and auditorium systems through louvers located in the basement mechanical room. There are window mounted A/C units in the majority of the classrooms. Windows (including frames) were recently replaced in this school.

- **P.S. 183Q** – This school is housed in a three-story brick building built in 1961. Four HVAC units are located on the roof; however, these HVAC units are not operable. There are also eleven exhaust fans located on the roof. Approximately ten window-mounted and ten portable units supply air conditioning in certain building spaces. Hot water and steam heat is supplied to the building from two boilers in the basement that operate on No. 6 fuel oil. Wall-mounted steam radiators are utilized throughout the building. The first floor and stairwell windows are "hopper" windows that fold inward to open. The second and third floor windows consist of two sets of operable double paned sashes for airplane noise reduction in each location.

- **P.S. 3R** – This school is housed in a one-story brick building with a basement. P.S. 3R was built in 1959, with additions in 1968 and 2005. The portion of the school that was constructed in 2005 is not included in the Pilot Study. The mechanical systems consist of a classroom exhaust system vented to the roof. Steam heated radiators are located in each room. Offices contain window-mounted air conditioning units. Three rooftop HVAC units service the newly constructed portion of the school.

1.2.4 Overview of Remedial Investigations

The scope of the remedial investigations, which have been completed within the five Pilot School Buildings, generally followed the sequential phasing of work as described below:

- Performed a caulk survey (including sampling, location, quantity, and condition) to inventory suspected PCB Caulk, as required.

- Conducted pre-remedial air and wipe sampling for laboratory analysis in the Pilot Study Areas. Samples were collected indoors, from primary exposure areas and transitory areas where students are typically located, immediately before performing remedial alternatives.
- Conducted soil sampling in unpaved areas immediately surrounding the building for laboratory analysis.
- Evaluated various remedial alternatives in each Pilot School Building in the areas where the pre-remedial sampling occurred. The remedial alternatives selected, in consultation with USEPA, for evaluation during the Pilot Study were:

  (1) Patch and repair of caulk (i.e., remove loose and deteriorating caulk and replace with new non PCB-containing caulk);

  (2) Encapsulation of caulk;

  (3) Removal of all caulk and replacement with new non PCB-containing caulk;

  (4) Window frame and caulk removal and replacement with new window frames and non PCB-containing caulk;

  (5) Removal and replacement of PCB light fixtures and ballasts; and,

  (6) Best management practices (i.e., use pre-remedial sampling data from each Pilot School Building to evaluate the effectiveness of current operation and maintenance practices).

  Remedial alternatives (1), (2), and (3) were evaluated in the Pilot School Buildings - P.S. 178X/176, P.S. 309K, and P.S. 199M, respectively. In each of these schools, the remedial alternatives were implemented in only limited Pilot Study areas in 2010; the remainder of the areas throughout the schools were remediated in 2011. Remedial alternative (4) was implemented in 2011 in all areas where windows had not been previously replaced in P.S. 183Q. Remedial alternative (6) was also evaluated in each of the five Pilot School Buildings through the evaluation of the pre-remediation sampling data. In addition, due to findings in the first three Pilot School Buildings studied during 2010, removal of light fixture PCB ballasts was evaluated as a remedial alternative in one Pilot School Building (P.S. 3R) in 2011 pursuant to the SCA RI Plan modification dated November 23, 2010, which was approved by the USEPA in correspondence dated November 29, 2010.
- Collected post-remedial air and wipe samples for laboratory analysis from the same locations as the pre-remedial air samples to evaluate the effectiveness of the remedial efforts.
- Conducted an exterior caulk survey and sampling (from windows, doors, louvers, and perimeter caulk) for laboratory analysis as warranted by the results of the soil sampling.
- Performed long-term monitoring wipe sampling of encapsulated caulk at P.S. 309K;
- Performed long-term monitoring bulk caulk sampling of replacement caulk at P.S. 178X and P.S. 199M;
- Performed additional remedial activities in each of the Pilot School Buildings as described in Section 7.
- Evaluated all data from sampling and remedial activities.
- Prepared this RI Report that describes and evaluates all Pilot Study sampling and remedial activities completed in the five Pilot School Buildings, including an evaluation of pre-remedial conditions and the effectiveness of current protocols.

- Prepared the appended Feasibility Study Report.

As described in further detail in Section 7.0, additional post-pilot remedial efforts were subsequently undertaken in each of the Pilot School Buildings, including additional cleaning in select rooms and areas at P.S. 3R, P.S. 183Q, and P.S. 309K, installation of granular activated carbon air filtration units in normally occupied areas at P.S. 199M, removal of deteriorated caulk in one stairwell at P.S. 3R, conducting indoor temperature and pollutant pathway studies at P.S. 199M, and performing additional ventilation studies at P.S. 309K. Additional rounds of air samples for PCBs were collected and analyzed to gauge the relative effectiveness of the measures taken in each school.

With respect to the first bullet above, paragraph 21 of the CAFO contains USEPA's acknowledgement that neither TSCA nor its implementing regulations mandate the testing of caulk for PCBs, except to characterize such materials for waste disposal purposes. Paragraph 21 further states that any sampling of caulk that respondents perform, except that conducted in order to characterize waste materials for disposal purposes, is not required by the TSCA regulatory provisions. In addition, paragraph II.B(C) of the NYC Work Plan provides that the SCA only needs to sample caulk as part of the Pilot Study if certain conditions within the school are identified.

However, in order to enhance the results of the Pilot Study, the USEPA requested and the City agreed to voluntarily perform additional caulk sampling as part of this work plan. Sampling and analysis of caulk is being carried out by the City and the SCA with the understanding that the results will not become the basis for any enforcement action by the USEPA, subject however to paragraph 63 in the Consent Agreement and Final Order in the matter of the City and the SCA, docket number TSCA-02-2010-9201.

1.2.5 Applicable Comparison Criteria

- **Bulk Caulk Samples**

  Any bulk caulk sample (hereafter referred to as "caulk samples") that equaled or exceeded 50 ppm of total PCBs was considered to be PCB Caulk.

- **Air Samples**

  Based upon USEPA's indoor air guidelines for schools and ages of building occupants (U.S. EPA 2009), all air sampling results were compared against the following values listed in Table 1.2 located on the following page:

Table 1.2 – USEPA's Public Health Guidance Values for PCBs in School Indoor Air (ng/m^3)

Age 3 to <6 yr (Pre Kindergarten and Kindergarten)	Age 6 to <12 yr (Elementary School)	Age 12 to <15 yr (Middle School)	Age 15 to<19 yr (High School)	Age 19+ yr (Faculty)
100	300	450	600	450

It is important to note that USEPA guidance contained in the document entitled "Proper Maintenance, Removal, and Disposal of PCB-Containing Fluorescent Light Ballasts" states, "In order to provide guidance on levels of concern regarding chemicals in the environment, USEPA develops reference doses (RfD) and concentrations (RfC). A reference dose is an estimate of a daily oral exposure level that the human population, including sensitive subpopulations, that if one were exposed to for a lifetime, would not cause appreciable risk to human health. USEPA's RfD for the one type of PCB, Aroclor 1254, is 0.02

micrograms per kilogram per day. Based on this RfD and exposure factors such as typical air inhalation rates and the period of time spent at school, USEPA has estimated the PCB levels of 0.2 - 0.3 micrograms per cubic meter of air in schools would not result in harmful effects to human health even if one were exposed over a lifetime. This is a conservative, health protective estimate. USEPA's goal is not to have people exposed above this RfD level. Exceeding this level does not mean that adverse effects will necessarily occur. However, as exposure levels become higher, USEPA has less confidence that the exposures will not result in adverse effects."

- **Surface Wipe Samples**

  Pre- and post-remedial wipe samples were compared to USEPA's High Occupancy wipe sample criteria of 10 µg/100 cm^2 (40 CFR 761.3, 761.123 and 761.30).

- **Soil Samples**

  Soil samples were compared to USEPA's clean backfill standard (40 CFR 761.125(c)(4) (v) and 40 CFR 761.125(b)(1) (ii)) and the New York State Department of Environmental Conservation (NYSDEC) CP-51/Soil Cleanup Guidance and 6 NYCRR Part 375 value of 1 ppm for PCBs.

1.2.6 Target Laboratory Reporting Limits

Laboratory reporting limits for each of the PCB Aroclors in the different sampling media were as follows:

- **Caulk Samples –** 1.0 milligram per kilogram (mg/kg).
- **Air Samples –** 50 nanograms per cubic meter (ng/m^3).
- **Surface Wipe Samples –** 0.1 micrograms per 100 square centimeters (µg/100 cm^2).
- **Soil Samples** – 0.5 mg/kg.

2.0 INITIAL BULK INTERIOR CAULK SURVEY AND SAMPLING

2.1 Bulk Caulk Survey and Sampling Procedures

Interior caulk in the Pilot Study areas was surveyed and sampled for laboratory analysis in 2011 in accordance with Appendix D of the RI Plan in four of the five Pilot School Buildings. Bulk caulk surveying and sampling was not performed in P.S. 3R in accordance with the USEPA-approved RI Plan modification dated November 23, 2010 as this remedial alternative evaluated PCB-ballast and lighting fixture removal; Refer to Table 2.1 in Section 2.6 below for a summary of the areas included in the Pilot Study.

Caulk within P.S. 183Q was evaluated in areas targeted as Pilot Study Areas, as identified in Section 3.3 of the RI Plan as modified by the USEPA-approved RI Plan modification. To supplement previous sampling events, in P.S. 199M, P.S. 309K, and P.S. 178X/176, areas not subject to surveying and sampling as part of the initial Pilot Study performed in 2010 were targeted. Appendix D contains completed NYCSCA Pre-Remedial PCB Caulk Pilot Study Area Caulk Inspection Forms documenting the scope of the survey in each school, as well as the physical location, description, and condition of the caulk.

PCB Caulk is considered to be caulk found to contain greater than 50 ppm PCBs. The approach to evaluating the presence of PCB Caulk in each Pilot Study area included a survey and sampling of suspect interior caulk materials. Glazing as part of the window system, where appropriate, was also included in the sampling event. Caulk which had been recently replaced (e.g., associated with recent window replacement) was not considered suspect since PCBs have been banned from production since 1978. Once the survey in each area of the school was complete, representative caulk samples were collected in each Pilot Study area based on homogenous materials (i.e., color, location, age of the building area, use, and renovation/repair history). Caulk samples were collected by physically removing sections of caulk using disposable stainless steel scalpels/utility knives. Sampling equipment was dedicated for each sample. Whenever possible, three (3) sub-samples of approximately ten (10) grams each were collected. Each sub-sample was placed in a separate, pre-cleaned glass jar with a Teflon-lined cap.

Samples were collected and containerized in accordance with USEPA protocols and sample methodology. Containers were properly labeled, preserved, and placed in a cooler for transport by courier to Northeast Analytical, Inc. (NEA) - A Division of Pace Analytical Services. NEA is a NYSDOH ELAP-certified analytical laboratory for USEPA Method 8082 analysis. Standard chain-of-custody procedures were followed.

The analytic laboratory was directed to create one (1) composite sample of each homogenous material from equal mass portions (±5%) of the three (3) sub-samples for extraction. Interior caulk samples were then prepared using Soxhlet extraction and analyzed by USEPA Method 8082 for PCB Aroclors. Results of analyses are presented in tables 1A, 2A, 3A and 4A.

2.2 P.S. 178X/176 Bulk Caulk Survey and Sampling Results

TRC evaluated the interior caulk at P.S. 178X/176 prior to any pre-remedial sampling or remediation. From April 25 to 26, 2011, TRC collected interior caulk samples from a total of thirty-two (32) homogenous materials. Laboratory results of the caulk samples indicated that PCB concentrations ranged from non-detect (less than 1.00 mg/kg) to 71,700 mg/kg, which can be found in Table 1A. Refer to Figures 1B, 1C, 1D, and 1E for the sampling locations. Seventy-seven (77) locations areas were surveyed and/or sampled to determine the presence of PCB Caulk and its condition prior to the implementation of the remedial alternative. The results of this survey are presented in Table 1B.

A total of fifteen (15) locations were noted to contain PCB Caulk, of which the caulk in eight (8) locations was damaged or significantly damaged. PCB Caulk was patched and repaired or, if loose, was removed and replaced with non PCB-containing caulk as part of the remedial alternative as discussed in Section 4.1 below.

2.3 P.S. 199M Bulk Caulk Survey and Sampling Results

TRC evaluated the interior caulk at P.S. 199M prior to any pre-remedial sampling or remediation. Between April 14 and 25, 2011 and on May 12, 2011, TRC collected interior caulk samples from a total of thirty-five (35) homogenous materials. Laboratory results for the caulk samples indicated that PCB concentrations ranged from non-detect (less than 1.00 mg/kg) to 138,000 mg/kg, which can be found in Table 2A. Refer to Figures 2B, 2C, 2D, and 2E for the sampling locations. Fifty-two (52) locations/areas were surveyed and/or sampled to determine the presence of PCB Caulk prior to the implementation of the remedial alternative. The results of this survey are summarized in Table 2B.

A total of four (4) locations were noted to contain PCB Caulk, of which the caulk in three (3) locations was damaged or significantly damaged. PCB Caulk was removed and replaced with non PCB-containing caulk as part of the remedial alternative discussed in Section 4.3 below.

2.4 P.S. 309K Bulk Caulk Survey and Sampling Results

TRC evaluated the interior caulk at P.S. 309K prior to any pre-remedial sampling or remediation. Between April 12 and 13, 2011, TRC collected interior caulk samples from a total of twenty-one (21) homogenous materials. Laboratory results of the caulk samples indicated that PCB concentrations ranged from non-detect (less than 1.00 mg/kg) to 92,100 mg/kg, which can be found in Table 3A. Refer to Figures 3B, 3C and 3D for the sampling locations. Fifty (50) locations/areas were surveyed and/or sampled to determine the presence of PCB Caulk prior to the implementation of the remedial alternative. The results of this survey are summarized in Table 3B.

A total of sixteen (16) locations were noted to contain PCB Caulk, of which the caulk in eight (8) locations was damaged or significantly damaged. All PCB Caulk was encapsulated as part of the remedial alternative as discussed in Section 4.4 below.

2.5 P.S. 183Q Bulk Caulk Survey and Sampling Results

TRC surveyed the interior caulk in areas where windows were to be replaced at P.S.183Q prior to any pre-remedial sampling or remediation (exterior caulk was also surveyed, as discussed in Section 6.2). Between April 12 and 13, 2011, TRC collected interior caulk samples from a total of sixty-three (63) homogenous materials. Laboratory results of the caulk samples indicated that PCB concentrations ranged from non-detect (less than 1.00 mg/kg) to 306,000 mg/kg. The results can be found in Table 4A. Refer to Figures 4B, 4C and 4D for the sampling locations. Twelve (12) areas were surveyed and/or sampled to determine the presence of PCB Caulk prior to the implementation of the remedial alternative. The results of this survey are summarized in Table 4A.

A total of five (5) locations were noted to contain PCB Caulk. Each of the five locations contained damaged or significantly damaged caulk. PCB Caulk was remediated through the complete removal and replacement of window systems, as part of the remedial alternative as discussed in Section 4.5 below.

2.6 Final Selection of Pilot Study Areas

After the conclusion of the bulk caulk survey and sampling, the Pilot Study Areas to be included in the Pilot Study within each of the five schools were identified. Sample results for bulk caulk samples collected in 2010, as presented in the IRIR, and in 2011, as presented in this report, were used in determining which areas and materials would be subject to remediation efforts. The Pilot Study Areas for the five schools are identified in Table 2.1. In 2011, remedial efforts were implemented on a school wide basis; however the Pilot Study areas represent the locations where Pilot Study sampling occurred.

Table 2.1 – Final List of Pilot Study Areas

NYC School ID	Pilot Study Areas

P.S 178X/176	**Primary Exposure Areas**
	• Classroom Areas
	  - Rooms 142 and 179 – 1^{st} Floor
	  - Rooms 204, 207 and 237 – 2^{nd} Floor
	  - Rooms 307, 323, 339 and 358 – 3^{rd} Floor
	• Kitchen (Room 128) – 1^{st} Floor
	
	Transitory Areas
	• Room 118 Foyer – 1^{st} Floor
	• Northwest Lobby (Room 164) – 1^{st} Floor
	• Northeast Lobby (Room 147) – 1^{st} Floor
	• East Corridor – 2^{nd} Floor
	• Bathroom (Room 363) – 3^{rd} Floor
	
	Outside Exposure Areas
	• Soil Remediation – All Sides of Building
	• Exterior Caulk Remediation – North, East and South Sides of Building

P.S. 199M	**Primary Exposure Areas**
	• Classroom Areas
	  - Rooms 110 and 118 – 1^{st} Floor
	  - Rooms 216 and 224 – 2^{nd} Floor
	  - Rooms 306, 314 and 332 – 3^{rd} Floor
	• Room 130 Office – 1^{st} Floor
	• Auditorium – 1^{st} Floor
	• Gym – 2^{nd} Floor
	
	Transitory Areas
	• West and East Corridors – 1^{st} Floor
	• Exit 4 – 1^{st} Floor
	• North and East Corridors – 2^{nd} Floor
	• Stairwell 2 – 2^{nd} Floor
	• South and West Corridors – 3^{rd} Floor
	• Stairwell 3 – 3^{rd} Floor
	
	Outside Exposure Areas
	• Soil Remediation – East, South and West Sides of Building
	• Exterior Caulk Remediation – All Sides of Building

Table 2.1 – Final List of Pilot Study Areas

NYC School ID	Pilot Study Areas
P.S. 309K	**Primary Exposure Areas** • Classroom Areas - Rooms 102 and 145 – 1st Floor - Rooms 205, 210 and 220 – 2nd Floor - Rooms 300, 309 and 318 – 3rd Floor **Transitory Areas** • Rooms 141/143 Vestibule – 1st Floor • North and East Corridors – 1st Floor • West Stairwell – 1st Floor • Corridor – 2nd Floor • Corridor – 3rd Floor • East Stairwell – 3rd Floor **Outside Exposure Areas** Soil Remediation – North Side of Building
P.S. 183Q	**Primary Exposure Areas** • Classroom Areas – Rooms 103, 105, 107, 109, 133, 139 and 151 – 1st Floor • Cafeteria – 1st Floor • Gym – 2nd Floor **Transitory Areas** • Southwest Staircase (Staircase D) –2nd Floor • South Corridor – 3rd Floor • Northeast Staircase (Staircase B) – 3rd Floor **Outside Exposure Areas** • Soil Sampling – North and South Sides of Building • Exterior Caulk Sampling – All Sides of Building
P.S. 3R	**Primary Exposure Areas** • Gym – Basement • Classroom Areas – Rooms 107, 116, 125 and 159 – 1st Floor • Cafeteria – 1st Floor **Transitory Areas** • East Staircase (Staircase A) – 1st Floor • West Corridor – 1st Floor • Southwest Corridor – 1st Floor **Outside Exposure Areas** • Soil Sampling – East and South Sides of Building and North and South Courtyards • Exterior Caulk Sampling – East and South Sides of Building and North Courtyard

Areas that were sampled during the bulk caulk sampling and found not to contain PCB Caulk were typically not included in the Pilot Study. However, as requested by the USEPA, pre and post-remedial air and wipe sampling was performed in select classroom areas in P.S. 178X/176, P.S. 309K and P.S. 199M, even though those areas did not contain PCB Caulk and were not subjected to remedial activities.

The following table summarizes the number of rooms/areas subjected to air samples and wipe samples in each school by type of interior exposure area.

Table 2.2 – Summary of Pilot Study Areas

School Building ID	Total Number of Classrooms	Number of Rooms/Areas Sampled		
		Classrooms	Transitory Areas	Cafeteria/Gym/Library Kitchen/Office/ Auditorium
P.S 178X/176	60	9	4	1
P.S 199M	42	7	6	3
P.S 309K	39	8	0	0
P.S. 183Q	43	7	3	2
P.S. 3R	27	4	3	2

Although the Pilot Study sampling focused on these representative spaces in the Pilot School Buildings, in the case of P.S 178X/176, P.S 199M, and P.S 309K; the remainder of the PCB Caulk identified in each building was remediated in 2011. Similarly, at P.S. 3R, the light fixture removal and replacement was implemented school-wide. At P.S. 183Q, the window replacement was limited to the first floor, the stairwells and bulkheads, and the Roof C/north corridor and Roof D/south corridor on the 3rd floor, as all other windows had previously been replaced.

3.0 PRE-REMEDIAL SAMPLING

3.1 Overview

Pre-Remedial wipe and air sampling at P.S. 178X/176, P.S 199M, P.S. 309K, P.S. 183Q, and P.S. 3R was conducted prior to implementation of remedial measures to determine background interior concentrations of PCBs in surface dust and in the air. Composite wipe samples were collected from high and low contact surfaces in each Pilot Study Area. High contact surfaces are defined as surfaces that are routinely contacted by students and teachers (i.e., tables, desktops, doorknobs, etc). Low contact surfaces are defined as surfaces that are not routinely contacted by students and teachers including floors and window sills. Pre-remedial air samples were collected in the center of each Pilot Study Area as described below. At each school an outdoor air sample was also collected concurrently with interior air samples for comparison purposes.

3.2 Pre-Remedial Wipe Sampling

3.2.1 Wipe Sampling Procedures

Wipe samples were collected in accordance with standards detailed in 40 CFR 761.3, 761.123, and 761.30(j) *Research and Development* which authorizes chemical analyses to determine PCB concentrations, as per Appendix F of the RI Plan. Samples were collected utilizing PCB-free gauze wipes, wetted with hexane. In each sample location, a 100 cm^2 area was wiped using 10 cm by 10 cm templates, in accordance with American Society for Testing and Materials (ASTM) *Standard Practice for Field Collection of Organic Compounds from Surfaces Using Wipe Sampling*. The samples were analyzed for PCBs using gas chromatography (GC) in accordance with USEPA SW846 Method 8082 with five peak match following Soxhlet Extraction (SW846 Method 3540C). Standard chain-of-custody procedures were followed and analysis of the samples was performed by NEA.

3.2.2 P.S. 178X/176 Pre-Remedial Wipe Sampling Results

A total of 30 pre-remedial wipe samples (composites of two samples from the same surface type), plus one field blank, were collected on June 11, 2011. Pre-remedial wipe sample room locations are depicted in Figure 1F, 1G and 1H. Laboratory results for the wipe samples indicate that they ranged from non-detect (less than 0.100) to 1.09 $\mu g/100cm^2$. Please refer to Table 1C for a summary of the results.

3.2.3 P.S. 199M Pre-Remedial Wipe Sampling Results

A total of 38 pre-remedial wipe samples (composites of two samples from the same surface type), plus one field blank, were collected on June 18, 2011. Pre-remedial wipe sample room locations are depicted in Figures 2F, 2G, and 2H. Laboratory results for the wipe samples indicate that they ranged from non-detect (less than 0.100) to 1.118 $\mu g/100cm^2$. Please refer to Table 2C for a summary of the results.

3.2.4 P.S. 309K Pre-Remedial Wipe Sampling Results

A total of 30 pre-remedial wipe samples (composites of two samples from the same surface type), plus one field blank, were collected on June 25, 2011. Pre-remedial wipe sample room locations are depicted in Figures 3F, 3G, and 3H. Laboratory results for the wipe samples indicate they ranged from non-detect (less than 0.100) to 1.60 $\mu g/100cm^2$. Please refer to Table 3C for a summary of the results.

3.2.5 P.S. 183Q Pre-Remedial Wipe Sampling Results

A total of 24 pre-remedial wipe samples (composites of two samples from the same surface type), plus one field blank, were collected on June 26, 2011. Pre-remedial wipe sample room locations are depicted in Figures 4E, 4F and 4G. Laboratory results for the wipe samples indicate they ranged from non-detect (less than 0.100) to 1.23 µg/100cm^2. Please refer to Table 4C for a summary of the results.

3.2.6 P.S. 3R Pre-Remedial Wipe Sampling Results

A total of 18 pre-remedial wipe samples (composites of two samples from the same surface type), plus one field blank, were collected on May 28, 2011. Pre-remedial wipe sample room locations are depicted in Figures 5B and 5C. Laboratory results for the wipe samples indicate they ranged from non-detect (less than 0.100) to 2.10 µg/100cm^2. Please refer to Table 5A for a summary of the results.

3.3 Pre-Remedial Air Sampling

3.3.1 Air Sampling Procedures

Indoor air samples were collected in accordance with USEPA Method TO-10A *(Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using Low Volume Polyurethane Foam (PUF) Sampling followed by Gas Chromatographic/Multi-Detector Detection (GC/MD))* per Appendix E of the RI Plan.

Air samples were collected at a flow rate of approximately five (5) liters per minute for approximately 400 minutes to obtain a total volume of approximately 2,000 liters in order to achieve a 50 ng/m^3 detection limit. Samples collected in classrooms and offices were taken near the center of each room in the breathing zone at desk level, away from doors, windows, and vents. At P.S. 178X/176, which has central air conditioning, the windows were kept closed during sampling. Per agreement with the USEPA, at P.S. 199M, P.S. 309K, P.S. 3R, and P.S. 183Q, where there is no central air conditioning of the school, if window mounted air conditioners were present in the study areas they were operated with the fresh air vent open during the sampling period and the windows were kept closed. In these schools, if the study area did not have a window mounted air conditioner, the windows were slightly open during sampling. The samples were sent to the laboratory by courier to NEA and analyzed for PCBs using gas chromatography in accordance with USEPA SW846 Method 8082 with five peak match. Standard chain-of-custody protocols were followed and analysis of the samples was performed by NEA. An Extech SD700 Barometric Pressure/ Humidity/Temperature Datalogger was used to continuously log indoor ambient temperature and barometric pressure during each sampling event. The daily temperature and barometric pressure averages were then used to calculate the actual air sample volumes in accordance with Method TO-10A.

