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MCP INTERIM PHASE II REPORT AND CURRENT ASSESSMENT SUMMARY FOR EAST STREET AREA 2/USEPA AREA 4

VOLUME XII OF XII

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

AUGUST 1994

BLASLAND, BOUCK & LEE, INC.
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SYRACUSE, NEW YORK 13214

MCP INTERIM PHASE II REPORT AND CURRENT ASSESSMENT SUMMARY
FOR EAST STREET AREA 2/USEPA AREA 4

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Appendix K

APPENDIX K

ZOREX ENVIRONMENTAL ENGINEERS, INC., NOVEMBER 1993,
BOOK 1 OF 3 OF REPORT ENTITLED "AMBIENT AIR MONITORING
FOR PCBS, MAY 4, 1993 TO AUGUST 17, 1993"
(and Appendix XIX, thereto)

Ambient Air Monitoring for PCB
May 4, 1993 to August 17, 1993

General Electric Company
Pittsfield, MA

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247 South Street
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November 8, 1993

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PROJECT SUMMARY

Zorex Environmental Engineers, Inc. has completed additional ambient air monitoring for polychlorinated biphenyls (PCBs) at and around the General Electric (GE) facility in Pittsfield, Massachusetts. This sampling program follows a one year sampling program for ambient PCBs conducted from August 14, 1991 to August 20, 1992, by Zorex Environmental Engineers on behalf of General Electric Company. The current ambient air sampling program was conducted to obtain valid and representative ambient air data for the following purposes: 1) to more accurately identify suspected sources of ambient PCBs from the GE facility and, if possible, estimate emission rates from identified sources; and 2) to further characterize ambient air levels of PCB downwind of the Newell Street MCP site.

To augment the ambient air sampling program, GE collected samples from other media at and around the GE facility. Soil, oil, sediment and sludge samples were collected from identified MCP sites and analyzed for PCB. The additional media sampling was conducted to assist in the identification of suspected sources of ambient PCBs.

The ambient air sampling program consisted of eight sampling events between May 4, 1993 and August 17, 1993. Five high-elevation samplers were located at or downwind from suspected PCB sources at or near the GE facility. A sixth high-elevation sampler, used for determining background PCB concentrations, was located 3.5 miles west of the GE facility at Berkshire Community College. Low-elevation sampling was conducted close to ground level at three of the five high-elevation sampling sites. Meteorological data from an on-site weather station was collected concurrently with the ambient PCB data.

The ambient monitoring program was conducted in accordance with the MCP Scope of Work for Additional PCB Ambient Air Monitoring, General Electric Company, Pittsfield, Massachusetts, dated March 10, 1993, the Quality Assurance Project Plan (QAPP) for the August 1991 - 1992 ambient air monitoring program, and the Massachusetts Department of Environmental Protection (MA DEP) letter of March 17, 1993.

The ambient high-elevation samples were collected in accordance with the EPA Compendium Method TO-4. Ambient low-elevation samples were collected in accordance with EPA Compendium Method TO-10. Sample extracts were analyzed for seven PCB Aroclors using gas chromatography with electron capture detection (GC-ECD) as described in EPA Method 608. Additional high-resolution analyses using gas chromatography/mass spectrometry (GC/MS) were conducted to confirm Method 608 results.

The analytical results of the samples from the high-elevation monitors reveal the following:

- At the Newell Street site, the ambient PCB concentrations measured in the rear of 191 Newell Street were at about the same level as those measured at that station during the same months (May-August) in the 1991-92 study. However,

the PCB concentrations measured at two new stations in the front of 191 Newell Street and at the F.W. Webb property were significantly lower -- on average about one-third of the levels measured in the rear of 191 Newell Street.

- At the Lyman Street site, the measured ambient PCB concentrations were somewhat higher than those measured at this station during May-August in the prior study.

- At the new Silver Lake station, located on the edge of Silver Lake, the measured ambient PCB concentrations were, on average, about twice as high as the concentrations measured during the same months in the prior study at a station located approximately 400 feet east of Silver Lake.

The PCB concentrations measured at the low-elevation monitors in the rear of 191 Newell Street, at Lyman Street and at Silver Lake were significantly higher than any of the concentrations found at the high-elevation monitors, ranging from 2 to 87 times as high. However, these samples were collected by a different sampling method using a different type of sampler (low-volume versus high-volume) and were subject to a much higher detection limit; and it is unclear whether or to what extent the higher measured PCB concentrations in these samples were attributable to such differences, rather than reflecting true differences in ambient PCB concentrations. Further sampling is proposed to investigate this question.

The analytical data also show that the results of the high-resolution analyses, which are likely to produce more accurate measurements of PCBs in ambient air than the Method 608 analyses, are about 40-60% lower than the Method 608 analytical results.

An evaluation of the PCB analytical data in relation to meteorological data reveals that:

- At the monitored sites (excluding the background site), ambient daily temperature appears to have some impact on ambient PCB concentrations, although it is not clear to what degree. At ambient temperatures below about 50-60°F, there are unlikely to be measurable concentrations of ambient PCBs, while at higher temperatures, particularly above about 60°F, there is a strong likelihood of obtaining measurable PCB concentrations. Thus, temperatures above about 50-60°F appear to be related to ambient PCB concentrations, although that relationship is not direct or linear at the high-elevation stations. The relationship between temperature and ambient PCB concentrations is stronger and more direct at the low-elevation stations.

- There is no apparent relationship between wind speed and ambient PCB concentrations at the high-elevation monitors, but the data do suggest an inverse relationship at the low-elevation monitors.

- There are no consistent associations between wind direction and ambient PCB concentrations, although it seems apparent that wind direction in concert with wind speed plays a role in the dispersion of PCBs from assumed source areas.

- There is no apparent relationship between barometric pressure and ambient PCB concentrations.

An evaluation of chromatograms prepared by GE using extracts of selected air samples returned from the laboratory reveals that at each of the sampling sites the distribution of PCB isomers has a consistent pattern over time. This evaluation also shows a similarity in the major peaks in the PCB isomer distribution between the high-volume and low-volume samples from Newell Street and between the high-volume and low-volume samples from Silver Lake. A similar comparison could not be made for the Lyman Street site. Review of these chromatograms also shows that those from the various Newell Street stations have a similar pattern of PCB isomer distribution, but can be distinguished from the Silver Lake and Lyman Street chromatograms, thus indicating the influence of different PCB sources.

A comparison of the air sample chromatograms with chromatograms from the soil, sediment, sludge, and oil samples collected from potential source areas reveals that the PCB isomer distribution in the air extracts is not directly comparable to that in the samples from the other media. However, this difference may be explained by the fact that PCBs volatilizing from other media would be expected to provide a higher proportion of the more volatile isomers to the ambient air that have a lower retention time.

Overall, review of the data from this monitoring program, particularly the comparisons of ambient PCB concentrations and air extract chromatograms among the various stations (including high-elevation versus low-elevation comparisons), indicate that surficial soil in the rear of the Newell Street site and the sediments in Silver Lake -- both of which are known to contain elevated concentrations of PCBs -- are principal sources of the PCBs detected in the ambient air around those respective areas. The data are insufficient, however, to identify the source of ambient PCBs at Lyman Street. At this time, no firm conclusions can be drawn about the magnitude of the low-elevation PCB concentrations due to the need for further sampling to evaluate the comparability of the low-volume and high-volume sampling methods. Moreover, emission rates from the assumed source areas cannot be accurately determined, although they are clearly higher in summer than in winter. The data do strongly indicate, however, that there is rapid dispersion of PCBs with elevation above the assumed source areas and that PCB concentrations further decrease rapidly with distance from those assumed sources.

Finally, an evaluation of the air monitoring data from a risk perspective indicates that, even using standard MA DEP exposure assumptions and toxicity values, the PCBs in the ambient air in these areas do not present any imminent hazard or significant risk to the populations likely to be most exposed -- i.e., residents living on Newell Street, students at the Hibbard School (on Newell Street), and residents living near Silver Lake.

1.0 Introduction

Zorex Environmental Engineers, Inc. (Zorex) was retained by General Electric Company (GE) to conduct additional ambient PCB air sampling at and around the General Electric facility in Pittsfield, Massachusetts. The sampling program was predicated on the results of a year-long ambient monitoring program for PCBs completed between August 20, 1991 and August 14, 1992. As with the year-long ambient air monitoring program for PCBs, this additional PCB ambient air monitoring program was conducted as part of continuing Massachusetts Contingency Plan (MCP) work to address Massachusetts Department of Environmental Protection (MA DEP) concerns about potential air pathway exposures to PCBs.

The objectives of the sampling program were: 1) to provide valid and representative ambient air data to more accurately identify suspected sources of ambient PCBs from the GE facility and, if possible, to estimate emission rates from potential sources; and 2) to further characterize ambient air levels of PCB downwind of the Newell Street MCP site.

To augment the ambient air sampling program, GE collected and analyzed several samples of other environmental media at and around the GE MCP sites. Soil, oil, sediment and sludge samples were collected and analyzed to assist in the identification of suspected sources of ambient PCBs.

Ambient air monitoring consisted of eight sampling events beginning on May 4, 1993 and ending on August 17, 1993. Meteorological data from an on-site weather station were collected concurrently with the ambient PCB sampling. All ambient air sampling, field work, sample collection, sample shipment and recordkeeping were completed by Zorex Environmental Engineers, Inc., Pittsfield, Massachusetts. The samples were analyzed by IT Analytical Services in Cincinnati, Ohio and in Knoxville, Tennessee.

The GE Environmental Laboratory at the Pittsfield facility completed the sampling and analysis of soil, oil, sediment and sludge samples. The GE Environmental Laboratory also completed confirming qualitative analyses of the ambient air samples (using extracts remaining from IT analysis). An evaluation of the data from a risk perspective was conducted by ChemRisk of Portland, Maine.

This final report presents a summary of all ambient air and other media analytical results, sampling activities, quality assurance/quality control objectives, laboratory data sheets, a summary of meteorological data and a discussion of problems and disruptions related to the sampling program. An interpretation of analytical data with respect to possible source areas is presented as well as a discussion of the need for further sampling and the appropriateness of air dispersion modeling.

2.0 Ambient Air Sampling Project Description

2.1 Ambient Air Sampling Program

2.1.1 High-Elevation

Ambient air sampling was completed at elevations 2-6 meters above the ground at six sampling sites. Five of these sites were at or downwind of potential sources of ambient PCBs around the GE Pittsfield facility. A sixth monitor was located on the grounds of Berkshire Community College (BCC), approximately 3.5 miles west of the GE facility. For data quality assessment, a seventh monitor was co-located at the 191 Newell Front Site. The locations of the monitoring stations are presented below and are shown in Figure A. The placement of the monitoring stations at the sites identified in Figure A was based on the results of the 1991-1992 ambient air monitoring program, the location of potential PCB source areas and the general direction of prevailing winds in the area.

Sampling Location	Sampling Site#	MCP Site
Roof of F.W. Webb, Newell St.	9	Downwind of Newell
Rear of 191 Newell Street	2	Newell
Lyman Street Parking Lot	3	Lyman
Berkshire Community College (Background)	6	Background
Silver Lake	11	Silver Lake
Front of 191 Newell Street	10	Newell
Front of 191 Newell Street (Co-located)	10-Co	Newell

High-elevation samples were collected using high-volume samplers in accordance with EPA Method TO-4 described below in Section 2.2.1. Samples were collected every fifteen days starting May 4, 1993, and ending August 17, 1993, for a total of eight sampling events.

2.1.1.1 Building 32S

In addition to the foregoing, three rounds of high-elevation samples (2/2/93, 2/10/93, 2/18/93) were collected at the former General Electric Building 32S located east-northeast of Silver Lake. The purpose of this sampling was to provide seasonal winter data to complement data collected during the previous year long study (Ambient Air Monitoring for PCB, August 20, 1991 - August 14, 1992, General Electric Co., Pittsfield, MA, November 13, 1993). During the year long-study, sampling at Building

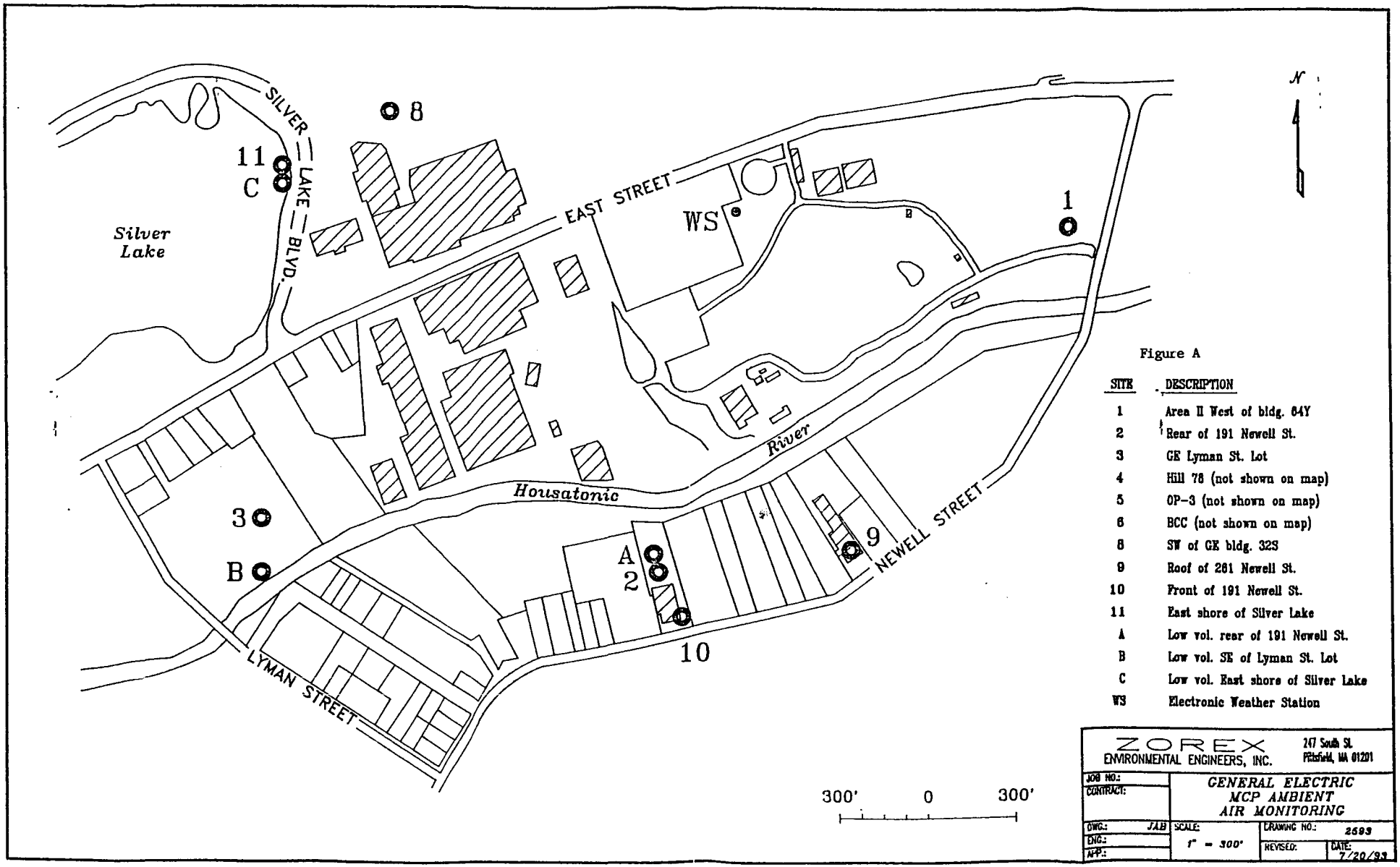

Figure A

SITE	DESCRIPTION
1	Area II West of bldg. 64Y
2	Rear of 191 Newell St.
3	GE Lyman St. Lot
4	Hill 78 (not shown on map)
5	OP-3 (not shown on map)
6	BCC (not shown on map)
8	SW of GE bldg. 32S
9	Roof of 261 Newell St.
10	Front of 191 Newell St.
11	East shore of Silver Lake
A	Low vol. rear of 191 Newell St.
B	Low vol. SE of Lyman St. Lot
C	Low vol. East shore of Silver Lake
WS	Electronic Weather Station

ZOREX ENVIRONMENTAL ENGINEERS, INC.
247 South St.
Pittsfield, MA 01201

JOB NO.:
CONTRACT:

GENERAL ELECTRIC
MCP AMBIENT
AIR MONITORING

DWG.: JAB
ENG.:
APP.:

SCALE: 1" = 300'

DRAWING NO.: 2593

REVISED:

DATE: 7/20/93

32S was not begun until June 15, 1992 and concluded in August, 1992, providing no winter data for the Silver Lake area. The samples were collected and analyzed using the methods described in Section 2.2.1 below for high-elevation sampling.

2.1.2 Low-Elevation

Low-elevation sampling at or near ground level was completed at three locations. The three locations are areas with known elevated PCB concentrations suspected of contributing to previously monitored levels of ambient PCBs. The three sites were also monitored at high-elevations (2-6 meters) as described in Section 2.1.1 above. A fourth low-elevation sampling site was co-located at Site #2 for data quality assessment. The locations of the low-elevation monitoring stations are presented below and are shown in Figure A.

Sampling Location	Sampling Site #	MCP Site
191 Newell Street Rear	A	Newell
Newell Street Rear (Co-located)	A-Co	Newell
Lyman Street, River Bank	B	Lyman
Silver Lake, Lake Front	C	Silver Lake

Low-elevation samples were collected using low-volume samplers in accordance with EPA Method TO-10 described below in Section 2.2.2. Samples were collected every fifteen days starting May 4, 1993, and ending August 17, 1993 for a total of eight sampling events.

2.2 Ambient Air Sampling Methods

2.2.1 High-Elevation Methods

A 24-hour sample was collected from 7 a.m. to 7 a.m. on each sampling day at each of the high-elevation sampling sites. The samples were collected according to the U.S. EPA Compendium Method TO-4, Method for the Determination of Organochlorine Pesticides and Polychlorinated Biphenyls in Ambient Air. This method employs a General Metal Works PS-1 modified high-volume sampler consisting of a glass fiber filter with a polyurethane foam (PUF) backup absorbent cartridge. The sampler inlet was located 2-6 meters from the ground. Ambient air was drawn through the cartridge at a rate of 200-280 L/minute for 24-hours. The total air volume collected for each sample was approximately 370 standard cubic meters. A figure describing the sampler and a complete copy of EPA Compendium Method TO-4 is presented in Appendix I.

The samplers were monitored at six-hour intervals over the 24-hour sampling period. At the end of the sampling period, the sampling modules

containing the fiber filters and PUF adsorbents were removed from the samplers. Each glass fiber filter was placed in a glass petri dish and each PUF adsorbent (inside a glass cartridge) was wrapped in hexane rinsed aluminum foil. Each fiber filter and PUF adsorbent set was labeled as one sample. The samples were wrapped, packaged in blue ice and sent under chain of custody to the IT Analytical Laboratory in Cincinnati, Ohio for analysis.

2.2.2 Low-Elevation Methods

A 24-hour air sample was collected from 7 a.m. to 7 a.m. on every sampling day at each of the low-elevation sampling sites. The samples were collected according to the U.S. EPA Compendium Method TO-10, Method for the Determination of Organochlorine Pesticides in Ambient Air Using Low-Volume Polyurethane Foam (PUF) Sampling with Gas Chromatography/Electron Capture Detector (GC/ECD). This method employs a low-volume pump controlled by a flowmeter which draws ambient air through a polyurethane foam cartridge (PUF) contained in a glass holder. The sampler inlet was located approximately 12 inches from the ground. Ambient air was drawn through the cartridge at a rate of approximately 5 L/minute for 24-hours. The total air volume collected for each sample was approximately 7.0 standard cubic meters. A copy of EPA Compendium Method TO-10 and a graphic illustration of the sampling system is presented in Appendix II.

The samplers were monitored at six-hour intervals over the 24-hour sampling period. During these six-hour checks, barometric pressure, temperature, flow and magnehelic pressure readings were taken. When necessary, the air flow was adjusted to the target flowrate. At the end of the sampling period, the PUF cartridges were removed from the sampling train. Each PUF cartridge (inside a glass holder) was wrapped in hexane rinsed aluminum foil. The PUF samples were wrapped, packaged in blue ice and sent under chain of custody to the IT Analytical Laboratory in Cincinnati, Ohio for analysis.

2.3 Analytical Methods

2.3.1 Method 608

The PCBs in both the high-and low-elevation samples were recovered by Soxhlet extraction with 5% ether in hexane. The extracts were reduced in volume using Kuderna-Danish (K-D) concentration techniques and subjected to column chromatographic cleanup. The extracts were analyzed for PCBs using gas chromatography with electron capture detection (GC-ECD), as described in EPA Method 608.

IT Analytical Services analyzed the samples for the following individual PCB Aroclors:

PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260

The quantities of PCBs in each sample were reported by IT Analytical Services as a specific Aroclor in ug/PUF above the analytical detection limit of 0.2 ug/PUF. These volumes were divided by the standard air volume sampled to provide ambient concentrations in micrograms per cubic meter (ug/m^3).

2.3.2 High-Resolution

For confirmation of the results from Method 608, some high-and low-elevation samples were split and analyzed by both Method 608 and high-resolution gas chromatography/mass spectrometry (GC/MS). A total of 16 high-elevation samples and three low-elevation samples were sent for high-resolution analysis. The high-resolution analyses were completed by IT Analytical Services, Knoxville, Tennessee.

2.4 Project Detection Limits

The PCB project detection limit for high-elevation samples is 0.0005 ug/m^3, based on a laboratory detection limit of 0.2 ug/PUF for an average 24-hour air volume of 370 m^3. The project detection limit for low-elevation samples is 0.029 ug/m^3 based on a laboratory detection limit of 0.2 ug/PUF for an average 24-hour air volume of 6.8 m^3.