3.3.2 P.S. 178X/176 Pre-Remedial Air Sampling Results

Prior to conducting the 2011 Pre-Remedial Air Sampling at P.S. 178X/176, air samples were taken during the heating season with windows closed to represent normal spring conditions. Please note that winter data for the other two initial pilot schools, P.S. 199M and P.S. 309K, were previously reported in the Interim Remedial Investigation Report.

A total of 28 spring condition air samples were collected on April 20, 2011. The samples consisted of 21 area samples, three duplicate samples, three front/back samples to evaluate Apparent Collection Efficiency (ACE), and one ambient air sample for comparison purposes. Air samples were collected from the locations described in the RI Plan and depicted in Figures 1I, 1J and 1K. Laboratory results for the air samples ranged from non-detect (less than 47.5 ng/m^3) to 142 ng/m^3. After implementing a normal, custodial cleaning in Room 179 where the April 20, 2011 result was above the USEPA guidance value an additional air sample was collected on May 14, 2011. One duplicate sample and one ambient air sample were also collected on May 14, 2011. Air samples were collected from the locations depicted in Figures 1I, 1J and 1K. All laboratory results for these samples were non-detect (less than 50.0 ng/m^3). Please refer to Table 1D for a summary of the April and May results from P.S. 178/176X.

A total of 19 pre-remedial air samples were collected on June 11, 2011. The samples consisted of 15 area air samples, one duplicate sample, two front/back samples to evaluate ACE, and one ambient air sample for comparison purposes. In addition, two field spiked samples, and one field blank were collected for quality control purposes. Air samples were collected from the locations described in the RI Plan and are depicted in Figures 1I, 1J and 1K. Laboratory results for the air samples ranged from non-detect (less than 47.9 ng/m^3) to 112.1 ng/m^3. Please refer to Table 1E for a summary of the results from P.S. 178X/176.

3.3.3 P.S. 199M Pre-Remedial Air Sampling Results

A total of 23 pre-remedial air samples were collected on June 18, 2011. The samples consisted of 19 area samples, one duplicate sample, two front/back samples to evaluate ACE, and one ambient air sample for comparison purposes. In addition, two field spiked samples, and one field blank were collected for quality control purposes. Air samples were collected from the locations described in the RI Plan and depicted in Figures 2I, 2J and 2K. Laboratory results for the air samples indicate that they ranged from non-detect (less than 49.1 ng/m^3) to 1,005 ng/m^3. Please refer to Table 2D for a summary of the sample results.

3.3.4 P.S. 309K Pre-Remedial Air Sampling Results

A total of 19 pre-remedial air samples were collected on June 25, 2011. The samples consisted of 15 area samples, one duplicate sample, two front/back samples to evaluate ACE, and one ambient air sample for comparison purposes. In addition, two field spiked samples, and two field blank samples were collected for quality control purposes. Air samples were collected from the locations described in the RI Plan and are depicted in Figures 3I, 3J and 3K. One sample (309-WST1-AR-PRE-7) was broken by the laboratory during analysis. Laboratory results for the other 14 pre-remedial area air samples indicate they ranged from non-detect (less than 48.9 ng/m^3) to 225.9 ng/m^3. Please refer to Table 3D for a summary of pre-remedial air sampling results from P.S.309K.

3.3.5 P.S. 183Q Pre-Remedial Air Sampling Results

A total of 16 pre-remedial air samples were collected on June 26, 2011. The samples consisted of 12 area samples, two front/back to evaluate ACE, one duplicate sample and one ambient sample for comparison purposes. In addition, two field spike samples, and two field blank samples were for quality control purposes. Air samples were collected from the locations described in the RI Plan and depicted in Figures 4H, 4I and 4J. One sample (183-133-AR-PRE-5) was broken by the laboratory while awaiting transfer to a Turbo-Tube. Laboratory results for the other 11 pre-remedial area air samples indicate they ranged from non-detect (less than 48.9 ng/m^3) to 867 ng/m^3. Please refer to Table 4D for a summary of pre-remedial air sampling results from P.S. 183Q.

3.3.6 P.S. 3R Pre-Remedial Air Sampling Results

A total of 13 pre-remedial air samples were collected on May 28, 2011. The samples consisted of nine (9) area samples, two front/back samples to evaluate ACE, one duplicate sample, and one ambient air sample for comparison purposes. In addition, two field spike samples, and two field blank samples were collected for quality control purposes. Air samples were collected in the locations described in the RI Plan and depicted in Figures 5D and 5E. Laboratory results for the pre-remedial air samples indicate they ranged from non-detect (less than 48.9 ng/m^3) to 674 ng/m^3. Please refer to Table 5B for a summary of pre-remedial air sampling results from P.S. 3R.

4.0 REMEDIAL ALTERNATIVES IMPLEMENTATION

In consultation with the USEPA, four different remedial alternatives for use in P.S. 178X/176, P.S. 199M, and P.S. 309K were selected for study in 2010. The remedial alternatives, which are explained in greater detail in the USEPA approved RI Plan, were: 1) Patch and repair of caulk (i.e., remove loose and deteriorating caulk and replace with new caulk); 2) Encapsulation of caulk; 3) Removal of all caulk and replacement with new caulk; and 4) Best management practices (i.e., use pre-remedial sampling data from each Pilot School Building to evaluate the effectiveness of current operation and maintenance practices).

In 2011, in addition to the remedial alternatives evaluated in 2010, window frame removal and replacement with new window frames was evaluated in P.S. 183Q, and due to findings in the first three Pilot School Buildings studied during 2010, removal of light fixture PCB ballasts was evaluated in one Pilot School Building (P.S. 3R) in accordance with the SCA RI Plan modification dated November 23, 2010, which was approved by the USEPA in correspondence dated November 29, 2010.

Table 4.1 lists the remedial alternatives implemented and the Pilot Study Areas at each school in 2011. In 2011, remedial efforts were implemented on a school-wide basis; however, the Pilot Study Areas represent the locations where Pilot Study sampling occurred.

Table 4.1 – List of Remedial Alternatives and Pilot Study Areas by School

Remedial Remedy	NYC School ID	Pilot Study Areas
Patch and repair of PCB Caulk (remove loose PCB Caulk and replace with new caulk)	P.S. 178X/176	**Primary Exposure Areas** • Classroom Areas - Rooms 142 and 179 – 1st Floor - Rooms 204, 207 and 237 – 2nd Floor - Rooms 307, 323, 339 and 358 – 3rd Floor • Kitchen (Room 128) – 1st Floor **Transitory Areas** • Room 118 Foyer – 1st Floor • Northwest Lobby (Room 164) – 1st Floor • Northeast Lobby (Room 147) – 1st Floor • East Corridor – 2nd Floor • Bathroom (Room 363) – 3rd Floor
Encapsulation of PCB Caulk	P.S. 309K	**Primary Exposure Areas** • Classroom Areas - Rooms 102 and 145 – 1st Floor - Rooms 205, 210 and 220 – 2nd Floor - Rooms 300, 309 and 318 – 3rd Floor **Transitory Areas** • Rooms 141/143 Vestibule – 1st Floor • North and East Corridors – 1st Floor • West Stairwell – 1st Floor • Corridor – 2nd Floor • Corridor – 3rd Floor East Stairwell – 3rd Floor

Table 4.1 – List of Remedial Alternatives and Pilot Study Areas by School

Remedial Remedy	NYC School ID	Pilot Study Areas
Remove and Replace Windows	P.S. 183Q	**Primary Exposure Areas** • Classroom Areas – Rooms 103, 105, 107, 109, 133, 139 and 151 – 1st Floor • Cafeteria – 1st Floor • Gym – 2nd Floor **Transitory Areas** • Southwest Staircase (Staircase D) –2nd Floor • South Corridor – 3rd Floor Northeast Staircase (Staircase B) – 3rd Floor
Removal of all PCB Caulk and replacement with new caulk	P.S. 199M	**Primary Exposure Areas** • Classroom Areas - Rooms 110 and 118 – 1st Floor - Rooms 216 and 224 – 2nd Floor - Rooms 306, 314 and 332 – 3rd Floor • Room 130 Office – 1st Floor • Auditorium – 1st Floor • Gym – 2nd Floor **Transitory Areas** • West and East Corridors – 1st Floor • Exit 4 – 1st Floor • North and East Corridors – 2nd Floor • Stairwell 2 – 2nd Floor • South and West Corridors – 3rd Floor • Stairwell 3 – 3rd Floor
Remove and Replace Fluorescent Light Fixtures and Ballasts	P.S. 3R	**Primary Exposure Areas** • Gym – Basement • Classroom Areas – Rooms 107, 116, 125 and 159 – 1st Floor • Cafeteria – 1st Floor **Transitory Areas** • East Staircase (Staircase A) – 1st Floor • West Corridor – 1st Floor • Southwest Corridor – 1st Floor
Best Management Practices	All Pilot School Buildings based upon pre-remedial sample results	As noted above for each Pilot School Building

In the case of P.S 178X/176, P.S 199M, and P.S 309K; the remainder of the PCB Caulk identified in each building was subject to remediation. Similarly, at P.S. 3R, the light fixture removal and replacement was implemented on a school-wide basis. At P.S. 183Q, the window replacement was limited to the first floor, the stairwells and bulkheads, and the Roof C/north corridor and Roof D/south corridor on the 3rd floor; as all other windows had previously been replaced. The scope of each of the remedial alternatives is described in additional detail in the sections below.

4.1 Patch and Repair of PCB Caulk

Patch and repair of all identified damaged and/or deteriorated PCB Caulk within the school involved removing any loose or damaged and/or deteriorated caulk and replacing the removed caulk with new, non PCB-containing caulk in the Pilot Study Areas within one Pilot School Building (P.S. 178X/176). In some cases, the amount of loose or damaged and/or deteriorated caulk was less than approximately ten percent (10%) of the total linear footage of each homogenous PCB Caulk identified in the study area; therefore additional "sound" PCB Caulk was removed and replaced to achieve a minimum of approximately 10% by linear footage of PCB Caulk subject to this remedial strategy. See Table 4.2 for a list of remediated areas and the quantity of caulk that was remediated.

Table 4.2 –List of Remediated Areas: PCB Caulk Patch and Repair at P.S. 178X/176

Bulk Material Description	Floor	Room/ Location	Total Quantity Remediated (linear feet)
Air handler caulk – gray*	Basement	Boiler room	40
Window frame caulk - brown	1	108	37
Ceiling caulk – white*	1	110	18
Ceiling caulk – white*	1	118	12
Display case glaze – gray*	1	121 – SE Lobby	11
Rolling gate case caulk - gray	1	Kitchen	6
Window frame caulk - brown	1	142	37
Window frame caulk - brown	1	145	6
Window frame caulk - brown	1	146	24
Display case glaze – gray*	1	147	6
Ceiling caulk – white*	1	150 – MER	56
Ceiling caulk – white*	1	154 – Foyer	18
Display case glaze – gray*	1	164 – NW Lobby	13
Window frame caulk - brown	1	179	24
Window frame caulk - brown	2	204	23
Window frame caulk - brown	2	207	17
Window frame caulk - brown	2	237	24
Window sill caulk - brown	3	307	3
Window frame caulk - brown	3	322B	10
Window sill caulk - brown	3	323	4
Window sill caulk - brown	3	339	3
Window sill caulk - brown	3	358	5

* - Caulk also contained greater than one percent (1%) asbestos and was therefore an ACM.

In areas where PCB Caulk was identified as also being an asbestos containing material (ACM), as indicated in Table 4.2, ACM dust control methods were utilized. For the remainder of the Pilot Study Areas, dust control methods in accordance with Appendix B of the RI Plan were used.

4.2 Encapsulation of All PCB Caulk

The encapsulant product utilized during the summer 2010 Pilot Study at P.S. 309K was Macropoxy® 646 Fast Cure Epoxy and Sealant manufactured by Sherwin Williams. TRC conducted an inspection of the encapsulated caulk at P.S. 309K on May 5, 2011. At the time of the inspection, less than ten percent (10%) of the total length of encapsulated caulk was observed to be cracked. Typically, the cracks were of a "hairline" nature. In limited areas within the cafeteria, the cracks in the encapsulant were wider and a new coat of Sikagard® 550W was applied over top the original encapsulant.

Due to the cracking observed within the Macropoxy® 646 encapsulant as noted above, two alternative commercially available encapsulant products were utilized for purposes of the whole-school remedy (i.e., Series-151-1051 Elasto-Grip FC manufactured by TNEMEC and Sikagard® 550W manufactured by Sika Corporation). The Elasto-Grip product was generally applied in the western half of the school, while the Sikagard® product was applied in the eastern half of the school. The encapsulant was applied to PCB Caulk in each Pilot Study Area within P.S. 309K, in accordance with manufacturers' recommendations and the SCA's specifications. Areas of significantly deteriorated and/or loose PCB Caulk were removed and replaced in accordance with procedures described above in the patch and repair remedial alternative prior to encapsulation, because loose caulk does not provide a suitable foundation for encapsulation. Patch and repair, with dust control measures consistent with Appendix B of the RI Plan, was performed as required in areas of significantly deteriorated and/or loose caulk prior to encapsulation at P.S. 309K.

See Table 4.3 for a list of remediated areas and the quantity of caulk that was remediated.

Table 4.3 – List of Remediated Areas: PCB Caulk Encapsulation at P.S. 309K

Bulk Material Description	Floor	Room / Location	Total Quantity Remediated (linear feet)
Door frame caulk – brown	Basement	Vestibule 2	18
Door frame caulk – red/brown	1	141/143 Vestibule	23
Door frame caulk – red/brown	1	145/147 Vestibule	23
Door frame caulk – red/brown	1	Kitchen Exit Vestibule	22
Door frame caulk – gray*			42
Door frame caulk – red/brown	1	South Exit Lobby E	31
Door frame caulk – gray			25
Door frame caulk – gray*	1	107 – Slop Sink	14
Door frame caulk – gray	1	East Corridor	210
Door frame caulk – gray*	1	North Auditorium Hallway	42
Door frame caulk – gray*	1	South Auditorium Hallway	70
Door frame caulk – gray	1	North Corridor	420

Table 4.3 – List of Remediated Areas: PCB Caulk Encapsulation at P.S. 309K

Bulk Material Description	Floor	Room / Location	Total Quantity Remediated (linear feet)
Column/Wall seam caulk – gray*	1	Cafeteria	71
Door frame caulk – gray*	2	219 – Slop Sink	14
Door frame caulk – gray*	2	Center Corridor	224
Door frame caulk – gray*	2	East Corridor	238
Door frame caulk – gray*	2	West Corridor	98
Door frame caulk – gray	3	319 – Slop Sink	14
Door frame caulk – gray	3	Corridor	738
Door frame caulk – gray	All	West Stairwell	42
Door frame caulk – red/brown			18
Door frame caulk – gray	All	East Stairwell	42
Door frame caulk – red/brown			63

* - Caulking was loose and/or significantly damaged and was patched and repaired prior to encapsulation.

Primary Exposure Areas were included in the pre and post-remedial sampling efforts, even though no PCB Caulk exists or was remediated in Primary Exposure Areas at P.S. 309K.

4.3 Removal of All PCB Caulk and Replacement with New Caulk

Removal of all remaining PCB Caulk within the building involved removing all visible and accessible interior PCB Caulk and replacing with new, non PCB-containing caulk within one Pilot School Building (P.S. 199M). Removal of PCB Caulk was accomplished utilizing manual tools. See Table 4.4 for a list of remediated areas and the quantity of caulk that was remediated.

Table 4.4 – List of Remediated Areas: PCB Caulk Removal and Replacement with New Caulk at P.S. 199M

Bulk Material Description	Floor	Room/ Location	Total Quantity Remediated (linear feet)
Door frame caulk – gray	1	113 – Slop Sink	14
Door frame caulk - white	1	Kitchen	28
Door frame caulk – gray	1	North Corridor	182
Gate runner caulk – gray			32
Metal panel caulk above fire extinguisher			8
Door frame caulk – gray	1	East Corridor	84
Door frame caulk – gray	1	South Corridor	196
Gate runner caulk – gray			32
Metal panel caulk above fire extinguisher			3

Table 4.4 – List of Remediated Areas: PCB Caulk Removal and Replacement with New Caulk at P.S. 199M

Bulk Material Description	Floor	Room/ Location	Total Quantity Remediated (linear feet)
Door frame caulk – gray	1	West Corridor	95
Door frame caulk – gray	1	Exit 4	90
Transom window glaze - gray			72
Door frame caulk – gray	1	Stairwell B	70
Door frame caulk – gray	1	Stairwell C	56
Door frame caulk – beige	2	235 - Bathroom	8
Gym rolling gate caulk - gray	2	Gym Gate Storage Rm.	14
Door frame caulk – gray	2	North Corridor	174
Gate runner caulk – gray			32
Metal panel caulk above fire extinguisher			5
Door frame caulk – gray	2	South Corridor	252
Gate runner caulk – gray			32
Metal panel caulk above fire extinguisher			8
Door frame caulk – gray	2	East Corridor	81
Door frame caulk – gray	2	West Corridor	56
Metal panel caulk above fire extinguisher			3
Door frame caulk – gray	2	Stairwell B	28
Door frame caulk – gray	2	Stairwell C	28
Door frame caulk – gray	3	South Corridor	213
Metal panel caulk above fire extinguisher			8
Door frame caulk – gray	3	West Corridor	35
Door frame caulk – gray	3	Stairwell B	19
Door frame caulk – gray	3	Stairwell C	28

This remedial alternative utilized dust control methods as outlined in Appendix B of the RI Plan.

4.4 Remove and Replace Windows

The window replacement project within one Pilot School Building (P.S. 183Q), which included the removal of PCB and ACM Caulk associated with window frames and window openings, was conducted utilizing ACM dust control procedures.

The window locations and contiguous spaces within a radius of ten (10) feet were demarcated with caution tape as regulated areas to allow only certified workers and authorized visitors to enter. A remote worker and waste decontamination unit was constructed outside the work area. The contractor personnel donned personal protective equipment (PPE) and prepared the work areas. The movable and loose items from the work areas were cleaned using HEPA vacuum equipment and removed in the work areas. Fixed objects within the work areas were pre-cleaned using HEPA vacuum equipment and enclosed with a minimum of two layers of six-mil plastic sheeting sealed airtight with tape. The contractor then installed two layers of polyethylene sheeting around the window frames and caulking, sealing it to form an airtight barrier between the window and caulking and the interior of the building. The contractor then constructed modified tents exterior to the building, fully framed with 2" x 3" wood studs, sufficient in size to effectively manage the large size of the window frames. The tents were enclosed with two layers of polyethylene sheeting inside and around the window frames and caulking, sealing them to form an airtight barrier between the window and caulking and the exterior of the building. An airlock between the two curtained doorways was constructed at the entrance to each tent. The window frame removal commenced after the tent enclosures successfully passed a pre-removal inspection.

The window frames were removed using wet methods, wrapped in two layers of six-mil polyethylene sheeting, and removed from the tent. The window openings were then thoroughly cleaned using hand tools with any residual caulk waste being directly bagged. The surfaces of the work area were rendered free of visible debris.

Final asbestos air sampling conducted inside the work areas indicated that acceptance criteria for re-occupancy were achieved in each work area prior to removal of containment.

4.5 Remove and Replace All Fluorescent Light Fixtures and Ballasts

Removal and replacement of all fluorescent light fixtures and ballasts was evaluated as a standalone remedial alternative in one Pilot School Building (P.S. 3R) (as noted above, full fixture replacements were also performed in P.S 178X/176, P.S 199M, and P.S 309K as a supplemental remedy). The furniture and all other movable items were either removed from each room or moved to the side. The contractor then installed three (3) polyethylene sheeting flaps on each doorway and sealed all openings/penetrations in the work area including exhaust and supply ventilation system vents. Electrical power to the light fixtures was de-energized. The fixed objects within the work area were enclosed with a minimum of one layer of six-mil polyethylene sheeting sealed airtight with tape. The contractor then installed six-mil polyethylene sheeting on the floor directly beneath the light fixture(s) and extending approximately five (5) feet in all directions. Non-movable objects within this five foot area were covered with one layer of sheeting.

The contractor workers, wearing PPE, removed the lamp cover or grille from each light fixture exposing the fluorescent lamps. The fluorescent lamps were removed and the ballast enclosure cover was then removed exposing the ballasts. The exterior of the ballast and the interior exposed section of the light fixture including housing (with ballast removed), cover and wires were visually inspected for evidence of any leakage or staining.

If leaking or staining was identified on the ballast and/or light fixture, the ballast was removed and placed directly in the authorized waste container (drum with leaking PCB ballasts), and the light fixture was wrapped in two layers of clear six-mil polyethylene sheeting, placed in waste container and disposed of as PCB remediation waste.

If no leaking or staining was identified on the ballast or light fixture, the ballast was removed and placed directly in the authorized waste container (drum with non-leaking PCB ballasts), and the light fixture was wrapped in two layers of clear six-mil polyethylene sheeting, placed in waste container and disposed of as ACM waste.

Two (2) non-leaking fluorescent light ballasts were sent to the laboratory and analyzed to document the concentrations of PCBs in the ballasts that were being removed as part of the remedial alternative.

Laboratory results for the ballast samples indicated that the Universal ballast capacitor oil contained 1,280,000 mg/kg, or pure PCB oil. Results for the potting insulation material and wire casings ranged from non-detect (less than 17.9 mg/kg) to 2,053 mg/kg. Wipe samples were also collected by the laboratory. Laboratory results for the ballast wipe samples indicated that they ranged from non-detect (less than 0.100 µg/100cm^2) to 0.89 µg/100cm^2. Please refer to Tables 5G and 5H that provide the results of the chemical analysis of bulk samples and surface wipe samples, respectively, for representative light ballast components that were sampled.

4.6 Best Management Practices

To evaluate current cleaning and routine maintenance activities practiced in the Pilot School Buildings, all Pilot Study pre-remedial air and wipe sampling data was evaluated to determine whether these current practices are effective in managing undisturbed PCB Caulk. The BMP protocol remedy reflects the baseline condition as the pre-remediation sampling is independent of the remedial alternative subsequently implemented in a particular Pilot School Building as summarized in Table 4.1 above. As such, no specific remedial actions were implemented to facilitate this evaluation. The City of New York has developed a Best Management Practices (BMP), that was approved by the EPA in April 2012, which includes measures and practices that will routinely be used to protect PCB Caulk from accidental damage and to identify the potential for deterioration requiring further action on an ongoing basis during school maintenance, repair and capital improvement projects (see Appendix F of the Feasibility Study report).

4.7 Waste Characterization and Disposal

All waste generated in the course of implementing the Pilot Study at P.S. 178X/176, P.S. 199M, P.S. 309K, P.S. 183Q, and P.S. 3R was disposed of as PCB waste in accordance with Section 3.6 of the RI Plan. Table 4.2 provides a summary of the quantities of waste generated and disposed in each of the five Pilot School Buildings for the Pilot Study phase of the work.

Table 4.5 – Total Waste Quantities (in Kilograms) by School and Work Phase

School	Quantity (kg)
P.S. 178X/176	7,195
P.S. 199M	3,587 *
P.S. 309K	2,127
P.S. 183Q	29,426
P.S. 3R	13,815
Total	56,150

* Includes hazardous (alkyd and latex enamel paints, deck stain, duplicating fluid and mineral oil) and non-hazardous waste from the basement that was disposed.

Appendix F contains copies of the waste manifests, organized by school, as well as tables detailing the total quantities of waste generated and disposed.

5.0 POST-REMEDIAL SAMPLING

5.1 Overview

Following implementation of remedial alternatives in the Pilot Study Areas, post-remedial air and wipe samples were collected in the same locations as the pre-remedial air and wipe samples. The sample methodologies described in Sections 3.2.1 and 3.3.1 were also used in the post-remedial sampling presented in this section.

5.2 Post-Remedial Wipe Sampling

5.2.1 P.S. 178X/176 Post-Remedial Wipe Sampling Results

A total of 30 post-remedial wipe samples (two subsamples), plus one field blank, were collected on August 10, 2011. The wipe sample locations are depicted in Figures 1F, 1G and 1H. Laboratory results for the post-remedial wipe samples indicate they ranged from non-detect (less than 0.100 µg/100cm^2) to 0.690 µg/100cm^2. Please refer to Table 1F for a summary of wipe sample results.

5.2.2 P.S. 199M Post-Remedial Wipe Sampling Results

A total of 38 post-remedial wipe samples (two subsamples), plus one field blank, were collected on August 6, 2011. The wipe sample locations are depicted in Figures 2F, 2G, and 2H. Laboratory results for the samples indicate they ranged from non-detect (less than 0.100 µg/100cm^2) to 2.346µg/100cm^2. Please refer to Table 2E for a summary of wipe sample results.

5.2.3 P.S. 309K Post-Remedial Wipe Sampling Results

A total of 30 post-remedial wipe samples (two subsamples), plus one field blank, were collected on August 7, 2011. Locations of the wipe samples collected are depicted in Figures 3F, 3G, and 3H. Laboratory results for the samples indicate they ranged from non-detect (less than 0.100 µg/100cm^2) to 0.708 µg/100cm^2. Please refer to Table 3E for a summary of the sample results.

5.2.4 P.S. 183Q Post-Remedial Wipe Sampling Results

A total of 24 post-remedial wipe samples, plus one field blank, were collected on August 21, 2011. Locations of wipe samples collected are depicted in Figures 4E, 4F and 4G. Laboratory results for the samples indicate they ranged from non-detect (less than 0.100 µg/100cm^2) to 2.72 µg/100cm^2. On September 1, 2011, an additional two samples were collected in order to provide additional information on conditions within the space with regard to possible PCBs in the settled dust. Laboratory results indicate the samples ranged from 0.106 µg/100cm^2 to 0.546 µg/100cm^2. Please refer to Table 4E for a summary of sample results.

5.2.5 P.S. 3R Post-Remedial Wipe Sampling Results

A total of 18 post-remedial wipe samples, plus one field blank, were collected on August 24, 2011. Locations of wipe samples collected are depicted in Figures 5B and 5C. Laboratory results for the samples indicate they ranged from non-detect (less than 0.100 µg/100cm^2) to 0.908 µg/100cm^2. Please refer to Table 5C for a summary of sample results.

5.3 Post-Remedial Air Sampling

5.3.1 P.S. 178X/176 Post-Remedial Air Sampling Results

A total of 19 post-remedial air samples were collected on August 10, 2011. The samples consisted of 15 area air samples, two front/back samples to evaluate ACE, one duplicate sample, and one ambient air sample for comparison purposes. Additionally, two field spiked samples, and one field blank were collected. Samples were collected from the same locations as Pre-Remediation locations described previously. The air sample locations are depicted in Figures 1I, 1J and 1K. Laboratory results for the air samples indicate that concentrations ranged from non-detect (less than 48.5 ng/m3) to 55.2 ng/m3. Please refer to Table 1G for a summary of the sample results. A comparison of pre- and post-remediation data performed, as described in Section 9.0 Findings, found post-remediation air sample results to be generally equal to or lower than the pre-remediation samples.

5.3.2 P.S. 199M Post-Remedial Air Sampling Results

A total of 23 post-remedial air samples were collected on August 6, 2011. The samples consisted of 19 area air samples, two front/back samples to evaluate ACE, one duplicate sample, and one ambient air sample for comparison purposes. Additionally, two field spiked samples, and one field blank were collected. Samples were collected from the same locations as Pre-Remediation locations described previously. Air sampling locations are depicted in Figures 2I, 2J, and 2K. Laboratory results for the air samples indicate that air concentrations ranged from non-detect (less than 48.7 ng/m^3) to 821 ng/m^3. Please refer to Table 2F for a summary of those results. A comparison of pre- and post-remediation data performed, as described in Section 9.0 Findings, found the results to be similar and the differences between pre-remediation and post-remediation air sample results to be insignificant.

In response to these results, many of which were above the USEPA guidance values of 100 ng/m^3 for kindergarten and pre-kindergarten classrooms and 300 ng/m^3 for elementary school aged children, additional investigations and remedial measures were taken, including installation of carbon air-filtration devices, and additional air sampling conducted as described in Section 7.0 Post-Pilot Study Investigation and Remediation. Results of post-carbon filtration samples showed a significant decrease in air concentrations as compared to pre- and post-remediation air sample results. The mean airborne PCB concentrations in primary areas were reduced by more than 45%, from 289.8 ng/m^3 measured in June, 2011 and 288.5 ng/m^3 measured in August, 2011, to 157.8 ng/m^3 measured in September, 2011 following installation of the carbon air filtration units.

5.3.3 P.S. 309K Post-Remedial Air Sampling Results

A total of 19 post-remedial air samples were collected on August 7, 2011. The samples consisted of 15 area samples, two front/back samples to evaluate ACE, one duplicate sample and one ambient air sample for comparison purposes. Additionally, two field spiked samples, and one field blank sample were collected. Samples were collected from the same locations as Pre-Remediation locations described previously. The air sample locations are all depicted in Figures 3I, 3J, and 3K. The laboratory results for the air samples indicate that concentrations ranged from non-detect (less than 49.7 ng/m^3) to 409 ng/m^3. Please refer to Table 3F for a summary of the sample results. A comparison of pre- and post-remediation data performed, as described in Section 9.0 Findings, found the post-remediation air sample results in Primary exposure areas to be statistically higher on average than the pre-remediation samples. Pre-remedial Transitory Area data, which is from the areas where encapsulation actually occurred, was not significantly different from the mean of the post-remedial Transitory Area data.

In response to these results, some of which were above the USEPA guidance values of 100 ng/m^3 for kindergarten and pre-kindergarten classrooms and 300 ng/m^3 for elementary school aged children, additional investigations and remedial measures were taken as described in Section 7.0 Post-Pilot Study Investigation and Remediation. Results of the latest October 2011 round of air samples collected in Primary Exposure Areas showed a statistically significant decrease in air concentrations as compared to pre- and post-remediation air sample results, with all results being less than applicable USEPA guideline concentrations. The mean airborne PCB concentrations in primary areas were reduced by more than 45%, from 90.7 ng/m3 measured in June, 2011 and 168.8 ng/m3 measured in August, 2011, to 49.6 ng/m3 measured in October, 2011. See Section 5.3.2, above regarding USEPA's guidance on airborne PCBs in schools

5.3.4 P.S. 183Q Post-Remedial Air Sampling Results

A total of 16 post-remedial air samples were collected on August 21, 2011. The samples consisted of 12 area samples, two front/back samples to evaluate ACE, one duplicate sample and one ambient air sample for comparison purposes. Additionally, two field spiked samples and one field blank sample were collected. Samples were collected from the same locations as Pre-Remediation locations described previously. The air sample locations are all depicted in Figures 4H, 4I and 4J. The laboratory results for the air samples indicate that concentrations ranged from non-detect (less than 49.2 ng/m^3) to 785 ng/m^3. A comparison of pre- and post-remediation data performed, as described in Section 9.0 Findings, found no statistical difference between the pre- and post-remediation Primary Exposure Area air sample results.

In response to the results which were above the USEPA guidance values of 100 ng/m^3 for kindergarten and pre-kindergarten classrooms and 300 ng/m^3 for elementary school aged children in some cases, additional investigations and remedial measures were taken as described in Section 7.0 Post-Pilot Study Investigation and Remediation. Results of the latest September 2011 round of air samples collected in Primary Exposure Areas showed a statistically significant decrease in air concentrations as compared to pre- and post-remediation air sample results, with all Primary Exposure Area results being non-detected and less than applicable USEPA guideline concentrations. The mean airborne PCB concentrations in primary areas were reduced by more than 60%, from 124.9 ng/m3 measured in June, 2011 and 156.9 ng/m3 measured in August, 2011, to 48.8 ng/m3 measured in September, 2011. Please refer to Table 4F for a summary of the sample results. See Section 5.3.2 above regarding USEPA's guidance on airborne PCBs in schools.

5.3.5 P.S. 3R Post-Remedial Air Sampling Results

A total of 13 post-remedial air samples were collected on August 24, 2011. The samples consisted of nine (9) area samples, two front/back samples to evaluate ACE, one duplicate sample and one ambient air sample for comparison purposes. Additionally, two field spiked samples and one field blank sample were collected. Samples were collected from the same locations as Pre-Remediation locations described previously. The air sample locations are depicted in Figures 5D and 5E. The laboratory results for the air samples indicate that concentrations ranged from non-detect (less than 48.3 ng/m^3) to 675 ng/m^3. A comparison of pre- and post-remediation data performed, as described in Section 9.0 Findings, found the post-remediation air sample results to be generally, but not statistically significantly, lower than the pre-remediation samples.

In response to the one result in the East Stairwell, which was above the USEPA guidance value of 300 ng/m^3 for elementary school aged children, additional investigations and remedial measures were taken as described in Section 7.0 Post-Pilot Study Investigation and Remediation. Results of the latest September 2011 round of air samples collected in the East Stairwell were less than applicable USEPA guideline concentrations. See Section 5.3.2 above regarding USEPA's guidance on airborne PCBs in schools.

6.0 EXTERIOR SOIL AND CAULK SAMPLING

6.1 Soil Sampling

6.1.1 Soil Sampling Procedures

Soil sampling was conducted at P.S. 183Q and P.S. 3R in accordance with Appendix G of the RI Plan. Samples were collected every 20 linear feet along the building face, in three rows, located approximately 0.5 feet, three feet and eight feet away from the building. Samples were collected from zero (0) to two (2) inches below the ground surface (bgs). The surface of the soil began below the "vegetative layer" or cover material (i.e., gravel and/or wood chips). Where vegetation was present, the samples were collected from within the root zone beneath the top vegetative layer. For purposes of the Pilot Study, all three rows of soil samples were analyzed, rather than performing sequential testing to a negative stop (i.e., the final row analyzed demonstrates that all samples collected contain less than 1 ppm PCBs).

Samples were collected utilizing dedicated scoops and containerized in accordance with USEPA protocols and sample methodology. Each container was individually labeled, preserved, and placed in a cooler for transport by courier to NEA. Samples were analyzed for total PCBs by GC in accordance with USEPA Method 8082.

Concentrations of total PCBs in soil sample results were compared to the USEPA's clean backfill standard (40 CFR 761.125(c)(4) (v) and 40 CFR 761.125(b)(1) (ii)) and the New York State Department of Environmental Conservation's (NYSDEC) CP-51/Soil Cleanup Guidance and 6 NYCRR Part 375 value of 1 ppm.

6.1.2 P.S. 183Q Soil Sampling Results

A total of 31 soil samples were collected on June 26, 2011, from depths of zero to two inches and two to four inches bgs. In addition, two duplicate soil samples and five site-specific matrix spiked and matrix spiked duplicate (MS/MSD) soil samples were submitted for analysis for quality control purposes. Laboratory results indicate the soil samples ranged from non-detect (less than 0.5 ppm) to 36.0 ppm. In addition, two further delineation samples were taken on August 21, 2011 at distances of twelve and sixteen feet from the building with measured concentrations of 1.75 ppm and 0.674 ppm, respectively. Please refer to Figure 4K for the soil sampling locations and results where the concentrations of PCBs in soil were found to be greater than 1 ppm. Refer to Table 4G for a summary of the soil sampling results.

6.1.3 P.S. 3R Soil Sampling Results

A total of 101 soil samples were collected on May 28, 2011 from depths of zero to two inches bgs. In addition, five site-specific MS/MSD soil samples were also submitted for analysis for quality control purposes. Laboratory results for the soil samples indicate that concentrations ranged from non-detect (less than 0.5 ppm) to 7.67 ppm. Please refer to Figure 5F for the soil sampling locations and results where the concentrations of PCBs in soil were found to be greater than 1 ppm. Refer to Table 5E for a summary of the soil sampling results.

6.2 Exterior Caulk Sampling

6.2.1 Exterior Caulk Sampling Procedures

As a requirement of the RI Plan, exterior caulk samples were collected at the two schools (P.S. 183Q and P.S. 3R) adjacent to any areas where PCB impacted soil (greater than 1 ppm PCBs) was identified. Exterior caulk samples were collected in accordance with Appendix D of the RI Plan, and sufficient material was sampled at each location to ensure a one milligram per kilogram (1 mg/kg) detection limit. Samples were collected of each suspect homogeneous caulk material present on the exterior of the building located within ten feet of the location of the elevated soil sample. In general, the caulk materials sampled were typically associated with windows, doors, louvers, and perimeter expansion joints.

Caulk samples were collected by physically removing sections of caulking using stainless steel scalpels/utility knives. All sampling equipment was dedicated for each sample (i.e., equipment was disposed of after collecting each sample). When possible, three (3) sub-samples (weighing approximately 10 grams each) of every homogenous material were collected. Each sub-sample was placed in a separate, pre-cleaned glass jar with a Teflon-lined cap.

The laboratory was directed to create one (1) composite sample of each homogenous material from equal mass portions (±5%) of the three (3) sub-samples for extraction. Interior caulk samples were then prepared using Soxhlet extraction and analyzed by USEPA Method 8082 for PCB Aroclors.

All samples were collected and containerized in accordance with USEPA protocols and sample methodology. Each container was properly labeled, preserved, and placed in a cooler for transport by courier to NEA. Standard chain-of-custody procedures were followed.

6.2.2 P.S. 183Q Exterior Caulk Sampling Results

Exterior caulk samples were collected from a total of 48 homogenous materials at P.S. 183Q on April 28 and 29, 2011 and October 19, 2011, in locations from the north, south, and east sides of the building, as depicted in Figures 4L, 4M, 4N, 4O and 4P. Laboratory results for the caulk samples indicate that concentrations ranged from non-detect (less than 1.00 mg/kg) to 328,000 mg/kg. Twenty-seven (27) of the 48 homogeneous materials identified and sampled had concentrations of PCBs greater than 50 ppm and are therefore considered PCB Caulk. Refer to Table 4H for a summary of the results.

6.2.3 P.S. 3R Exterior Caulk Sampling Results

Exterior caulk samples were collected from 15 homogenous materials at P.S. 3R on November 5, 2011, in locations from the east side of the building and from the North Courtyard, as depicted in Figures 5G and 5H. Laboratory results for the caulk samples indicate that concentrations ranged from 1.68 mg/kg to 226,000 mg/kg. Seven of the 15 homogeneous materials identified and sampled had concentrations of PCBs greater than 50 ppm and are therefore considered PCB Caulk. Refer to Table 5F for a summary of the results.

7.0 POST-PILOT STUDY ACTIVITIES

7.1 P.S. 178X/176

All of the pre and post-remedial air samples collected at P.S. 178X/176 in June and August of 2011 were below the applicable USEPA guidance values. Based upon those results, no additional activities or air sampling was performed within the school.

Bulk sampling of exterior caulk in locations where soils were found with PCB levels exceeding 1 ppm indicated the presence of window and masonry caulk containing PCBs greater than 50 ppm. As a result, those materials were subsequently encapsulated during the summer of 2011, prior to implementation of soil remedial activities. Remediation of soils containing greater than 1ppm of PCBs was performed during the summer of 2011 following completion of encapsulation of exterior window and masonry caulk.

The results of these activities are further detailed in the following subsections, and the findings are provided in Section 9.0.

7.1.1 Exterior PCB Caulk Remediation

In July, 2011, approximately 1,030 linear feet of PCB containing window caulk and 2180 linear feet of PCB containing masonry caulk on the north and south sides of the building exterior were encapsulated. On each side of the building the contractor divided the work zones into equal size areas. In each area the contractor applied one of two different commercially available encapsulant products. Prior to encapsulation, the PCB Caulk surfaces were wet cleaned and any damaged or loose caulk was removed and replaced with non PCB-containing caulk (Sikasil-C995, manufactured by Sika). Caulking on the northeast and southeast areas was encapsulated with a base coat of Elasto-Grip FC and a finish coat of Enviro-Crete® 156, manufactured by TNEMEC, while the caulking on the northwest and southwest areas was encapsulated with Sikagard®--62 two-part epoxy protective coating, manufactured by Sika.

7.1.2 Soil Remediation

On July 16, 2010 and August 23, 2010, TRC assessed the condition of exterior soils at P.S. 178X/176 and collected surface soil samples wherever soil was present within ten (10) feet from the school building. Soil samples were collected from areas along the northern and southern building facades, in accordance with the RI Work Plan.

As reported in the Interim RI Report, the analytical results of the surface soil investigation indicated that soil samples collected on the northern and southern facades of the school building had PCB concentrations above the USEPA clean backfill standard and the NYSDEC PCB soil cleanup level of 1 ppm and that one soil sample along the northern facade had PCB concentrations greater than or equal to 50 ppm. On August 25, 2010, the soil areas identified as exceeding 1 ppm total PCBs were temporarily covered with geotextile fabric and a 3" - 4" top layer of cedar mulch as an interim measure in order to limit contact and dust exposure.

Louis Berger and Associates, P.C. (LBA) was subsequently retained by SCA. LBA prepared a Surface Soil Remediation Plan on January 14, 2011, which was subsequently approved by the USEPA. Later, LBA monitored the remediation of PCB-impacted soils conducted by the environmental contractor, John Civetta & Sons, Inc., and collected post-excavation soil samples after excavation activities were completed.

Based on the results of the surface soil investigation, along the northern and southern facades of the building soils areas where sample results had PCB concentrations that exceeded 1 ppm were excavated. Soil areas were excavated to a depth of two (2) feet bgs. Post-excavation soil samples were collected and laboratory results, with the exception of one (1) sidewall sidewalk sample, indicated PCBs were less than 1 ppm. Additional excavation was conducted under the sidewalk surrounding the elevated sidewall sidewalk sample.

As reported by LBA, 62 tons (approximately 67 cubic yards) of excavated soil identified as containing less than 50 ppm total PCBs was disposed of as non-hazardous PCB Remediation Waste at a licensed municipal solid waste disposal facility. Thirty-nine (39) tons (approximately 33 cubic yards) of excavated soil identified as greater than or equal to 50 ppm PCBs was disposed of as hazardous PCB Remediation Waste at a licensed commercial hazardous waste treatment, storage and disposal facility.

Excavated areas were restored by backfilling with environmentally clean fill including sand and the backfilled remediated areas were then landscaped and hydro-seeded on August 1 through August 3, 2011. The details and documentation regarding the soil remediation are presented in a Polychlorinated Biphenyl (PCB) Soil Remediation Report prepared by LBA and dated October 17, 2011. See Appendix J for a copy of the soil remediation report.

7.1.3 Long-Term Monitoring Bulk Sampling

On February 6, 2012, long-term monitoring bulk caulk samples were collected at P.S. 178X from locations where PCB caulk was removed and replaced with non-PCB caulk (DAP Dynaflex 230 - manufactured by DAP Products) as part of the patch and repair remedial alternative during the initial Pilot Study activities conducted in July of 2010. One composite caulk sample, consisting of three sub-samples, was collected from each homogenous PCB caulk material that had been identified, removed and replaced in the 2010 Pilot Study rooms. Samples were collected from the approximate middle of the new replacement caulk section, at least one inch (1") from where the new caulk joined with the original caulk.

A total of 12 long-term monitoring composite bulk caulk samples were collected from rooms 139, 182, 223, 229, 258, 304, 322A, 337A and 357, and the 1st floor southwest lobby where PCB caulk material had been previously removed and replaced as part of the patch and repair remedial alternative in 2010. Laboratory results revealed that the new replacement caulk contained PCBs ranging from less than 1 to 18,700 mg/kg, and five of the 12 caulk samples contained PCBs in excess of 50 mg/kg.

On April 5, 2012, long-term monitoring bulk caulk samples were collected at P.S. 178X from select locations where PCB caulk was removed and replaced with non-PCB caulk (Sikasil-C995 manufactured by Sika) as part of the patch and repair remedial alternative during the initial Pilot Study activities conducted in July of 2011. Sampling was targeted for locations where the 2011 remediated caulk contained at least 10,000 ppm of PCBs. One composite caulk sample, consisting of three sub-samples, was collected from locations where PCB caulk material had been identified, removed and replaced in the 2011 Pilot Study Rooms. Samples were collected from the approximate middle of the new replacement caulk section, at least one inch (1") from where the new caulk joined with the original caulk.

A total of four long-term monitoring composite bulk caulk samples were collected from rooms 142, 204 and 322B and the kitchen where PCB caulk material had been previously removed and replaced in 2011. Samples were collected from each homogenous area as defined during the initial Pilot Study testing. Analytical results indicate that the sample concentrations ranged from 1,186 to 3,490 mg/kg. All four caulk samples exceeded 50 mg/kg of total PCBs.

These results suggest that PCBs from the original caulk contaminated the underlying substrate and those PCBs have, in turn, penetrated and contaminated the replacement caulk. See Appendix N for a copy of Supplemental Report #2 which contains additional details, results of the analyses and the sample location drawings.

7.2 P.S. 199M

As described in greater detail below, following completion of Pilot Study remedial activities and collection of post-remediation air samples, Kiss Construction installed activated carbon air filtration units in two classrooms and air testing was performed in those rooms on August 22, 2011. Based on the marked improvement in air concentrations in these two rooms, activated carbon air filtration units were subsequently installed in all normally occupied rooms throughout the building and air sampling was performed in those areas on September 2, 2011. Another round of testing was subsequently performed in those same locations on October 29 – 30, 2011. The results of these two testing rounds are provided in Tables 2G and 2H, respectively.

In addition, bulk sampling of exterior caulk in locations where soils were found with PCB levels exceeding 1 ppm indicated the presence of door, louver and masonry caulk in certain locations containing PCBs greater than 50ppm. As a result, the door and louver caulk was removed, and masonry caulk on the south side of the building was encapsulated, in April of 2011 prior to implementation of soil remedial activities.

Remediation of soils containing greater than 1 ppm of PCBs was performed during the summer of 2011.

The results of these activities are described in further detail in the following subsections while the findings are further elaborated upon in Section 9.0.

7.2.1 Air Filtration

7.2.1.1 Air Filtration Activity

Activated carbon air filtration units were installed in classrooms 118 and 314 at P.S. 199M on August 18, 2011. The carbon air filtration units, which are manufactured by Can Filter Group Inc., were operated continuously through August 21, 2011, as part of a pilot test. The results of air samples collected on August 22, 2011 from Rooms 118 and 314 (See Table 2G) showed an average reduction of approximately 67% in PCB concentrations. For this reason, on August 26, 2011, activated carbon air filtration units were subsequently installed in all normally occupied rooms throughout the building. Each unit consists of a Can 125 Activated Carbon Filter containing approximately 103 pounds of granular activated carbon, a Can Fan Model 8”HO fan with a maximum exhaust flow rate of 1,020 CFM and a minimum exhaust flow rate of 510 CFM, (722 CFM at zero inches of water column), and a fan speed regulator. The units were initially operated at maximum speed continuously through September 1, 2011. Since September 2, 2011, the units have been operated at approximately half-speed throughout the school day and at full speed after school hours and during weekends and holidays. Decisions to continue to operate the activated carbon air filtration units will be made on the basis of available air monitoring data in consultation with the USEPA. The existing activated carbon filters were replaced in the spring of 2012

7.2.1.2 Post-Air Filtration Air Sampling

Prior to the start of the school year, and after approximately six (6) days of carbon air filtration, air samples were collected in P.S. 199M in all occupied rooms on September 2, 2011. The samples consisted of 56 area air samples, four (4) duplicates, six (6) front/back ACE samples, and one ambient air sample for comparison purposes. In addition, two field spikes and one field blank sample were submitted for quality control purposes. Laboratory results of the air samples indicate concentrations that ranged from non-detect (less than 47.8 ng/m^3) to 355 ng/m^3, with a mean concentration of 157.8 ng/m^3, which represents an average reduction of approximately 45% in PCB concentrations from the previous round of sampling. Please refer to Table 2H for a summary of the results and Figures 2I, 2J and 2K for sampling locations. As discussed in Section 9.2.2, the results showed a statistically significant decrease in the mean concentration as compared to the mean concentration of the previous post-remediation air sample results and only six (6) of the 56 locations exhibited concentrations above applicable USEPA guidance values.

An additional round of air samples were collected in P.S. 199M in all occupied rooms on October 29 - 30, 2011. The samples consisted of 56 area air samples, three (3) duplicates, six (6) front/back ACE samples, and one ambient air sample for comparison purposes. In addition, two field spikes and one field blank sample were submitted for quality control purposes. One (1) sample, collected from Room 328, was destroyed during the laboratory extraction procedure due to a crack in the glassware. Laboratory results of the other area air samples indicate concentrations that ranged from non-detect (less than 46.3 ng/m^3) to 414 ng/m^3, with a mean concentration of 138.67 ng/m^3 Please refer to Table 2I for a summary of the results and Figures 2I, 2J, and 2K for the sampling locations. As discussed in Section 9.2.2, the mean airborne PCB concentration from this additional round of post-carbon air filtration sampling was statistically consistent with the mean concentration of the September sampling and continued to show, on average, a statistically significant improvement as compared to post–remediation air sample results; however, seven locations, including one kindergarten classroom, exhibited concentrations above applicable USEPA guidance values.

7.2.2 Ventilation Assessments/Studies

The mechanical systems for P.S. 199M consist of a classroom and bathroom exhaust system, with perimeter radiating heating units. Make-up air for the system is provided through operable windows. There are 19 rooftop exhaust fans that service the classrooms and bathrooms. The gymnasium and auditorium utilize forced air for heating and ventilation. The gym and auditorium are serviced by separate blower and exhaust fans located in mechanical rooms on the second and third floors. Outside air enters the gym and auditorium systems through louvers located adjacent to the auditorium roof.

Exhaust and supply ventilation rates were measured using an Alnor Balometer® Standard Capture Hood 6461CFM. The device was placed over air intakes or diffusers and the air flow volume was determined and reported in cubic feet per minute (cfm). In locations where the instrument could not be used because the hood would not fit completely over the exhaust grate being measured (i.e., inside the closet locations), a hot wire velometer (TSI VelociCheck® Model 8330) was used to measure air flow in feet per minute (fpm) across the face of the intake grates and these readings were averaged and converted to cfm based on the cross sectional area of the intake. All measurements were collected with the classroom windows and doors closed.

A review of the original ventilation drawings and specifications for the school indicated that design air exhaust rates for the various rooms ranged from 400 to 675 cfm. Air flow rate measurements, however, revealed that actual air exhaust rates for those rooms were between 33 and 952 cfm. Refer to Table 7.1 for a summary of the design and actual air exhaust rates measured in various rooms.

Table 7.1 – Summary of Design and Actual Air Exhaust Rates Measured in Various Rooms at P.S. 199M

Room #	Design air exhaust rate (cfm)	Actual air exhaust rate (cfm)	Actual/Design
106	400	136	0.34
108	400	189	0.47
110	400	178	0.45
112	400	33	0.08
114	675	263	0.39
116	575	328	0.57
118	575	388	0.67
120	575	330	0.57
202	500	249	0.50
204	500	210	0.42
206	500	678	1.36
208	500	677	1.35
210	500	509	1.02
212	500	681	1.36
214	500	952	1.90
216	500	561	1.12
218	500	501	1.00
220	500	420	0.84
302	500	373	0.75
304	500	366	0.73
306	500	548	1.10
308	500	659	1.32
310	500	458	0.92
312	500	490	0.98
314	500	481	0.96
316	500	498	1.00
318	500	672	1.34
320	500	766	1.53

In addition to the measurements discussed above, in select rooms measurements were also collected with the classroom windows slightly opened (two windows opened approximately two inches) and the doors closed. Air flow rate measurements revealed that air exhaust rates for those rooms, when the windows were closed, ranged from 136 to 330 cfm, and with the windows slightly opened the air exhaust rates ranged from 276 to 548 cfm. On average, air exhaust rates increased by 68 percent when the windows were slightly opened versus when they were closed. See Table 7.2 for a summary of the design and calculated air exchange rates measured in various rooms.