2.5 Meteorological Data

An on-site weather station was installed in East Street Area 2 at the GE facility in July 1991 to continuously record meteorological data concurrently with sampling. The Climatronics Electronic Weather Station (EWS) measures and records, every 15 minutes, wind speed, wind direction, wind direction standard deviation, precipitation, relative humidity, temperature and integrated solar radiation. The location of the weather station is identified on Figure A.

The station was installed and continues to operate in accordance with EPA guidance contained in On-Site Meteorological Program Guidance for Regulatory Modeling

Applications, U.S. EPA, June, 1987 and the Quality Assurance Plan for Meteorological Monitoring Station at General Electric Company, Pittsfield, Massachusetts. The siting of the meteorological station was approved by MA DEP in May 1991.

2.6 Quality Assurance/Quality Control

The objective of the Quality Assurance Project Plan was to ensure that the data collected on ambient levels of PCB were adequate to meet the objective of the monitoring program and the intended uses of the data. The following procedures were carried out to assure quality in the design and implementation of the monitoring program.

- The sampling and analytical procedures were conducted in accordance with EPA Compendium Method TO-4, EPA Compendium Method TO-10 and EPA recommended guidelines.

- All phases of the sampling program were adequately documented. Documentation was maintained to evidence the validity of calibrations, sample collection, flow calculations, sample custody, analytical performance, data reduction and audit procedures. A record book has been maintained to identify and reconstruct sampling events, calibration procedures, maintenance and repair activity, and other related information.

- The GE Project Manager was kept informed of sampling activity with update memoranda.

2.6.1 Calibrations

Calibrations for all sampling equipment were conducted in accordance with the schedules and procedures specified in the EPA High Volume Reference Method TO-4 and Method TO-10. All data and calculations for the calibrations are maintained in a calibration log file.

2.6.2 Quality Control

The following internal quality control checks were performed on each high-elevation sampler:

- A one-point calibration check of the calibrated flow rate versus sampler magnehelic pressure indication was performed on each sampler before and after each sampling event;

- A zero check on the samplers' pressure gauges was verified before and after each sampling event;

- A leak check was performed on each sampler before and after each sampling event;

- A recording and adjustment of the sampler pressure indicator was undertaken to maintain a constant rate flow at six-hour intervals during the sampling event; and

- One additional sampler was located at 191 Newell Front as a sampling precision check on the field sampler. The ambient PCB data from the co-located sampler were used to verify the precision of the primary sampler.

The following internal quality control checks were performed on each low-elevation sampler:

- A zero check on the samplers' pressure gauges was verified before and after each sampling event;

- A leak check was performed on each sampler before and after each sampling event;

- A recording and adjustment of the sampler's pressure indicator and flowmeter reading was undertaken to maintain a constant rate flow at six-hour intervals during the sampling event; and

- One additional sampler was located at 191 Newell Rear as a sampling precision check on the primary sampler. The ambient PCB data from the co-located sampler were used to verify the precision of the primary sampler.

The following quality control measures were performed in both high-and low-elevation sampling to insure the integrity of the ambient air samples:

- One PUF from each batch of 21 PUFs was extracted by IT Analytical Services before the batch was shipped from IT. The PUF was analyzed as a Method Blank check for PCBs for that batch. The blank control limit was the detection limit. Each set of PUFs used for sampling was verified using this method.

- One PUF field blank was transported with the samples to and from the field and was handled like all of the other PUFs, except no air was drawn through it. The PUF was shipped along with the

samples to the laboratory for analysis. All field blanks analyzed by IT were verified blank.

- All samples were labeled and transported under chain of custody by Federal Express to IT Cincinnati. At IT, the samples were recorded and handled according to strict chain-of-custody outlined in the SOP provided in the Quality Assurance Project Plan (QAPP) for this project.

2.6.3 Data Validation

All sampling data recorded in the field and flow calculations based on the field data were verified by the Project Manager or her designee before final recording. Calibration charts for flow calculations were validated by the Project QA Manager.

IT Analytical Services has documented procedures for data validation of analytical results. These procedures comply at a minimum with the requirements in Method TO-4, Method TO-10 and associated references. These were submitted as part of the QAPP. Analytical results and laboratory validation procedures were reviewed by the Zorex Project Manager.

2.6.4 Meteorological Data

The meteorological station was installed and operates in accordance with the standard operating procedures recommended by the manufacturer, Climatronics Corporation. Additional EPA guidance is contained in On-Site Meteorological Program Guidance for Regulatory Modeling Applications, U.S. EPA, revised February 1993. The meteorological station is operated in accordance with the Quality Assurance Plan for Meteorological Monitoring Station at General Electric Company, Pittsfield, Massachusetts. The siting of the meteorological station was approved by MA DEP in May 1991. The Department of Environmental Protection conducted a Quality Assurance audit of the station in August 1993.

3.0 Qualitative Analysis Performed by General Electric

3.1 Ambient Air Qualitative Analysis

The extracts from a total of 25 air samples were returned to GE from IT Analytical Services for qualitative analysis. The air samples chosen for additional analysis by GE included all samples which were split and analyzed by both Method 608 and High-Resolution analysis (17 samples), and eight samples for events for which no high-resolution analyses were requested (including two background samples).

These extracts were analyzed by capillary column GC/MS using methods developed by GE for the characterization of PCB degradation. These methods were developed to support bioremediation studies, particularly at Woods Pond, over the past year and a half. As part of this study, GE has determined retention times for 120 PCB isomers which occur in Aroclors 1242, 1254 and 1260, as well as for 45 other PCB isomers which may be formed by the selective dechlorination of the Aroclor isomer.

The analyses of the PUF extracts in this way generated a uniform set of chromatograms for the PCB isomers captured on the PUF Cartridges to qualitatively compare the PCB isomer distribution found at the air monitoring sites and to compare the distribution of airborne PCB isomers with the PCB isomers found in soil, sediment and oil samples from the surrounding area.

One group of PUF extracts returned from IT had been concentrated by IT for high-resolution (capillary column) GC/MS analysis. These are listed in Table 1. Only small volumes (250 ul) of these extracts were available. 2-Fluorobiphenyl (2FBP), which serves as a retention time reference and as an internal standard in the GC/MS method, was added to each of the extracts. Isooctane (1.0 ul) containing 100 ug/ml of 2FBP was added to 100 ul of extract. (Ordinarily, for quantitative analysis, the 2FBP is added in a dilution step so that the resulting solution contains exactly 1.0 ug/ml 2FBP.) Since the analysis of the PUF extracts was intended to be qualitative, and since it was undesirable to dilute the extracts any more than necessary, the 2FBP concentration was approximated.

TABLE 1
AMBIENT AIR SAMPLES ANALYZED BY GENERAL ELECTRIC - HIGH RESOLUTION

PUF ID	IT Lab ID	Monitoring site	Monitoring date	Appendix III Figure
Z29-050493-1	AA2101	FW Webb	May 4, 1993	1
Z48-052093-1	AA2153	FW Webb	May 20, 1993	2
Z37-061893-1	AA2262	FW Webb	Jun 18, 1993	3
Z26-070393-1	AA2342	FW Webb	Jul 3, 1993	4
Z07-071893-1	AA2410	FW Webb	Jul 18, 1993	5
Z32-080293-1	AA2432	FW Webb	Aug 2, 1993	6
Z132-080293-1	AA2433	FW Webb	Aug 2, 1993	7
Z17-061893-2	AA2256	191 Newell - Rear	Jun 18, 1993	8
Z111A-061893-2	AA2259	191 Newell - Rear LV	Jun 18, 1993	9
Z02-070393-5	AA2408	191 Newell - Front	Jul 3, 1993	10
Z46-071893-7	AA2411	191 Newell - Front	Jul 18, 1993	11
Z06-061893-3	AA2257	Lyman Street	Jun 18, 1993	12
Z113A-061893-3	AA2260	Lyman Street - LV	Jun 18, 1993	13
Z49-070393-3	AA2407	Lyman Street	Jul 3, 1993	14
Z57-071893-3	AA2409	Lyman Street	Jul 18, 1993	15
Z27-061893-8	AA2258	Silver Lake	Jun 18, 1993	16
Z114A-061893-8	AA2261	Silver Lake - LV	Jun 18, 1993	17

A second group of extracts had been prepared at IT for analysis solely by GC/ECD using Method 608. These are listed in Table 2. Larger quantities (2.5 to 3.5 ml) of these extracts were available. However, preliminary screening (by GC/ECD) indicated that all of these extracts would need to be concentrated to obtain solutions suitable for analysis by GC/MS. The total amount of each extract was taken to dryness in a stream of pure nitrogen at room temperature. The residue was dissolved in 100 ul of isooctane containing 1.0 ug/ml 2FBP. It would have been desirable to concentrate these extracts 100:1, but due to the limited volumes, GE was only able to achieve from 20:1 to 30:1 increase in analyte concentration. Most of these extracts were still too dilute for satisfactory analysis by GC/MS.

All of the concentrates were analyzed on a 30 m X 0.25 mm DB5 capillary column in a HP 5890 GC equipped with a 5871A MS detector. The carrier gas was helium at a flow rate of 0.932 ml/min (40 psi head pressure) at 80°C. The injector was operated in splitless mode and maintained at 290°C. The injection volume was 1.0 ul. The injector purge valve was opened at 2.00 min after injection. The column oven was held at 80°C for 2.05 min. The oven temperature was increased to 120°C at a rate of 20.00 Deg-C/min and held at 120°C for 1.45 minutes. The oven temperature was next increased to 270°C at a rate of 4.00 Deg-C/min and held at 270°C for 7.00 minutes for a total analysis time of 50 minutes.

The GC-MS transfer line was held at 290°C. The MS was tuned to the standard autotune parameters for perfluorotributylamine (PFTBA). The MS was operated in the SIM mode, acquiring only the ions appropriate for the PCB congener groups (and 2FBP). The response of the MS was calibrated with mixed calibration standards which contained known amounts of Aroclors 1242, 1254 and 1260. Three calibration standards (three different concentrations of the mixed Aroclors) and several blanks were run with each batch of extracts.

The chromatograms generated by these qualitative analyses are presented in figures in Appendix III. Figures 1-17 in that appendix show the chromatograms from GE's qualitative analyses of the extracts that were prepared by IT for high-resolution analysis, while Figures 18-25 show the chromatograms from GE's qualitative analyses of the remaining extracts. These chromatograms are discussed in Section 4.2 below.

3.2 Other Media Qualitative Analysis

Several samples of soil, sediment and oil were analyzed for PCB isomer distribution by the GE Environmental Laboratory in Pittsfield. These samples, as well as several known Aroclors (1242, 1248, 1254, and 1260), were analyzed by capillary column GC/MS using methods developed by GE for the characterization of PCB degradation. These methods were developed to support bioremediation studies, particularly at Woods Pond, over the past year and a half. As part of this study, GE has

TABLE 2
AMBIENT AIR SAMPLES ANALYZED BY GENERAL ELECTRIC - METHOD 608

PUF ID	IT LAB ID	Monitoring Site	Monitoring Date	Appendix III Figure
Z12-060393-2	AA7450	191 Newell Rear	Jun 3, 1993	18
Z35-060393-P5	AA7458	191 Newell Front	Jun 3, 1993	19
Z18-060393-3	AA7453	Lyman Street	Jun 3, 1993	20
Z50-060393-6	AA7455	BCC	Jun 3, 1993	21
Z56-061893-6	AA8527	BCC	Jun 18, 1993	22
Z40-060393-8	AA7456	Silver Lake	Jun 3, 1993	23
Z102A-080293-8	AB2017	Silver Lake LV	Aug 2, 1993	24
Z03A-081793-8	AB3548	Silver Lake LV	Aug 18, 1993	25

determined retention times for 120 PCB isomers which occur in Aroclors 1242, 1254 and 1260 as well as for 45 other PCB isomers which may be formed by the selective dechlorination of the Aroclor isomer.

A listing of the soil, sediment, oil and Aroclor samples analyzed in this way is presented in Table 3. As shown in that table, these included (in addition to the known Aroclor samples): oil samples from the burn tank at GE's Thermal Oxidizer; oil samples recovered from a well at the Lyman Street site; samples of the filter press residue from the Building 64T waste water treatment operation and the Building 64G groundwater treatment plant in the East Street Area 2 at the GE facility; a sample of filter press residue from the groundwater treatment facility at the Lyman Street site; a sample of the Silver Lake sediment; and soil samples from 191 Newell Street taken near the air sampling station in the rear of that property. GE's analyses of these samples generated a uniform set of chromatograms to qualitatively compare the PCB isomer distribution found in the soil, sediment, oil and Aroclor samples with the distribution of airborne PCB isomers in the extracts of PUF cartridges from various monitoring sites in the Pittsfield area.

The liquid samples were prepared for GC/MS analysis by dilution (Method 3580A - SW846) to an appropriate PCB concentration range and the addition of 1.0 ug/ml of 2-Fluorobiphenyl (2FBP) which serves as a retention time reference and an internal standard on the GC/MS method.

The soil and sediment samples were prepared for a GC/MS analysis by modified Soxhlet extraction (modified Method 3540A - SW846). The method modification consisted of the addition of a Dean-Stark trap between the condenser and the Soxhlet extractor. This trap removes the water from the system and permits the efficient extraction of PCB isomers from soil and sediment samples without the addition of anhydrous sodium sulfate. This method has been shown to give acceptable analyte recoveries from soil and sediment samples.

All of the resulting solutions were analyzed for PCBs by capillary GC/MS. The resulting chromatograms are shown as Figures 28-48 in Appendix III. These are compared with the air sample chromatograms in Section 4.2.

TABLE 3
OTHER MEDIA SAMPLES ANALYZED BY GENERAL ELECTRIC

Sample ID	File ID	Source	Media/ Phase	Sample Date	Appendix III Figure
Aroclor 1242		Monsanto	Liquid		28
Aroclor 1248		Monsanto	Liquid		29
Aroclor 1254		Monsanto	Liquid		30
Aroclor 1260		Monsanto	Liquid		31
TK1 5/19-20/93	P5486	Burn Tank Comp [a]	Liquid	May 19&20,1993	32
TL1 6/2-3/93	P5494	Burn Tank Comp [a]	Liquid	Jun 2&3, 1993	33
TK1 6/17/93	P5509	Burn Tank Comp [b]	Liquid	Jun 17, 1993	34
TK1 6/18/93	P5509	Burn Tank Comp [b]	Liquid	Jun 18, 1993	35
TK1 7/2/93	P5518	Burn Tank Comp [b]	Liquid	Jul 2, 1993	36
TK3 7/2/93	P5518	Burn Tank Comp [b]	Liquid	Jul 2, 1993	37
K3 7/3/93	P5518	Burn Tank Comp [b]	Liquid	Jul 3, 1993	38
LS-2-C1	P5238	Lyman Street Well	Liquid	Jul 31, 1992	39
LS-21-C1	P5044	Lyman Street Well	Liquid	Feb 13, 1992	40
LS-4-C1	P5044	Lyman Street Well	Liquid	Feb 13, 1992	41
F3-64T&G-13	P5519	Filter Cake 64T/G[c]	Solid	Jun 29, 1993	42
71-41958-c1	P5632	Filter Cake 64T/G[c]	Solid	Jul 1, 1993	43
H3-Lyman-10	P5559	Filter Cake Lyman[d]	Solid	Aug 10, 1993	44
Silver Lake NO2	P5355	Silver Lake	Sediment	Dec 2, 1992	45
QP-12	P5607	191 Newell Rear	Soil	Sep 29, 1993	46
QP-19	P5607	191 Newell Rear	Soil	Sep 29, 1993	47
QP-20	P5607	191 Newell Rear	Soil	Sep 29, 1993	48

NOTES:

a - Mixture of daily composite samples from the burn tank of the Thermal Oxidizer on days when air monitoring was underway.

b - Individual daily composite sample from burn tank of Thermal Oxidizer on days when air monitoring was underway.

c - Filter Press residue from Bldg 64T wastewater treatment operation and Bldg 64G ground water treatment operation.

d - Filter Press residue from Lyman Street groundwater treatment operation.

4.0 Analytical Results

4.1 Ambient PCB Concentrations

4.1.1 Results

Ambient 24-hour concentrations of total PCBs in ug/m^3 from high-elevation samples collected between May 4, 1993 and August 20, 1993, for each of the monitoring locations are presented in Table 4. Ambient 24-hour concentrations of total PCBs in ug/m^3 from low-elevation samples collected between May 4, 1993 and August 20, 1993, for each of the monitoring locations are presented in Table 5. In both of these tables, the Method 608 analytical results are presented without parentheses, while the high-resolution analytical results for those samples that were subjected to high-resolution analysis are shown in parentheses. (The two methods are compared in Section 4.1.2.) In computing the average site concentrations for the May - August sampling period, non-detect (ND) measurements were assumed for the purposes of this report to be one half the detection limit (per EPA Guidance in Air/Superfund National Technical Guidance Study Series. Volume 4, Procedures for Dispersion Modeling and Air Monitoring for Superfund Air Pathway Analysis. U.S. EPA, July 1989). Table 6 is a summary of results from winter sampling at Building 32S. Table 7 presents a comparison between the results from the high-elevation samples and those from the low-elevation samples (using the Method 608 analytical data) at each location where both high- and low-elevation sampling was performed.

Complete sets of the analytical results provided by IT Analytical Services are contained in Appendix IV for the Method 608 analyses and in Appendix V for the high-resolution analyses.

4.1.2 Comparison of Method 608 and High-Resolution Analysis

Method 608 is the specified analytical method for the EPA TO-4 PCB sampling procedure. It is not a compound-specific method, but quantifies PCB as Aroclors by matching a pattern of peaks on a chromatogram with a known standard. The total PCBs in a sample are quantified as the Aroclor which most closely matches the peak pattern. It is a visual method subject to interpretation by the analyst. In addition, the quantification of PCBs using Method 608 chromatograms is further complicated by the potential for non-PCB compounds with similar retention times as PCB isomers being interpreted as PCB isomers. Thus, Method 608 tends to provide a very conservative quantification of total PCBs in the sample.

High-resolution analysis, unlike Method 608, does not make the assumption of an Aroclor mixture of PCB isomers and allows the identification of true PCB isomers. Each group of PCB isomers (di-'s, tri-'s, etc.) is quantified with an isomer of the same group. For these reasons, this approach results in more accurate quantification of PCB concentrations than does Method 608.

A comparison of the results from the high-resolution analyses with the Method 608 analytical results is presented in Table 8 for all samples for which both types of analyses were performed. That table also lists the percent difference, standard deviation, and an indication of whether the difference was positive (high-resolution results were higher than Method 608 results) or negative (high-resolution results were lower than Method 608 results). As shown in Table 8, the high-resolution analytical results are generally lower than the Method 608 results.

4.1.3 Data Anomalies

As part of the data validation procedures, all of the sampling results were reviewed for trends and characteristic values. Data that appeared to be unusually high, low, or otherwise irregular were flagged for further evaluation. Due to the fact that there were only eight sampling events, it was difficult to identify true data anomalies. The following, however, appear to be suspect:

- A ND was recorded at the primary high-elevation sample at 191 Newell Front on June 3, 1993. However, the results of the co-located sample, collected during the same time, showed a concentration of 0.0035 ug/m^3.

- A ND was recorded at the primary high-elevation sample at 191 Newell Front on August 2, 1993. However, the results of the co-located sample, collected during the same time, showed a concentration of 0.010 ug/m^3.

- The analytical results of both low-elevation samples taken on May 20, 1993, show that no PCBs were detected (ND). However, low-elevation samples at Lyman and Silver Lake showed 0.071 ug/m^3 and 0.072 ug/m^3 respectively.

A review of these data has not provided any explanation or reason for the apparent anomalies. Hence, these data are included in the summary tables on ambient PCB concentrations. However, they should be viewed with caution.

TABLE 4
24-HOUR HIGH-VOLUME AMBIENT PCB CONCENTRATIONS IN ug/m^3 [1]
METHOD 608 (HIGH RESOLUTION)[2]

DATE	F.W. WEBB	191 NEWELL REAR	LYMAN	BCC	SILVER LAKE	191 NEWELL FRONT	191 NEWELL FRONT CO-LOCATOR
May 4, 1993	ND[3](0.000038)	0.0056	0.0035	0.0014	0.014[4]	0.0021	0.0016
May 20, 1993	0.0027(0.00084)	ND	0.0027	NA[5]	0.0027	0.0024	0.0019
June 3, 1993	0.0030[6]	0.0075[7]	0.0054[6]	0.0035[6]	0.0054[6]	ND	0.0035[6]
June 18, 1993	0.0090(0.0054)	0.012[7](0.013)	0.0051[7](0.0026)	0.0021[7]	0.014[7](0.015)	0.0078[7]	0.0084[7]
July 3, 1993	0.0057(0.0026)	0.0089	0.0087(0.0023)	ND	0.023[7]	0.0097[7](0.0033)	0.0075[7]
July 18, 1993	0.0084(0.0054)	0.023	0.0052(0.0026)	ND	0.011	NA[8]	0.010(0.0062)
August 2, 1993	0.0068(0.0036)	0.028	0.011(0.0056)	0.0016	0.0040	ND	0.010
August 17, 1993	0.0038(0.0022)	0.035	0.0072(0.0048)	0.0011	0.012	0.0065	0.0024
Mean Concentration	0.0053(0.0029)	0.015(0.015)	0.0061(0.0037)	0.0015	0.011(0.011)	0.0041(0.0032)	0.0057(0.0052)
Max 24-Hour Occurrence	0.0090	0.035	0.011	0.0035[7]	0.023[7]	0.0097[7]	0.010
Date of Occurrence	6/18/93	8/17/93	8/2/93	6/3/93	7/3/93	7/3/93	7/18/93 & 8/2/93
Min 24-Hour Occurrence	0.0027[9]	ND	0.0027	ND	0.0027	ND	0.0016
Date of Occurrence	5/20/93	5/20/93	5/20/93	7/3/93 & 7/18/93	5/20/93	6/3/93 & 8/2/93	5/4/93

ND Non-Detect (ND) samples had a detection limit of 0.0005 ug/m^3 unless otherwise noted.
1 Quantified as Aroclor 1254 unless otherwise noted.
2 Results of the Method 608 analyses are presented without parentheses; results of the high resolution GC/MS analyses (where preformed) are presented in parentheses.
3 Sample detection limit raised to 0.005 ug/m^3 due to interference. Samples were submitted for high resolution GC/MS analysis.
4 A power failure occurred on 5/4/93 at Silver Lake Boulevard. Samples were collected 5/6 - 5/7/93.
5 A power failure occurred on 5/19/93 at BCC. There is no background sample for 5/19 - 5/20/93.
6 Quantified as Aroclor 1242
7 Quantified as Aroclor 1248
8 A power failure occurred at the Newell Street front sampler; however, a co-located sample was taken.
9 A non-detect was found on 5/4/93; however, the laboratory detection limit was raised to 2.0 ug/PUF due to matrix interferences. The detection limit for that sample was 0.0054 ug/m^3.