Table 7.2 – Summary Actual Air Exhaust Rates Measured in Various Rooms at P.S. 199M			
Room #	**Air exhaust rate with windows closed (cfm)**	**Air exhaust rate with windows slightly opened (cfm)***	**Window opened/ Window closed**
106	136	276	1.82
108	189	308	1.45
110	178	305	2.39
120	330	471	1.28
124	250	548	2.18

Air exchange rates were also measured in select classrooms and areas of the building using tracer gas techniques. Sulfur hexafluoride (SF_6) was used as a tracer gas to determine air change rates in the rooms using the constant injection method. Tracer gas was injected into each room at a uniform rate until steady state was achieved. Once steady state was achieved, the tracer gas was shut off and the decay rate was calculated. Concentrations of SF_6 were measured using a Brüel & Kjær Multi-gas Monitor Type 1302 set up in a multipoint monitoring configuration in order to monitor up to 12 separate locations at the same time. During the testing the charcoal air filtration units in each space were turned off and 20" box fans were used to ensure even mixing of SF_6 within the space. All measurements were collected with the classroom windows and doors closed. Air exchange rates for the rooms, as measured using tracer gas techniques, were found to vary from 1.26 to 3.40 ACH.

A separate tracer gas study was conducted in the first floor classrooms to determine the differences in air exchange rates when the windows are partially opened versus when they are closed. During the first round of tests, all the classroom windows and doors were closed. Immediately following this initial tracer gas study, the rooms were purged and then re-tested with the doors closed and two (2) windows partially opened in each room. The measured air exchange rates measured with the windows and doors closed ranged from 1.07 to 2.61 ACH, while the air exchange rates for the same rooms with the windows slightly opened ranged from 2.12 to 3.33 ACH. Refer to Table 7.3 for a summary of the calculated and measured air exchange rates measured in various rooms.

7.2.3 Exterior PCB Caulk Remediation

During spring recess, in April, 2011, all identified PCB containing exterior door and louver caulk was removed and replaced. In all, approximately 607 linear feet of caulking around 26 doors and four (4) louvers were removed. During the same time period, approximately 1,685 linear feet of PCB containing masonry caulk on the south side of the building was encapsulated. The contractor divided the south side of the building into three (3) equal-sized areas. In each area the contractor applied a different commercially available encapsulant product. Prior to encapsulation, the PCB Caulk surfaces were wet-cleaned, and any damaged or loose caulk was removed and replaced with non PCB-containing caulk (Pecora 890 manufactured by Pecora Corporation). The southeast section was encapsulated with Macropoxy® 646 Fast Cure Epoxy Coating, manufactured by Sherwin Williams, the center section was encapsulated with Elasto-Grip FC, manufactured by TNEMEC, and the southwest section was encapsulated with Sikagard®-62 two-part epoxy protective coating, manufactured by Sika.

7.2.4 Soil Remediation

On July 18, 2010, TRC assessed the condition of exterior soils at P.S. 199M and collected surface soil samples wherever soil was present within ten (10) feet from the school building. Soil samples were collected from soil areas along all building facades, in accordance with the RI Work Plan.

As reported in the Interim RI Report, the analytical results of the surface soil investigation indicated that soil samples collected on the eastern, western, and southern facades of the school building had PCB concentrations above the USEPA clean backfill standard and the NYSDEC PCB soil cleanup level of 1 ppm. None of these soil samples exceeded PCB concentrations of 50 ppm. SCA relied on existing conditions (i.e., grass cover and permanent fencing) to provide isolation and restrict access to soil identified as having greater than or equal to 1 ppm PCBs. Installation of a protective cover layer (i.e., geotextile fabric topped with a 3-4" layer of cedar mulch) was used for impacted areas where there was insufficient vegetative cover.

LBA was retained by SCA and prepared a Surface Soil Remediation Plan on January 14, 2011, which was subsequently approved by the USEPA. Later, LBA monitored the remediation of PCB-impacted soils conducted by the environmental contractor, Creamer Environmental, Inc. (Creamer), and collected post-excavation soil samples after excavation activities were completed.

Based on the results of the surface soil investigation, along the eastern, western, and southern facades of the building soils areas where sample results had PCB concentrations that exceeded 1 ppm were excavated. Soil areas were excavated to a depth of two (2) feet bgs. Post-excavation soil samples were collected and laboratory analytical results of all initial post-excavation samples, with the exception of one (1) sidewall sample, indicated PCBs were less than 1 ppm. Additional excavation was conducted surrounding the failed sidewall sample and an additional post-excavation sample was collected. Laboratory analysis showed this sample to be less than 1 ppm total PCBs and there was no further excavation required in this or any other remediation area of the site.

As reported by LBA, 120 tons (approximately 85 cubic yards) of excavated soil identified as containing less than 50 ppm total PCBs was disposed of as non-hazardous PCB Remediation Waste at a licensed municipal solid waste disposal facility. Excavated areas were restored by backfilling with environmentally clean fill including sand and the backfilled remediated areas were then landscaped and hydro-seeded, with final project completion on August 10, 2011. The details and documentation regarding the soil remediation are presented in a Polychlorinated Biphenyl (PCB) Soil Remediation Report prepared by LBA and dated October 17, 2011. See Appendix J for a copy of the soil remediation report.

7.2.5 Pollutant Pathway Study

Tracer gas studies were performed on February 11 and 12, 2012 at P.S. 199M to better understand PCB migration pathways in the south side of the building. The purpose of the tracer gas studies was to determine if PCBs on the 1st floor migrate to other areas in the building, particularly to classrooms on the 2nd and 3rd floors, since there has been a trend of higher PCB concentrations on the upper floors. Sulfur hexafluoride (SF_6) was used as a tracer gas in the studies. In addition, pressure differentials were monitored at various locations to help understand the tracer gas migration. Testing was performed under two different scenarios: 1) classroom windows and doors closed, exhaust ventilation operating and carbon air filtration units turned off, and 2) in each classroom tested, two windows slightly open, doors closed, exhaust ventilation operating and carbon air filtration units turned off.

The results indicated that when the classroom windows were closed, approximately 95% of the tracer gas was removed from the room via the exhaust ventilation system, and when the windows were slightly opened, approximately 57% of the tracer gas migrated to the adjacent hallway and around 42% was removed via the exhaust ventilation system. Only trace amounts of tracer gas migrated from the 1st floor classroom to the upper floor classrooms, most likely via the pipe risers for the perimeter radiators. See Appendix M for a copy of Supplemental Report #1 which contains additional details and the full pollutant pathway study report.

7.2.6 Long-Term Monitoring Bulk Sampling

On February 7, 2012, long-term monitoring bulk caulk samples were collected at P.S. 199M from locations where PCB caulk was removed and replaced with non-PCB caulk (DAP Dynaflex 230 - manufactured by DAP Products) during the initial Pilot Study activities conducted in July 2010. One composite caulk sample, consisting of three sub-samples, was collected from locations where PCB caulk material had been identified, removed and replaced in the 2010 Pilot Study rooms.

A total of 18 long-term monitoring composite bulk samples of the replacement caulk were collected from rooms 116, 118, 202, 308, 316, 318, 320 and 328, the cafeteria, gymnasium, main entrance stairwell, and the 3rd floor north corridor where PCB caulk material had been previously removed and replaced in 2010. Analytical results indicate that the sample concentrations ranged from less than 1.76 to 70,000 mg/kg, and eight of the 18 caulk samples equaled or exceeded 50 mg/kg of total PCBs.

On April 4, 2012 long-term monitoring bulk caulk samples were collected at P.S. 199M from select locations where PCB caulk was removed and replaced with non-PCB caulk (Pecora 890 - manufactured by Pecora Corporation) during the Pilot Study activities conducted in July of 2011. One composite caulk sample, consisting of three sub-samples, was collected from locations where PCB caulk material had been identified, removed and replaced in the 2011 Pilot Study Rooms.

A total of five long-term monitoring composite bulk samples of the replacement caulk were collected from the 1st, 2nd and 3rd floor corridors where PCB caulk material had been previously removed and replaced in 2011. Sampling was targeted for locations where the 2011 remediated caulk contained at least 10,000 ppm of PCBs. Samples were collected from each homogenous area as defined during the initial Pilot Study testing. Analytical results indicate that the sample concentrations ranged from 651 to 3,820 mg/kg. All five caulk samples exceeded 50 mg/kg of total PCBs

These results suggest that PCBs from the original caulk contaminated the underlying substrate and those PCBs have, in turn, penetrated and contaminated the replacement caulk. See Appendix N for a copy of Supplemental Report #2 which contains additional details, results of the analyses and the sample location drawings.

7.2.7 Indoor Temperature Study

Temperature data logging was performed for two consecutive weeks in select classrooms throughout the building to determine if any trends in the average temperatures in the various rooms and/or on different floors could be identified and how such trends may relate to airborne PCB concentrations in different areas of the building. Monitoring was performed using Dickson TP425 temperature and humidity data loggers which utilize an internal digital temperature sensor with an accuracy of $\pm$0.8 degrees Fahrenheit (^{o}F) over a range of +20 to +120^{o}F. Temperature data was recorded every two minutes.

Temperature data logging was performed from February 27 to March 13, 2012 in rooms 106, 108, 110, 112, 206, 208, 210, 212, 306, 308, 310 and 312. These represent a three floor set of four rooms located directly above each other (i.e., room 306 is directly above room 206 which is directly above room 106). Temperatures within those rooms over that time period were 58.9^{o}F to 82.3^{o}F. The average temperature for the classrooms that were monitored was 72.7^{o}F on the first floor, 71.1^{o}F on the second floor and 70.7^{o}F on the third floor. By comparison, the average post carbon filtration PCB concentrations for the same group of classrooms, measured between September 2011 and April 2012, was 64.1 ng/m^3 on the first floor, 140.4 ng/m^3 on the second floor and 267.8 ng/m^3 on the third floor.

Temperature data logging was performed in rooms 114, 116, 118, 120, 214, 216, 218, 220, 314, 316, 318 and 320 from April 16 to 30, 2012. These represent a second set of four rooms located directly above each other over three floors. Temperatures within those rooms over that time were 58.9°F to 79.2°F. Outdoor temperatures over the same time period were 38°F to 88°F. The average temperature for the classrooms that were monitored was 70.3°F on the first floor, 68.7°F on the second floor, and 70.1°F on the third floor. By comparison, the average post carbon filtration PCB concentrations for the same group of classrooms, measured between August 2011 and April 2012, was 81.4 ng/m^3 on the first floor, 143.4 ng/m^3 on the second floor, and 218.7 ng/m^3 on the third floor. See Appendix O for a copy of Supplemental Report #3 which contains additional details and copies of the temperature data graphs.

7.2.8 Post Encapsulation Air Sampling

Air sampling was conducted in February 2012 in two classrooms, rooms 118 and 322, where various identified materials and coatings (i.e., wall paint, door paint, shelf laminate, etc.) containing PCB's at concentrations greater than 50 parts per million had been identified and encapsulated with Macropoxy 646 during the December 2011 recess. Air sampling was also conducted in primary exposure areas where one or more air sampling result exceeded applicable EPA guideline values within the past two rounds of testing. A first round of air sampling was conducted under typical occupancy conditions.

Immediately following that round of sampling, all furniture and moveable objects in rooms 118 and 322 were removed and stored in the adjacent hallways. Air registers and any other penetrations within the rooms, including pipe risers, were sealed using two layers of six-mil polyethylene sheeting. All surfaces which had not previously been encapsulated were then covered with two layers of six-mil polyethylene sheeting and sealed with tape, leaving only the encapsulated surfaces exposed. An airlock to each room was then constructed on the hallway side and the entrance sealed with duct tape. The rooms remained sealed for three days, after which a second round of sampling was conducted to evaluate the effectiveness of the encapsulation process. Sealed condition air sampling was performed to determine if the encapsulated surfaces are contributing to the PCB air concentrations within those rooms.

A total of 13 air samples were collected on February 17, 2012 under typical occupancy conditions. Ten air samples were collected from classrooms 116, 118, 306, 308, 310, 312, 314, 322 and 336, and the library, and three comparison/quality control samples were collected as described above. The final, validated laboratory results for the indoor air samples ranged from less than 49.1 to 249 ng/m^3.

A total of six air samples were collected on February 23, 2012. Three air samples were collected from classrooms 118 and 322, under sealed conditions as described above, as well as within the gymnasium. Three comparison/quality control samples were also collected. The final, validated laboratory results for the air samples collected in classrooms 118 and 322 were less than 49.5 ng/m^3, while the result for the air sample collected in the gymnasium was 389 ng/m^3. The results suggest that the exposed encapsulated surfaces within the two tested classrooms did not contribute measureable quantities of PCBs to the air during the testing period. See Appendix N for a copy of Supplemental Report #2 which contains additional details and results of the analyses.

7.2.9 Bulk Carbon Air Filtration Media Sampling

On March 29, 2012, bulk samples of carbon media were collected from two air filters on each of the three floors to characterize the filters prior to disposal. Carbon media was collected from air filters in rooms with a history of the highest average airborne PCB concentrations. Samples were collected from classrooms 116, 118, 310 and 314, as well as from the library and the gymnasium. Core samples of the activated carbon were collected from the approximate mid-height on the filter canisters. A total of six core samples of carbon media were collected from the air filters for analysis of total PCBs. Each sample was placed in a separate, pre-cleaned amber glass jar and sealed with a Teflon-lined cap. Containers were properly labeled, preserved, and placed in a cooler for transport by courier to Pace. Standard chain-of-custody procedures were followed. Activated carbon samples were then prepared using Soxhlet extraction and analyzed by USEPA Method 8082 for PCB Aroclors.

Analytical results indicated that the bulk carbon samples contained PCB concentrations of 7.09 to 24.60 ppm, with an average of 13.25 ppm. Both Aroclor 1248 and Aroclor 1254 were present in all of the samples in approximate equal concentrations. The Aroclor pattern found in the bulk carbon samples is similar to that found in the air of each of the rooms sampled. See Appendix O for a copy of Supplemental Report #3 which contains additional details and results of the analyses.

7.2.10 P.S. 199M Post Filter Change Air Sampling

Air sampling was performed on April 12, 2012, approximately two days after carbon filters throughout the building were replaced. Samples were collected under typical occupancy conditions in each primary exposure area where one or more air sample results had exceeded applicable EPA guideline values within the past year. Indoor samples were collected in classrooms 110, 116, 118, 216, 306, 308, 310, 312, 314, 322, 332 and 336, the gymnasium and the library. In addition, one duplicate sample, two front/back samples to evaluate apparent collection efficiency (ACE), and one ambient air sample were collected for comparison and quality control purposes. Two field spikes and one field blank were also submitted. The final, validated laboratory results for the indoor air samples indicated that total PCB concentrations ranged from less than 47.3 to 469 nanograms per cubic meter of air (ng/m^3). See Appendix O for a copy of Supplemental Report #3 which contains additional details, results of the analyses and sample location diagrams.

7.3 P.S. 309K

As described in greater detail below, following completion of Pilot Study remedial activities and collection of post-remediation air samples, specific rooms where air sample analysis revealed airborne PCB concentrations in excess of the USEPA guidance values were re-cleaned. Following completion of the cleaning activities, air samples were collected from within the affected rooms. Testing was performed on August 17 and 23, 2011. Another round of testing, in all of the kindergarten rooms, was then performed on October 30, 2011.

In addition, remediation of soils containing greater than 1 ppm of PCBs was performed during the summer, 2011.

The results of these activities are described in greater detail in the following subsections while the findings are further elaborated upon in Section 9.0.

7.3.1 Building Cleaning

Based upon results of the post-remediation air sampling, Rooms 300, 309 and 318 were re-cleaned on August 17, 2011 as described below. Each of the rooms received a thorough custodial type cleaning. This included HEPA vacuuming or wet wiping all horizontal surfaces and any other surfaces with visible signs of dust. All smooth building and fixture surfaces were wet wiped with Simple Green® followed by a water-based wet-wipe. After cleanup, moveable objects were returned to their original position and the work area and surrounding areas were inspected. Subsequent to completion of successful cleaning, the work areas were allowed to ventilate (i.e., window air conditioners were turned on and the building's exhaust system was operating normally) for approximately two hours prior to collecting air samples.

7.3.2 Post-Re-Cleaning Air Sampling

Following cleaning activities, on August 17, 2011, TRC collected a total of five (5) air samples. The samples consisted of two (2) area air samples, taken in Rooms 300 and 318, one (1) duplicate, one (1) front/back samples to evaluate apparent collection efficiency (ACE), and one (1) ambient air sample for comparison purposes. In addition, two (2) field spikes and one (1) field blank sample were submitted for quality control purposes. Laboratory results for the area air samples were 267 and 312 ng/m^3. On August 23, 2011 TRC collected one (1) additional area air sample in Room 309, one (1) ambient air sample for comparison purposes, and two (2) field spikes and one (1) field blank sample for quality control purposes. Laboratory results of the area air sample indicated the concentration in the room was 192.8 ng/m^3. The results showed an improvement in all samples, as compared to previous post-remediation air sample results; however, two (2) locations, including one kindergarten classroom, still exhibited concentrations above applicable USEPA guidance values. Please refer to Figures 2I, J and K for sampling locations and Table 3G for a summary of the results.

7.3.3 October 2011 Air Sampling Results

An additional set of air samples was collected from kindergarten rooms only on October 30, 2011. Air samples were collected in P.S. 309K in locations depicted in Figures 2I, 2J, and 2K. TRC collected a total of 11 air samples, consisting of eight (8) area air samples, one (1) duplicate, one (1) front/back sample to evaluate apparent collection efficiency (ACE), and one (1) ambient air sample for comparison purposes. In addition, two (2) field spikes and one (1) field blank sample were submitted for quality control purposes. Laboratory results for the area air samples ranged from less than 47.2 ng/m^3 to 63.2 ng/m^3. Please refer to Table 3H for a summary of the results. All of the air samples were below the 100 ng/m^3 USEPA guidance value for kindergarten classrooms.

7.3.4 Air Exhaust Rates Evaluation

Exhaust ventilation rates were measured in November and December, 2011 using an Alnor Balometer® Standard Capture Hood 6461CFM. The device was placed over exhaust grilles and the air flow volume was determined and reported in cubic feet per minute (cfm). In locations where the instrument could not be used because the hood would not fit completely over the exhaust grate being measured (i.e., inside the closet locations), a hot wire velometer (TSI VelociCalc® Air Velocity Meter Model 8355) was used to measure air flow in fpm across the face of the intake grates and these readings were averaged and converted to cfm based on the cross sectional area of the intake. All measurements were collected with the classroom windows and doors closed.

A review of the original ventilation drawings and specifications for the school indicated that design air exhaust rates for the various rooms ranged from 250 to 500 cfm. Air flow rate measurements, however, revealed that exhaust rates for those rooms were 6 to 615 cfm. Please refer to Table 7.4 for a summary of the design and calculated air exchange rates measured in various rooms.

Table 7.3 – Summary of Design and Actual Air Exhaust Rates Measured in Various Rooms at P.S. 309K

Room #	Design air exhaust rate (cfm)	Actual air exhaust rate (cfm)*	Actual/Design
100	500	547	1.09
102	500	531	1.00
104	500	378	0.76

Table 7.3 – Summary of Design and Actual Air Exhaust Rates Measured in Various Rooms at P.S. 309K

Room #	Design air exhaust rate (cfm)	Actual air exhaust rate (cfm)*	Actual/Design
106	500	326	0.65
116	500	219	0.44
118	500	40	0.08
141	400	92	0.23
143	400	147	0.37
145	400	123	0.31
147	400	75	0.19
149	500	404	0.81
200	500	579	1.16
202	500	81	0.16
204	500	100	0.20
206	500	126	0.25
207	500	31	0.06
209	500	12	0.02
210	500	8	0.02
212	500	8	0.02
214	500	32	0.06
216	500	37	0.07
218	500	84	0.17
220	500	81	0.16
239	250	230	0.92
243	500	523	1.05
300	500	615	1.23
302	500	528	1.06
304	500	191	0.38
306	500	238	0.48
307	500	39	0.08
309	500	32	0.06
310	500	6	0.01
311	500	106	0.21
312	500	40	0.08
314	500	54	0.11
316	500	115	0.23
318	500	127	0.25
320	500	45	0.09
339	250	81	0.32
341	500	305	0.61

Table 7.3 – Summary of Design and Actual Air Exhaust Rates Measured in Various Rooms at P.S. 309K

Room #	Design air exhaust rate (cfm)	Actual air exhaust rate (cfm)*	Actual/Design
349	500	294	0.59

* Based on ventilation flow rates as measured using a balometer and velometer.

Following minor repair work performed on the roof mounted exhaust fans, exhaust ventilation rates were again measured on May 12 and 13, 2012 using a TSI Accubalance® Air Capture Hood 8370. The device was placed over exhaust grilles and the air exhaust rate was determined and reported in cfm. In locations where the instrument could not be used because the hood would not fit completely over the exhaust grille being measured (i.e., inside the closet locations), a hot wire velometer (TSI VelociCalc® Air Velocity Meter Model 9555) was used to measure air flow in fpm across the face of the exhaust grilles and these readings were averaged and converted to cfm based on the cross sectional area of the grille. All measurements were collected with the classroom windows and doors closed.

Follow-up airflow measurements indicated that air exhaust rates were 10 to 693 cfm and the average rate was approximately 14.6 percent higher than the average rate measured prior to the exhaust system repair work. Measurements were also collected in select classrooms with the windows slightly open (two windows open approximately two inches) and the doors closed. Airflow measurements indicated that air exhaust rates with the windows closed were 55 to 693 cfm, and air exhaust rates with the windows slightly open were 64 to 1027 cfm. Average air exhaust rates increased by approximately 45 percent when the windows were slightly open versus when they were closed. See Appendix O for a copy of Supplemental Report #3 which contains additional details and summaries of the actual exhaust rates measured in each room.

7.3.5 Soil Remediation

On July 14, 2010, TRC assessed the condition of exterior soils at P.S. 309K and collected surface soil samples wherever soil was present within ten feet from the school building. Soil samples were collected from the planting areas located along the northern facade of the school, in accordance with the RI Work Plan. The soils in the planting areas were the only exposed soils present adjacent to the school building.

As reported in the Interim RI Report, the analytical results of the surface soil investigation indicated that soil samples collected in the soil areas adjacent to the northern facade of the school building had PCB concentrations above the USEPA clean backfill standard and the NYSDEC PCB soil cleanup level of 1 ppm. None of these soil samples exceeded PCB concentrations of 50 ppm. SCA relied on temporarily installed protective cover and existing permanent fencing to provide isolation and restrict access to soil identified as having greater than or equal to 1 ppm PCBs.

LBA was subsequently retained by SCA and prepared a Surface Soil Remediation Plan on January 14, 2011, which was subsequently approved by the USEPA. Later, LBA monitored the remediation of PCB-impacted soils conducted by the environmental contractor, Creamer, and collected post-excavation soil samples after excavation activities were completed.

Based on the results of the surface soil investigation, along the northern facade of the building soils areas where sample results had PCB concentrations that exceeded 1 ppm were excavated. Soil areas were excavated to a depth of two (2) feet bgs. Post-excavation soil samples were collected and laboratory analytical results of all initial post-excavation samples, with the exception of one (1) bottom centerline sample, indicated PCBs were less than 1 ppm. Additional excavation was conducted in the area of the failed bottom centerline sample down to a depth of three (3) feet bgs and an additional post-excavation sample was collected. Laboratory analysis showed this sample to be less than 1 ppm total PCBs and there was no further excavation required in this or any other remediation area of the site.

As reported by LBA, 127 tons (approximately 91 cubic yards) of excavated soil identified as containing less than 50 ppm total PCBs was disposed of as non-hazardous PCB Remediation Waste at a licensed municipal solid waste disposal facility. The resulting excavated areas were restored by backfilling with environmentally clean fill including sand and topsoil and then the backfilled remediated areas were landscaped on July 26-27, 2011. The details and documentation regarding the soil remediation are presented in a Polychlorinated Biphenyl (PCB) Soil Remediation Report prepared by LBA and dated October 17, 2011. See Appendix J for a copy of the soil remediation report.

7.3.6 Long-Term Monitoring Wipe Sampling

On January 30, 2012, long-term monitoring wipe samples were collected at P.S. 309K from surfaces of PCB caulk that were encapsulated, using Macropoxy 646 manufactured by Sherwin Williams, during the initial Pilot Study activities conducted in July 2010. A total of eight wipe samples were collected from surfaces of encapsulated PCB caulk in the cafeteria, gymnasium, 1st floor west corridor, and north stairwell. Samples were collected from each homogenous area as defined during the initial Pilot Study testing, and one field blank was collected for quality control purposes.

Analytical results indicate that the sample concentrations ranged from 36.24 to 1,362 micrograms per 100 square centimeters (ug/100 cm^2). All eight wipe samples exceeded the USEPA's High Occupancy wipe sample criteria of 10 µg/100 cm^2 (40 CFR 761.3, 761.123 and 761.30). These results suggest that some of the PCBs from the caulk have penetrated and migrated through the encapsulant. See Appendix N for a copy of Supplemental Report #2 which contains additional details, results of the analyses and the sample location drawings.

7.4 P.S. 183Q

Post-remedial air sampling conducted on August 21, 2011 following removal and replacement of window units with PCB Caulking at P.S. 183Q showed seven (7) of the twelve (12) air samples were above the applicable USEPA guidance value. In addition, two (2) post-remedial wipe samples were above 2 µg/100cm^2. As a result of these findings, an environmental contractor re-cleaned these areas and areas were retested as described below.

7.4.1 Re-Cleaning

Kiss Construction conducted additional, detailed, and fine re-cleaning activities including HEPA vacuuming and wet wiping of non-porous horizontal surfaces including, but not limited to, floors, desks, shelves, cabinets, radiator coverings, and window sills in the following areas:

- Rooms 103, 105, 107, 109, 151, and the SW and NE stairwells were re-cleaned on August 30, 2011, followed by a 24-hour ventilation period with windows opened, building ventilation on, and the doors to the stairwells and bulkheads opened. The exterior ground floor stairwell entrance door was opened during day-time hours only.

- The Gym was re-cleaned utilizing the same methods described above on August 31, 2011.

7.4.2 Post-Re-Cleaning Wipe Samples

Subsequent to implementation of re-cleaning activities, wipe samples were collected in the same locations as the post-remediation low-contact area wipe samples previously collected in Room 109 and the Gym. As presented in Table 4E, two samples were collected on September 1, 2011. Both results showed a decrease in concentrations and both results were below 1 µg/100cm^2, which is below the USEPA comparison criteria of 10 µg/100cm^2.

7.4.3 Post-Re-Cleaning Air Sampling

Following completion of re-cleaning activities, PCB air sampling was conducted in Rooms 103, 105, 107, 151, and the SW and NE stairwells in the same locations as the post-remediation air sample locations. An ambient air sample was also collected. As presented in Table 4I, laboratory results for five (5) of the seven (7) air samples indicated that concentrations were below the analytical detection limit (non-detected). The third floor NE stairwell sample location had a concentration of 106 ng/m^3 and the second floor SW stairwell sample location had a concentration of 480 ng/m^3. In response to these findings, an inspection of representative fixtures in those areas was conducted that identified fixtures with non-PCB ballasts; however, there was evidence of possible historic ballast staining/discharge within the fixtures. Therefore, it is recommended that P.S. 183Q be included in the ongoing light fixture replacement program.

7.5 P.S. 3R

Post-remedial air sampling conducted on August 24, 2011, following removal and replacement of PCB ballasts and associated light fixtures at P.S. 3R, showed only one result (675 ng/m^3) above the 300 ng/m^3 USEPA Guidance value. This sample was collected in the First Floor East Stairwell. An inspection of the area revealed that there was damaged suspect caulking around the stairwell door frames. In response to this finding, damaged caulk was repaired and encapsulated in this stairwell as described in greater detail below.

7.5.1 Caulk Repair and Encapsulation Activities

Caulk repair and encapsulation activities were conducted on damaged caulk located around doors in the East Stairwell that connects the first floor to the basement. A total of approximately 14 linear feet of damaged basement fire door frame caulking were removed and replaced with non PCB-containing caulk utilizing asbestos negative pressure tent removal techniques. In addition, approximately 64 linear feet of door frame caulk located on the first floor level of the East Stairwell were repaired and encapsulated with Sikagard® 550W also utilizing asbestos tent procedures. Removal and encapsulation activities were performed on August 31, 2011. Subsequent to completion of work and breakdown of tent containments, TRC collected another set of PCB air samples in the East Stairwell as described below.

7.5.2 Post-Encapsulation Air Sampling

Following completion of repair and encapsulation activities, PCB air sampling was conducted in the First Floor East Stairwell on September 2, 2011, in the same location as the Post-Remediation air sample location. A duplicate and ambient air sample was also collected. As presented in Table 5I, the First Floor East Stairwell air sample result of 277 ng/m^3 was below the post-remedial air sample result of 675 ng/m^3. The co-located duplicate sample was found to be 322 ng/m^3. The average of these two results is 299.5 ng/m^3, which is below the USEPA guidance value.

8.0 LABORATORY DATA QUALITY

Data generated during the investigation were assessed using the acceptance criteria and objectives specified in the RI Plan. Evaluating the quality of analytical data to determine whether the data were of sufficient quality for the intended purpose was a two-step process. The first step of the process was a data quality assessment (DQA) to identify and summarize any quality control problems that occurred during laboratory analysis (QC non-conformances). The results of the DQA were then used to perform a data usability evaluation to determine whether or not the quality of the analytical data was sufficient for decision-making purposes.

Data generated in association with quality control (QC) results which met the stated acceptance criteria were considered usable for decision-making purposes. Data generated in association with QC results that did not meet the stated acceptance criteria, however, may still be usable for decision-making purposes; this evaluation is discussed in more detail below. The data set was evaluated to identify potential data limitations, biases, or uncertainties in the laboratory results. In addition, the data set was reviewed for dilution factors that might affect sensitivity and the achievement of project objectives. All the Laboratory Analytical Data Reports are provided on a Compact Disk located in Appendix G. In addition, the details of the laboratory data assessment are presented in the Data Validation Reports (also on Compact Disk) and the Laboratory Data Quality Summary, provided in Appendices H and I, respectively.

Table 8.1 summarizes the percentages of data qualified or affected by the individual accuracy and precision parameters, as well as by instrument sensitivity issues.

Table 8.1 - Percentages of Remedial Investigation Data Qualified During Data Validation

	Air	Wipe	Soil	Bulk Caulk
Field Duplicates	0.13%	NA	0.43%	NA
MS/MSD Precision	NA	NA	0%	NA
Dual Column Variability	0%	0%	0%	0%
Holding Times	0%	0%	0%	0.38%
Calibrations	0%	0%	0%	0%
Laboratory Control Samples	0%	0%	0%	0%
Blanks	0%	0%	0%	0%
Surrogate Spikes	1.3%	0.68%	0%	1.0%
Field Spikes	0%	NA	NA	NA
Collection Efficiency	0%	NA	NA	NA
MS/MSD Recoveries	NA	NA	0%	NA
Target Compound Identification	100%*	100%*	100%*	100%*
Representativeness	0%	0%	0%	3.0%
Sensitivity	0%	0%	0%	0%

NA – Not applicable

*100% of detected PCB Aroclor results were qualified as estimated (See Section 1.4.3.10 of the Laboratory Data Quality Summary).

Due to the presence of altered PCB patterns and/or multiple PCB Aroclors, all detected PCB Aroclor results were qualified as estimated (J).

The laboratory completeness objective for the project was greater than 95%. This goal was achieved for each sampling event and matrix, as well as for the entire remedial investigation. None of the data were deemed unusable in the air, soil or wipe matrices (thereby, 100% completeness). The non-detect results for PCB Aroclors 1260, 1262, and 1268 in sample 199-FL1-CK-PRE-29 (from the pre-remedial bulk caulk survey) were rejected (R) due to the presence of a significant unresolved complex mixture present within the retention time range of these PCB Aroclors. This resulted in 99.8 percent laboratory completeness for bulk caulk samples.

In all but two cases, the QC and sensitivity issues did not have any adverse affect on the achievement of the project objectives and/or the decision-making process. The two (2) cases which may have been affected by the QC issues are as follows:

- Caution should be used with the total PCB results in the field duplicate pair for soil sample 183-SOUTH-SO-8-B due to field duplicate variability, as the total PCB results in the original sample significantly exceeds the project action level and the field duplicate result falls below the project action level. In order to remain conservative, the results from the original sample should be used for decision-making purposes at this location.

- Caution should be used with the total PCB result in sample 199-320-AR-POST-51 due to low surrogate recoveries as the concentration of total PCBs in this sample is slightly below the project action level and may have been affected by the low bias; the actual result may be higher and above the project action level. The achievement of project objectives was not adversely affected by this low bias, as activated carbon air filters continued to operate in Room 320 and additional air monitoring was performed at this location. The results of the additional air monitoring at this location exhibited acceptable surrogate recoveries and PCB results below the project action level.

The Laboratory Data Quality Summary in Appendix I provides a detailed discussion on the QC and/or sensitivity issues and any effect they may have had on the usability of the data, the achievement of project objectives, and/or the decision-making process.

9.0 FINDINGS

9.1 Comparison of Pre and Post-Remediation Wipe Sampling Results

Pre- and post-remediation wipe sampling results in the five (5) Pilot School Buildings were consistently below the applicable wipe sample comparison criteria of 10 µg/100 cm^2.

Based upon these results, the presence of PCBs on surfaces is not thought to represent a significant source of potential PCB exposures in the study areas. The current cleaning methodologies described in the best management practices (as supported by the favorable pre-remedial wipe sample analytical results) were deemed effective in controlling exposures to PCBs on surfaces. In addition, to the extent that the PCB Caulk within the study areas may have contributed to the presence of PCBs on surfaces, the dust control and cleaning methodologies utilized as a part of the PCB Caulk remedial activities were also deemed appropriate to control exposure to PCBs on surfaces, as evidenced by the post-remedial wipe sample results.

9.1.1 P.S. 178X/176 Wipe Sampling

As previously discussed, remedial activities in P.S. 178X/176 consisted of patch and repair of all damaged PCB Caulk within the building. The results from the post-remediation wipe sampling in the study areas were consistent with the pre-remedial wipe sampling results, and all results were below the comparison criteria of 10 µg/100 cm^2 (refer to Tables 1C and 1F for sample results).

9.1.2 P.S. 199M Wipe Sampling

Remedial activities in P.S. 199M consisted of removal and replacement of all PCB Caulk with new non PCB-containing caulk within the building. The results from the post-remediation wipe sampling in the study areas were consistent with the pre-remedial wipe sampling results, and all results were below the comparison criteria of 10 µg/100 cm^2 (refer to Tables 2C and 2F for sample results).

9.1.3 P.S. 309K Wipe Sampling

Remedial activities in P.S. 309K consisted of encapsulating all PCB Caulk within the building. The results from the post-remediation wipe sampling in the study areas were consistent with the pre-remedial wipe sampling results, and all results were below the comparison criteria of 10 µg/100 cm^2 (refer to Tables 3C and 3E for sample results).

9.1.4 P.S. 183Q Wipe Sampling

Remedial activities at P.S. 183Q consisted of removal of window systems and associated PCB Caulk and replacing it with new, non PCB-containing caulk. Results from the post-remediation wipe sampling in remediated areas were consistent with the pre-remedial wipe sampling results and all results were below the comparison criteria of 10 µg/100 cm^2 (refer to Tables 4C and 4E for sample results).

9.1.5 P.S. 3R Wipe Sampling

Remedial activities at P.S. 3R consisted of removal and replacement of all suspect fluorescent light fixtures and ballasts within the building. Results from the post-remediation wipe sampling in remediated areas were consistent with the pre-remedial wipe sampling results and all results were below the comparison criteria of 10 µg/100 cm^2 (refer to Tables 5C and 5E for sample results).

9.2 Comparison of Air Sampling PCB Results

The PCB air sample results were evaluated to determine whether there are differences in the pre-remediation data as compared to the post-remediation data. This included a statistical analysis of the data to identify differences that are statistically significant to a 95% confidence level (indicated as "$p \leq 0.05$"). Sample results are provided in Tables 1D through 1G, 2D through 2H, 3D through 3H, and Supplemental Report #3.

The statistical analysis method included confirming that the data are normally distributed and comparison of typical statistical parameters (e.g., average and variance) using parametric hypothesis testing methodology and assumptions. Normality was evaluated using standard chi-square and cumulative distribution function tests. Comparison of the pre- and post-remediation mean concentrations was performed using t-distribution hypothesis tests (t-tests). Data were grouped by Primary Exposure Areas (Primary) and Transitory Areas (Transitory), and by date, for P.S. 3R, P.S. 183Q, P.S. 199M and P.S. 309K. Data for P.S. 178X/176 were only grouped by date due to very low concentrations, which did not warrant more detailed comparisons (i.e., did not warrant further analysis of data grouped by Primary vs. Transitory).

Based on the statistical analysis, the pre- and post- PCB air data sets from all Primary Exposure Areas are normally distributed, with the exception of P.S. 178X/176. Statistical inference of the distribution was not attainable for some of pre and post-remediation PCB air data sets from the Transitory Areas due to low numbers of samples. Normality of data distribution is noted for the various sample groups in the tables below.

Although temperature data were not collected as a potential correlation variable, temperature data are considered as a potential source of variance in the PCB air sample concentrations. An initial review of the 2011 data indicated temperature data sets for P.S. 3R, P.S. 183Q and P.S. 309K were limited, and PCBs were not detected in most air sample data for P.S. 178X/176. Therefore, no further evaluation of temperature data for these locations was performed. A cursory analysis of the 2011 temperature data from P.S. 199M was performed to evaluate potential correlations between PCB concentrations in air and temperature of the indoor space being assessed. The 2011 temperature and total PCB air data were grouped by date, building floor (i.e., Floor 1, 2 or 3), and exposure area type (Primary and Transitory). No correlation between temperature and PCBs in air was noted as a result of this analysis. However, the statistical significance of the correlation results cannot be evaluated due to the low numbers of temperature data. To further evaluate the correlation between air concentrations and temperature, TRC expanded the data set to include data previously collected at P.S. 199M. This additional evaluation of potential effects of temperature on PCB concentrations in air is provided in Section 9.5 below. Future data collection efforts should consider incorporating temperature as a monitoring parameter to compliment PCB data to facilitate more detailed data evaluation for potential temperature effects.

Further evaluation of mean (average) concentrations calculated for the pre-and post-remediation PCB air data using t-tests is described for each school in the following sections.

9.2.1 P.S. 178X/176 Air Sampling

The mean PCB concentrations in Spring Air Sampling (April/May, 2011), Pre-Remediation (June, 2011) and Post-Remediation (August 2011) air sample data are summarized as follows:

Table 9.1 – P.S. 178X/176 Air Sampling PCB Data (ng/m^3)

Sample Date	April/May 2011	June 2011	August 2011
Mean	52.1	52.77	49.6
Std. Dev.	18.3	14.9	1.8
Count (n)	N=26	N=18	N=18
Distribution	Not Normal	Not Normal	Not Normal

PCB was detected in only two (2) samples above the most stringent comparison criteria (100 ng/m^3) at 112 and 142 ng/m^3. These samples were collected prior to remediation activities (April/May 2011) and Pre-Remediation (June 2011) air samples. All Post–Remediation (August 2011) data were non-detect (ND at RL<60 ng/m^3) and below the most stringent comparison criteria of 100 ng/m3. Therefore, because most data were non-detect at reporting limits below the most stringent comparison criteria, further statistical comparisons are not warranted.

9.2.2 P.S. 199M Air Sampling

The mean PCB concentrations in Pre-Remediation (June, 2011), Post-Remediation (August, 2011) and Post-Carbon Filtration (September and October, 2011 and April, 2012) air sample data in the Primary and Transitory areas are summarized as follows:

Table 9.2 – P.S. 199M Removal and Replacement Summary of Total PCBs in Air (ng/m^3)

Sampling Status	Pre-Remedial	Pre-Remedial	Post-Remedial	Post-Remedial	Post-Carbon Filtration	Post-Carbon Filtration	Post-Carbon Filtration
Sample Date	**June 2011**	**June 2011**	**August 2011**	**August 2011**	**September 2011**	**October 2011**	**April 2012**
Area Type	**Primary**	**Transitory**	**Primary**	**Transitory**	**Primary**	**Primary**	**Primary**
Mean	289.8	324.2	288.5	371.4	157.8	138.7	135.8
Std. Dev.	149.8	267.3	176.6	185	94.1	111.2	108.4
Minimum	49.1	49.4	49.6	223.4	47.8	46.3	47.7
Maximum	471	1005	588	821	355	414	449
Count (n)	11	9	15	9	60	58	14
Distribution	Normal	Normal	Normal	Normal	Normal	Normal	Normal

The mean of the Primary and Transitory data sets from the Pre-Remediation Air Samples (June) and Post-Remedial Air Samples (August) were not significantly different ($p > 0.05$). However, the mean of the Post-Carbon Filtration air samples collected in September and October are both significantly lower than the mean of both the Pre-Remedial Air Samples (June) and Post-Remedial Air Samples (August) ($p < 0.05$). Post-Carbon Filtration Air Samples data collected in September, October and April included only samples collected in Primary areas and the mean concentrations of the September, October and April sampling events are not significantly different ($p > 0.05$) from one another.

9.2.3 P.S. 309K Air Sampling

The mean PCB concentrations in Pre-Remediation (June 2011), Post-Remediation (August 7, 2011) and supplemental October 2011 air sample data in the Primary and Transitory areas are summarized below. Four Post-Re-cleaning air samples were collected on August 17 and 23, 2011, but were not included in the statistical analysis due to the low number of samples.

Table 9.3 – P.S. 309K Encapsulation Summary of Total PCBs in Air (ng/m^3)

Sampling Status	Pre-Remedial	Pre-Remedial	Post-Remedial	Post-Remedial	Fall Conditions
Sample Date	**June 2011**	**June 2011**	**August 2011**	**August 2011**	**October 2011**
Area Type	**Primary**	**Transitory**	**Primary**	**Transitory**	**Primary**
Mean	90.7	168.9	168.8	164.9	49.6
Std. Dev.	41.9	42.5	132.7	48.2	5.1
Minimum	49.8	109	49.7	63.5	47.2
Maximum	167.5	225.9	409	207.8	63.2
Count (n)	9	6	9	7	9
Distribution	Normal	Normal	Normal	Normal	Normal

The mean of the Pre-Remediation (June) Primary data is significantly lower than both the mean of the Pre-Remediation June Transitory data and the mean of the Post-Remediation (August) Primary data ($p < 0.05$). The mean of the Pre-Remediation (June) Transitory data is not significantly different from the Post-Remediation (August) Primary or Transitory data ($p > 0.05$). The mean of the October data is significantly lower than the mean of the data from both June and August, respectively ($p < 0.05$). It should be noted that the Post-Re-cleaning air data (August 17 and 23) included samples collected in Primary Exposure Areas only (Rooms 309, 310 and 318) that contained total PCBs ranging from 192 to 312 ng/m^3.

As PCB Caulk did not exist in Primary Exposure Areas at P.S. 309K, only Transitory Areas were remediated (See Table 4.3). The data therefore shows that there is no significant difference between pre and post-remedial air sampling results in the areas remediated. Differences between pre- and post-remedial results in Primary Exposure Areas are likely due to the variable nature of PCB air concentrations between sampling events which are influenced by differing site conditions (i.e., air movement, temperature, site activity, etc.) during each sampling event and variability inherent to the sampling and analytical method.

9.2.4 P.S. 183Q Air Sampling

The mean PCB concentrations in Pre-Remediation (June, 2011), Post-Remediation (August, 2011) and Post-Re-Cleaning (September, 2011) air sample data in the Primary and Transitory areas are summarized as follows:

Table 9.4 – P.S. 183Q Window Replacement Summary of Total PCBs in Air (ng/m^3)						
Sampling Status	**Pre-Remedial**	**Pre-Remedial**	**Post-Remedial**	**Post-Remedial**	**Post-Re-Cleaning**	**Post-Re-Cleaning**
Sample Date	**June 2011**	**June 2011**	**August 2011**	**August 2011**	**September 2011**	**September 2011**
Area Type	**Primary**	**Transitory**	**Primary**	**Transitory**	**Primary**	**Transitory**
Mean	124.9	738.3	156.9	507.7	48.8	293
Std. Dev.	96.6	142.6	62.1	245.9	0.4	264.5
Minimum	48.9	585	49.4	316	48.3	106
Maximum	293	867	242.9	785	49.2	480
Count (n)	9	3	10	3	5	2
Distribution	Normal	NA	Normal	NA	Normal	NA

NA – Not applicable

The mean of Pre-Remediation (June) data is not significantly different from the Post-Remediation (August) Primary data ($p > 0.05$). The mean of Post-Re-Cleaning (September) Primary data is significantly lower than mean of June and August Primary data ($p < 0.05$). Note that the September Primary data were all non-detect (reporting limit <60 ng/m3). The data sets for Transitory areas are too small to confirm the data distribution as indicated by the "NA" for the data distribution above. However, the mean of the Transitory data for all three dates are notably higher than the mean concentrations from the Primary data.

9.2.5 P.S. 3R Air Sampling

The mean PCB concentrations in Pre-Remediation (May, 2011), Post-Remediation (August, 2011) and Post-Caulk Repair (September, 2011) air sample data in the Primary and Transitory areas are summarized as follows:

Table 9.5 – P.S. 3R Light Ballast and Fixture Replacement Summary of Total PCBs in Air (ng/m^3)				
Sample Status	**Pre-Remedial**	**Pre-Remedial**	**Post-Remedial**	**Post-Remedial**
Sample Date	**May 2011**	**May 2011**	**August 2011**	**August 2011**
Area Type	**Primary**	**Transitory**	**Primary**	**Transitory**
Mean	109.0	279.2	84.8	287.3
Std. Dev.	102.9	343.4	59.9	338.7
Minimum	48.9	50.2	48.3	48.6
Maximum	301	674	175.7	675
Count (n)	6	3	7	3
Distribution	Normal	NA	Normal	NA

NA – Not applicable

Although the Post–Remedial Primary data mean and maximum were lower than both the Pre-Remedial Primary data and the Post-Remedial Transitory data, the differences are not significant ($p>0.05$). The data distribution was not inferred for the May and August Transitory data (indicated as "NA" above) due to the low number of samples (i.e., n=3).

9.2.6 Summary of Air Sampling Data Comparison

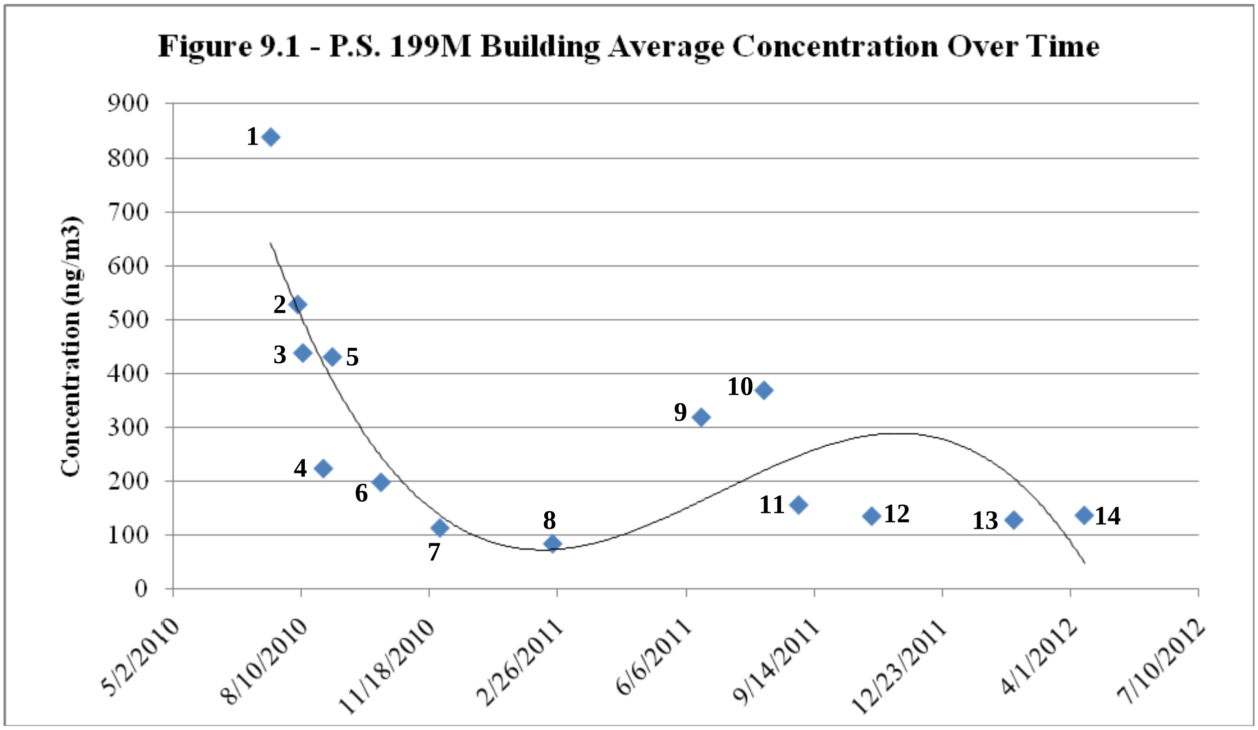
The overall objective of the statistical analysis was to determine whether differences among the pre-remediation, post-remediation and post-pilot PCB air data are significantly different in a given Pilot School Building. As part of the analysis, data from Primary Exposure Areas and Transitory Areas were arranged as separate groups for statistical comparison. Evaluation of pre- and post-remediation air sampling results from the Pilot Study activities performed in 2010 determined that there are not enough data to run statistical analysis of Primary exposure areas versus Transitory Areas. Data from P.S. 178X, and data from Transitory Areas in P.S. 183 and P.S. 3R, were omitted from comparison due to low numbers of samples, as noted above. Based on the comparison and statistical analysis of the PCB air sample analytical results described above, most of the pre- and post-remediation PCB air sampling data obtained from among the Primary Exposure Areas were not significantly different ($p > 0.05$). However, air sampling data obtained from Primary Areas within P.S. 183Q, P.S. 199M, and P.S. 309K, after additional remedial activities were implemented, were significantly lower than pre- and post-remediation data ($p < 0.05$). Although low numbers of samples limited statistical analysis of Transitory Areas, there is enough available data to suggest airborne PCB concentrations in the Transitory Areas were higher than airborne PCB concentrations in the Primary Exposure Areas in P.S. 199M, P.S. 3R, and P.S. 183Q.