NOTE: For averaging purposes, one-half of the detection limit was used for Non-Detect (ND).

TABLE 5
24-HOUR LOW-VOLUME AMBIENT PCB CONCENTRATIONS IN ug/m^3 [1]
METHOD 608 (HIGH RESOLUTION)[2]

DATE	191 NEWELL REAR	191 NEWELL REAR CO-LOCATED	LYMAN	SILVER LAKE
May 4, 1993	0.029	0.034	0.057	0.073[3]
May 20, 1993	ND	ND	0.071[4]	0.072
June 3, 1993	ND[5]	ND	ND	0.073[6]
June 18, 1993	0.073[6]	0.087[6](0.025)	0.058[6](0.028)	0.14[6](0.11)
July 3, 1993	ND	ND	ND	ND
July 18, 1993	0.058	NA[7]	ND	0.15
August 2, 1993	0.14	0.13	0.10	0.35
August 17, 1993	0.092	0.10	0.071	0.25
Mean Concentration	0.055	0.056(0.048)	0.050(0.046)	0.14(0.14)
Max 24-Hour Occurrence Date of Occurrence	0.14 8/2/93	0.13 8/2/93	0.10 8/2/93	0.35 8/2/93
Min 24-Hour Occurrence Date of Occurrence[8]	ND ---	ND ---	ND ---	ND 7/3/93

ND Non-Detect (ND) samples had a detection limit (DL) of 0.029 ug/m^3 unless otherwise noted.
1 Quantified as Aroclor 1254 unless otherwise noted.
2 Results of the Method 608 analyses are presented without parentheses; results of the high resolution GC/MS analyses (where preformed) are presented in parentheses.
3 A power failure occurred on 5/4/93 at Silver Lake Boulevard. Samples were collected on 5/6 - 5/7/93
4 Quantified as Aroclor 1260
5 Sample had a DL of 0.032 ug/m^3.
6 Quantified as Aroclor 1248
7 Samples invalidated due to sampling system problems.
8 "---" Indicates a Non-Detect (ND) was found on more than one date.

TABLE 6
BUILDING 32S WINTER SAMPLING RESULTS IN ug/m^3

Date	Concentration
February 2, 1993	0.0005[1]
February 10, 1993	ND(<0.0005)
February 18, 1993	ND(<0.0005)

[1] Quantified as Aroclor 1260

TABLE 7
COMPARISON BETWEEN HIGH AND LOW VOLUME SAMPLING (ug/m^3)
(USING METHOD 608 ANALYTICAL RESULTS)

DATE	SITE	HIGH-VOLUME	LOW VOLUME	RATIO (low/high)
MAY 4, 1993	191 NEWELL R.	0.0056	0.029	5.2
	191 NEWELL R. CO	*	0.034	6.1
	LYMAN	0.0035	0.057	16.0
	SILVER LAKE	0.014[1]	0.073[1]	5.2
MAY 20, 1993	191 NEWELL R.	ND	ND	—
	191 NEWELL R. CO	*	ND	—
	LYMAN	0.0027	0.071[2]	26.0
	SILVER LAKE	0.0027	0.072	27.0
JUNE 3, 1993	191 NEWELL R.	0.0075[3]	ND	—
	191 NEWELL R. CO	*	ND	—
	LYMAN	0.0054[4]	ND	—
	SILVER LAKE	0.0054[4]	0.073[3]	14.0
JUNE 18, 1993	191 NEWELL R.	0.012[3]	0.073[3]	6.1
	191 NEWELL R. CO	*	0.087[3]	7.3
	LYMAN	0.0051[3]	0.058[3]	11.0
	SILVER LAKE	0.014[3]	0.14[3]	10.0
JULY 3, 1993	191 NEWELL R.	0.0089	ND	—
	191 NEWELL R. CO	*	ND	—
	LYMAN	0.0087	ND	—
	SILVER LAKE	0.023[3]	ND	—
JULY 18, 1993	191 NEWELL R.	0.023	0.058	2.5
	191 NEWELL R. CO	*	NA[5]	—
	LYMAN	0.0052	ND	—
	SILVER LAKE	0.011	0.15	14.0
AUGUST 2, 1993	191 NEWELL R.	0.028	0.14	5.0
	191 NEWELL R. CO	*	0.13	4.6
	LYMAN	0.011	0.10	9.1
	SILVER LAKE	0.0040	0.35	88.0
AUGUST 17, 1993	191 NEWELL R.	0.035	0.092	2.6
	191 NEWELL R. CO	*	0.10	2.9
	LYMAN	0.0072	0.071	9.9
	SILVER LAKE	0.012	0.25	21.0

* NOTE: High volume data from Newell rear is used for comparison with both Newell rear low-volume samples.

1 A power failure occurred on May 4, 1993. Both high and low-volume samples were collected on May 7, 1993.
2 Aroclor 1260
3 Aroclor 1248
4 Aroclor 1242
5 Sample invalidated due to a power failure.

TABLE 8
HIGH RESOLUTION CONFIRM DATA

DATE	SITE	SAMPLE VOLUME (m^3)	METHOD 608 CONCENTRATION (ug/m^3)	HIGH RESOLUTION CONCENTRATION (ug/m^3)	PERCENT DIFFERENCE %
MAY 4, 1993	F.W. WEBB (HV)	368.6	ND(<0.005)	0.000038	---
MAY 20, 1993	F.W. WEBB (HV)	365.8	0.0027	0.00084	-69
JUNE 18, 1993	F.W. WEBB (HV)	368.6	0.0090	0.0054	-40
	191 NEWELL REAR (HV)	373.0	0.012	0.013	+8.3
	LYMAN (HV)	370.1	0.0051	0.0026	-49
	SILVER LAKE (HV)	373.0	0.014	0.015	+7.1
	191 NEWELL REAR CO(LV)	6.88	0.087	0.025	-71
	LYMAN (LV)	6.87	0.058	0.028	-52
	SILVER (LV)	6.93	0.14	0.11	-21
JULY 3, 1993	F.W. WEBB (HV)	370.1	0.0057	0.0026	-54
	191 NEWELL FRONT (HV)	373.0	0.0097	0.0033	-66
	LYMAN (HV)	367.2	0.0087	0.0023	-74
JULY 18, 1993	F.W. WEBB (HV)	370.2	0.0084	0.0054	-36
	191 NEWELL FRONT CO(HV)	373.0	0.010	0.0062	-38
	LYMAN (HV)	367.4	0.0052	0.0026	-50
AUGUST 2, 1993	F.W. WEBB (HV)	368.6	0.0068	0.0036	-47
	LYMAN (HV)	362.9	0.011	0.0056	-49
AUGUST 17, 1993	F.W. WEBB (HV)	370.1	0.0038	0.0022	-42
	LYMAN (HV)	373.0	0.0072	0.0048	-33
			STANDARD DEVIATION	LOW ELEVATION HIGH ELEVATION	17.8 6.3

(HV) High-Volume Samples
(LV) Low-Volume Samples
"-" Indicates a negative percent difference
"+" Indicates a positive percent difference

4.2 Evaluation of Chromatograms from Qualitative Analyses by General Electric

All of the chromatograms from the analysis of the PUF extracts as described in Section 3.1 are shown in Appendix III, Figures 1 through 25. The large peak at 10.3 minutes in each chromatogram is due to the internal standard, 2FBP. The peak which occurs immediately after the 2FBP peak in some of the chromatograms is due to biphenyl. All the remaining peaks are due to PCB isomers. Biphenyl was found in some of the PUF extracts.

With two exceptions, all of the extract chromatograms show very similar patterns of PCB isomer distribution. The two exceptions, Appendix III Figures 1 and 18, show a pattern of large, uniformly spaced peaks. These peaks are clearly seen in Figure 1, which has no other significant peaks. The same pattern of peaks is seen in Figure 18, superimposed on a more typical pattern for the PUF extracts. The origin of these peaks is unknown. The appearance of these peaks suggests that they are caused by several, individual PCB isomers such as would be contained in a mixture added by the laboratory to mark the retention times for isomer identification. Hence, GE believes that these peaks do not reflect PCBs from the environment.

The remainder of the PUF chromatograms all show very similar patterns. The general upward drift of the baseline between 20 and 28 minutes is typical of samples that contain non-PCB materials (such as oil) in combination with low concentrations of PCB. These non-PCB materials do not produce distinct peaks, but, due to their high concentration compared to the PCB isomers, tend to cause significant noise in the detector, which appears as a drifting baseline. The sudden drop of the baseline that occurs at 28 minutes, is caused by the shift of the MS from one PCB parent ion to the parent ion of the next congener group.

In general, the chromatograms of the PUF extracts from a given site show a consistent pattern of PCB isomer distribution over time. Although the concentration of airborne PCB varies with time, the PCB isomer composition remains relatively constant. This is illustrated for the F.W. Webb station in Figure 26, which shows a composite of all the F.W. Webb chromatograms (except for sample AA2101 - Figure 1).

Further comparison of the chromatograms from the high-volume samples from the 191 Newell Street Rear sampler (Figures 8 and 18) with the low-volume sample chromatogram from 191 Newell Street Rear (Figure 9) shows that the major peaks in PCB isomer distribution are very similar. There is likewise a great similarity in the major peaks in PCB isomer distribution between the chromatograms from the Silver Lake high-volume samples (Figures 16 and 23) and those from the low-volume samples from Silver Lake (Figures 17, 24 and 25). Isomer peaks on the Lyman Street low-volume sample chromatogram could not be discerned because of the small amount of PCB in the sample; therefore, a comparison of the chromatograms from the Lyman Street low-volume and high-volume samplers was not possible.

Comparison of the PCB chromatograms of the PUF extracts with the chromatograms of authentic Aroclors (Appendix III, Figures 28-31) shows that the airborne PCBs are not Aroclor mixtures. Thus, as noted previously, the analysis of PUF extracts by packed column GC methods (Method 608) is likely to produce inaccurate results since these methods rely on the assumption that the PCB isomers in the sample are the same isomers found in the Aroclors and that these isomers occur in the same relative ratios in both the sample and the Aroclor standards. Capillary column GC/MS methods are much more likely to be accurate since these methods quantify PCBs by congener group (mono-, di-, tri-, etc.) versus a PCB standard for each group. Alternatively, the GC/MS method developed by GE for the study of PCB degradation quantifies each peak of the chromatogram against a response curve established for the PCB isomer(s) which that peak represents.

Appendix III, Figure 27 (A through H) shows a comparison of one chromatogram from each of the monitoring stations. Figure 27A shows the entire chromatogram from each station. Figures 27B through H show the same chromatograms expanded to five-minute intervals for better comparison. All of the PUF extracts have very similar PCB isomer distributions. However, it appears that there are relatively more of the shorter-retention-time isomers (Figures 27C-E) in the Silver Lake samples, and to some extent in the Lyman Street samples, than there are in the samples from the Newell Street area. This is especially noticeable in Figure 27C, which shows a distinct peak at 17.99 minutes in both the Silver Lake and the Lyman Street chromatograms. This is also shown by the peaks at 21.25 and 22.99 minutes (Figure 27D) and the peaks at 24.35 and 24.49 minutes (Figure 27E). Also in Figure 27D, the pair of peaks at 22.43 and 22.54 minutes shows a reversal of their relative abundances between the Silver Lake/Lyman Street chromatograms and the chromatograms from the Newell Street area.

These differences suggest that the source(s) of the airborne PCBs at the Silver Lake and Lyman Street sites are somewhat different from the source(s) of the airborne PCBs at the Newell Street stations. This is consistent with the view that most of the airborne PCB isomers absorbed on the PUFs are of nearby origin and that their concentration in air diminishes rapidly as one moves away from the source.

The chromatograms of the PUF extracts from the BCC site (Appendix III, Figures 21 and 22) show a few of the lower chlorinated PCB isomers (di- and tri-), but no evidence of significant amounts of the higher chlorinated isomers. These two extracts show more "background" material (drifting baseline), relative to the PCB peak, than most of the other chromatograms. Unfortunately, the only extracts of PUFs from the BCC site were too dilute to obtain good quality GC/MS chromatograms.

Finally, a comparison has been made between the PUF extract chromatograms and the chromatograms from the soil, sediment, filter cake, and oil samples collected from potential source areas (which are listed in Table 3 and presented in Appendix III, Figures 32-48). None of the PUF extract chromatograms shows a PCB isomer distribution

directly comparable to any of the isomer distributions in the chromatograms from the other media samples. However, if the PCB isomers absorbed on the PUFs were attributable to volatilization from such other media (rather than carried on dust particles or droplets), one would expect that the isomer distribution in the PUF extracts would be somewhat different from the isomer distribution in the source media. Specifically, in this event, the more volatile (higher vapor pressure) isomers which have a shorter retention time should appear as a larger fraction of the PCB isomer distribution in the air. Preliminary calculations by GE of the theoretical PCB isomer distribution that would be expected in air samples assuming the volatilization of PCBs of the type found in soil and sediment samples from around the monitors bears out this hypothesis. This factor could thus explain the increased presence of shorter retention time isomers in the PUF chromatograms compared to the soil/sediment chromatograms.

4.3 Meteorological Data

Data from the on-site weather station were summarized and tabulated for each of the sampling days. Table 9 summarizes the mean, maximum and minimum temperatures for each sampling day. Table 10 summarizes the mean, maximum and minimum wind speed for each sampling day. Table 11 presents barometric pressure and total precipitation for each sampling day. The wind speed and wind direction data were combined to produce wind roses for each of the sampling days. The wind roses are presented in Appendix VI.

TABLE 9
MEAN, MAXIMUM AND MINIMUM TEMPERATURE (°F)
ON SAMPLING DAYS

DATE	MEAN	MAXIMUM	MINIMUM
May 4, 1993	57.39	65.56	47.03
May 7, 1993	59.24	70.30	45.58
May 20, 1993	50.57	51.67	47.87
June 3, 1993	53.78	63.58	43.43
June 18, 1993	64.52	78.10	51.16
July 3, 1993	63.88	68.63	55.50
July 18, 1993	64.19	74.40	51.11
August 2, 1993	72.25	81.80	59.67
August 17, 1993	69.29	78.20	64.75

TABLE 10
MEAN, MAXIMUM AND MINIMUM WIND SPEED (mph)
ON SAMPLING DAYS

DATE	MEAN	MAXIMUM	MINIMUM
May 4, 1993	5.45	11.30	<0.75
May 7, 1993	5.04	11.74	<0.75
May 20, 1993	2.59	6.58	<0.75
June 3, 1993	6.18	14.85	<0.75
June 18, 1993	3.24	7.27	<0.75
July 3, 1993	4.10	8.55	1.39
July 18, 1993	5.22	12.16	<0.75
August 2, 1993	2.51	6.07	<0.75
August 17, 1993	3.15	7.51	<0.75

TABLE 11
AVERAGE BAROMETRIC PRESSURE AND TOTAL PRECIPITATION
ON SAMPLING DAYS

DATE	MEAN PRESSURE (in Hg)	TOTAL PRECIPITATION (in)
May 4, 1993	29.33	0
May 7, 1993	29.17	0
May 20, 1993	28.66	0.01
June 3, 1993	28.80	0
June 18, 1993	29.09	0
July 3, 1993	29.02	0.04
July 18, 1993	28.93	0
August 2, 1993	28.77	0.42
August 17, 1993	28.96	0.23

5.0 Data Quality

5.1 Ambient Air Monitoring

5.1.1 Data Quality in Terms of the Data Quality Objectives

Prior to the initiation of sampling, a Quality Assurance Project Plan (QAPP) was developed and submitted to the MA DEP. The QAPP defined the quality assurance objectives in terms of comparability, completeness, representativeness, precision and accuracy. The QAPP also fully described the organization of the project including the assignment of responsibility for specific quality assurance and quality control procedures to meet the project's quality assurance objectives. The QAPP was developed in accordance with the OTS Guidance Document for the Preparation of Quality Assurance Project Plans, U.S. EPA, 1984, and the Quality Assurance Handbook for Air Pollution Measurement Systems, U.S. EPA, 1976. A copy of the Table of Contents from the QAPP is included in Appendix VII.

5.1.1.1 Validity

A valid sample was defined as an air sample that was collected over 24-hours, +/- 30 minutes, from 7 AM to 7 AM, at a rate of 200 - 280 l/min. Additionally, a valid sample must represent a minimum total collected volume of air of 288 cubic meters. Only samples which met the criteria for validity were used in the calculations for completeness, precision and accuracy.

5.1.1.2 Representativeness

All samples were collected at the locations and during the time period approved by MA DEP as being representative for the purpose of this study.

5.1.1.3 Comparability

All measured PCB concentrations were converted to ug/m^3 for comparison with the standard.

5.1.1.4 Completeness

There were 88 possible samples (high- and low-elevation) from the entire monitoring event (including the co-located sampling sites). Of these, 85 samples met the criteria for validity as defined in the QAPP. Completeness, therefore, was measured as 97 percent.

5.1.1.5 Precision

Field sampling precision was measured by samples taken at the co-located samplers. The high-elevation co-located sampler was at 191 Newell Street Front. The samplers were 2-4 meters apart. Sampler 2 was considered the primary sampler and Sampler 2-Co was designated as the duplicate, co-located sampler. The calibration, sampling and analysis procedures for the two samplers were the same as for all samplers. The co-located sampler operated whenever the primary sampler operated.

The low-elevation co-located sampler was located at 191 Newell Street Rear. The samples were located approximately one meter apart. Sampler A was designated the primary sampler and Sampler A-Co was designated the co-located sampler. The calibration, sampling and analysis procedures for the two samplers were the same as for all samplers. The co-located sampler was operated whenever the primary sampler was operated.

The average percent difference and standard deviation were calculated in accordance with procedures defined in the QAPP. The calculations were made only with data which were considered hits (i.e. not ND). The calculations are presented in Appendix VIII. Using this approach, the average percent difference in ambient concentrations between the high-elevation co-located sampling sites was 25 percent and the standard deviation was 13 percent. The average percent difference in ambient concentrations between the low-elevation co-located sampling sites was 9.4 percent and the standard deviation was 6.9 percent. A control limit of variation between the samplers was not specified in the QAPP. It should be noted that because there were only eight sampling events, the number of events actually used after eliminating all NDs for high- and low-elevation sampling was five and four, respectively. This is not a statistically significant number of samples; therefore, the standard deviation calculation may provide little meaning.

5.1.1.6 Accuracy

One-point calibration checks were conducted before and after each sampling event and were used as a check of flow measurements. The one-point calibration checks on all samplers were within $\pm$ 10% deviation of calculated flow values.

5.1.2 Quality Assurance/Quality Control

Calibrations for all sampling equipment were conducted in accordance with the schedules and procedures specified in the EPA High Volume Reference Method, Method TO-4, and Method TO-10. Copies of all calibrations conducted on the high-elevation samplers and their associated parts (ETMs, timers, etc.) are presented in Appendix IX. Also presented in Appendix IX are copies of the calibration conducted on the calibration orifice. The calibration orifice calibration was completed by BGI Incorporated of Waltham, MA. Calculations to determine the calibration curve of the calibration orifice are also included.

One-point calibration checks of the calibrated flow rate versus sampler magnehelic pressure indication were performed on each sampler before and after each sampling event. The readings were documented and copies of all of the one-point calibration checks are located in Appendix X.

Six-hour recordings of the sampler pressure indicators, adjusted flowrate, flowmeter readings, temperature readings, and barometric pressure readings were recorded on the high- and low-elevation sampling event data sheets. All sampling event data sheets are presented in Appendix XI.

All high- and low-volume air flow calculations to determine air flow through the samplers were conducted on air flow calculation sheets, contained in the sampling event file. Copies of all air flow calculation sheets are contained in Appendix XII.

All samples were sent to IT Analytical Services under Chain of Custody/Request for Analysis (COC/RA) by Federal Express. All COC/RA forms and Federal Express Airbills are presented in Appendix XIII.

All maintenance activities and repair work done on the samplers were recorded in the maintenance log. All entries are presented in Appendix XIV.

Activities involving the Meteorological Station on East Street were recorded in a calibration/maintenance log. A copy of this log is found in Appendix XV. Also included in Appendix XV is a copy of the MA DEP audit of the meteorological station conducted in August 1993.

All Method Blank check confirmation sheets are presented together with the analytical data in Appendices IV and V.

5.1.3 Problems and Disruptions

The following problems and disruptions occurred during the sampling program:

- A power failure occurred at the Silver Lake station on May 4, 1993. Power was restored to the site and both high- and low-elevation samples were re-taken on May 6 - 7, 1993.

- The analysis of the high-volume sampling field blank for the May 6-7, 1993, Silver Lake retest, showed that the blank PUF contained PCB levels above the detection limit. IT Analytical Services explained that there was an interference peak in all the samples and the blank, therefore all of the data were blank corrected.

- It was necessary to sample on May 19-20, 1993, in the place of the scheduled May 18-19, 1993 sampling event, due to a lack of TO-4 PUFs. IT Analytical Services did not have a cleaned supply of TO-4 PUFs, and therefore it was necessary to identify a laboratory that had a supply of cleaned TO-4 PUFs. Ross Analytical Services had a cleaned supply, the PUFs were sent out by Federal Express, and sampling was begun on the morning of May 19, 1993.

- A power failure occurred on May 20, 1993, at Berkshire Community College. For the May 20, 1993, sampling event, there is no background sample. Power was restored to the site within 24-hours.

- A motor failure in the 191 Newell Street Front high-elevation sampler on July 18, 1993, invalidated that sample. A sample was taken from the co-located sampler at that site. The sampler's motor was replaced within 24-hours and all other samplers' motors were inspected or replaced to prevent future problems.

- The sample taken from the 191 Newell Street Rear co-located low-elevation sampler on July 18, 1993 was invalidated due to a problem with the sampling system. The sampling system was corrected and all other sampling systems were inspected to prevent a similar problem.

- The East Street meteorological station wind direction indicator was found to be misaligned on November 5, 1992, and was repaired on June 11, 1993. Meteorological data from the East Street Area 2 meteorological station were supplemented by weather data from the F.T. Rose Site meteorological station when East Street data were not available.

- It is believed that lightning struck the meteorological station on July 28, 1993. This event placed the meteorological station out of order between July 29 and August 3, 1993. When the situation was discovered, the equipment was inspected, repaired, recalibrated and restored to service. Meteorological data from the East Street Area 2 meteorological station were supplemented by weather data from the F.T. Rose Site meteorological station when East Street data were not available.

All of the problems and disruptions listed above were resolved in an expedient manner and to the satisfaction of the GE Project Manager. The problems encountered were not unusual for the type of sampling program undertaken, and they did not affect the quality of data for the purposes of this study. These problems were considered while assessing the Quality Assurance/Quality Control techniques performed to assure valid data. All of the data quality objectives defined in the QAPP were met.

6.0 Interpretation of Data

6.1 Meteorological Variables

Before completing an evaluation of the implications of the ambient PCB concentrations in determining potential source areas, an attempt was made to identify what impact various meteorological parameters had on the ambient concentrations of PCBs. The meteorological parameters of temperature, wind speed, barometric pressure, precipitation and wind direction measured at the on-site weather station were compared with the measured PCB concentrations at all of the sampling sites. To assist in the interpretation of ambient concentrations and meteorological parameters, several graphs of measured PCB concentrations against the various meteorological parameters were developed. Tables 9, 10 and 11 provide data on sampling days for temperature, wind speed, barometric pressure and precipitation. In addition, Tables 12, 13, 14 and 15 provide summaries of meteorological data for the days on which the highest and lowest PCB concentrations occurred at each of the sampling sites. These materials were developed to assist in identifying any patterns in the ambient concentrations that could be explained by meteorological variables which were monitored on-site.

A summary of the identified relationships between the 1993 PCB concentrations and meteorological variables of temperature, wind speed, wind direction, barometric pressure and precipitation is presented in the following sections. Since previous efforts at statistical evaluations of meteorological data and ambient concentrations did not prove to be effective in interpreting ambient PCB data, no statistical analyses were conducted.

6.1.1 Temperature

Appendix XVI includes graphs of ambient PCB concentration versus temperature for the six high-elevation and three low-elevation sampling locations for the eight sampling events in the May-August 1993 study. It also includes, for comparison and completeness, graphs of ambient PCB concentration versus temperature from the year-long 1991-92 study for the stations involved in that study. Inspection of these graphs shows that, at the high-elevation stations (excluding the background site), ambient PCB concentrations begin to increase at ambient temperatures around 50-60°F. This trend can be seen both in the graphs for 1993 and in the graphs for 1991-92, particularly at the locations of interest here (i.e., those at and around Newell Street, near Silver Lake, and at the Lyman Street site). At temperatures of 50-60°F and higher, temperature appears to be related to ambient PCB concentrations, although it is not a direct linear relationship. For the low-elevation monitors, the graphs show that temperature begins to be associated with ambient PCB concentration at around 63-64°F, and that at these and higher temperatures there is a strong and more direct relationship between increasing temperature and increasing PCB concentrations.

TABLE 12
CONDITIONS AT MAXIMUM CONCENTRATION FOUND DURING HIGH ELEVATION SAMPLING

SITE	CONCENTRATION	DATE	TEMP	WIND SPEED	PREDOMINANT WIND DIRECTION
WEBB	0.0090	6/18/93	64.52	3.24	W/SW
191 NEWELL FRONT	0.0097	7/3/93	63.88	4.10	E/SE
191 NEWELL REAR	0.035	8/17/93	69.29	3.15	E
LYMAN	0.011	8/2/93	72	2.51	Calm, N-S, NW, NNW
SILVER LAKE	0.023	7/3/93	63.9	4.0	E/SE
BCC	0.0035	6/3/93	53.78	6.18	

TABLE 13
CONDITIONS AT MINIMUM CONCENTRATION FOUND DURING HIGH ELEVATION SAMPLING

SITE	CONCENTRATION	DATE	TEMP	WIND SPEED	PREDOMINANT WIND DIRECTION
WEBB	0.0027	5/20/93	50.57	2.59	SE
191 NEWELL FRONT	ND	6/3/93	53.8	6.18	NW
	ND	8/2/93	72	2.51	Calm, N-S, NW, NNW
191 NEWELL REAR	ND	5/20/93	50.57	2.59	SE
LYMAN	0.0027	5/20/93	50.57	2.59	SE
SILVER LAKE	0.0027	5/20/93	50.57	2.59	SE
BCC	ND	7/3/93	63.88	4.10	
		7/18/93	64.19	5.22	

TABLE 14
CONDITIONS AT MAXIMUM CONCENTRATION FOUND DURING LOW ELEVATION SAMPLING

SITE	CONCENTRATION	DATE	TEMP	WIND SPEED	PREDOMINANT WIND DIRECTION
191 NEWELL REAR	0.14	8/2/93	72.25	2.51	Calm, N-S, NW, NNW
LYMAN	0.10	8/2/93	72.25	2.51	Calm, N-S, NW, NNW
SILVER LAKE	0.35	8/2/93	72.25	2.51	Calm, N-S, NW, NNW

TABLE 15
CONDITIONS AT MINIMUM CONCENTRATION FOUND DURING LOW ELEVATION SAMPLING

SITE	CONCENTRATION	DATE	TEMP	WIND SPEED	PREDOMINANT WIND DIRECTION
191 NEWELL REAR	ND	---	---	---	
LYMAN	ND	---	---	---	
SILVER LAKE	ND	7/3/93	63.9	4.10	E/SE

"---" Indicates there were more than two occasions on which a non-detect was found.

Review of the tables showing meteorological data on days with maximum and minimum PCB concentrations reveals information consistent with the foregoing conclusions. The maximum concentration at each of the low-elevation monitors occurred on August 2, 1993, coinciding with the date of the highest recorded average daily temperature (Table 14; see also Table 9). The maximum concentrations at all of the high-elevation monitors, except BCC, occurred when the average daily temperature was greater than 63° (Table 12). The maximum PCB concentrations at the high-elevation monitors, however, did not necessarily occur on the day with the highest average daily temperature.

The minimum concentrations recorded at each sampling location, excluding BCC, tended to occur on days with average daily temperatures less than 60°F, particularly at the high-elevation monitors (Table 13). (One obvious exception was the ND recorded at 191 Newell Street Front on August 2, 1993 when the average daily temperature was 72°F.)

Review of these data indicates that average daily temperature appears to have some impact on ambient PCB concentrations, but it is not clear to what degree. At the monitored sites, excluding BCC, the overall data demonstrate that at ambient temperatures below about 50°F, there are unlikely to be measurable concentrations of ambient PCBs, while at higher temperatures, particularly above 60°F, there is a strong likelihood of obtaining measurable concentrations of PCBs. Thus, temperatures above about 50-60°F appear to be related to ambient PCB concentrations, although that relationship is not direct at the high-elevation locations. At the low-elevation sampling stations, PCB concentrations appear to be more sensitive to temperature (above about 63-64°F). Indeed, at these stations, the warmest days produced the maximum concentrations, whereas the warmest days did not consistently coincide with the maximum concentrations at the high-elevation stations.

6.1.2 Wind Speed

To investigate whether ambient PCB concentrations may be linked to wind speed, the ambient PCB concentrations for the high-elevation and low-elevation monitors were plotted against the 24-hour average wind speed for each sampling day. These graphs are presented in Appendix XVII. Again, these graphs include data both from the May-August 1993 study and the year-long 1991-92 study.

An inspection of these graphs reveals no evidence of a relationship between wind speed and ambient concentrations of PCBs at the high-elevation monitors. The graphs for the low-elevation monitors, however, are suggestive of an inverse relationship of PCB concentrations with wind speed (i.e., higher concentrations associated with lower wind speed). In addition, as shown in Table 5, the highest ambient PCB concentration at all of the low-elevation monitors occurred on

August 2, 1993, which was also the date with the lowest wind speed (Table 10) -- as well as the highest average daily temperature (Table 9) and the greatest daily precipitation (Table 11).

6.1.3 Wind Direction

To assist in the evaluation of wind direction, wind roses depicting the wind speed and wind direction during each of the sampling events were created. Copies of these wind roses are included in Appendix VI. In addition, Tables 12, 13, 14, and 15 were used to examine the meteorological conditions at each site on the days of the highest and lowest observed concentrations.

In the evaluations of wind direction, it was assumed that the Silver Lake, Lyman Street and 191 Newell St. Rear samplers are located at or directly above sources of the airborne PCBs, since those areas are known to contain elevated PCB concentrations. The evaluation also took into account that the 191 Newell Street Front and F.W. Webb monitors are located at some distance (potentially downwind) from the assumed source area at 191 Newell Street Rear.

This evaluation of the data indicated that wind direction alone does not account for the observed concentrations of ambient PCBs at the sampling locations. The wind direction varied from day to day, and it was not possible to establish a consistent relationship between measurable ambient PCB concentrations and the wind direction. It does appear, however, that wind direction and wind speed are mechanisms which play a role in the dispersion and dilution of PCBs from the assumed source areas. This is evidenced in the Newell Street area by higher concentrations observed close to the potential source area (i.e. the rear of 191 Newell Street) and lower concentrations observed farther away (i.e. 191 Newell Street Front and F.W. Webb).

6.1.4 Barometric Pressure

In reviewing the previous year-long study, MA DEP had suggested that ambient PCB concentrations may be linked to increasing or decreasing barometric pressure. To investigate this possibility, the ambient PCB concentrations for the high-elevation and low-elevation monitors were plotted against the average barometric pressure for each sampling day. These graphs are presented in Appendix XVIII. (They include only the 1993 data.) An inspection of these graphs shows no identifiable pattern or relationship, with the possible exception of the high-elevation sampling at Silver Lake. There was considerable variation within stations and between stations. There is thus no evidence, again with the possible exception of the Silver Lake high-elevation station, to suggest that barometric pressure impacted ambient concentrations of PCB.

6.1.5 Precipitation

The precipitation data (Table 11) reveal that a significant amount of precipitation occurred on two of the eight sampling days (August 2 and August 17, 1993). There were two additional days with minor accumulations (drizzle) of precipitation (May 20 and July 3, 1993). As shown in Table 5, the two days with the highest ambient PCB concentrations at all of the low-elevation sampling locations coincided with the two days of significant precipitation (August 2 and 17, 1993). There is no obvious relationship between precipitation and PCB concentrations at the high-elevation stations. Overall, the precipitation data are insufficient to draw any supportable conclusions about the impact of precipitation on ambient concentrations of PCBs.

6.1.6 Summary

The meteorological parameters of temperature, wind speed and wind direction appear to have some impact on the variation in ambient PCB concentrations. The impacts of temperature and wind speed appear to be more pronounced at the low-elevation stations than the high-elevation stations. The impact of wind speed and wind direction is evidenced by the dispersion and dilution of PCBs in the air. It is nevertheless not clear to what degree these parameters directly affect ambient PCB concentrations. These meteorological parameters are, by their very nature, variable and characteristically do not operate independently of one another. It is more likely that these factors along with other factors, which may include source strength and proximity to the source area(s), combine in various ways to determine the concentration of ambient PCBs at a given point on any given day.

6.2 Comparison of Data With 1991-1992 Year-Long Study

Three of the high-volume sampling stations from the 1993 sampling program are directly comparable to three of the sampling stations from the 1991-1992 sampling program. Table 16 below summarizes and compares the average PCB concentrations from these stations:

TABLE 16

COMPARISON BETWEEN 1991-92 AND 1993
SAMPLING PROGRAMS

	Average PCB Conc. (ug/m^3) May-August, 1991-92*	Average PCB Conc.(ug/m^3) May-August, 1993
BCC	<0.0005	0.0015
Lyman Street	0.0029	0.0061
191 Newell Rear	0.015	0.015

* Samples collected during months of May, June, July and August in the 1991-1992 year-long study.

It is unclear why the concentration at the background site at BCC is three times higher in 1993 than in 1991-92. There were several more NDs recorded at BCC in 1991-92 than there were in 1993. It is also unclear why the concentration at Lyman Street is twice as high in 1993 as during 1991-1992.

6.3 Implications of Ambient Air Studies in Determining Sources

GE's analyses of PCB isomer distribution (Section 4.2) show that at each of the sampling stations, the distribution of PCB isomers in the air samples has a consistent pattern over time. Although the concentrations vary with time, the PCB isomer composition remains relatively constant at each station. The analyses further show that PCB isomer distributions on chromatograms from air samples at the Newell Street area sampling stations (including 191 Newell Front, 191 Newell Rear and F.W. Webb) can be distinguished from the PCB isomer distributions on chromatograms from air samples at the Lyman Street and Silver Lake sampling stations. This is demonstrated in Figures 27 C, D and E of Appendix III showing several isomer peaks (e.g. peaks eluted at 7.99, 21.25, 24.35, and 24.49) in the Silver Lake and Lyman Street samples that do not appear in the samples from the Newell Street area stations. In addition, the peak patterns in the Lyman Street and Silver Lake samples show a different proportionality than corresponding peaks in the Newell Street area samples. This phenomenon can be observed by examining peaks eluted at 22.43 and 22.54 in Figure 27D.

This isomer distribution and peak ratio analysis indicates that the source of airborne PCBs in the Newell Street area is different from the source(s) of airborne PCBs at Lyman Street and Silver Lake. Based on this position, the implications of this ambient

air study in determining source areas for the Newell Street area, Lyman Street and Silver Lake sampling locations have been evaluated separately.

6.3.1 Newell Street Area

6.3.1.1 High-Volume/Low-Volume Comparison

A comparison of the GE Environmental Laboratory's PUF extract chromatograms from the 191 Newell Street Rear low-elevation sample (Figure 9, Appendix III) and high-elevation samples (Figures 8 and 18, Appendix III) shows a very similar distribution of the major PCB isomer peaks. This similarity in isomer peak distribution indicates that the source of PCBs in the low-elevation air sample is the same as the source of PCBs in the high-elevation air samples.

The PCB concentration recorded at the low-elevation sampler was consistently greater than the PCB concentration recorded at the high-elevation sampler. Table 7 shows that the low-elevation concentrations were 2.8 to 6 times greater than high-elevation concentrations. If the ground behind 191 Newell Rear were the source of airborne PCBs, one would expect to see higher PCB concentrations closer to the ground and lower PCB concentrations at higher elevations, and this is in fact what was found.

It should be noted, however, that there is some question about the comparability of the low-elevation and the high-elevation sampling results, since the samples were collected using different sampling methods (TO-10 for the low-elevation samples versus TO-4 for the high-elevation samples). The low-volume samplers used at the low-elevation stations pull a total volume of approximately only 7 m^3 of air over 24 hours, compared to approximately 370 m^3 of air at the high-volume samplers used at the high-elevation locations. Moreover, due to the lower volume, the low-volume samples have a PCB detection limit of 0.029 ug/m^3, which is substantially higher than the detection limit of 0.0005 ug/m^3 for the high-volume samples. In these circumstances, any PCBs detected by the low-volume sampler would be quantified at a relatively elevated concentration. Further sampling is proposed in Section 8 to evaluate the comparability between high-volume and low-volume methods. Until that sampling is completed, any comparisons between the high-elevation and low-elevation sampling data should be viewed with considerable caution.

6.3.1.2 Variations Between High-Volume Sampling Locations

GE's analyses of the chromatograms have shown that the peak ratios and isomer distributions in PUF extracts from 191 Newell Street Rear (Figures 8 and 18, Appendix III), 191 Newell Street Front (Figures 10, 11 and 19, Appendix III) and F. W. Webb (Figures 1-7, Appendix III) are all very similar, suggesting that the same source(s) are influencing the Newell Street area monitors. As noted in section 6.3.1.1, above, this pattern is also evident in the chromatogram from the low-elevation samples in the rear of 191 Newell Street.

The PCB concentrations recorded at 191 Newell Street Front and F.W. Webb averaged less that the concentrations recorded at 191 Newell Rear, which is assumed to be directly over the assumed source area. The PCB concentrations at 191 Newell Street Front and F.W. Webb are approximately one-third of the PCB concentrations at 191 Newell Street Rear. This seems logical because if the source of airborne PCBs is assumed to be the ground area behind 191 Newell Street, one would expect to see lower PCB concentrations at monitors farther away from the source due to the effects of dispersion and dilution.

6.3.1.3 Wind Directional Data

The wind roses in Appendix VI, the PCB site concentration data in Table 4 and the predominant wind direction recorded on days with the maximum and minimum PCB concentrations (Tables 12-15) were used to evaluate whether the Newell Street rear area might be a source of ambient PCBs for the Newell St. area sites. On some days, as on June 18, 1993, when the highest ambient concentration of PCBs was recorded at the F.W. Webb station, the wind direction (W/SW on that date) seemed to suggest that the ambient PCBs found at F.W. Webb may be coming from the assumed source area (i.e. 191 Newell Street Rear). However, this wind direction association could not be consistently applied.

6.3.1.4 Comparison of Soil Chromatograms with Ambient Air Chromatograms

A comparison has been made between the PUF extract chromatograms from the Newell Street area (Appendix III, Figures 8-11, 18-19) and the chromatograms from the soil samples from 191 Newell Street Rear (Appendix III, Figures 46-48). None of the PUF extract chromatograms shows a PCB isomer distribution directly comparable to the isomer distribution in the soil sample chromatograms. However, as discussed in Section 4.2, the differences are consistent with, and may be

explained by, the expectation that if the PCBs volatilized from the soil, the isomer distribution in the PUF extracts would show a greater proportion of the more volatile isomers that have a shorter retention time.

6.3.1.5 Overall Interpretation

Review of all the data, particularly the comparison of ambient PCB concentrations among the various monitors in the Newell Street area and the comparison of air extract chromatograms among those monitors, indicates that the ground surface in the rear of 191 Newell Street is a principal source of PCBs in the ambient air of the surrounding area. Emission rates from this assumed source cannot be determined with any precision, although it is clear that they are higher in warm periods than in cold periods. Moreover, the data indicate that there is rapid dispersion of PCB concentrations with elevation above the assumed source area, and that ambient PCB concentrations further decrease rapidly with distance from the source.

6.3.2 Lyman Street Area

6.3.2.1 High-Volume/Low-Volume Comparison

Because of the small quantities of PCBs in the Lyman Street low-elevation samples, GE Environmental Laboratory was unable to make a direct comparison of PUF extract chromatograms from the Lyman Street low-elevation monitor (Appendix III, Figure 13) and high-elevation monitor (Appendix III, Figures 12, 14 and 20). A few of the major isomer peaks are evident in the low-elevation chromatogram, but they are not sufficient to draw any conclusions regarding similarity with the high-elevation chromatogram peaks.

The PCB concentrations recorded at the Lyman Street low-elevation sampler were consistently greater than the PCB concentration recorded at the high-elevation sampler. Table 7 shows that the low-elevation concentrations were 9.2 to 26 times greater than high-elevation concentrations. If the Lyman Street river bank were the source of airborne PCBs, one would expect to see higher PCB concentrations closer to the ground and lower PCB concentrations farther away. Again, however, given the questions about the comparability of the sampling methods used in the high-elevation and low-elevation sampling (as discussed in Section 6.3.1.1), any comparisons between these data sets should be viewed with caution.

6.3.2.2 Wind Directional Data

The wind roses and wind directional data provide no real assistance in identifying the Lyman Street river bank or any other potential area as the source of airborne PCBs at Lyman Street. For example, on August 2, 1993 and July 3, 1993, the two days with the highest recorded PCB concentrations at Lyman Street, the predominant wind direction was from the N/NW and E/SE, respectively.

6.3.2.3 Comparison of Oil and Filter Cake Chromatograms with Ambient Air Chromatograms

A comparison has been made between the PUF extract chromatograms from the Lyman Street site (Appendix III, Figures 12-15 & 20) and the chromatograms from the oil and filter cake samples taken from this site (Appendix III, Figures 39-41 & 44). Again, the PCB isomer distribution in the PUF extract chromatograms is not comparable to that in the oil and filter cake chromatograms, although the differences may be explained by the volatilization of shorter retention time isomers.