The data for P.S. 178X are mostly non-detect, with only two samples having concentrations at slightly over the most stringent comparison criteria of 100ng/m^3 in air samples prior to remediation. The data for P.S. 3R indicate (1) the average and maximum PCB concentrations detected in the air samples obtained after light ballast replacement are generally lower than those in the samples collected before replacement, and (2) PCB concentrations in Transitory areas appear higher than Primary areas. However, the noted differences are not significant ($p > 0.05$).

The data evaluation could not eliminate the potential for differences in PCB air data between Primary Exposure Areas vs. Transitory Areas, or potential differences in PCB air concentrations due to temperature and location (floor level, proximity to areas with relatively elevated PCB concentrations, potential alternative sources of PCB). Therefore, the number of samples and locations of these variables should be considered for any future sampling programs or confirmatory follow-up sampling activities.

9.3 P.S. 199M Airborne PCB Concentrations Over Time

Between August 23, 2008, and April 12, 2012, twenty (20) rounds of wide-scale testing were performed in P.S. 199M. Four (4) of these rounds were performed prior to the initiation of the Pilot Study, and the other sixteen (16) rounds were performed as part of the Pilot Study. Eight (8) rounds of sampling were performed in August, three (3) rounds in October, two (2) rounds each in February and September, and one (1) round each in January, April, June, July and November. Building-wide monthly PCB averages ranged from a high of 839.67 ng/m^3, measured in July, 2010, to a low of 78.06 ng/m^3, in February 2011. Please refer to Figure 9.1 for a graphical representation of the building-wide airborne PCB average concentration trend since the beginning of the Pilot Study in June, 2010.



Key to Air Sampling Events:
1 – June 17, 2010 pre-remedial sampling
2 – August 7, 2010 post-remedial sampling
3 – August 11, 2010 post-remedial resampling
4 – August 27, 2010 post-light fixture replacement sampling
5 – September 3, 2010 post-encapsulation sampling
6 – October 11, 2010 post-ventilation sampling
7 – November 26, 2010 winter conditions sampling
8 – February 22, 2011 winter conditions sampling
9 – June 18, 2011 pre-remedial sampling
10 – August 6, 2011 post-remedial sampling
11 – September 2, 2011 post-carbon filtration sampling
12 – October 30, 2011 post-carbon filtration sampling
13 – February 17, 2012 winter conditions sampling
14 – April 12, 2012 spring conditions sampling

Between October 1, 2008 and April 12, 2012, eleven (11) rounds of wide-scale air testing were performed in the building during regular school months (September through June). Over the course of that period, three (3) rounds of sampling were performed in October, two (2) rounds each were performed in September and February, and one (1) round was conducted in January, April, June and November. Building-wide monthly PCB averages ranged from 78.06 ng/m^3 to 318.44 ng/m^3, and the building wide average for the regular school year was 167.1 ng/m^3. The data indicates that school wide averages are generally highest over the summer months and at the beginning and end of the school year and lowest during the school year winter months. As indicated by the data, average building-wide airborne PCB concentrations at P.S. 199M has tended to decrease with time and following implementation of the remedial and post-pilot activities. The same trend has also been noted in P.S. 309K, as detailed in Supplemental Report #1 located in Appendix M of this report.

9.4 P.S. 199M Floor-by-Floor PCB Concentration Comparison

Airborne PCB concentration data in P.S. 199M was analyzed to determine if there was any correlation between building floor and airborne PCB concentration in Primary Exposure Areas. Airborne PCB concentration data from the following sampling events was utilized in this analysis:

Table 9.6 – Summary of Air Sampling Events at P.S. 199M Utilized in Floor-by-Floor Comparison					
Sample Date	10/1/2008	1/19/2009	8/27/2010	9/2/2011	10/29/2011
Sample Status	Post-Ventilation	No Ventilation	Post-Fixture Replacement	Post-Carbon Air Filtration	Post-Carbon Air Filtration

In a few cases, no data was available for a particular room and sampling event. The available airborne PCB concentration data for these sampling events, grouped by floor, is as follows:

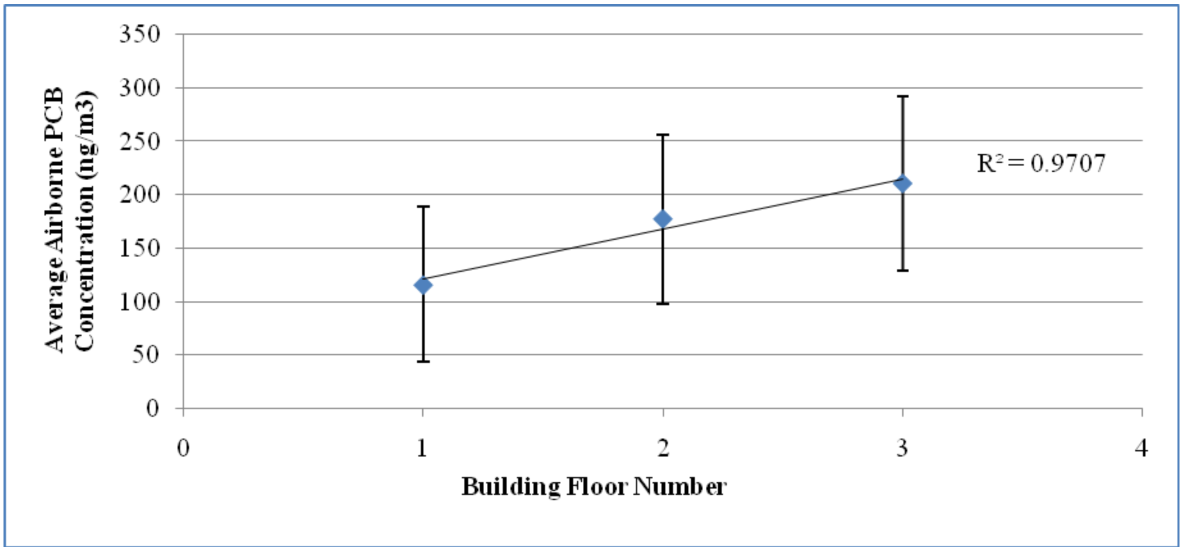
Table 9.7 – Total Airborne PCB Concentration by Sampling Event, Room Number and Floor					
Sample Date	**10/1/2008**	**1/19/2009**	**8/27/2010**	**9/2/2011**	**10/29/2011**
Sample Status	**Post-Ventilation**	**No Ventilation**	**Post-Fixture Replacement**	**Post-Carbon Air Filtration**	**Post-Carbon Air Filtration**
First Floor (Airborne PCB Concentration – ng/m^3)					
106	148	51 U	244	48.4 U	86.0
108	152	51 U	180	69.4	70.8
110	76	52 U	225	67.8	75.3
112	131	51 U	208	47.8 U	47.0 U
114	324	160	155	63.9	47.7 U
116	140	70	173	151.7	69.6
118	81	201	253	184.6	169.2
120	94	51 U	266	58.2	56.4
124	148	64	175	47.9 U	54.0
126	No Data	73	243	48.5 U	48.4 U
128	No Data	No Data	160	65.8	47.7 U
Second Floor (Airborne PCB Concentration – ng/m^3)					
202	138	67	229.1	162.4	147.5
204	219	167	272	217	194.6
206	281	No Data	235	172.6	140.9
208	305	116	258	158.1	104.0
210	300	88.5	No Data	177.3	68.9
212	332	178	276	200.2	101.0
214	268	114	199.7	228	47.6 U
216	251	123	224.3	61.3	53.8
218	49 U	125	347	198.2	175.8
220	261	135	295	221	153.4
222	205	57	172	83.1	53.7

Table 9.7 – Total Airborne PCB Concentration by Sampling Event, Room Number and Floor					
Sample Date	**10/1/2008**	**1/19/2009**	**8/27/2010**	**9/2/2011**	**10/29/2011**
Sample Status	**Post-Ventilation**	**No Ventilation**	**Post-Fixture Replacement**	**Post-Carbon Air Filtration**	**Post-Carbon Air Filtration**
224	236	135	263	163.5	79.3
Third Floor (Airborne PCB Concentration – ng/m^3)					
302	171	146	191.5	268	246
304	221.5	127.5	283	260	124
306	264	236	194.5	243	410
308	310	No Data	240	261	354
310	No Data	182	226.8	281	385
312	No Data	269	234.2	325.5	292
314	196	185	302	184.9	372
316	253	186	No Data	267	239
318	251	162	277	236	231
320	207	110	213.6	159	179.1
322	219	204	279	276	414
324	213	155	260	210.4	189.4
326	220	82.5	282	235	170.8
328	305	177	212.6	185.1	No Data
330	236	73	224	48.3 U	47.5 U
332	213	148	198	87.7	47.7 U
333	182	124	48.1 U	189.3	47.8 U
334	168	70	187.5	87.9	61.4
336	212	171	279	355	175.2

U = concentrations were non-detect and represent the reporting limit.

The above PCB data were combined into three groups by floor (i.e., Floor 1, 2 and 3). The mean and standard deviation (sd) were calculated for each group, and statistical analyses were performed, including normality tests (chi-square) and hypothesis tests (completed as a one-way Analysis of Variance [ANOVA] two-sample t-test) comparing the mean PCB concentrations. The average and sd of the airborne PCB concentrations for the three groups is 115.9 ng/m^3 (sd = 73), 177.3 ng/m^3 (sd = 79), and 210 ng/m^3 (sd = 82) for the first, second and third floors; respectively. Each of the three groups is normally distributed and the differences between the mean PCB concentrations for all three groups are significant ($p < 0.05$). A plot of the mean PCB concentration with sd error bars (See Figure 9.2) indicates a positive trend with floor level (i.e., PCB air concentrations increase with increasing floor levels).

Figure 9.2 - Average Airborne PCB Concentrations for Various Rooms by Floor at P.S. 199M



The results suggest that there is a positive relationship between the building floor level and the average concentration of airborne PCBs measured within classrooms grouped by floor. The same trend has also been noted in P.S. 309K, as detailed in Supplemental Report #1 located in Appendix M of this report.

9.5 P.S. 199M Temperature versus Airborne Concentrations Evaluation

9.5.1 Outdoor Air Temperatures Comparison

Data was analyzed to determine if there was any correlation between outdoor air temperatures and airborne concentrations. The data was examined on a floor-by-floor basis. Following is a listing of the rooms and sampling dates included in the analysis:

Table 9.8 – Summary of Air Sampling Events and Rooms at P.S. 199M Evaluated in the Outdoor Temperature Evaluation		
Floor	**Air Sampling Data Collection Dates**	**Rooms**
1st Floor	10/1/2008, 1/19/2009, 8/27/2010, 9/3/2010, 10/11/2010, 11/26/2010 and 2/22/2011	108, 110, 112, 114, 116, 118, 120 and 124
3rd Floor	10/1/2008, 1/19/2009, 7/17/2010, 8/7/20108/11/2010, 8/27/2010 and 2/22/2011	308, 316, 318, 320 and 328

These particular data sets were selected because multiple rooms were sampled on each date, allowing a direct comparison between the results. In addition, all of the sampling events took place after the exhaust fans on the roof had been replaced, which was completed in September, 2008. For the second floor, an insufficient number of rooms were sampled during the same time period to perform a similar statistical analysis. For each sampling event, the maximum outdoor air temperature measured during the sampling period, as reported by Weather Underground for Central Park, was used in the comparison. As depicted in the following figures, there appears to be a positive correlation between the two variables.

Figure 9.3 – 1st Floor Classroom Average Total Airborne PCB Concentrations versus Maximum Outdoor Air Temperature

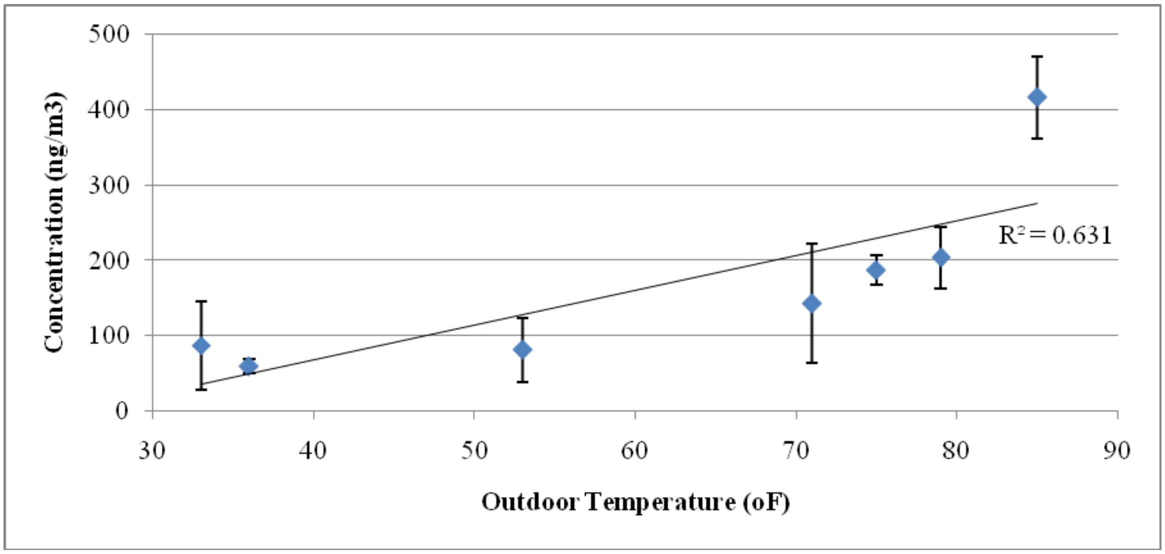
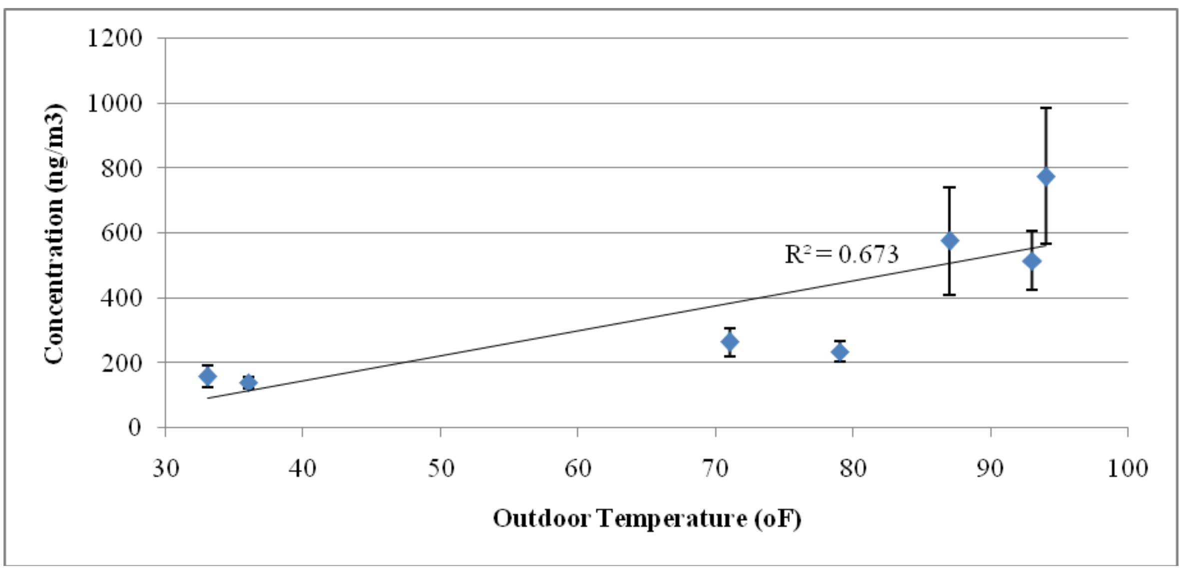


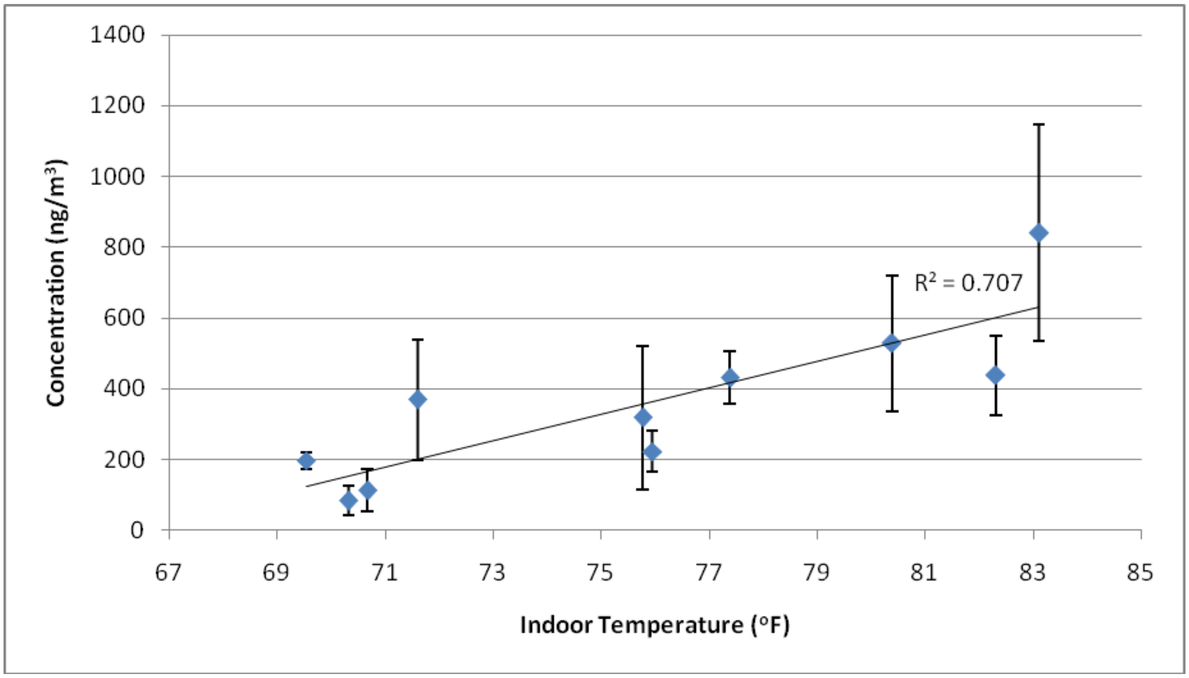
Figure 9.4 – 3rd Floor Classroom Average Total Airborne PCB Concentrations versus Maximum Outdoor Air Temperature



9.5.2 Indoor Air Temperatures Comparison

Data was analyzed to determine whether there was any correlation between indoor air temperatures and airborne concentrations. The data was examined on a building-wide average concentration basis, which includes data collected from both primary and transitory areas. A total of ten (10) rounds of wide-scale testing, performed between July 17, 2010, and August 6, 2011, were included in the analysis. For each sampling event, continuous indoor air temperature measurements were collected from one central location for the duration of each sample collection event (generally 7 to 9 hours) using an Extech SD700 Barometric Pressure/ Humidity/Temperature Datalogger. The average indoor air temperature for each sampling event versus average PCB air concentration for the same event is depicted in Figure 9.5.

Figure 9.5 – Building Average Total Airborne PCB Concentrations versus Average Indoor Air Temperature



Due to limitations regarding the building-wide data depicted above (e.g, temperature was only measured in one location of the building), a statistical analysis of the temperature data was not completed. However, the above comparison of temperature and PCB data suggests a positive relationship may exist between indoor air temperatures and airborne PCB concentrations.

As noted in section 7.2.7 above, and in Supplemental report #3 located in Appendix O of this report, an indoor temperature study performed over four weeks in early 2012 revealed that the first floor classrooms had the highest mean temperatures, but over time have had the lowest average airborne PCB concentrations. Conversely, the third floor classrooms have historically had the highest average airborne PCB concentrations, but lower mean temperatures than on the first floor. Those results, therefore, suggest that there is no direct, positive correlation between the mean indoor air temperature measured in various classrooms over time and the mean concentration of airborne PCBs measured within those same rooms. Due to limitations regarding the study, and the conflicting results between these two data comparisons, additional evaluation of this variable on a room-by-room basis is warranted.

9.6 Relative Source Strength Evaluation

9.6.1 P.S. 199M

Relative source strength (RSS) calculations were performed on the P.S. 199M data to determine if there was any link or correlation between concentrations of total PCB concentration in specific materials and total airborne PCB concentrations. The following basic model equation was used to determine the RSS for the various identified PCB-containing materials in each room/area:

$$RSS_i = C_i A_i$$

where

RSS_i = relative source strength for material 'i' (ppm-m^2)
C_i = PCB concentration in material 'i' (ppm)
A_i = surface area of material 'i' (m^2)

The model described above was used to calculate the total RSS of all identified suspect PCB-containing materials in various rooms throughout the building. Materials with a PCB content of less than the laboratory's detection limit (less than 1 ppm) were assigned a value of 0.5 ppm. The following table is an example of how the total, non-normalized, RSS estimates for different materials in one classroom (Room 118) were calculated. Please refer to Table 9.10 for calculated RSS data for other rooms and areas within the building.

Table 9.9 – Relative Source Strengths of Selected Materials in Room 118 at P.S. 199M

Material	Description	Source Area (m^2)	Source PCB Conc. (ppm)	RSS (ppm-m^2)
Floor Tile	9"x9" Gray	59.5	11.39	677.2
Floor Tile Mastic	9"x9" Tile Mastic	59.5	21.59	1,283.7
Ceiling Paint	Light Blue	2.8	29.6	82.5
Ceiling Paint	White	4.6	32.0	148.6
Ceiling Tile	Beige Perforated	52.0	4.48	233.1
Ceiling Tile	White Wormhole	1.2	2.11	2.5
Ceiling Tile Mastic	Brown	52.0	0.5	26.0
Varnish	Closet Door	8.4	39.5	330.3
Varnish	Classroom Door	7.8	48.2	403.0
Varnish	Door Frame	1.9	28.9	53.7
Varnish	Sink Cabinet Door	1.9	13.4	24.9
Cove Base	Black	3.2	42.3	135.6
Cove Base Mastic	Brown	3.2	9.48	30.4
Door Paint	Door Paint – Blue	8.4	444	3,712.4
Door Frame Paint	Blue	5.6	102	568.6
Fiberboard	Brown	12.4	26.5	329.9
Particle Board	Light Blue	0.9	10.26	9.5
Radiator Mastic	Black	1.2	143	176.7
Radiator Paint	Blue	9.7	52.0	502.4
Wall Paint	Cream	19.5	51.5	1,004.7
Wall Paint	Light Blue	102.2	36.7	3,750.5
			Total	**13,486.3**

The total RSS for each room/area was then normalized to account for individual room size and ventilation rates by dividing the RSS by the volume of the room/area and then multiplying that figure by the measured air exchange rate for that room/area, as determined by the previously described tracer gas studies (Section 7.2.2).

$RSS_N = [RSS_{Ti}/V_i] \times E_i$

where:

RSS_N = normalized relative source strength (unit less)
RSS_{Ti} = total relative source strength for room/area 'i' (ppm-m^2)
V_i = volume of room/area 'i' (ft^3)
E_i = air exchange rate of room/area 'i' (air changes per hour)

The largest RSS values were typically for those materials which had the largest surface area (i.e., wall paint), even though those materials, for the most part, were found to contain less than 50 ppm. Other materials which tended to have relatively high RSS values included higher concentration orange and blue door paint.

Total RSS was calculated for select classrooms on the first, second, and third floor and the data compared to airborne concentrations measured in those rooms on three separate occasions, as depicted in Table 9.10. In general, the rooms are of comparable construction and size, and have similar exhaust ventilation configurations. Each of the rooms have vinyl composition floor tiles (9" x 9" or 12" x 12"), painted plaster walls, painted concrete ceilings, operable windows and a window mounted air conditioning unit. Many of the first floor classrooms, however, have ceiling tiles which are not present in any of the classrooms on the second or third floors. In addition, each of the 1st floor kindergarten classrooms has a bathroom, which none of the other rooms contain. Exhaust ventilation for the rooms is generally provided through a single, wall-mounted exhaust vent situated adjacent to the classroom door, and two ceiling mounted exhaust vents located inside built-in closets. Rooms 106, 108, 110, and 112 are the only classrooms within the school that do not contain any closet vents. The design exhaust flow rate for each of the classrooms ranges from 400 to 575 cfm, depending on whether or not the room contains closet vents and/or a bathroom.

Table 9.10 – Normalized Relative Source Strengths in Select Classrooms and Total Airborne PCB Concentrations Measured on Select Dates at P.S. 199M

Room #	Room volume (ft^3)	Air Exchange Rate (ACH)	Total RSS (ppm-m^2)	Total RSS (Normalized)	8/27/10 conc. (ng/m^3)	9/2/11 conc. (ng/m^3)	10/29-30/11 conc. (ng/m^3)
108	7969	1.79	9925.3	2.229	180	69.4	70.8
110	7924	1.65	12410.1	2.584	225	67.8	75.3
112	7942	1.39	7953.1	1.392	208	<47.8[a]	<47.0[a]
114	9339	1.35	13233.7	1.913	155	63.9	<47.7[a]
116	8174	1.88	6226.3	1.432	173	151.7	69.6
118	8153	2.17	13486.3	3.590	253	184.6	169.2
120	9260	2.94	8482.1	2.693	266	58.2	56.4
202	7512	2.34	11726.9	3.653	229.1	162.4	147.5
204	6643	2.26	7513.7	2.556	272	217	194.6
206	7488	2.50	9065.8	3.027	235	172.6	140.9
208	7537	3.10	9105.8	3.745	258	158.1	104.0
210	7558	2.08	10567.9	2.908	[b]	177.3	68.9
212	7420	2.57	11263.5	3.901	276	200.2	101.0
302	8956	1.42	12909.1	2.047	191.5	268	246
304	7899	1.83	11924.0	2.762	283	260	124
306	8672	2.96	12256.0	4.183	194.5	243	410

Table 9.10 – Normalized Relative Source Strengths in Select Classrooms and Total Airborne PCB Concentrations Measured on Select Dates at P.S. 199M

Room #	Room volume (ft^3)	Air Exchange Rate (ACH)	Total RSS ($ppm\text{-}m^2$)	Total RSS (Normalized)	8/27/10 conc. (ng/m^3)	9/2/11 conc. (ng/m^3)	10/29-30/11 conc. (ng/m^3)
308	8769	2.89	12054.0	3.973	240	261	354
310	8743	2.32	12005.4	3.186	226.8	281	385
312	8709	2.83	8491.3	2.759	234.2	325.5	292

[a] value reported was less than the detection limit
[b] sample was broken in the laboratory during analysis

The following figures depict the correlation analysis for total airborne PCB concentration and the total normalized RSS for the rooms depicted in Table 9.10.