6.3.2.4 Overall Interpretation

The chromatograms of the high-volume samples at Lyman Street were consistent over time. However, unlike the Newell Street area, the quantity of PCBs in the low-volume sample was insufficient to characterize the low-volume and high-volume samples as similar. Therefore it was not possible to identify the river bank as the source area for ambient PCBs recorded at the high-volume monitor. In general, there are insufficient data to identify the source of ambient PCBs at Lyman Street.

6.3.3 Silver Lake Area

6.3.3.1 High-Volume/Low-Volume Comparison

A comparison of the GE Environmental Laboratory's PUF extract chromatograms from the Silver Lake low-elevation samples (Appendix III, Figures 17, 24 and 25) and high-elevation samples (Appendix III, Figures 16 and 23) shows a very similar distribution of the major PCB isomer peaks. This similarity in isomer peaks distribution indicates that the source of PCBs in the low-elevation air sample is the same as the source of PCBs in the high-elevation air samples.

The PCB concentrations recorded at the low-elevation monitor ar Silver Lake were consistently greater than the PCB concentrations recorded at the high-elevation monitor. Table 7 shows that the low-elevation PCB concentrations varied from 5.2 to 87.5 times greater than high-elevation PCB concentrations. This wide variability between the high-volume and low-volume sampling results did not occur at the other sites. It is also noticeable that, unlike the Newell Street Rear and Lyman Street sites, the highest PCB concentrations at the Silver Lake low-elevation monitor did not correspond with the days when the highest PCB concentrations occurred at the Silver Lake high-elevation monitor.

The high PCB concentrations at the low-elevation monitor suggest that Silver Lake is a source of ambient PCBs. The results also illustrate that significantly higher concentrations are observed at low elevations than at higher elevations at breathing height. However, no firm conclusions can be reached regarding the magnitude of the low-elevation PCB concentrations or the extent of differences between them and high-elevation concentrations until the questions regarding the comparability of the high-volume and low-volume sampling methods are resolved (See Section 8).

6.3.3.2 Variations Between High-Volume Sampling Locations

A comparison between PCB levels found at Building 32S (approximately 400 feet east of Silver Lake) during the summer of 1991-92 and the concentrations found at the eastern edge of Silver Lake in 1993 show consistently higher ambient PCB concentrations at the Silver Lake shore. This comparison shows that the PCB levels at Building 32S are roughly one-half those found at the edge of Silver Lake. This comparison is analogous to the comparison of the 191 Newell Street Rear sampling location with 191 Newell Street Front and F.W. Webb. In each case, the data illustrate that PCBs diminish rapidly with distance from the potential source area.

6.3.3.3 Wind Directional Data

As with the other sites, wind direction was not especially helpful in identifying the source areas of PCBs. On some days, the wind direction from the west seemed to provide an explanation for the PCB concentrations observed, but there was no evident consistent pattern or relationship.

6.3.3.4 Comparison of Sediment Chromatograms with Ambient Air Chromatograms

A comparison has been made between the PUF extract chromatograms from the Silver Lake site (Appendix III, Figures 16-17, 23-25) and the chromatogram of a sediment sample from Silver Lake (Appendix III, Figure 45). Once again, the PCB isomer distribution in the PUF extract chromatograms is not comparable to that in the sediment sample chromatogram. Again, too, the differences involve a greater proportion of shorter retention time isomers in the PUF extract chromatograms, which is consistent with the theoretical PCB isomer distribution that would be expected assuming the volatilization of PCBs from the sediments.

6.3.3.5 Overall Interpretation

Review of all the data, particularly the ambient monitoring data from Silver Lake and Building 32S and comparisons of the low-volume and high-volume sample chromatograms from Silver Lake, indicates that Silver Lake is a principal source of PCBs in the ambient air in this area. Emission rates cannot be determined, although they appear to be higher in warmer months. Significantly, PCB concentrations appear to decrease rapidly with elevation above the lake surface and to decrease rapidly further with distance from the lake.

7.0 Evaluation of Potential Risk

GE requested ChemRisk of Portland, Maine, to evaluate the potential health risks associated with the inhalation of airborne PCBs, based on the PCB monitoring data collected in 1991-92 and in May-August 1993. This evaluation focused principally on the area around the Newell Street site, since the monitoring data show the highest ambient PCB concentrations at that site. However, since there is no potential for continuous 24-hour exposures at that site itself, the assessment was directed to the residential properties adjacent to the site and to the nearby Hibbard School. A comparative evaluation was also made of the potential risks to residents living near Silver Lake. In addition, alternative assessments were made for all these areas using an approach recommended by MA DEP's Office of Research and Standards. ChemRisk's evaluation is presented in Appendix XIX.

7.1 Estimated Average PCB Concentrations for Newell Street Area

For analysis of potential exposures and risks to the residents on Newell Street, ChemRisk and Zorex jointly determined that the most representative, but still conservative, data are the data from 191 Newell Street Front and F.W. Webb, since those locations are closer to the receptor areas of interest than 191 Newell Street Rear. Similarly, it was determined that the most representative data for the analysis of potential exposures and risks for the Hibbard School students are the data from F.W. Webb due to the proximity of that sampling station to the school. Monitoring data are available for the 191 Newell Street Front and F.W. Webb stations for May-August 1993. For some of the shorter-term exposure analyses, these data could be used directly. For the chronic exposure analyses, however, it was necessary to estimate annual or other long-term average concentrations for those two stations. These estimates were made by the application of calculated ratios to the year-long 1991-92 monitoring data from 191 Newell Street Rear, as discussed below.

For the various averaging periods specified by ChemRisk, Zorex calculated the appropriate average PCB concentrations. A description of the calculations and the resulting averages is provided below, while a copy of the underlying calculations is presented in Appendix XX. Note that these calculations are based on the data from the Method 608 analyses, rather than the high-resolution analyses, because the former constitute a more complete data set. Thus, the risk assessment is overly conservative because the Method 608 analyses generally produce higher PCB concentrations than the high-resolution analyses which generate more accurate values for actual ambient PCB levels. See Section 4.1.2 above.

1. Ratios. For several of the estimates, it was necessary to calculate a ratio of the concentrations at 191 Newell Street Front or F.W. Webb to those at 191 Newell Street Rear. For the calculation for 191 Newell Street Front, the average concentration for this station from all 1993 sampling events (0.0041 ug/m^3) was divided by the average concentration for 191 Newell Street Rear from the same sampling events (0.015 ug/m^3). Similarly, for F.W. Webb, the average concentration for this station for the 1993 events (0.0053 ug/m^3) was divided by the 191 Newell Street Rear average for these events (0.015 ug/m^3). The resulting ratios are:

191 Newell St. Front	F.W. Webb
0.27	0.35

2. Annual Averages. To estimate the annual average PCB concentrations for 191 Newell Street Front and F.W. Webb, the foregoing ratios were applied to the annual average concentration at 191 Newell Street Rear in 1991-92 (0.0062 ug/m^3). The results are (in ug/m^3):

191 Newell St. Front	F.W. Webb
0.0017	0.0022

The combined average for these two stations is 0.0020 ug/m^3.

3. September-June Average at F.W. Webb. To estimate the average concentration for F.W. Webb for the school year, all concentrations detected at 191 Newell Street Rear in the 1991-92 study were multiplied by the foregoing ratio for F.W. Webb (to simulate a full year of data at F.W. Webb), and the average of the calculated values from September through June was then determined. That average was 0.0018 ug/m^3.

4. Confirmatory Comparison. To evaluate the accuracy of this approach of applying 1993 ratios to the 1991-92 Newell Street Rear data and thus to judge the accuracy of the simulated data sets based on application of the ratios, average concentrations were calculated for May-August from the simulated data sets for 191 Newell Street Front and F.W. Webb; and these calculated concentrations were then compared with the average of the actual concentrations measured at 191 Newell Street Front and F.W. Webb in May-August 1993. These comparisons show good agreement between the calculated and the actual data:

Average of	191 Newell St. Front	F.W. Webb
Calc. Data (May-Aug)	0.0038	0.0050
Actual Data (May-Aug)	0.0041	0.0053

5. June-August Averages. To calculate averages for the summer months, the actual measured data for the sampling events in June through August 1993 were averaged. These averages were (in ug/m^3):

191 Newell St. Front	F.W. Webb
0.0058	0.0061

The combined average for these two stations is 0.0060 ug/m^3.

6. April-June Average for F.W. Webb. To estimate the highest average concentration at F.W. Webb for any consecutive three-month period during the school year, the calculated data for April, May, and June from the simulated data set for F.W. Webb were averaged. That average was 0.0039 ug/m^3.

7. Maximum 24-Hour Concentrations. To determine the maximum estimated 24-hour concentrations for 191 Newell Street Front and F.W. Webb, the foregoing ratios were applied to the maximum 24-hour concentration measured at 191 Newell Street Rear in 1991-92 (0.030 ug/m^3). These estimates were then compared to the highest 24-hour concentrations actually monitored at 191 Newell Street Front and F.W. Webb in 1993. The results are (in ug/m^3):

	191 Newell St. Front	F.W. Webb
Max Calc.	0.0081	0.011
Max Actual	0.0097	0.0090

7.2 Risk Evaluation

Using the foregoing airborne PCB concentrations as appropriate, ChemRisk has completed an evaluation of the carcinogenic, chronic noncarcinogenic, and subchronic noncarcinogenic risks for the residents living on Newell Street and for the students at the

Hibbard School. This evaluation, which uses standard MA DEP exposure assumptions and toxicity values, is provided in Appendix XIX. It demonstrates that the PCBs in the ambient air do not present any imminent hazard or significant risk to the target population groups evaluated. ChemRisk's assessment also includes a comparative risk evaluation for residents living near Silver Lake. This evaluation likewise indicates that the airborne PCBs pose no imminent hazard or significant risk to those residents. Alternative analyses following an approach recommended by MA DEP's Office of Research and Standards confirm the lack of such risks for the areas near Newell Street and Silver lake.

ChemRisk thus concludes that there is no risk-based justification for further short-term measures or immediate response actions to address the ambient PCB concentrations at the Newell Street site and Silver Lake.

8.0 Evaluation of Need for Further Sampling

This section provides an evaluation of the need to conduct further ambient air sampling at sites at or near the GE facility. In addition, to the extent that further sampling appears to be warranted, a proposal is presented for such additional sampling.

There does not appear to be any need for additional high-volume air sampling. For the spring/summer months, the results from the May-August monitoring in 1993 support and confirm the general characteristics of ambient PCB concentrations resulting from the 1991-92 data. For the winter, additional sampling is not likely to provide useful information, since the ambient PCB concentrations are much lower, with most levels below the detection limit. Further, given the evaluation presented in Section 6.3, it seems unlikely that additional high-volume sampling would provide further useful information about the sources of the PCBs detected in the ambient air at the various sites.

Additional air sampling is needed, however, to evaluate the validity of the low volume sampling method. As discussed above, the reported PCB concentrations from the low-volume low-elevation samples are much higher than any of the concentrations found at the high-volume high-elevation stations. This leads to some question about the comparability of the two sampling methods. The low-volume samplers pull a total of only 7 m^3 of air over a 24-hour period, compared to 370 m^3 for a high-volume sampler. Moreover, due to the lower volume, the low-volume samples have a much higher detection limit, at 0.029 ug/m^3, than the 0.0005 ug/m^3 detection limit for the high-volume samples. In these circumstances, any PCBs detected by the low-volume sampler will be quantified at a relatively elevated concentration level. The data collected to date do not allow for a direct comparison of the two methods, since the data do not include any high-volume and low-volume results from the same elevation or any low-volume results from a high elevation or from an area with no known ground-level source of PCBs. Hence, questions about the validity of the low-volume sampling method and its comparability with the high-volume method remain open and need to be resolved before any firm conclusions can be drawn from comparisons of the high-volume and low-volume data sets.

To evaluate the accuracy and consistency of the low volume sampling method, it is proposed to co-locate two low-volume sampling systems, one at high elevation and one at low elevation, at the Silver Lake sampling location. A high-volume sample would also be collected concurrently from the existing high-volume monitor at this location for comparative purposes. It is proposed to collect at least three rounds of samples from these monitors for PCB analysis. Such sampling would best be conducted during the summer months, when ambient PCB concentrations are expected to be the highest. Comparisons among these results should provide important information regarding whether the existing low-volume sampling results reflect truly elevated PCB concentrations or have been inflated through some artifact of the low-volume method.

9.0 Evaluation of Appropriateness of Air Dispersion Modeling

A review of the existing ambient air monitoring data and the potential benefits of performing an ambient air dispersion modeling procedure to further characterize downwind concentrations of airborne PCBs indicates that it would be inappropriate and unnecessary to carry out such dispersion modeling. There are a number of reasons for this conclusion.

First, the dimensions of and emission rates from specific source areas have not been, and are not likely to be, accurately defined. Hence, the completion of a dispersion modeling exercise would be subject to significant supposition and a great deal of uncertainty.

Furthermore, a principal purpose of performing a dispersion modeling procedure would be to generate an estimate of the "worst case" ambient PCB concentration resulting from emissions from one or several source areas. However, given the lack of data on emission rates, the most appropriate way to calculate emission rates (maximum or average) from source areas, if they were defined, would be simply to back-calculate those rates from the monitored data. In these circumstances, since dispersion models for ground-level sources assume that concentrations decrease with increasing distance from the source, the modeled concentrations would likely not be more "worse case" than the concentrations monitored at the sites with the highest concentrations (i.e., 191 Newell Street Rear and Silver Lake). Rather, the model would likely predict ambient concentrations further downwind at levels lower than those monitored.

Finally, the existing monitoring data can themselves be used to make conservative estimates of the ambient PCB concentrations to which downwind receptors of interest could be exposed. An evaluation using those data already shows no significant risk to populations of concern, as demonstrated in ChemRisk's analysis in Appendix XIX.

APPENDIX XIX

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MEMORANDUM

To: Grant Bowman; Jeff Ruebesam

From: Mark Maritato MCM

Date: November 4, 1993

Subject: PCB Inhalation Risk Issues at Newell Street and Silver Lake Sites

cc Ellen Ebert

INTRODUCTION

At your request, ChemRisk has conducted an evaluation of potential health risks that could result from the inhalation of PCBs in ambient air in certain areas around the GE facility in Pittsfield, Massachusetts. This evaluation is based on the results of PCB air monitoring conducted by Zorex Environmental Engineers (Zorex) from August 1991 through August 1992 and again in May-August 1993, as well as certain estimates of ambient PCB concentrations derived from those results (Zorex, 1992, 1993). The purpose of this evaluation is to determine whether levels of PCBs in the ambient air in these areas present an "imminent health hazard" under criteria established by the Massachusetts Department of Environmental Protection (DEP), and thus whether they warrant the implementation of Short-Term Measures (STMs), now known as Immediate Response Actions (IRAs) under the Massachusetts Contingency Plan (MCP).

The main risk assessment presented herein focuses on the area around the Newell Street site, because the monitoring conducted by Zorex consistently shows the highest ambient PCB concentrations at that site. DEP has recognized this. In a memorandum of March 5, 1993, DEP expressed concern that PCB levels in the air on certain days at the Newell Street site were sufficiently high that if one were to breathe those levels for 24 hours, there might be a potential for adverse health effects (Manganaro and Hutcheson, 1993). DEP also acknowledged, however, that this type of exposure would not occur at the Newell Street site itself (Manganaro and Hutcheson,

1993). It is our understanding that, in verbal discussions with GE, DEP expressed concern about off-site exposures at the residential properties adjacent to the Newell Street site and at the nearby Hibbard School. Hence, the present analysis evaluates potential inhalation risks for the residents living in the vicinity of the Newell Street site and for the teenage children attending the Hibbard School.

For these populations, ChemRisk has conducted a screening-type evaluation of carcinogenic, chronic noncarcinogenic, and subchronic noncarcinogenic risks, using standard DEP exposure assumptions and the toxicity values prescribed by DEP for PCBs. Although ChemRisk believes that some of the exposure assumptions used could be modified based on site-specific data and that the DEP toxicity values are not scientifically justified, it has nevertheless used those assumptions and values in this analysis in order to provide a highly conservative screening-level assessment which should be acceptable to DEP without detailed discussion.

In addition, as an even more conservative (and unrealistic) "worst-case" analysis, ChemRisk has evaluated the potential risks to residents from a single-day exposure using the highest concentration measured in the front of the Newell Street site and the most conservative receptor (a small child).

An evaluation of the potential risks associated with the inhalation of PCBs by residents living adjacent to Silver Lake is also provided. This evaluation is based on a comparison of the estimated PCB concentrations to which such residents might be exposed with the estimated concentrations for areas in the front of the Newell Street site, and an assessment of potential risks for residents near Silver Lake relative to the risks calculated for residents on Newell Street.

Finally, as an alternative risk evaluation method, ChemRisk has followed the approach recommended by DEP's Office of Research and Standards (ORS) in a memorandum of August 24, 1993 (Hutcheson, 1993). This approach (which is also overly conservative) involves comparison of daily PCB levels with DEP's Threshold Effects Limit (TEL) for PCBs, using a hazard index of 5 to 50. This comparison has been made for measured and estimated ambient PCB concentrations in the front of the Newell Street site, considered as conservatively representing exposure point concentrations for the nearby residents and Hibbard School students. A similar comparison has also been made for estimated ambient PCB concentrations in the residential area near Silver Lake.

RISK ANALYSIS FOR AREA AROUND NEWELL STREET

To analyze potential exposures and risks for the residents living near the Newell Street site and the students at Hibbard School, it is necessary to determine the ambient PCB concentrations to which such populations would be expected to be exposed. Although PCB air monitoring data were obtained for a full year (1991-92) from a monitoring station located in the rear of 191 Newell Street, those data are not representative of levels that would be expected to occur at the residential properties or at Hibbard School. Rather, data from the front of 191 Newell Street and from the front of the F.W. Webb property are more representative of expected levels at the residential properties and at the school, due to the closer proximity of these monitoring stations to the receptor areas of interest. However, data are available from these monitoring stations only for the months of May-August 1993, which are known to be among the months with the highest PCB concentrations. Hence, for the analysis of chronic exposures, it was necessary to estimate annual or other long-term average ambient PCB concentrations for the front of 191 Newell Street and the F.W. Webb property. Zorex has made such estimates by first calculating the ratio of the average concentration measured at each of those locations in 1993 to the average concentration measured at the rear of 191 Newell Street for the same time period, and then applying those ratios to the pertinent 1991-92 data from the rear of 191 Newell Street. These calculations and results are presented in detail in Section 7.1 of the Zorex (1993) report. The specific data used and the rationales for their use in each exposure scenario are presented in the appropriate sections below.

It should also be noted that the PCB monitoring data used in this analysis, either directly or as the basis for estimated concentrations, are the analytical results from the high-volume samples, analyzed for PCBs by Method 608. Although the results of the high-resolution GC/MS analyses would be expected to be more accurate, those results are less complete than the Method 608 results. Hence, the latter have been used in this analysis, which is conservative since these results are almost always higher than the high-resolution analytical results.

Finally, it was assumed that all inhalation exposures to PCBs occur in the vapor phase. This assumption is consistent with the data presented by Zorex (1992) indicating that almost all the PCBs detected in the ambient air in this area were in the vapor phase. This assumption is conservative because vapors are assumed to be 100% inhaled and 100% bioavailable, whereas for particulates lesser percentages may be justified to model these parameters.

Evaluation of Exposures to Residents on Newell Street

For the residential population living across Newell Street from the Newell Street site, chronic carcinogenic, chronic noncarcinogenic, and subchronic noncarcinogenic risks have been estimated (Tables la, lb, and lc). For chronic exposures, it was assumed that an individual could be exposed for a total of 30 years, age 0 to <30, during a lifetime. To model exposures, this 30-year period was divided into three periods during which behavior patterns would be expected to differ. These periods were preschool years (age 0 to <6), school years (age 6 < 18), and adult years (age 18 < 30). To evaluate subchronic hazard, exposure of a 2-year old child was modeled. Selection of this age group was based on the high air intake rate reported for this age group in Table 10 of DEP's Summary of Interim Procedures and Assumptions Used in Relating Soil Contaminant Levels and Risk to Human Health (DEP, 1993).

1. Average Air Concentration

For the chronic cancer and noncancer residential analyses, an estimated average annual concentration of 0.002 $\mu g/m^3$ was used, representing an annual average combined concentration for the front of the F.W. Webb and 191 Newell Street properties. To derive this estimate, Zorex (1993) calculated an annual average concentration for each of the stations in the front of the Newell Street site (the front of 191 Newell Street and the F.W. Webb property) by: (a) calculating the ratio of the average concentration monitored at each of those properties in 1993 to the average concentration monitored during the same time period at the rear of 191 Newell Street; and (b) applying those ratios to the annual average of the 1991-92 monitoring data collected at the rear of 191 Newell Street (refer to Section 7.1 of Zorex (1993) report). The estimated annual average PCB concentrations for these two stations (0.0017 $\mu g/m^3$ for the front of 191 Newell Street and 0.0022 $\mu g/m^3$ for F.W. Webb) were then averaged together to produce the estimated exposure point concentration of 0.002 $\mu g/m^3$.

To evaluate subchronic exposure, an ambient air concentration of 0.006 $\mu g/m^3$ was used. This concentration was calculated by determining, for each of the stations in the front of Newell Street, the average of the actual measured concentrations for the period of June through August 1993, and then combining those averages (see Section 7.1 of Zorex (1993) report). This average concentration should thus represent a worst-case scenario corresponding to a single, consecutive 90-day summer exposure period.

2. Ventilation Rates

The adult ventilation rate selected was based on EPA's (1989) recommended value of 20 m^3/day, divided by 24 hours to derive an hourly rate of to 0.83 m^3/hour. EPA (1989) does not provide detailed ventilation data for all age groups. Thus, to derive an estimated hourly ventilation rate for the 0 to 6 year-old child, ChemRisk calculated a weighted average based on minute ventilation rates for each year for resting and light activity as provided in Table 2 of DEP's Interim Procedures document (DEP, 1993). As recommended by DEP (1993), it was assumed that 8 of the hours spent were engaged in resting activity and that the remainder of the exposure period was spent engaged in light activity. The resulting weighted inhalation value for this age group was 0.32 m^3/hour.

For 6 to 18 year old, a similar approach was used. A weighted average of 0.6 m^3/hr was derived based on DEP's (1993) recommended minute ventilation rates for each year of age, assuming that eight hours of the day were spent resting and that the remainder of the exposure period was spent in light activity.

To evaluate subchronic exposures, a ventilation rate for a 2-year-old child, 0.27 m^3/hour, was used. This estimate is based on DEP's (1993) recommended minute ventilation rates for children aged 2<3, assuming 8 hours of resting activity and 16 hours of light activity.

3. Vapor Penetration Factor

It was assumed that indoor PCB air levels were equivalent to outdoor levels. This is a conservative assumption because walls, windows, and doors are likely to provide a partial barrier to the infiltration of off-site fugitive PCB vapors.

4. Exposure Time

In estimating exposure times for each potentially exposed resident, ChemRisk conservatively assumed that adults and 0 to 6 year-old children are at home 24 hours per day. For 6 to 18 year-old children, it was conservatively assumed that 16 hours are spent at home during the school year (180 days), and that 24 hours per day are spent at home during non-school days. This resulted in

a time-weighted average of 20 hours per day. For the subchronic evaluation, an exposure time of 24 hours per day was assumed.

5. Exposure Frequency

For chronic exposures, all exposure groups were assumed to reside at home 350 days per year, assuming that a total of 2 weeks per year are spent away from home on vacation. For subchronic childhood exposures, an exposure frequency of 90 days over the summer months was assumed.

6. Exposure Duration

Chronic exposure durations for each age group correspond to the total number of years within each age group. The 30-year cumulative exposure duration corresponds to the EPA's (1989) upper 90th percentile for tenure in a single residential location and is therefore a very conservative measure. The exposure duration for the subchronic evaluation is equivalent to 1 because the period evaluated is a single 90-day event.

7. Body Weights

In this screening-level assessment, body weights correspond to an average of the median values for males and females. Because ventilation rates do not vary appreciably by gender, average male/female body weights were deemed appropriate for this assessment. For the 0 to 6 and 6 to 18 year-old age groups, body weights of 14 kg and 42 kg, respectively, were utilized. A body weight of 68 kg was used for adults. These correspond to the average of EPA's (1989) age-specific median body weights for males and females. Finally, a body weight of 13 kg was assumed for the 2-year-old child (EPA, 1989).

8. Averaging Time

An averaging time of 27,375 days was assumed for the carcinogenic residential evaluation, based on 365 days per year times a lifetime of 75 years. In the evaluation of chronic noncarcinogenic risks, averaging periods were determined for each group by multiplying the age group-specific exposure duration times 365 days per year. Lastly, the averaging period for the subchronic residential evaluations is equivalent to the exposure frequency (90 days).

9. Cancer Slope Factor

For the purposes of this screening-level assessment, ChemRisk has relied on the EPA cancer slope factor (CSF) of 7.7 (mg/kg-day)$^{-1}$ for PCBs, which is based on the female rat bioassay in a study by Norback and Weltman (1985) of Aroclor 1260. However, we believe that this value is no longer scientifically justified. A recent independent analysis of the rat liver slides from Norback and Weltman (1985) and from other studies on the carcinogenic potency of various PCB mixtures indicates that the tumor incidence in the studies of PCBs with 60% chlorination was less than previously reported and that lesser chlorinated PCB mixtures were not shown to be carcinogenic at all (IEHR, 1991). For Aroclor 1260, use of the results of this reanalysis, together with a revised cross-species scaling approach proposed jointly by the EPA, the Food and Drug Administration, and the Consumer Products Safety Commission in 1992, results in a revised CSF of 3.3 (mg/kg-day)$^{-1}$ if only the Norback and Weltman (1985) female rat bioassay data are considered, and a revised CSF of 1.2 (mg/kg-day)$^{-1}$ if one considers the results of all relevant bioassays of 60% chlorinated PCBs (ChemRisk, 1993a). The CSF for Aroclor 1254, if it is considered carcinogenic at all, would be even lower. Thus, the use of EPA's CSF of 7.7 (mg/kg-day)$^{-1}$ for the PCBs detected in the air around the Pittsfield facility, which were quantified principally as Aroclor 1254, is substantially overconservative.

10. Noncarcinogenic Acceptable Dose

DEP has adopted a value of 0.02 µg/kg-day as a chronic allowable daily intake (ADI) for Aroclor 1254 and other mixtures of highly chlorinated PCBs (Harnois, 1993a). This ADI is based on immunological effects observed in rhesus monkeys that were exposed to Aroclor 1254 at doses ranging from 5 µg/kg-day to 80 µg/kg-day (Tryphonas et al., 1989; 1991a,b). To derive this ADI, the LOAEL of 5 µg/kg-day was adjusted by uncertainty factors of 10 for use of a LOAEL, 3.16 for extrapolation from monkeys to humans, and 10 to compensate for variation in human sensitivity. In addition to the ADI, DEP has adopted a "acceptable" dose for PCBs which is considered the dose at which adverse effects are expected with a high degree of confidence (Harnois, 1993b). This acceptable dose of 0.2 µg/kg-day is based on the LOAEL in the same study used to derive the ADI, adjusted by the uncertainty factors for human sensitivity and for extrapolation from monkeys to humans. DEP recommends the use of this acceptable dose based on an adjusted LOAEL when evaluating the potential for imminent hazards (Harnois, 1993b).

For the purposes of this screening-level assessment, ChemRisk has used DEP's acceptable dose of 0.2 µg/kg-day to evaluate noncarcinogenic effects of PCBs. We believe, however, that this value is not scientifically justified. ChemRisk has conducted a thorough analysis of the Tryphonas et al. studies and has found no evidence that the immunological health of the primates was impaired by chronic exposure to PCBs at the doses tested (ChemRisk, 1993a,b). Based on this analysis, ChemRisk has concluded that the results of the Tryphonas et al. studies do not form an appropriate foundation for establishing a toxicity dose-response value for Aroclor 1254 or other PCB mixtures. Several leading immunologists have reached similar conclusions (Dosch, 1993; Letvin, 1993, Whitaker, 1993).

Evaluation of Exposures to Hibbard School Students

Potential chronic and subchronic hazards to Hibbard School students (teenagers) resulting from exposures to PCBs in air were also evaluated (Tables 2a, 2b, and 2c). For this scenario, the assumption for the vapor penetration factor and the toxicity values are identical to those used in the residential scenario. Other parameters are discussed below.

1. Air Concentration

Because the air monitor at the F.W. Webb property is closest to the school, air data from this location exclusively were used in estimating exposures for the students. For the chronic exposure analyses, the concentration used is the estimated average PCB concentration for the school year (September through June) at the F.W. Webb property. This concentration was calculated by Zorex to be 0.0018 µg/m^3, based on applying the previously calculated ratio for F.W. Webb/Newell Street rear to the 1991-92 data set from the rear of 191 Newell Street (to simulate a full year of data at F.W. Webb), and then determining the average of the calculated values for September through June (see Section 7.1 of Zorex (1993) report).

For the evaluation of subchronic exposure, a 90-day average PCB air concentration of 0.0039 µg/m^3 was used. This concentration was calculated by Zorex to represent the highest average concentration for any consecutive 90-day period during the September through June school year. It was derived by determining the average of the calculated concentrations for April through June in

the simulated annual data set that had been calculated for F.W. Webb through application of the F.W. Webb/Newell Street rear ratio (refer to Section 7.1 of Zorex (1993) report).

2. Ventilation Rate

The assumed ventilation rate was 0.82 m^3/hr. This is based on an average of DEP's recommended minute ventilation rates for 15, 16, 17, and 18 year-old children (DEP, 1993).

3. Exposure Frequency and Duration

An exposure time of 7 hours/day was selected to conservatively represent a typical school day. In the chronic exposure analyses, an exposure frequency of 180 days per year was assumed, representing the length of a school year. For the subchronic analysis, it was assumed that students would attend school five days per week during the 90-day period in question; this is equivalent to an exposure frequency of 64 days. An exposure duration of 4 years was determined to be the typical period of attendance at Hibbard School.

4. Body Weight

A body weight of 58 kg (EPA, 1989) was utilized. This represents the average of median body weights for females and males aged 15 to 18.

5. Averaging Period

An averaging time of 27,375 days (365 days per year, 75 years) was assumed for the carcinogenic exposure analysis. For the chronic noncarcinogenic analysis, the averaging period equaled the product of the exposure duration (4 years) and 365 days/year. As with the residential analyses, the subchronic evaluation assumed that subchronic exposures occur during a 90-day period in a single year.

Risk Characterization Results

The calculations of PCB intake and estimated risks for the carcinogenic, chronic noncarcinogenic, and subchronic analyses are presented in Tables la, lb, and lc, respectively, for the residents of

properties near the Newell Street site, and in Tables 2a, 2b, and 2c, respectively, for the students at the Hibbard School. The results of these screening-level calculations indicate that neither the residents nor the students are at risk from exposure to ambient air concentrations of PCBs. Estimates of the total incremental carcinogenic risks due to PCB inhalation are 2.0×10^{-6} for the residents and 3.6×10^{-8} for the students. Both of these cancer risk estimates are well below the 1×10^{-4} cancer risk level generally used by DEP as the level at which an imminent hazard is considered to exist and at which further immediate response action must be taken. Chronic noncarcinogenic hazard indices, based on the DEP's "acceptable" toxicity value of 0.2 µg/kg-day range from 0.0108 for the 30-year resident to 0.0004 for the Hibbard School student. Even when subchronic noncarcinogenic risks are estimated based on the relevant 90-day period with the highest measured air levels, the hazard indices range from 0.0150 for the 2-year old resident to 0.00137 for the Hibbard School student. These are well below levels of concern and thus indicate that there is no need to take immediate response actions to address the concentrations of PCBs in the ambient air in this area.

COMPARATIVE RISK EVALUATION FOR RESIDENTS NEAR SILVER LAKE

In an October 13, 1993 letter to GE, DEP indicated its belief that Silver Lake " appears to be a likely source of [PCB] contamination in ambient air." ChemRisk has prepared the following comparative analysis to offer perspective on measured PCB air concentrations near Silver Lake.

Estimation of Ambient Air Concentrations

Two air monitoring stations are positioned closely to Silver Lake. One station, referred to as the Silver Lake air monitor, is located on the eastern side of the lake on top of a permanent concrete platform at which water levels in the lake are controlled. The second air monitoring station, located at GE's Building 32S, lies approximately 400 feet east of Silver Lake (Zorex, 1993). There is no residential area adjacent to the eastern shore of the lake; rather, all nearby residential properties are located at the southwestern corner of the lake. All of those homes are set back from the lake and are separated from the lake by areas of heavy vegetation and undergrowth. Thus, exposure points for nearby residents would be at some distance from the lake. Finally, because the prevailing wind in this area is from the west (Zorex, 1992), the tendency would be for any vapor emissions from the lake to be dispersed and distributed in an easterly direction.

Given these site-specific considerations, ChemRisk believes that it is inappropriate to assume that air levels measured at the Silver Lake monitor would be representative of air levels at the residential properties, for several reasons. First, the monitoring station is located in the area of the lake where sediment levels are the highest and may not be considered representative of emissions from the entire lake. Second, the monitor is located just above the surface of the lake so that there is little opportunity for mixing and dispersion to occur before the air reaches the monitor. Mixing and dispersion would occur before lake emissions reached any residential properties. Third, the prevailing winds tend to move emissions in an easterly direction, away from residential areas and toward the Silver Lake monitoring station. As a result, it is expected that air levels measured at that monitoring station would be far higher, generally, than the levels that would be measured in the nearest residential area.

For these reasons, ChemRisk believes that the PCB air concentrations reported at the Building 32S sampling station are the more appropriate available data to use in evaluating PCB air impacts on nearby residents. This monitor lies essentially downwind of Silver Lake and is located at a generally similar distance from the lake as are the residences. Because of the prevailing winds, it is likely that the impact of vapor emissions from Silver Lake (if any) would result in higher measured concentrations at Building 32S than would be expected to occur at the residential neighborhood to the southwest. For this reason, the air monitoring data collected at Building 32S in 1992 may be considered to be conservative but reasonably representative surrogates for hypothetical air concentrations at the residential properties.

Based on six samples collected at the Building 32S monitoring station over the summer months in 1992, Zorex (1992) reported a mean PCB air concentration of 0.005 $\mu g/m^3$. Three winter sampling events at this location resulted in a single detected PCB air concentration of 0.0005 $\mu g/m^3$ and two nondetect events with a reported detection limit of <0.0005 $\mu g/m^3$ (Zorex, 1993). These data indicate a winter average PCB concentration below the detection limit for this location.

The available data for the Building 32S monitoring station indicate that the PCB concentration levels at that location are generally similar to the levels at the stations in the front of the Newell Street site. Thus, the average summer concentration of 0.005 $\mu g/m^3$ for Building 32S is similar to the average summer concentration of 0.006 $\mu g/m^3$ for the stations in the front of the Newell Street properties. The low winter concentrations at Building 32S are likewise similar to those estimated

for the front of the Newell Street site through application of the front-to-rear ratios to the winter data from the rear of 191 Newell Street (Zorex, 1993, App. XX)

Discussion of Potential Risks for Residents Near Silver Lake

Based on the assumptions that ambient PCB concentrations measured at Building 32S are conservatively representative of ambient levels in the residential area near Silver Lake and that those concentration levels are generally similar to the levels measured or estimated for the front of the Newell Street properties, risks to the residents near Silver Lake can be qualitatively evaluated through a comparison with the estimated risks for the Newell Street residents.

For subchronic risks, this evaluation is straightforward. As shown in Table 1c, the calculated subchronic noncarcinogenic risk for a two-year-old resident on Newell Street for a 90-day summer exposure period (which represents worst-case conditions), using an average summer PCB concentration of 0.006 $\mu g/m^3$, results in a hazard index of 0.015. This hazard index is far below that which DEP considers a concern. The monitoring data from Building 32S, which are considered to represent levels in the residential area near Silver Lake, show a slightly lower average summer PCB concentration (0.005 $\mu g/m^3$) than that for the stations in the front of the Newell Street site. Hence, it follows that subchronic risks are also acceptable for the residents living near Silver Lake.

As indicated earlier, annual air sampling data are not available for Building 32S. However, because average summer and winter PCB concentrations at 32S are similar to average summer and winter PCB concentrations at the front of Newell Street, it seems reasonably to assume that annual concentrations at 32S are also similar. Given that assumption, it follows that chronic cancer and noncancer risk estimates for 32S would be similar to those presented in Tables 1a and 1b of the Newell Street residential risk analysis. Because both risk estimates were well below the DEP's risk benchmarks triggering the need for an immediate response action, the same would be true for conditions at station 32S. Thus, based on sampling data from 32S, PCB air concentrations in residential areas adjacent to Silver Lake would not be expected to pose any short- or long-term health risks.

ALTERNATIVE RISK EVALUATION AND SENSITIVITY ANALYSES

In a memorandum dated August 24, 1993, ORS recommended that daily ambient PCB concentrations be compared with DEP's Threshold Effects Limit (TEL) for PCBs to determine the need for STMs (now IRAs) (Hutcheson, 1993). This approach indicates a view that it is appropriate to use the results from a single sampling day to estimate health risks from PCBs. ChemRisk does not agree with that approach. Nevertheless, as a sensitivity analysis, ChemRisk has conducted an evaluation using the highest applicable single-day exposure concentration for the Newell Street residents. We have also conducted the comparisons recommended by ORS for the PCB concentrations pertinent to the Newell Street residents and Hibbard School students and to residents living near Silver Lake.

Sensitivity Analysis Using Worst-Case Single-Day Exposure

As a worst-case analysis, a single-day exposure has been evaluated for the residents of Newell Street using the highest 24-hour concentration measured in the front of the Newell Street site. That maximum 24-hour concentration was 0.0097 $\mu g/m^3$, measured in the front of 191 Newell Street on July 3, 1993. To complete this analysis, a single-day exposure to that concentration by a two year-old child was modeled using an inhalation rate of 0.27 m^3/hr (based on DEP's (1993) recommended minute ventilation rates), an exposure time of 24 hours, an exposure frequency of one day, a body weight of 13 kg, and an averaging time of one day. DEP's noncarcinogenic intake level of 0.2 µg/kg-day for imminent hazard evaluations was used in this analysis. The results are presented in Table 3. They show an estimated noncarcinogenic hazard index of 0.024, which is substantially lower than DEP's suggested intake level, indicating that the risks are acceptable even in this worst-case analysis. It should also be recognized that this calculation is highly conservative due to the use of a chronic health criterion (0.2 µg/kg-day) for an acute exposure event.

Comparisons with the TEL

As noted above, the ORS memorandum of August 24, 1993, recommended a comparison of 24-hour PCB concentrations with DEP's TEL for PCBs (0.003 $\mu g/m^3$). The memorandum recommended further that in any case where that comparison results in a hazard index of 5 or greater (i.e., where any concentration exceeds the TEL by 5 or more times), further action should

be required. According to the ORS memorandum, the ambient PCB concentration associated with a hazard index of 5, based on DEP's TEL value of 0.003 μg/m³ for PCBs (and considering certain rounding off), is 0.014 μg/m³.

1. Newell Street Area

As explained by ORS (Hutcheson, 1993), DEP's TEL of 0.003 μg/m³ is based on an occupational exposure limit, adjusted to more closely represent continuous exposures to more sensitive populations. It was derived using a number of adjustment factors, including a relative source allocation factor of five to account for possible exposure to PCBs via other exposure routes. While it may be appropriate to apply a relative source allocation factor when there is potential for exposure through dermal or ingestion pathways, it does not appear to be relevant when considering off-site inhalation exposures attributable to the Newell Street site. Because the Newell Street properties are commercial properties providing very limited access to contaminated areas, it would not be expected that nearby residents or Hibbard School students would experience direct contact with contaminated soils. For this reason, comparison of sampling results with the TEL is an overly conservative approach.

Nevertheless, for screening-level purposes, we have made a comparison of relevant monitoring data from the Newell Street site with the 0.014 μg/m³ action level derived by ORS. In this comparison, we have not used concentrations measured at the monitor in the rear of 191 Newell Street, because that monitor is located in an area that has highly restricted access and no potential for continuous 24-hour exposure. Rather, we have used concentrations from the monitors in the front of 191 Newell Street and at the F.W. Webb property, which are more representative of actual exposures at the residences on Newell Street and at Hibbard School. The comparison has been made both for the 24-hour concentrations measured at these stations in 1993 and for the estimated 24-hour concentrations calculated for these stations by Zorex based on application of the 1993 front-to-rear ratios to the 1991-92 data from the rear of 191 Newell Street. None of the measured or estimated 24-hour PCB concentrations for the stations in the front of the Newell Street properties exceeds the ORS acceptable of 0.014 μg/m³. The maximum measured 24-hour concentration at either of these stations was 0.0097 μg/m³ and the maximum calculated concentration is 0.011 μg/m³ (see Section 7.1 of Zorex (1993) report).

2. Silver Lake Area

A similar comparison has been made to assess exposures for residents living near Silver Lake. In this comparison, for the reasons articulated earlier in the Silver Lake exposure and relative risk discussion, it is not considered appropriate to use the ambient PCB concentrations measured at the Silver Lake monitoring station itself, which is located on the eastern side of the lake. The location of the residential properties (on the western side of the lake), the distance of those properties from the lake, the dispersion and mixing that occur above the lake, and the prevailing wind direction from the west (Zorex, 1992) all indicate that concentrations of PCBs in air would be lower in the residential locations than the levels measured at the Silver Lake monitor. As discussed above, it is more reasonable to consider the ambient PCB concentrations measured at the Building 32S monitoring station as a conservative, yet reasonable, surrogate for air concentrations at the residential properties.

Despite the fact that the Silver Lake PCB emissions would generally be expected to move in the direction of monitor 32S, none of the sampling days for 1992 at that monitor exceeded the DEP's action level of 0.014 $\mu g/m^3$. The maximum 24-hour concentration at that monitor was 0.0071 $\mu g/m^3$ (Zorex, 1992). This indicates that dispersion and dilution reduce concentrations before they reach the monitor. It is expected that air concentrations in the residential neighborhood west of the lake would be even lower than those measured at 32S; consequently, it is unlikely that residential air levels are in exceedance of the DEP's action level.

CONCLUSION

The foregoing deterministic risk calculations, together with the sensitivity and alternative analyses presented above, indicate that the PCBs measured in the ambient air at the Newell Street site and Silver Lake do not present an imminent hazard or a significant risk to residents in the area or to students at Hibbard School. On a risk basis, therefore, further STMs or IRAs are unwarranted.