Figure 9.6 - Total Normalized Relative Source Strength versus Total Airborne PCB Concentration for Various Rooms Measured on 8/27/2010

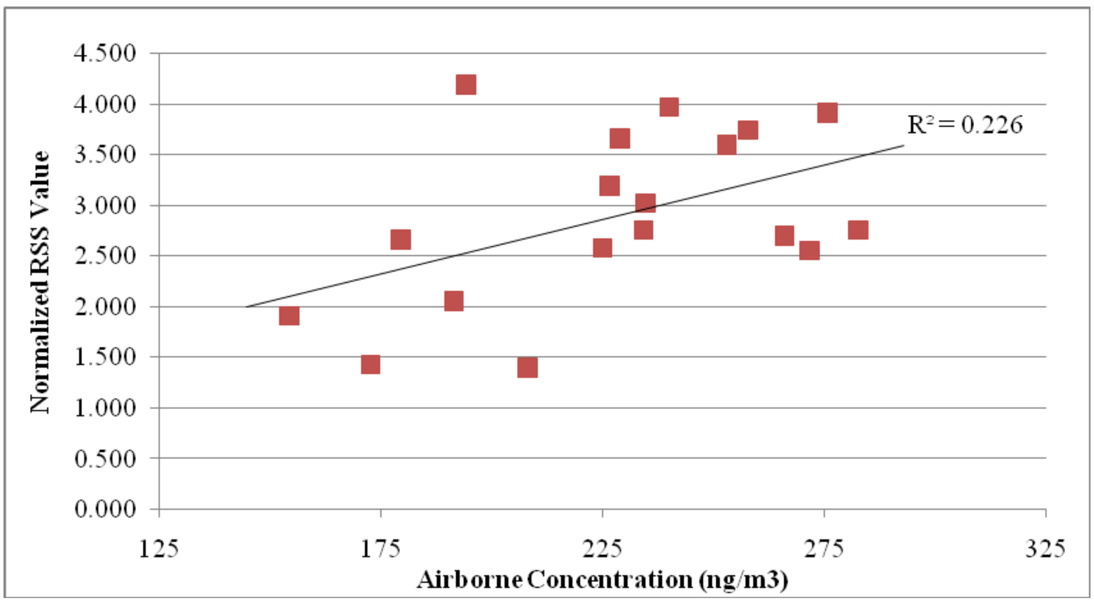


Figure 9.7 - Total Normalized Relative Source Strength versus Total Airborne PCB Concentration for Various Rooms Measured on 9/2/2011

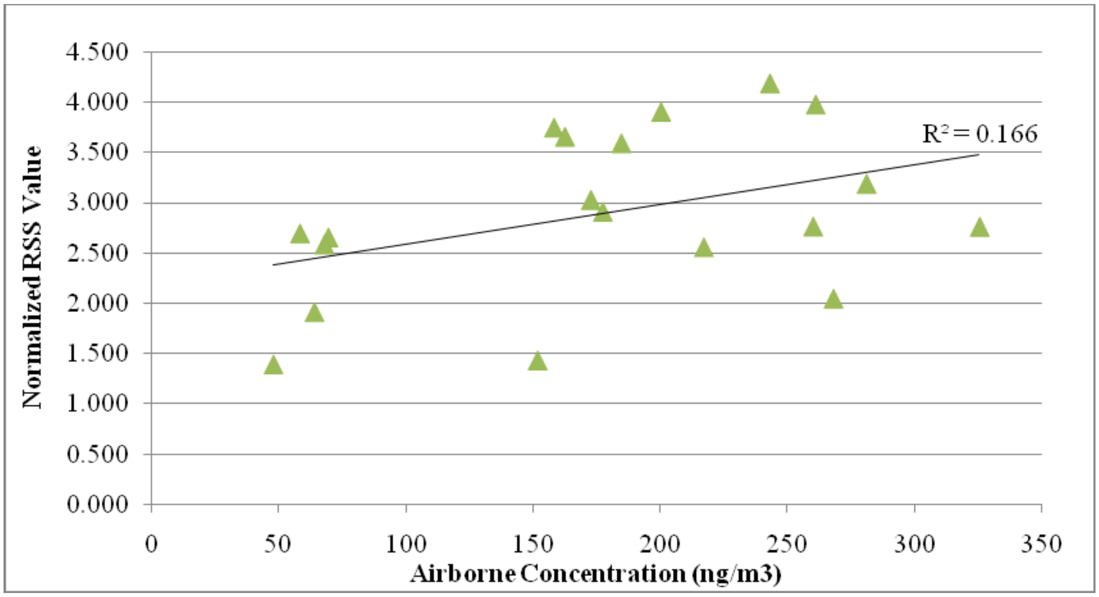
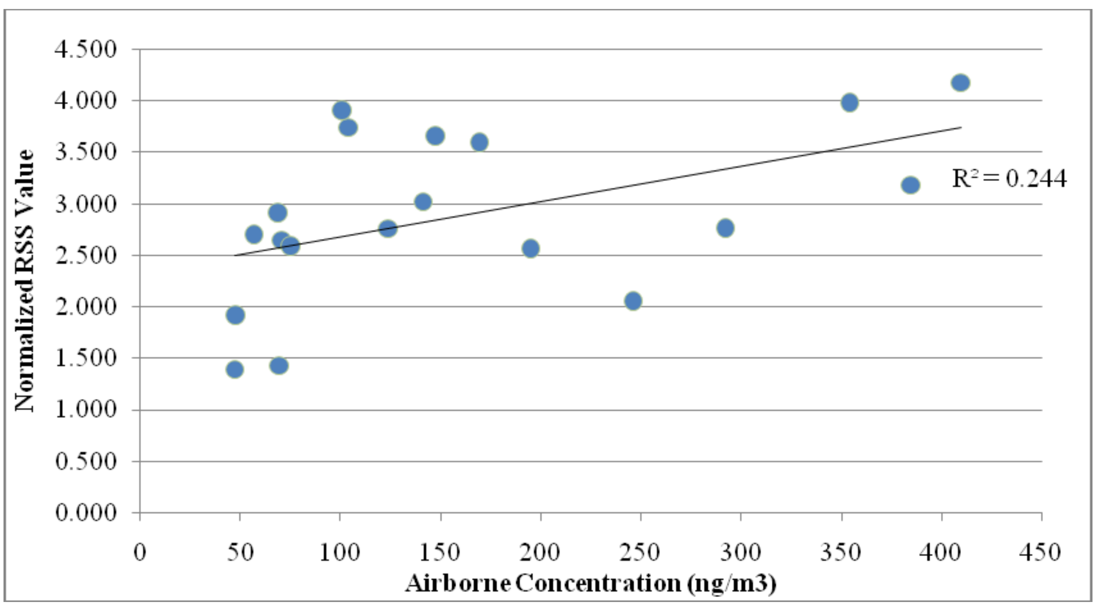


Figure 9.8 - Total Normalized Relative Source Strength versus Total Airborne PCB Concentration for Various Rooms Measured on 10/29-30/2011



The results suggest that there is no direct, positive correlation between the total quantity of other PCB containing materials in the various classrooms and the concentration of airborne PCBs measured within those rooms.

In order to determine if there was any type of correlation between specific types of materials and total airborne PCB concentrations, the RSS for like-materials (i.e., ceiling paint, wall paint, floor tiles, etc.) in each room/area were added together and data for each room/area was normalized, as described above.

The normalized RSS for the major materials in each of the classrooms listed in Table 9.11 were calculated and then compared against the airborne concentrations measured on August 27, 2010, September 2, 2011, and October 29 - 30, 2011.

Table 9.11 – Normalized RSS Values for Various Materials in Select Classrooms at P.S. 199M

Room #	Floor Tiles	Floor Tile Mastic	Ceiling Paint	Wall/ Shelf Paint	Door/ Frame Paint	Varnish	Radiator Paint	Radiator Mastic
108	0.069	0.026	0.092	1.612	0.138	0.169	0.102	0.045
110	0.055	0.024	0.060	0.604	0.151	0.141	0.075	0.028
112	0.099	0.186	0.352	0.238	0.505	0.115	0.261	0.034
114	0.162	0.264	0.033	0.308	0.228	0.219	0.076	0.044
116	0.180	0.342	0.061	1.266	1.139	0.216	0.134	0.047
118	0.130	0.240	0.093	0.419	1.179	0.200	0.121	0.060
120	0.242	0.458	0.507	1.905	0.118	0.060	0.130	0.056
202	0.218	0.409	0.427	1.083	0.083	0.046	0.039	0.070
204	0.240	0.452	0.473	1.451	0.063	0.072	0.034	0.060
206	0.329	0.577	0.877	1.579	0.078	0.171	0.056	0.074
208	0.238	0.450	0.661	0.911	0.052	0.163	0.027	0.049
210	0.281	0.531	0.812	1.273	0.131	0.147	0.025	0.062
212	0.139	0.254	0.450	0.816	0.060	0.045	0.166	0.027
302	0.155	0.292	0.488	1.225	0.044	0.051	0.222	0.048
304	0.257	0.486	0.786	1.660	0.065	0.115	0.445	0.059
306	0.248	0.470	0.759	1.603	0.009	0.098	0.430	0.059
308	0.200	0.378	0.611	1.296	0.050	0.041	0.229	0.048
310	0.306	0.282	0.804	0.346	0.062	0.071	0.420	0.056
312	0.233	0.215	0.611	0.263	0.047	0.054	0.319	0.043

The following figures show the correlation for airborne total PCB concentration and the normalized RSS for various materials for the rooms depicted in Table 9.11.

Figure 9.9 - Total Normalized Relative Source Strength versus Total Airborne PCB Concentration for Various Materials and Rooms Measured on 8/27/2010

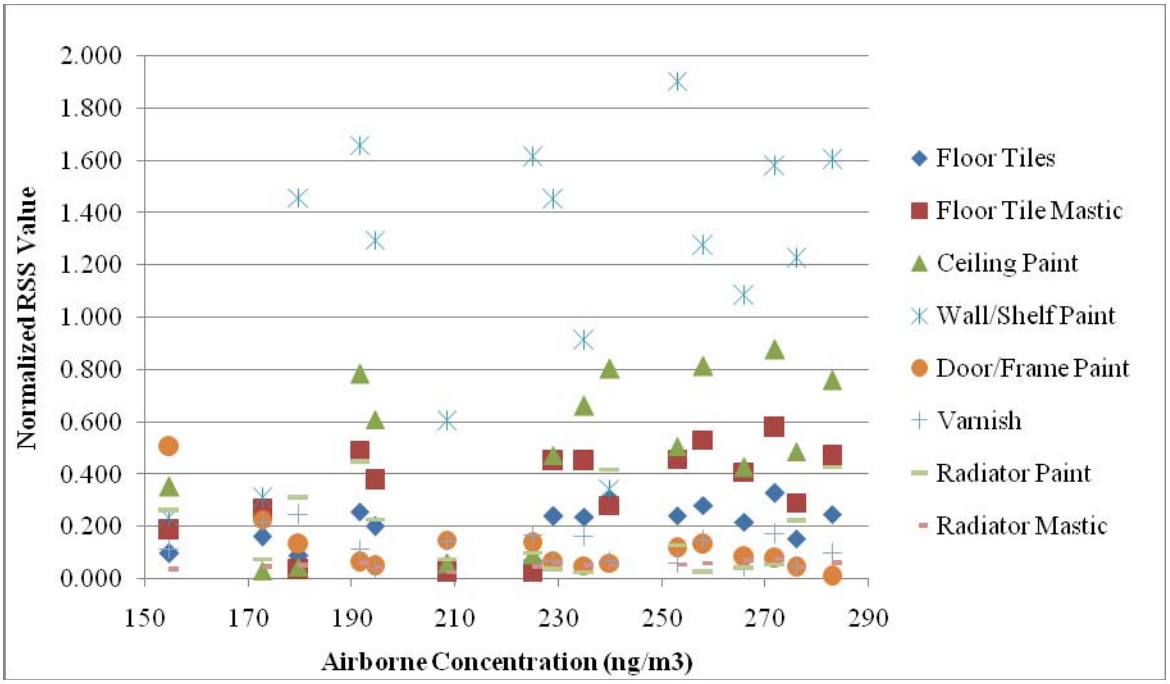


Figure 9.10 - Total Normalized Relative Source Strength versus Total Airborne PCB Concentration for Various Materials and Rooms Measured on 9/2/2011

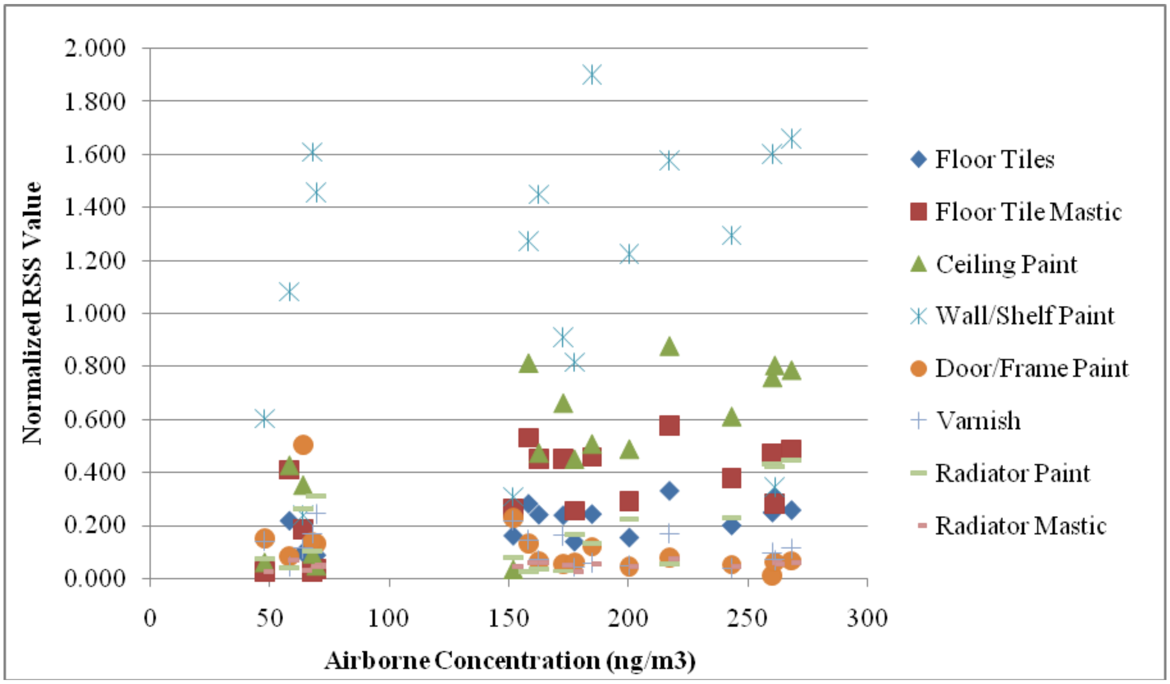
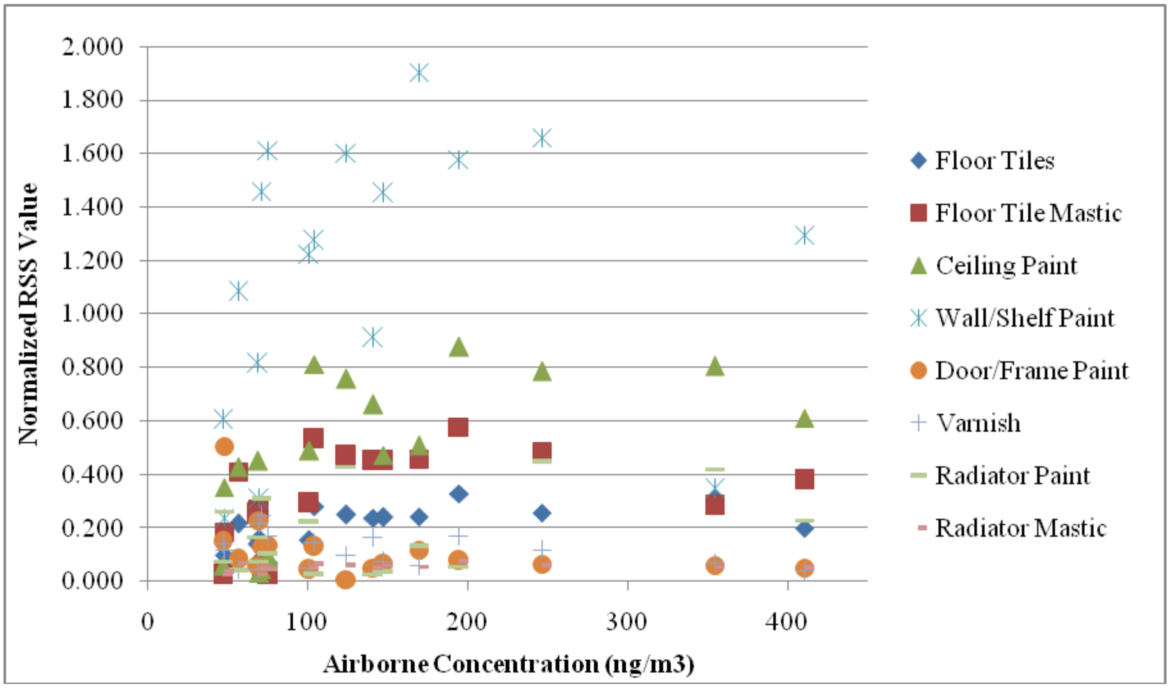


Figure 9.11 - Total Normalized Relative Source Strength versus Airborne Total PCB Concentration for Various Materials and Rooms Measured on 10/29-30/2011



The results suggest that there is no direct, positive correlation between the quantity of other, specific PCB containing materials in the various classrooms and the concentration of airborne PCBs measured within those rooms.

9.6.2 P.S. 199M and P.S. 309K RSS Comparison

Total RSS was calculated for the major surface area materials in select classrooms on the first, second and third floors at both P.S. 199M and P.S. 309K and the results were then normalized for room volume. As there was a greater number of sampling events and materials sampled at P.S. 199M due to more persistent PCB air concentrations, only those major surface area materials which were present and sampled for in the classrooms at both buildings (i.e., floor tiles, wall paint, radiator paint, etc.) were included in the calculations to allow for a representative comparison. In general, the rooms in both schools are of comparable construction and size. Both schools are three-story brick buildings constructed in 1962 and 1963. Each of the selected rooms has vinyl composition floor tiles (9" x 9" or 12" x 12"), painted plaster walls, and painted plaster or concrete ceilings. Bulk sample analysis of the different materials, as discussed in greater detail elsewhere in the report, indicated that, in general, materials in P.S. 199M contained more PCBs than did similar bulk materials in P.S. 309K. The calculations indicated that, for the select rooms at P.S. 199M, the total normalized RSS ranged from 0.373 to 1.385, with an average of 1.107, while the total normalized RSS for the select classrooms at P.S. 309K ranged from 0.199 to 0.621, with an average of 0.419. This evaluation shows that average normalized RSS of major surface area materials at P.S. 199M was more than double the average normalized RSS of major surface area materials at P.S. 309K. Although analysis of the data did not identify any direct relationship between total relative source strengths and airborne PCB concentrations within individual rooms, the higher normalized RSS in P.S. 199M as compared to P.S 309K, which is similar to P.S. 199M in both construction type and date, as well as ventilation configuration, suggests that the other interior PCB-containing materials may be contributing to the higher mean airborne PCB concentration associated with post-remediation samples at

P.S. 199M. Please refer to Tables 2I and 3I for details on the rooms studied and the total RSS calculations.

Table 9.12 – Normalized Total Relative Source Strengths of Major Materials Only in Select Classrooms at P.S. 199M

Room #	Room volume (ft^3)	Total RSS ($ppm\text{-}m^2$)	Total RSS (Normalized)
108	7969	7487.2	0.940
110	7924	6026.7	0.761
112	7942	5121.9	0.645
114	9339	7712.0	0.826
116	8174	3829.9	0.469
118	8153	7944.9	0.974
120	9260	3453.7	0.373
202	7512	10113.4	1.346
204	6643	6250.2	0.941
206	7488	8594.3	1.148
208	7537	8033.6	1.066
210	7558	9756.1	1.291
212	7420	10279.7	1.385
302	8956	11670.3	1.303
304	7899	10300.1	1.304
306	8672	11187.0	1.290
308	8769	10950.0	1.249
310	8743	10459.0	1.196
312	8709	7181.7	0.825
		Average	**1.017**

Table 9.13 – Normalized Total Relative Source Strengths of Major Materials Only in Select Classrooms at P.S. 309K

Room #	Room volume (ft^3)	Total RSS ($ppm\text{-}m^2$)	Total RSS (Normalized)
102	6797	1627.5	0.239
104	6797	3587.1	0.528
106	6797	3523.1	0.518
141	9600	3051.4	0.318
143	9600	4002.4	0.417
145	9600	3067.0	0.319
202	6797	4164.9	0.613
204	6797	3420.4	0.503
206	6797	2511.5	0.370
212	6797	4185.9	0.616
214	6797	2722.7	0.401
216	6797	2341.7	0.345
302	6797	4222.8	0.621
304	6797	1354.8	0.199
312	6797	2306.9	0.339
314	6797	2509.7	0.369

316	6797	2999.4	0.441
343	6797	2642.5	0.389
		Average	**0.419**

9.7 P.S. 199M Air Exchange Rates versus Airborne PCB Concentration Analysis

Data was analyzed to determine if there was any correlation between air exchange rates and airborne concentrations. Air exchange rates were calculated based on tracer gas decay measurements collected in December, 2011, as discussed in Section 7.2.2 of this report. The data was examined on a floor-by-floor basis. For each of the rooms examined, data from at least three rounds of testing was used to calculate the average airborne PCB concentration for each room, as follows:

Table 9.14 – Summary of Air Sampling Events and Rooms at P.S. 199M Utilized in the Air Exchange Evaluation

Floor	Air Sampling Data Collection Dates	Rooms
1st Floor	10/1/2008, 1/19/2009, 8/27/2010, 9/3/2010, 10/11/2010, 9/2/2011, 10/29/2011	108, 110, 112, 114, 116, 118, 120, 124 and 126
2nd Floor	10/1/2008, 1/19/2009, 8/27/2010, 9/2/2011 and 10/29/2011	202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 232,233, 234, Gymnasium and Library
3rd Floor	10/1/2008, 1/19/2009, 8/27/2010, 9/2/2011 and 10/29/2011	302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 333, 334 and 336

These particular data sets were selected because multiple rooms were sampled on each date, allowing a direct comparison between the results. In addition, all of the sampling events took place after the exhaust fans on the roof had been replaced, which was completed in September, 2008. As depicted in the following figures, no readily apparent correlation exists between the two (2) variables. Analysis of the airborne PCB concentration data versus the measured air exchange rates for both the first and third floor classrooms showed a slight positive correlation - as the air exchange rates increased, so too did the PCB concentrations. A slight negative correlation, however, was noted for the second floor classrooms.