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EXPOSURE AND RISK CALCULATIONS

Table 1a. Off-site Residential Carcinogenic Risk Via Inhalation

LADI = AC * IR * VPF * ET * EF * ED * 1/BW * 1/ATc * CF
Risk = CSF * LADI

Receptor	AC Average Air Concentration	IR Inhalation Rate	VPF Vapor Penetration Factor	ET Exposure Time	EF Exposure Frequency	ED Exposure Duration	BW Body Weight	ATc Averaging Time, Carcinogen	CF Conversion Factor	LADI Lifetime Average Daily Intake	CSF Cancer Slope Factor	Cancer Risk Estimate
	(ug/m^3)	(m^3/hr)	(unitless)	(hr/day)	(days/year)	(years)	(kg)	(days)	(mg/ug)	(mg/kg-day)	kg-day/mg	unitless
Adult: 18<30 yr	0.002	0.83	1.0	24	350	12	68	27375	1.00E-03	8.99E-08	7.7	6.92E-07
Child:												
0 < 6 yrs	0.002	0.32	1.0	24	350	6	14	27375	1.00E-03	8.42E-08	7.7	6.48E-07
6 < 18 yrs	0.002	0.6	1.0	20	350	12	42	27375	1.00E-03	8.62E-08	7.7	6.64E-07
											Total Inhalation Risk:	**2.00E-06**

Table 1b. Off-site Residential Chronic Noncarcinogenic Hazard Via Inhalation

CDI = AC * IR * VPF * ET * EF * ED * 1/BW * 1/ATnc
Risk = Hazard Index = CDI/RfD

Receptor	AC Average Air Concentration	IR Inhalation Rate	VPF Vapor Penetration Factor	ET Exposure Time	EF Exposure Frequency	ED Exposure Duration	BW Body Weight	ATnc Averaging Time, Noncarcinogen	CDI Chronic Daily Intake	RfD Reference Dose	Noncancer Hazard Index (Chronic)
	(ug/m^3)	(m^3/hr)	(unitless)	(hr/day)	(days/year)	(years)	(kg)	(days)	(µg/kg-day)	(µg/kg-day)	unitless
Adult: 18<30 yr	0.002	0.83	1.0	24	350	12	68	4380	5.62E-04	0.2	2.81E-03
Child:											
0 < 6 yrs	0.002	0.32	1.0	24	350	6	14	2190	1.05E-03	0.2	5.26E-03
6 <18 yrs	0.002	0.6	1.0	20	350	12	42	4380	5.39E-04	0.2	2.69E-03
										Total Hazard Index:	**1.08E-02**

Table 1c. Off-site Residential Subchronic Noncarcinogenic Hazard Via Inhalation

SCDI = AC * IR * VPF * ET * EF * 1/BW * 1/ATnc
Risk = Hazard Index = CDI/RfD

Receptor	AC Average Air Concentration	IR Inhalation Rate	VPF Vapor Penetration Factor	ET Exposure Time	EF Exposure Frequency	BW Body Weight	ATnc Averaging Time, Noncarcinogen	SCDI Subchronic Daily Intake	RfD Reference Dose	Noncancer Hazard Index (Subchronic)
	(ug/m^3)	(m^3/hr)	(unitless)	(hr/day)	(days)	(kg)	(days)	(µg/kg-day)	(µg/kg-day)	unitless
Child (2 years)	0.0060	0.27	1.0	24	90	13	90	2.99E-03	0.2	1.50E-02

Table 2a. Off-site Carcinogenic Risk to Hibbard School Students Via Inhalation

LADI = AC * IR * VPF * ET * EF * ED * 1/BW * 1/ATc * CF
Risk = CSF * LADI

Receptor	AC Average Air Concentration (ug/m^3)	IR Inhalation Rate (m^3/hr)	VPF Vapor Penetration Factor (unitless)	ET Exposure Time (hr/day)	EF Exposure Frequency (days/year)	ED Exposure Duration (years)	BW Body Weight (kg)	ATc Averaging Time, Carcinogen (days)	CF Conversion Factor (mg/ug)	LADI Lifetime Average Daily Intake (mg/kg-day)	CSF Cancer Slope Factor kg-day/mg	Cancer Risk Estimate unitless
Teenager	0.0018	0.82	1.0	7	180	4	58	27375	1.00E-03	4.69E-09	7.7	3.61E-08

Table 2b. Off-site Chronic Noncarcinogenic Hazard to Hibbard School Students Via Inhalation

CDI = AC * IR * VPF * ET * EF * ED * 1/BW * 1/ATnc
Risk = Hazard Index = CDI/RfD

Receptor	AC Average Air Concentration (ug/m^3)	IR Inhalation Rate (m^3/hr)	VPF Vapor Penetration Factor (unitless)	ET Exposure Time (hr/day)	EF Exposure Frequency (days/year)	ED Exposure Duration (years)	BW Body Weight (kg)	ATnc Averaging Time, Noncarcinogen (days)	CDI Chronic Daily Intake (µg/kg-day)	RfD Reference Dose (µg/kg-day)	Noncancer Hazard Index (Chronic) unitless
Teenager	0.0018	0.82	1.0	7	180	4	58	1460	8.78E-05	0.2	4.39E-04

Table 2c. Off-site Subchronic Noncarcinogenic Hazard to Hibbard School Students Via Inhalation

SCDI = AC * IR * VPF * ET * EF * 1/BW * 1/ATnc
Risk = Hazard Index = CDI/RfD

Receptor	AC Average Air Concentration (ug/m^3)	IR Inhalation Rate (m^3/hr)	VPF Vapor Penetration Factor (unitless)	ET Exposure Time (hr/day)	EF Exposure Frequency (days)	BW Body Weight (kg)	ATnc Averaging Time, Noncarcinogen (days)	SCDI Subchronic Daily Intake (µg/kg-day)	RfD Reference Dose (µg/kg-day)	Noncancer Hazard Index (Subchronic) unitless
Teenager	0.0039	0.82	1.0	7	64	58	90	2.74E-04	0.2	1.37E-03

Table 3. Single-Day Hazard for Two Year Old Resident Via Inhalation

AI = AC * IR * VPF * ET * EF * 1/BW * 1/ATnc
Risk = Hazard Index = CDI/RfD

Receptor	AC Average Air Concentration (ug/m^3)	IR Inhalation Rate (m^3/hr)	VPF Vapor Penetration Factor (unitless)	ET Exposure Time (hr/day)	EF Exposure Frequency (days)	BW Body Weight (kg)	ATnc Averaging Time, Noncarcinogen (days)	AI Acute Intake (µg/kg-day)	RfD Reference Dose (µg/kg-day)	Noncancer Hazard Index (acute) unitless
Child (2 years)	0.0097	0.27	1.0	24	1	13	1	4.84E-03	0.2	2.42E-02

Appendix L

APPENDIX L

"AMBIENT AIR MONITORING FOR POLYAROMATIC HYDROCARBONS AT GENERAL ELECTRIC COMPANY, PITTSFIELD, MASSACHUSETTS"
ZOREX ENVIRONMENTAL ENGINEERS, INC. 1991

AMBIENT AIR MONITORING

FOR

POLYAROMATIC HYDROCARBONS

at

GENERAL ELECTRIC COMPANY, PITTSFIELD, MASSACHUSETTS

prepared by

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1. PROJECT SUMMARY

Zorex Environmental Engineers conducted ambient air monitoring for Polyaromatic Hydrocarbons (PAH) at General Electric Company in Pittsfield, Massachusetts on August 1, 1991. The PAH sampling was conducted at the MCP site designated as East Street Area II. The overall objective of the monitoring program was to determine, under worst case emission rate and meteorological conditions, whether volatile hydrocarbons from buried coal tar pitch in the East Street Area II site are contributing to ambient concentrations of PAHs.

Three sampling stations were set-up at locations spanning an arc of approximately 90° down wind (east-southeast) of the suspected source of buried coal tar pitch (Figure 1). A co-located site is installed at site 002. It is identified as site 004. An upwind site, 001 was located NE of the source area. Sampling was conducted over one 8 hour period (11 am - 7 pm) on Thursday August 1, 1991. The average air temperature during sampling was 84.12° F. Wind speed averaged 10.13 mph, blowing from the WSW or SW 100 percent of the time. There was no rainfall during the sampling period.

There are 17 PAH compounds which can be qualitatively and quantitatively analyzed by the study's analytical procedure, EPA Method TO-13. Test results showed no measurable levels of PAHs above the project detection limit (DL) of 0.417 ug/m^3 for any of the compounds at any of the sampling sites.

Of the 17 PAH compounds for which the samples were analyzed, only naphthalene and 2-methylnaphthalene, together, have a defined Massachusetts Allowable Ambient Limit (AAL) 8270. The 24 hour AAL for naphthalene (including 2-methylnaphthalene) is 14.25 ug/m^3.

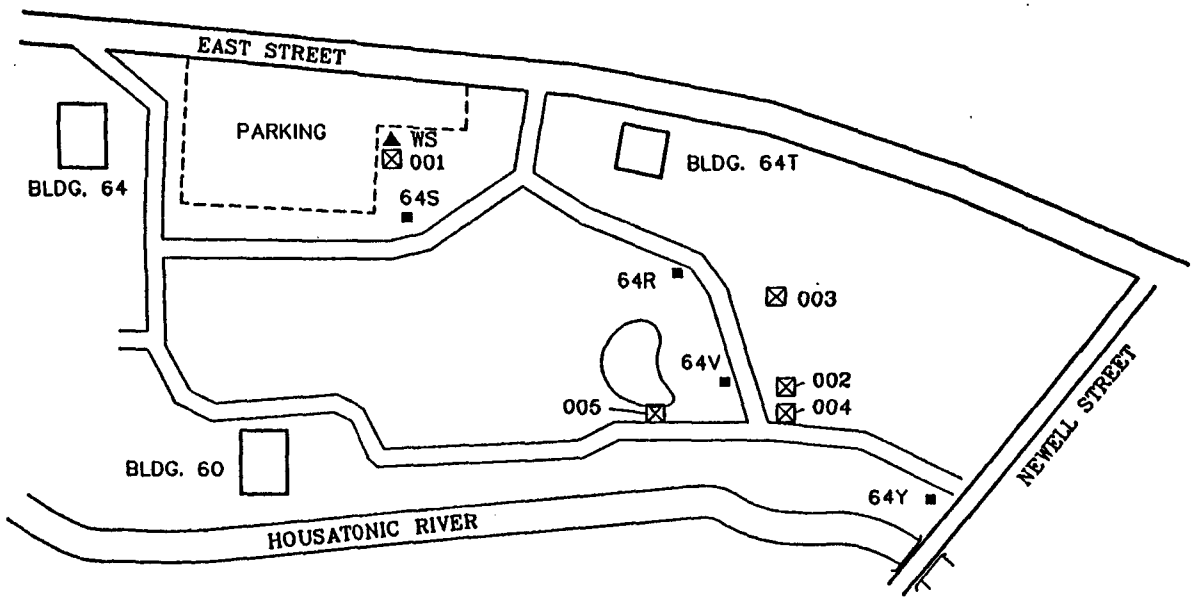


Figure 1

⊠ MONITORING SITES

▲ WEATHER STATION

0 150' 300'

ZOREX CORPORATION Pittsfield, MA			
JOB NO.:	GENERAL ELECTRIC COMPANY PITTSFIELD, MA PAH MONITORING SITES		
CONTRACT:			
DRW.: JAB	SCALE: AS SHOWN	DRAWING NO.: 6491	
ENG.:		REVISED:	DATE: 12/24/91
APP.:			

2. SAMPLING PROCEDURES

Samples were collected using General Metal Works Model PS-1 samplers. Ambient air was drawn through a glass fiber filter and a polyether-type polyurethane foam (PUF) adsorbent over 8 hours from 11am to 7pm. The sampling rate was set at 0.25 standard m^3/min. Total air volume collected for each sample was approximately 120 standard cubic meters.

Data on the operation of the samplers was recorded on a sampling data sheet. The data sheet serves as a field record of sampler operation (flow rate, sampler elapsed time, etc.) and was used for later data reduction, validation and interpretation.

The sampling modules containing the fiber filters and PUF adsorbents were removed from the samplers at the end of the sampling period. Each glass fiber filter was placed in a glass petri dish and each PUF adsorbent (inside a glass cartridge) was wrapped in hexane rinsed aluminum foil. Each fiber filter and PUF adsorbent set was labeled as one sample. The samples were wrapped, packaged in dry ice and shipped under chain of custody to IT Analytical Laboratory in Cincinnati, Ohio for analysis.

TABLE 1

PAH AMBIENT MONITORING

FIELD SAMPLING DATA SUMMARY

LOCATION[1]	SAMPLE NUMBER	SAMPLE START TIME	TOTAL[2] SAMPLING TIME (HOURS)	AVERAGE STANDARD FLOW RATE (M^3/MIN)	STANDARD SAMPLE VOLUME (M^3)
001	Z04-080191	10:57 a.m.	8.00	.25	120
002	Z13-080191	10:55 a.m.	8.00	.25	120
003	Z15-080191	10:55 a.m.	8.00	.25	120
004	Z24-080191	10:55 a.m.	8.00	.24	115.2
005	Z21-080191	10:55 a.m.	8.01	.25	120.2
Blank	Z12-080191	N/A	N/A	N/A	N/A

[1] LOCATIONS
001 = Weather Station
002 = SE of Bldg 64V
003 = NE of Bldg 64V
004 = SE of Bldg 64V (Co-located side)
005 = SW of Bldg 64V

[2] Run time approximately 11:00 a.m. - 7:00 p.m.

3. ANALYTICAL RESULTS

The samples were extracted from the fiber filter and PUF at the laboratory with dichloromethane. Each sample extract was concentrated to 5 mL and analyzed by gas chromatography/mass spectrometry (GC/MS) according to EPA SW-846 Method 8270 (see EPA Method TO-13) for the following PAH compounds:

CAS Number	Compound
91-20-3	Naphthalene
91-57-6	2-Methylnaphthalene
208-96-8	Acenapthylene
83-32-9	Acenaphthene
86-73-7	Fluorene
85-01-8	Phenanthrene
120-12-7	Anthracene
206-44-0	Fluoranthene
129-00-0	Pyrene
56-55-3	Benzo(a)anthracene
218-01-9	Chrysene
205-99-2	Benzo(b)fluoranthene
207-08-9	Benzo(k)fluoranthene
50-32-8	Benzo(a)pyrene
193-39-5	Indeno(1,2,3-cd)pyrene
53-70-3	Dibenzo(a,h)anthracene
191-24-2	Benzo(g,h,i)perylene

The laboratory reported quantities of individual PAHs in ug/PUF using the Contract Laboratory Program (CLP) DL of 50 ug/PUF. These values were divided by the measured standard air sampling volume to provide ambient concentrations in ug/m^3.

Test results showed no measurable levels of PAHs above the analytical DL of 0.417 ug/m^3 for any of the listed compounds at any of the sampling sites.

PAH AMBIENT MONITORING
AMBIENT AIR CONCENTRATIONS

SAMPLING LOCATION 001

SAMPLE NO. Z04-080191 SAMPLE VOL. 120m^3

Compound	ug/PUF	ug/m^3
Naphthalene	50	0.417
2-Methylnaphthalene	50	0.417
Acenapthylene	50	0.417
Acenaphthene	50	0.417
Fluorene	50	0.417
Phenanthrene	50	0.417
Anthracene	50	0.417
Fluoranthene	50	0.417
Pyrene	50	0.417
Benzo(a)anthracene	50	0.417
Chrysene	50	0.417
Benzo(b)fluoranthene	50	0.417
Benzo(k)fluoranthene	50	0.417
Benzo(a)pyrene	50	0.417
o(1,2,3-cd)pyrene	50	0.417
Dibenzo(a,h)anthracene	50	0.417
Benzo(g,h,i)perylene	50	0.417

SAMPLING LOCATION 002

SAMPLE NO. Z13-080191 SAMPLE VOL. 120m^3

Compound	ug/PUF	ug/m^3
Naphthalene	50	0.417
2-Methylnaphthalene	50	0.417
Acenapthylene	50	0.417
Acenaphthene	50	0.417
Fluorene	50	0.417
Phenanthrene	50	0.417
Anthracene	50	0.417
Fluoranthene	50	0.417
Pyrene	50	0.417
Benzo(a)anthracene	50	0.417
Chrysene	50	0.417
Benzo(b)fluoranthene	50	0.417
Benzo(k)fluoranthene	50	0.417
Benzo(a)pyrene	50	0.417
Indeno(1,2,3-cd)pyrene	50	0.417
Dibenzo(a,h)anthracene	50	0.417
Benzo(g,h,i)perylene	50	0.417

SAMPLING LOCATION 003

SAMPLE NO. Z15-080191 SAMPLE VOL. 120m^3

Compound	ug/PUF	ug/m^3
Naphthalene	50	0.417
2-Methylnaphthalene	50	0.417
Acenapthylene	50	0.417
Acenaphthene	50	0.417
Fluorene	50	0.417
Phenenthrene	50	0.417
Anthracene	50	0.417
Fluoranthene	50	0.417
Pyrene	50	0.417
Benzo(a)anthracene	50	0.417
Chrysene	50	0.417
(b)fluoranthene	50	0.417
Benzo(k)fluoranthene	50	0.417
Benzo(a)pyrene	50	0.417
Indeno(1,2,3-cd)pyrene	50	0.417
Dibenzo(a,h)anthracene	50	0.417
	50	0.417

SAMPLING LOCATION 004 (Colocated site)

SAMPLE NO. Z24-080191 SAMPLE VOL. 115.2m^3

Compound	ug/PUF	ug/m^3
Naphthalene	50	0.434
2-Methylnaphthalene	50	0.434
Acenapthylene	50	0.434
Acenaphthene	50	0.434
Fluorene	50	0.434
Phenenthrene	50	0.434
Anthracene	50	0.434
Fluoranthene	50	0.434
Pyrene	50	0.434
Benzo(a)anthracene	50	0.434
Chrysene	50	0.434
Benzo(b)fluoranthene	50	0.434
Benzo(k)fluoranthene	50	0.434
Benzo(a)pyrene	50	0.434
Indeno(1,2,3-cd)pyrene	50	0.434
Dibenzo(a,h)anthracene	50	0.434
Benzo(g,h,i)perylene	50	0.434

PAH AMBIENT AIR CONCENTRATIONS (CONTINUED)

SAMPLING LOCATION 005		
AMPLE NO. Z21-080191	SAMPLE VOL. 120.2m^3	
Compound	ug/PUF	ug/m^3
Naphthalene	50	0.416
2-Methylnaphthalene	50	0.416
Acenapthylene	50	0.416
Acenaphthene	50	0.416
Fluorene	50	0.416
Phenanthrene	50	0.416
Anthracene	50	0.416
Fluoranthene	50	0.416
Pyrene	50	0.416
Benzo(a)anthracene	50	0.416
Chrysene	50	0.416
Benzo(b)fluoranthene	50	0.416
Benzo(k)fluoranthene	50	0.416
Benzo(a)pyrene	50	0.416
Indeno(1,2,3-cd)pyrene	50	0.416
Dibenzo(a,h)anthracene	50	0.416
Benzo(g,h,i)perylene	50	0.416

SAMPLING LOCATION: BLANK		
SAMPLE NO. Z12-080191	SAMPLE VOL. –	
Compound	ug/puf	ug/m^3
Naphthalene	50	
2-Methylnaphthalene	50	
Acenapthylene	50	
Acenaphthene	50	
Fluorene	50	
Phenanthrene	50	
Anthracene	50	
Fluoranthene	50	
Pyrene	50	
Benzo(a)anthracene	50	
Chrysene	50	
Benzo(b)fluoranthene	50	
Benzo(k)fluoranthene	50	
Benzo(a)pyrene	50	
Indeno(1,2,3-cd)pyrene	50	
Dibenzo(a,h)anthracene	50	
Benzo(g,h,i)perylene	50	

4. CALIBRATION, QUALITY CONTROL, DATA VALIDATION, AND AUDIT ACTIVITY

A. Calibrations

Calibrations for all sampling equipment were conducted in accordance with the procedures specified in the EPA High Volume Reference Method or Method TO-13. All data and calculations for the calibrations are maintained in a calibration log file.

The sampling equipment was calibrated on the dates noted:

EQUIPMENT	FREQUENCY OF CALIBRATION	DATE CALIBRATED
Flow Rate Transfer Standard	Annually	June 3, 1991
High Volume Samplers	6 Months	June 10, 1991
Elapsed Time Meters	6 Months	June 3, 1991
On-Off Timers	Quarterly	June 5,6,7, 1991

From the calibration of the high volume samplers, charts are produced relating the standard sampler flow rate to a magnehelic pressure indicator at the sampling pump. Pressure was recorded at the beginning, middle and end of the sampling run. The pressure readings were converted to flow rates using the calibration charts, and the flow rates were averaged to determine the average flow rate for the sampling event.

B. Quality Control

The following internal quality control checks were performed on the sampler:

- A one point audit of the calibrated flow rate versus sampler magnehelic pressure indication was performed on each sampler before and after the sampling event. The control limit was +/- 10% deviation from the calculated value;

- A zero check on the samplers' pressure gauges was verified before and after the sampling event;

- A leak check on each sampler before and after the sampling event;

- A recording and adjustment of the sampler pressure indicator to maintain a constant flow rate at the beginning, middle and end of the sample event; and

- One additional sampler was collocated at sampling site 002 as a sampling precision check on the field sampler. The ambient PAH data from the collocated sampler was used to verify the precision of the primary sampler. The limits of acceptable variation were not precisely defined.

The following quality control measures were also performed to insure the integrity of the ambient air samples:

- All PUFs and filters were extracted by IT Analytical before use. One PUF adsorbent from the each batch of 21 extracted PUFs was analyzed, without shipment to the field, as a blank check for PAHs. The blank control limit was the limit of detection;

- One PUF field blank was transported with the samples to and from the field without being unwrapped or having air drawn through it. The PUF was shipped along with the samples to the laboratory for analysis; and

- All samples were labelled and transported under chain of custody by Federal Express to IT Analytical in Cincinnati. At IT the samples, were recorded and handled according to strict chain-of-custody outlined in the SOP provided in the Quality Assurance Project Plan (QAPP) for this project.

C. Data Validation

All sampling data recorded in the field and flow calculations based on the field data were verified by the Project Manager or her designee before final recording in the computer database. The calibration charts for flow calculations were validated by the Project QA Manager.