Figure 9.12 – 1st Floor Classroom Average Total Airborne PCB Concentrations versus Measured Air Exchange Rates at P.S. 199M

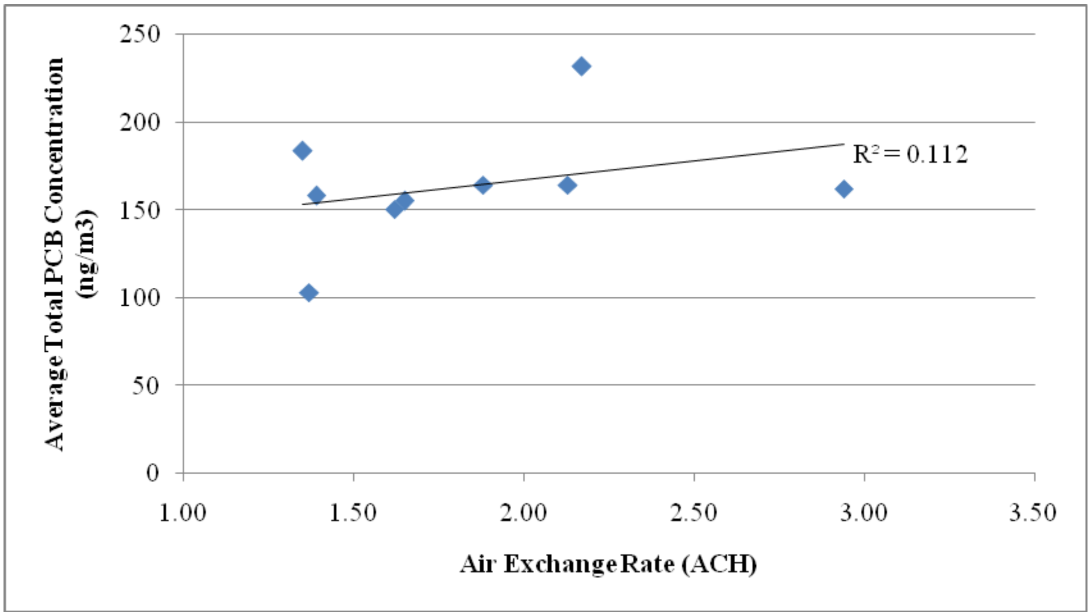


Figure 9.13 – 2nd Floor Classroom Average Total Airborne PCB Concentrations versus Measured Air Exchange Rates at P.S. 199M

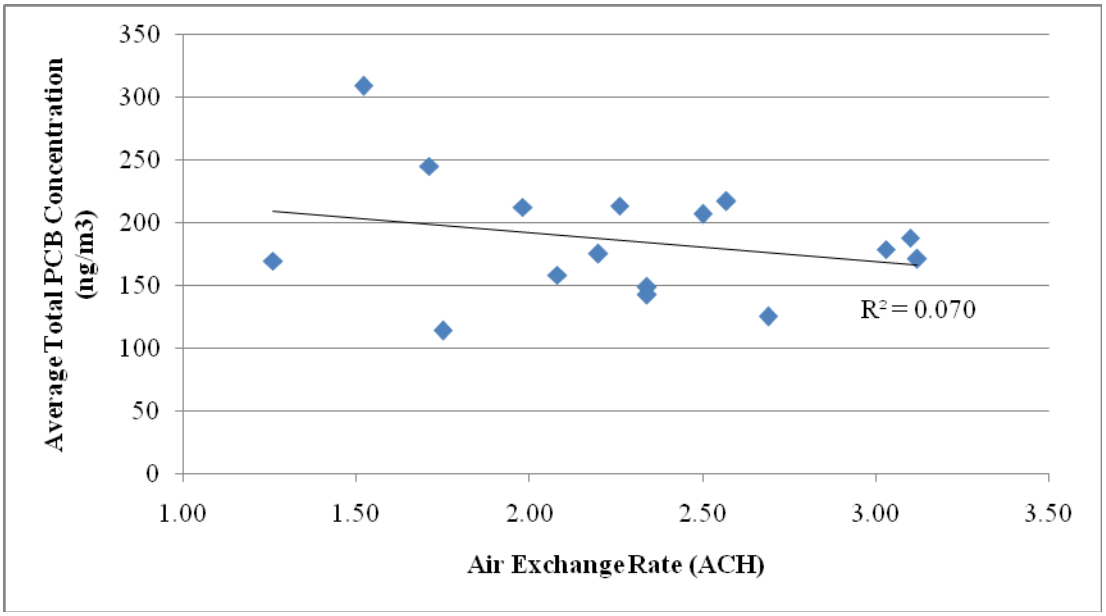
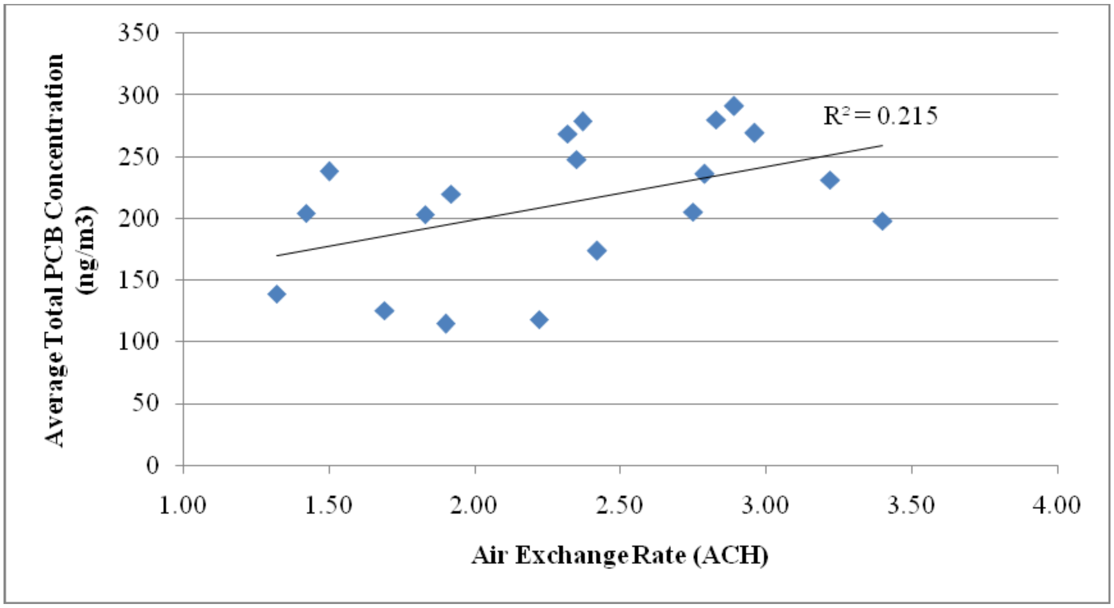


Figure 9.14 – 3rd Floor Classroom Average Total Airborne PCB Concentrations versus Measured Air Exchange Rates at P.S. 199M



9.8 P.S. 199M Ventilation Studies Analysis

The mechanical systems for P.S. 199M consist of a classroom and bathroom exhaust system, with perimeter radiating heating units. There are 15 "mushroom-type" rooftop exhaust fans with vertical duct shafts that service the classrooms and four (4) exhaust fans that service the bathrooms. The gymnasium and auditorium, both of which utilize forced air for heating and ventilation, are serviced by separate blowers and exhaust fans which are located in mechanical rooms on the second and third floors.

Exhaust ventilation for the classrooms is generally provided through either a 10" x 14" or a 12" x 16" wall-mounted exhaust grilles, located approximately eight (8) to ten (10) inches above the floor adjacent to or near the classroom entrance, which are connected to the exhaust duct riser. Most classrooms also contain two, 10"x 12" exhaust grilles which are located in a soffit inside built-in wardrobe closets that are typically opposite the windows and by the classroom door. Unlike the exhaust grille at the door entrance, the grilles in the closets are not directly connected to the exhaust duct riser. Instead, an open duct tap off the riser exhausts the soffit in which the grilles are located. In addition, each of the kindergarten classroom toilets on the first floor contain an 8" x 8" ceiling mounted exhaust grilles.

There is no existing mechanical make-up air system for the classrooms. Make-up air for the system is instead provided through operable windows and from the hallways through gaps around the classroom doors. Airflow measurements performed at the exhaust grilles within select classroom when the windows were opened and closed indicated that there is approximately a 70% increase in exhaust airflow when the windows are open. However, depending upon the outdoor conditions, opening windows for make-up air is not practical.

As reported in Section 7.2, design exhaust volumes for the classrooms vary from 400 cfm to 675 cfm per room, which equates to approximately 3 to 5 ACH. Exhaust grille airflow measurements, however, indicated that exhaust volumes in the classrooms, with the windows closed, varied from approximately 30 cfm to 951 cfm, which works out to between 0.25 and 7.77 ACH. The tracer gas studies, which measured the air exchange rates in the middle of the classrooms, revealed that the air change rates in those rooms varied from 1.26 to 3.40 ACH. The tracer gas study also revealed that air change rates with the windows slightly opened, versus with the windows closed, increased by an average of 78%.

Based on the results of the tracer gas study, it is suspected that 'short circuiting' of the fresh ventilation air may be occurring in the classrooms, particularly when the windows are closed. Make-up air coming from the hallways, through the room entrance, may be extracted from the room before it has thoroughly mixed with or displaced stale air in the middle of the room. This may be occurring because of the proximity of the exhaust vents to the doorway and to each other.

9.9 Exterior Location Sampling Results

Soil samples were collected at P.S. 183Q and P.S. 3R. A review of the laboratory data for the samples suggest that PCB soil concentrations tend to be highest next to the building and decrease with distance from the building. Sample results of Caulk from the exterior of both schools were evaluated to determine whether the PCB Caulk was the source of PCB contamination in the soil.

9.9.1 P.S. 183Q Exterior Soil and Caulk Sampling Summary

At P.S. 183Q, the exterior caulk sample results (refer to Table 4H) demonstrate that the level of PCBs present in the exterior caulk, on the four (4) sides of the building, exceeded the comparison criteria of 50 ppm PCBs in 31 of the 49 samples collected, of which 30 sample results exceeded 500 ppm. The condition of the caulk was typically good, but varied from good to damaged. Elevated soil results could have been from the exterior PCB Caulk and/or historic construction activities which previously impacted PCB Caulk prior to the implementation of current control procedures.

9.9.2 P.S. 3R Exterior Soil and Caulk Sampling Summary

At P.S. 3R, where elevated soil concentrations samples were encountered, on the east side of the building and in the North Courtyard, the exterior caulk of the building was sampled in accordance with the RI Plan to evaluate if the elevated levels of PCB in the soil were potentially from elevated levels of PCB in the exterior caulk on the face of the building. The exterior caulk sample results (refer to Table 5F) demonstrate that the level of PCBs present in the exterior caulk exceeded the comparison criteria of 50 ppm in seven of the 15 samples collected, of which six samples exceeded 500 ppm. The condition of the caulk varied from good to severely damaged. Elevated soil results could have been from the exterior PCB Caulk and/or historic construction activities which previously impacted PCB Caulk prior to the implementation of current control procedures.

9.9.3 Soil Sampling Methodology

For the purposes of the Remedial Investigation, all soil samples were analyzed. An evaluation of the soil sampling data from the two (2) Pilot School Buildings evaluated in the summer, 2011 was performed, based on the methodology currently used by the SCA (as described below) to evaluate potential soil impacts from exterior modernization projects. Please refer to Figures 4K and 5F, located in Appendix B, which graphically depict the sampling locations and soil sample results in comparison to the 1 ppm criteria for soil.

This evaluation analyzed the implication of analyzing soil samples on a row-by-row basis only to a negative stop (i.e., until no sample result in a given row exceeded the 1 ppm criteria). The specific methodology currently used by the SCA is as follows:

- Analyze first row samples ("A" row, located 0.5 feet from the building envelope);

- If all first row samples were below 1 ppm, no further action taken;
- If at least one first row sample was above 1 ppm, analyze second row samples (“B” row, located three feet from the building envelope);
- If all second row samples were below 1 ppm, no further action taken;
- If at least one second row sample was above 1 ppm, analyze third row samples (“C” row, located eight feet from the building envelope);
- If third row sample(s) above 1 ppm, delineate extent of contamination.

Based on the evaluation of the soil sampling results collected during this Remedial Investigation (where all samples were analyzed), for P.S. 183Q the methodology described above would have yielded the same soil remediation plan as analyzing all of the soil samples simultaneously. For P.S. 3R, however, the current SCA methodology would have yielded the same soil remediation plan (with one exception discussed below), but fewer samples would have needed to be collected and analyzed. The exception is Sample No. E-10-B collected three feet from the east entrance wall at three feet away from the building had an elevated concentration of 3.17 ppm, whereas the first row sample, Sample No. E-10-A had a concentration of 0.975. Had the SCA current methodology described above been used in this case, the elevated level of PCBs at this one location would not have been found through the delineation process. However, this one exception would not have significantly altered the scope of the remediation.

9.10 Summary of Findings

Based on the results of the pilot activities to-date, the following is a summary of the overall findings of the Pilot Study:

- In all five (5) Pilot School Buildings, despite the significant variability in the quantity and concentration of PCB Caulk concentrations in the study areas, pre- and post-remediation wipe samples were consistently below the USEPA guidance value of 10 µg/100 cm^2. Based on those results, surface exposure through ingestion or dermal contact with PCB-laden dust has not been identified as a concern and current housekeeping/cleaning methods employed by the schools adequately address this issue. Therefore, future pre- and post-remediation low and high contact surface wipe sampling should be discontinued. Airborne PCB concentrations within individual classrooms were typically variable from one sampling event to another. Airborne PCB concentrations also varied between Pilot Study areas during the same sample event. These results are consistent with the temporal and spatial variations associated with the behavior of air in building interiors.
- Aroclor 1254 was, by far, the most common contributor to the reported total PCB concentrations in air and wipe samples, with a much smaller portion being attributed to Aroclor 1248. No other Aroclors were identified in any of the air or wipe samples collected in the Pilot School Buildings.
- There was not a statistically significant change in airborne PCB concentrations between pre- and post-remedial air sample results at the four (4) Pilot School Buildings in locations where interior PCB Caulk remediation was performed in the summer, 2011. At P.S. 309K, there was a statistically significant increase in airborne PCB concentrations between the pre and post-remediation samples in the primary exposure areas. However, no remedial activities were performed in those locations. Rather, the increases are believed to be attributable to temporal and spatial variations typical of airborne PCB concentrations, as well as variabilities associated with

the sampling and analytical methodologies. Based on those results, the various remedial alternatives to address PCB caulk did not either improve or make worse the PCB air concentrations in the areas where they were implemented and, therefore, the remedial methodologies utilized were effective at controlling PCB releases during the remedial process.

- Mean airborne PCB concentrations in Transitory Areas appear greater than in Primary Exposure Areas within P.S. 199M, P.S. 3R, and P.S. 183Q for the 2011 Pilot Study, which may be due to the general absence of exhaust ventilation in hallways and stairwells.

- At P.S. 183Q, an additional, detailed, and fine cleaning of the physical spaces subject to the window removal and replacement work by a qualified environmental contractor resulted in subsequent air sampling results meeting the applicable acceptance criteria. Future window replacement project procedures should be modified to incorporate such a detailed and fine cleaning following the replacement work and prior to re-occupancy.

- Based on a review of the results of soil sampling efforts in 2010 and 2011, varying areas of soil contamination were identified at all five Pilot School Buildings studied. With the exception of one (1) sample location at P.S. 3R, the row-by-row methodology that SCA currently utilizes for soil evaluations outside the Pilot Study would have resulted in the same contaminated soil delineation with less data collection than was required for the remedial investigations. The distance from the building face to which soil contamination extended was typically limited to eight feet. Soil contamination encountered at P.S. 199M, P.S. 178X/176 and P.S. 309K was successfully mitigated through the process of delineation, excavation, and off-site disposal. Soil contamination at P.S. 3R and P.S. 183Q has been isolated pending implementation of soil excavation and disposal.

- With the exception of P.S. 309K, PCB Caulk was identified on the building exterior of each of the Pilot School Buildings. Survey inspections indicated that the existing PCB Caulk was most often not deteriorated or damaged; therefore, it is unclear as to the extent existing PCB Caulk has contributed to PCBs present in surface soils. PCB Caulk impacted by historical construction projects prior to the use of current PCB Caulk containment and removal procedures is thought to represent a primary source of the PCBs encountered in soil rather than release from existing PCB Caulk.

- As reported in the IRIR, removal and replacement of the PCB light ballasts and associated fixtures had the most pronounced effect in terms of lowering PCB levels in air in the three Pilot School Buildings in which more than one remedy was implemented (i.e., P.S. 199M, P.S. 178X/176 and P.S. 309K). The major source of airborne PCB in these schools appears to have been leaking light fixture ballasts, rather than caulk. In PS. 199M, other non-ballast and non-caulk PCB sources appear to be contributing factors as well. In P.S. 3R, concentrations in air were on average lower in Primary Exposure Areas following light fixture removal; however the difference was not statistically significant.

- Evaluation of multiple rounds of wide-scale testing data at P.S. 199M and P.S. 309K suggests a positive relationship between indoor air PCB concentration and outdoor temperature. In addition, school-wide mean airborne PCB concentrations at both buildings are higher in the warmer summer months, when school is generally not in session, and lower in cooler fall and winter months, when school is in session. Finally, on a floor-by-floor basis, mean PCB air concentrations in classrooms were highest on the third floor and lowest on the first floor.

- The mean airborne PCB concentrations at P.S. 199M were significantly reduced after the light ballast removal and replacement in 2010, and were below the USEPA guidance values during the 2011 winter sampling. However, airborne PCB concentrations were found to be elevated in several spaces prior to and after removal and replacement of all identified PCB Caulk during the summer, 2011. This suggests one or more other contributing sources of PCBs are likely present at this school.

- To continue to reduce PCB air concentrations in P.S. 199M, activated carbon air filtration units are currently operating in all occupied spaces (i.e., classrooms, offices, library, cafeteria, and gymnasium). Carbon filtration has been effective at reducing airborne PCB concentrations, as the mean PCB concentration measured in air within the Primary Exposure Areas decreased significantly after implementing the on-going carbon filtration for approximately one (1) month. After two (2) months of operation, the mean PCB concentration in air was lower than the one-month results, but the difference was not statistically significant. In the case of both rounds of measurements, the mean PCB concentration was less than the guidance value for elementary-age rooms, with certain individual measurements exceeding guidance values.

- An evaluation of the total normalized Relative Source Strength (RSS) of PCB-containing materials for select classrooms at P.S. 199M indicated that the average RSS was more than two times higher than the average RSS for comparable select classrooms at P.S. 309K. Although no correlation between the RSS and airborne PCB concentration in either school was identified, the higher normalized RSS in P.S. 199M as compared to P.S 309K, which is similar to P.S. 199M in both construction type and date, as well as ventilation configuration, suggests that the other interior PCB-containing materials may be contributing to the higher mean airborne PCB concentration associated with post-remediation samples at P.S. 199M.

- An evaluation of the ventilation systems at P.S. 199M and P.S. 309K indicated that designed and measured exhaust ventilation rates were variable between classrooms. With one or two windows partially opened, measured air exhaust rates in select classrooms at P.S. 199M increased by an average of 68%, and air exchange rates increased by an average of 76%. Similarly, at P.S. 309K measured air exhaust rates in select classrooms increased by an average of approximately 45% when one or two windows were opened slightly versus when they were closed.

- Based on air sample results at P.S. 178X, which is mechanically ventilated, an increase in the amount of fresh air introduced into the building via the ventilation system helped reduce indoor air PCB concentrations. Conversely, based on a simple trend analysis of the air sample results from P.S. 199M, which has a mechanical exhaust system that relies on operable windows for make-up air, there was no correlation between air exhaust rates and indoor air PCB concentrations.

- The pollutant pathway study at P.S. 199M revealed that, when the classroom windows were closed, a majority of the tracer gas was removed from the room via the exhaust ventilation system, and when the windows were slightly opened, a majority of the tracer gas migrated to the adjacent hallway. Only trace amounts of tracer gas migrated from the 1st floor classroom to the upper floor classrooms, most likely via the pipe risers for the perimeter radiators.

- Long-term monitoring results of wipe samples collected in January 2012, from surfaces of PCB caulk that were encapsulated at P.S. 309K in July 2010, indicate that PCBs from the caulk have penetrated and migrated through the encapsulant. These results suggest that encapsulation of PCB caulk, with the currently available encapsulants and methods utilized in this study, is of limited benefit.

- Long-term monitoring results of bulk samples collected in February and April 2012, from replacement caulk that was installed in P.S. 178X and P.S. 199M in July 2010 and July/August 2011, indicate that PCBs from the original caulk appear to have contaminated the underlying substrates and that those PCBs have, in turn, penetrated and contaminated the new non-PCB caulk. These results suggest that removal and replacement of PCB caulk, without additional actions to isolate the underlying substrate prior to installing the new caulk, is of limited benefit.

- Despite the relative ineffectiveness of the various caulk remedial alternatives, as evidenced by the long term monitoring results, the majority of post–remediation air sampling results were found to be below the applicable guidance criteria. In addition, there was not a statistically significant change in airborne PCB concentrations between pre- and post-remedial air sample results, suggesting that PCB caulk is not a major contributor to indoor PCB air concentrations at the schools that were evaluated.

10.0 RECOMMENDATIONS AND PROPOSED ACTIONS

On the basis of the work performed and summarized in the Interim Remedial Investigation Report and this Final Remedial Investigation Report (RIR), the following proposed supplemental actions are recommended:

(1) Supplemental Actions Related to P.S. 199M

- In order to determine if there is any correlation between indoor air temperatures and airborne PCB concentrations, for future air sampling events, data log temperature in representative areas throughout each sampling event.

- Subsequent to publication of the EPA's research report on their evaluation of PCB encapsulants, and depending upon the effectiveness of the various tested products, encapsulate other PCB-containing materials within a representative number of interior spaces and conduct a minimum of two rounds of air sampling and analysis in these same spaces, following encapsulation, to evaluate the impact, if any, on the concentration of PCBs in air.

(2) Supplemental Actions Related to P.S. 178X/176

- Other than continuing to implement the Long Term Monitoring Plan, no further post-pilot investigation or remediation actions are recommended at this time.

(3) Supplemental Actions Related to P.S. 309K

- Due to the relatively low air exhaust rates measured in specific areas at P.S. 309K, engage a heating and ventilation contractor and/or engineer to evaluate the building exhaust system and make recommendations for repairs and/or upgrades as may be necessary.

(4) Supplemental Actions Related to P.S. 183Q

- To mitigate potential exposure to PCB contaminated soil, continue to isolate surface soil documented to contain PCB concentrations above 1 ppm as an interim measure pending implementation of soil excavation and disposal. A construction fence associated with a capital improvement project is currently in place. When construction is completed and the construction fence is removed, cover the contaminated soil areas with geotextile fabric and a 3" to 4" top layer of cedar mulch and maintain it. Encapsulate exterior PCB Caulk in areas immediately adjacent to soils to be remediated in accordance with the SCA's commitment to USEPA prior to soil remediation. Remediate soils above 1 ppm by excavation and off-site disposal, and obtain confirmatory post-excavation soil results. Backfill with clean fill and reestablish surface features.

- Due to evidence of historic ballast leakage, remove and replace ballasts and light fixtures as part of the on-going light fixture replacement program.

(5) Supplemental Actions Related to P.S. 3R

- To mitigate potential exposure to PCB contaminated soil, continue to isolate surface soil documented to contain PCB concentrations above 1 ppm as an interim measure pending implementation of soil excavation and disposal. Maintain the existing geotextile fabric and cedar mulch. Encapsulate exterior PCB Caulk in areas immediately adjacent to soils to be remediated in accordance with the SCA's commitment to USEPA prior to soil remediation. Remediate soils above 1 ppm by excavation and off-site disposal, and obtain confirmatory post-excavation soil results. Backfill with clean fill and reestablish surface features.

(6) Supplemental Actions Related to All Pilot School Buildings

- In accordance with the USEPA approved RIWP, continue to perform bulk and wipe sampling in the four Pilot Schools where PCB Caulk work was performed.

The status of the proposed Pilot Preferred Remedy, as supported by the companion Feasibility Study, is as follows:

- The Pilot Study evaluated five (5) remedial alternatives with respect to interior caulk: (1) Patch and repair of caulk at P.S. 178X/176; (2) Encapsulation of caulk at P.S. 309K; (3) Removal of all caulk and replacement with new non PCB-containing caulk at P.S. 199M; (4) Window frame and caulk removal and replacement with new window frames and non PCB-containing caulk at P.S. 183Q; and (5) Best Management Practices at all Pilot School Buildings. Based on the current data, with the exception of the Best Management Practices, each of these alternative remedial approaches, as designed and implemented in this Pilot Study, have been shown to be relatively ineffective over the long term as sole remedies. Best Management Practices have been shown to be effective at reducing surface dust levels below USEPA criteria. Long-term monitoring results, however, suggest that removal and replacement of PCB caulk, without additional actions to isolate the underlying substrate prior to installing the new caulk, is of limited benefit as a remedial alternative over the long term. Additionally, results suggest that encapsulation of PCB caulk, using the various coatings and methodology employed in the Pilot Study, is also of limited benefit as a remedial alternative to isolate PCB caulk over the long term. Accordingly, additional revisions of the remedial approaches should be explored and evaluated prior to identifying a preferred remedy for PCB caulk and Best Management Practices should be included as part of the final Pilot Preferred Remedy.

- The Pilot Study determined that the replacement of PCB light ballasts and associated fixtures is a successful remedial measure for lowering PCB levels in indoor air where concentrations exceed the USEPA air guidance values. Light fixture replacements were implemented at P.S. 309K, P.S. 178X/176, and P.S. 199M as supplemental remedial measures, and at P.S. 3R as the primary remedial measure. Light fixture replacement is effective where a supplemental remedy is necessary, and also as a primary remedial measure. Accordingly, the Pilot Preferred Remedy includes light fixture replacement at the Pilot School Buildings. Light fixture replacement will be implemented at P.S. 183Q in accordance with the Greener, Healthier Schools for 21st Century and Energy Savings Performance Contracting (ESPC) program.

- PCB contamination of soil encountered in Outside Exposure Areas at P.S. 199M, P.S. 178X/176 and P.S. 309K was successfully mitigated through the process of delineation, excavation, and off-site disposal. The PCB contaminated soil identified in the outdoor exposure areas at P.S. 183Q and P.S. 3R should be excavated and disposed utilizing these same protocols. A Soil Remediation Plan should be created for USEPA approval and soils above 1 ppm should be remediated by excavation and off-site disposal, and confirmatory post-excavation soil results should be obtained. In addition, the soil should be backfilled with clean fill and surface features should be reestablished.. Exterior caulk at the Pilot School Buildings should be periodically inspected and be repaired to the extent it becomes damaged or deteriorated.

This proposed Pilot Preferred Remedy – based on a detailed assessment of currently available remedial strategies and technologies – offers a reasoned approach to efficiently manage PCB Caulk, PCB light ballasts and associated fixtures, and contaminated surface soils in Outside Exposure Areas, at the Pilot School Buildings. This proposed Pilot Preferred Remedy is subject to USEPA review and possible modification prior to approval.

11.0 REFERENCES

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