IT Analytical has documented procedures for data validation of analytical results. These were submitted as part of the QAPP. Analytical results and laboratory validation procedures were reviewed by the Zorex Project Manager.

D. Audit Activity

The only audit activity for this one 8 hour sampling event were one point calibration checks on the sampler flow rates. These one point checks were performed before and after each sampling event as described in the section on Quality Control.

5. DATA QUALITY IN TERMS OF THE QUALITY ASSURANCE OBJECTIVES

Quality Assurance (QA) objectives were defined in the QAPP for sample validity, representativeness, comparability, completeness, precision and accuracy. Each of these is described below.

A. VALIDITY - All collected samples met the criteria for validity as described in the QAPP. Each sample was collected over 8 hours +/- 15 minutes at a rate of 200 -280 l/minute (0.25 m^3/min). Sample volume was approximately 120 m^3. (The co-located sampler at Site 002 averaged 0.24 m^3/min for an overall sample volume of 115 m^3).

B. REPRESENTATIVENESS - All samples were collected at the locations and during the time period approved by the Massachusetts DEP as being representative for the purposes of this study.

C. COMPARABILITY - Final PAH concentrations were converted to ug/m^3 for comparison with Massachusetts AALs.

D. COMPLETENESS - All five of the collected samples, four sites and one collocated sampler, were valid. Completeness, therefore, was measured as 100 percent.

E. PRECISION - Field sampling precision was measured by a collocated sampler at Site 002. A control limit of variation was not specified in the QAPP. However, there was a zero percent difference in the measured PAH at the collocated samplers at the DL of 50 ug/PUF.

F. ACCURACY - One point audits conducted before and after each sampling event are used as a check on the accuracy of flow measurements. The one point audits on all machines were within +/- 10% deviation with calculated flow values. Overall accuracy of the samplers is measured by auditing the samplers every six months with calibrated flow transfer standard. The samplers were put into service in July 1991 shortly after initial calibration.

6. DISRUPTIONS AND PROBLEMS

There were no disruptions or upsets in the sample collection or analysis performed. However, there are two areas of concern which may have any impact on the interpretation of the sampling results. Each of these is described below.

A. Initial Puf Blank Check

The PUFs used for sampling were pre-cleaned and extracted according to standard procedure. However, the initial blank check of the PUFs was performed for PCB and not PAH. When the problem was noticed, it was too late to have the laboratory re-check PUFs for PAH and still maintain the sampling schedule. IT Analytical advised that PAH would most likely have shown up in the blank check for PCBs particularly since the PCB DL was 0.2 ug/PUF.

The problem was brought to the attention of the GE project manager, Jeff Ruebesam, and the DEP project manager, Larry Hanson. It was agreed that sampling would proceed as scheduled. Results of a subsequent PAH analysis on the field blank revealed an acceptable blank check. It was, therefore, assumed that the PUFs were "blank" prior to use.

B. Project Detection Limit

The DEP approved a project DL of 0.25 ng/m^3. The actual project DL was 417 ng/m^3 using a sampling volume of 120 m^3 and the laboratory's analytical DL of 50 ug/PUF.

The default EPA Contract Laboratory Program (CLP) analytical DL, used by IT Analytical, for PAH is 10 ug/PUF based on a 1 mL final sample volume. This sampling program used a final sample volume of 5 mL, raising the analytical DL to 50 ug/PUF, as stated.

The actual project DL of 417 ng/m^3 for PAH compounds is well below the Massachusetts AAL for naphthalene (Naphthalene is the only PAH analyzed by TO-13 that has an associated Massachusetts AAL). The 24 hour AAL for naphthalene is 14.25 ug/m^3.

7. METEOROLOGICAL CONDITIONS

The meteorological conditions during the sampling period were monitored at an on-site weather station located in Area II. The approximate location of this weather station is shown on Figure 1. The most appropriate meteorological conditions for this ambient sampling project were previously defined in the QAPP.

A. Wind Direction

The sampling sites were located down wind of the suspected source area to demonstrate worst case ambient conditions at the sampling sites. The down wind sampling sites spanned an arc of approximately 90° NE to SE of the source area (see Figure 1). During the 8 hour sampling run, wind direction was from the WSW or SW 100 percent of the time (see Figure 2).

Sampling sites 002 and 003 were down wind during the sampling period. Sample site 005 was not directly down wind, but its location immediately adjacent to the retaining pond makes it a reasonable worst case location for ambient concentrations. Site 001 was up wind through out the sampling period.

B. Wind Speed

The average wind speed during the sampling period was 10.126 mph. The wind speed did not vary significantly, ranging from 7.03 to 12.32 mph (Table 2). The average wind speed meets the criteria of light winds (< 12 mph) as described in the siting analysis.

C. Temperature

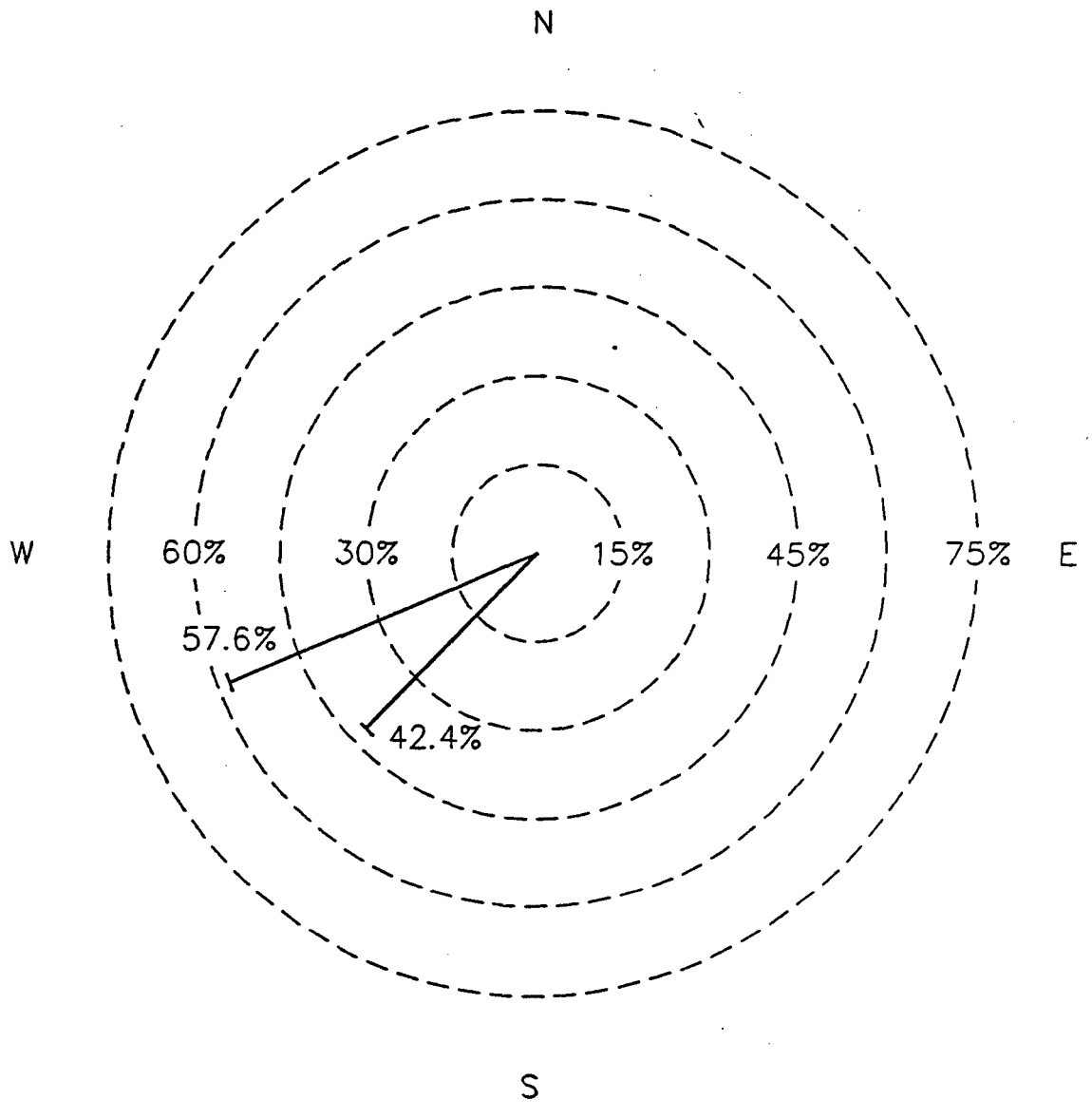
The average temperature during sampling was 84.109°F. The lowest recorded temperature was 78.3°F measured at 11:00am at the start of the sampling run. The highest recorded temperature was 86.9°F recorded at 4:45pm.

D. Precipitation

There was no measurable precipitation during the sampling period.

Figure 2

FREQUENCY OF WIND SPEED & DIRECTION



WSW – AVE. SPEED: 10.09 MPH
SW – AVE. SPEED: 10.17 MPH

NOTE – WIND DIRECTION IS THE DIRECTION WIND IS BLOWING FROM

PITTSFIELD. MA
STATION 10317
AUG. 1, 1991
11:00 AM – 7:00 PM

TABLE 2

PAH AMBIENT MONITORING

METEORLOGICAL CONDITIONS

Time	Wind Speed	Wind Direction	Temp.	Precipitation
1100	7.03	239.6	78.3	0
1115	8.04	229.4	79.0	0
1130	8.47	237.7	80.0	0
1145	8.17	233.6	80.7	0
1200	9.61	229.9	80.5	0
1215	10.26	238.8	81.1	0
1230	8.73	237.2	81.9	0
1245	9.0	236.4	82.5	0
1300	10.03	231.1	82.6	0
1315	9.56	235.3	83.2	0
1330	10.64	232.0	83.8	0
1345	11.01	242.2	83.9	0
1400	10.81	238.3	84.3	0
1415	11.59	236.6	84.9	0
1430	11.08	230.8	84.9	0
1445	10.11	235.5	85.0	0
1500	10.57	231.6	85.9	0
1515	10.85	233.1	86.1	0
1530	10.93	228.1	86.0	0
1545	9.99	230.2	86.4	0
1600	11.07	244.7	86.4	0
1615	10.29	243.5	86.7	0
1630	9.73	239.2	87.1	0
1645	10.66	243.4	86.9	0
1700	11.52	239.7	86.7	0
1715	12.1	235.1	85.9	0
1730	11.29	237.8	85.6	0
1745	12.32	236.7	85.6	0
1800	10.69	233.4	85.8	0
1815	11.1	236.5	85.3	0
1830	9.48	247.6	84.6	0
1845	8.55	238.0	84.2	0
1900	8.87	245.4	83.8	0
Average	10.126	*	84.109	0

* See Figure 2 - Wind Rose.

8. ASSESSMENT OF AMBIENT PAH CONCENTRATIONS AND RECOMMENDATIONS FOR FURTHER STUDY

Test results showed no measurable levels of PAHs above the project detection limit of 0.417 ug/m^3 for any of the compounds at any of the sampling sites. At this detection limit there was no difference in PAHs measured at the down wind or up wind sampling sites. The analytical results suggest that based on the project detection limit of 0.417 ug/m^3 and under the specific sampling conditions buried coal tar pitch volatiles do not appear to significantly contribute to ambient concentrations of PAHs.

Massachusetts DEP has a defined Ambient Air Level (AAL) for only two of the 17 compounds quantitatively assessed by the sampling analysis. The DEP has a combined 24 hour AAL (14.25 ug/m^3) for naphthalene and 2-methylnaphthalene. Analysis showed no measurable concentrations above this level. Massachusetts DEP has no ambient standard for PAHs or coal tar pitch volatiles.

This study is limited in scope to one 8 hour sample under specific meteorological conditions and at a specified detection limit. Considering these limits, it is not possible to conclude that there is absolutely no source (buried coal tar pitch) contribution to ambient concentrations of PAH. It does appear, however, that there is no significant contribution to ambient concentrations.

APPENDIX I

GE MCP AMBIENT MONITORING

Sampling Data Sheet

DATE: 8/1/91 PERFORMED BY: J. Bordeau / M. Hawkins

BAROMETRIC PRESSURE: _____ AMBIENT TEMPERATURE: _____ ON MAP (004)

SAMPLER LOCATION	WS	SE64V	NE64V		SW64V		SE64VC
SAMPLER NO.	001	002	003		005		007
SAMPLE HEAD NO.	101	102	103		105		100
SAMPLE NO.	Z-04	Z-13	Z-15		Z-21		Z-24
MAG. (FLOW) SETTING	55	61	55		58		52
MAG. ZERO SET (CHECK)	✓	✓	✓		✓		✓
START-UP MAG. READING	55	61	55		58		52
TIMER SET TO START AT	—	—	—		—		—
TIME OF SAMPLE HEAD INST.	10:45	10:35	10:40		10:30		10:37
ETM READING (START)	97.03	95.99	111.68		79.95		95.74
ETM READING (FINISH)	105.03	103.99	119.68		87.96		103.74
EST. TIME OF SAMPLER START	10:57	10:55	10:55		10:55		10:55
6-HOUR READINGS: MAG. READING	52	58	52		55		52
6-HOUR READINGS: MAG. ADJUSTED TO	55	61	55		58		—
6-HOUR READINGS: ETM READING	100.87	99.99	115.63		83.98		99.73
6-HOUR READINGS: TIME	2:48	2:55	2:53		2:57		2:54
12-HOUR READINGS: MAG. READING							
12-HOUR READINGS: MAG. ADJUSTED TO							
12-HOUR READINGS: ETM READING							
12-HOUR READINGS: TIME							
18-HOUR READINGS: MAG. READING							
18-HOUR READINGS: MAG. ADJUSTED TO							
18-HOUR READINGS: ETM READING							
18-HOUR READINGS: TIME							
FINAL MAG. READING	55	66	57		58		54
TIME OF SAMPLE COLLECTION	7:28	7:14	7:01		7:20		7:09

X1-03-171-12A = 212-080191 = Blank

GE MCP AMBIENT MONITORING
Flow Calculation and Data Record Sheet

Sample No.: Z04-080191 Name of Preparer: Maura Hawkins - Coniglio
Sampler No.: 001 Name of Reviewer: John Poulsen
Date: 8-1-91

PAH SAMPLING

1) To convert magnehelic readings to flow rate, obtain appropriate equation for sampler from sampler calibration worksheet and write in below.

EQUATION:

TIME	MAGNEHELIC READING	CALCULATED Qstd (m^3/min)
START	55	.25
~~8~~ HOURS	~~52~~	
4 ~~12~~ HOURS	52	.24
~~16~~ HOURS		
FINISH	55	.25

2) Determine average flow rate.

$\overline{Q}std = Q1+Q2+Q3+Q4+Q5 / 5$ $\overline{Q}std =$ 0.25 m^3/min

3) Determine elapsed time.

ET (hrs) = ETM(finish) - ETM(start) ET = 8.0 hrs

4) Determine total standard volume.

Vs (m^3) = $\overline{Q}std$ (m^3/min) x 60 min./hr. x ET (hrs) Vs = 120 m^3

~~Vs (m3 / min.)~~

TO BE COMPLETED WHEN ANALYTICAL RESULTS ARE RETURNED :

5) Convert lab results (ug/puf) to ambient concentrations.

Ca = (ug/puf) / (Vm/puf) $\frac{50\ ug/PUF}{120\ m^3/PUF}$ Ca = 0.417
= conc. of PCBs in sample (ug/m3)
Vm = standard volume of air

GE MCP AMBIENT MONITORING
Flow Calculation and Data Record Sheet

Sample No.: Z13-080191
Sampler No.: 002
Date: 8-1-91

Name of Preparer: Maura Hawkins-Cowgill
Name of Reviewer: John Bordeaux

PAH SAMPLING

1) To convert magnehelic readings to flow rate, obtain appropriate equation for sampler from sampler calibration worksheet and write in below.

EQUATION:

TIME	MAGNEHELIC READING	CALCULATED Qstd
START	61	.25
~~8~~ HOURS		
4 ~~12~~ HOURS	58	.24
~~18~~ HOURS		
FINISH	66	.26

2) Determine average flow rate.

$\overline{Q}std = Q1+Q2+Q3+Q4+Q5 / 5$ $\quad \overline{Q}std =$ [.25]

3) Determine elapsed time.

ET (hrs) = ETM(finish) - ETM(start) $\quad ET =$ [8.0]

4) Determine total standard volume.

V_M (m3 /~~min.~~) = $\overline{Q}std$ x 60 min./hr. x ET (hrs) $\quad V_M =$ [120]

TO BE COMPLETED WHEN ANALYTICAL RESULTS ARE RETURNED :

Convert lab results (ug/puf) to ambient concentrations.

Ca = (ug/puf) / (Vm/puf)
= conc. of PCBs in sample (ug/m3)
Vm = standard volume of air

$\frac{50 \text{ ug/PUF}}{120 \text{ m}^3/\text{PUF}}$ $\quad Ca =$ [0.417]

GE MCP AMBIENT MONITORING
Flow Calculation and Data Record Sheet

Sample No.: Z15-080191
Sampler No.: 003
Date: 8-1-91

Name of Preparer: Maura Hawkins-Coniglio
Name of Reviewer: John Bodeau

PAH Sampling

1) To convert magnehelic readings to flow rate, obtain appropriate equation for sampler from sampler calibration worksheet and write in below.

EQUATION:

TIME	MAGNEHELIC READING	CALCULATED Qstd
START	55	.25
~~8~~ HOURS		
4 ~~12~~ HOURS	52	.24
~~18~~ HOURS		
FINISH	57	.25

2) Determine average flow rate.

$\overline{Q}std = Q1+Q2+Q3+Q4+Q5 / 5$ $\quad \overline{Q}std =$ [.25] m^3/min.

3) Determine elapsed time.

ET (hrs) = ETM(finish) - ETM(start) $\quad ET =$ [8.0] hrs

4) Determine total standard volume.

Vs (m3 /~~min~~.) = $\overline{Q}$std x 60 min./hr. x ET (hrs) $\quad Vs =$ [120] m^3

TO BE COMPLETED WHEN ANALYTICAL RESULTS ARE RETURNED :

5) Convert lab results (ug/puf) to ambient concentrations.

Ca = (ug/puf) / (Vm/puf)
= conc. of PCBs in sample (ug/m3)
Vm = standard volume of air

$\frac{50 ug/PUF}{120 m^3/PUF}$ $\quad Ca =$ [0.417]

GE MCP AMBIENT MONITORING
Flow Calculation and Data Record Sheet

Sample No.: Z21-080191
Sampler No.: 005
Date: 8-1-91

Name of Preparer: Maura Hawkins-Conigliaro
Name of Reviewer: [signature]

PAH SAMPLING

1) To convert magnehelic readings to flow rate, obtain appropriate equation for sampler from sampler calibration worksheet and write in below.

EQUATION:

TIME	MAGNEHELIC READING	CALCULATED Qstd
START	58	.25
~~0~~ HOURS		
4 ~~12~~ HOURS	55	.24
~~18~~ HOURS		
FINISH	58	.25

2) Determine average flow rate.

$\overline{Q}std = Q1+Q2+Q3+Q4+Q5 / 5$ $\quad \overline{Q}std =$ [.25]

3) Determine elapsed time.

ET (hrs) = ETM(finish) - ETM(start) $\quad$ ET = [8.01]

4) Determine total standard volume.

Vs (m3 / ~~min.~~) = $\overline{Q}$std x 60 min./hr. x ET (hrs) $\quad$ Vs = [120.2]

TO BE COMPLETED WHEN ANALYTICAL RESULTS ARE RETURNED :

Convert lab results (ug/puf) to ambient concentrations.

Ca = (ug/puf) / (Vm/puf)
= conc. of PCBs in sample (ug/m3)
Vm = standard volume of air

$\frac{50. \text{ ug/PUF}}{120.2 \text{ m}^3/\text{PUF}}$ $\quad$ Ca = [0.416]

GE MCP AMBIENT MONITORING
Flow Calculation and Data Record Sheet

Sample No.: Z24-080191
Sampler No.: 007
Date: 8-1-91

Name of Preparer: Maura Hawkins-Coniglio
Name of Reviewer: John Bozzelli

PAH SAMPLING

1) To convert magnehelic readings to flow rate, obtain appropriate equation for sampler from sampler calibration worksheet and write in below.

EQUATION:

TIME	MAGNEHELIC READING	CALCULATED Qstd
START	52	.24
~~8~~ HOURS		
4 ~~12~~ HOURS	52	.24
~~18~~ HOURS		
FINISH	54	.25

2) Determine average flow rate.

$\overline{Q}std = Q1+Q2+Q3+Q4+Q5 / 5$ $\quad \overline{Q}std =$ [.24]

3) Determine elapsed time.

ET (hrs) = ETM(finish) - ETM(start) $\quad$ ET = [8.0]

4) Determine total standard volume.

Vs (m3 / ~~min.~~) = $\overline{Q}$std x 60 min./hr. x ET (hrs) $\quad$ Vs = [115.2] m^3

TO BE COMPLETED WHEN ANALYTICAL RESULTS ARE RETURNED :

Convert lab results (ug/puf) to ambient concentrations.

Ca = (ug/puf) / (Vm/puf)
= conc. of PCBs in sample (ug/m3)
Vm = standard volume of air

$\frac{50\ ng/PUF}{115.2\ m^3/PUF}$ $\quad$ Ca = [0.434] ng/m^3

APPENDIX II

INTERNATIONAL CHEMICAL CORPORATION

REQUEST FOR ANALYSIS

H/A Control # -2-25

C/C Control No. 21663

PROJECT NAME	PAH SAMPLING	DATE SAMPLES SHIPPED	August 2, 1991
PROJECT NUMBER		LAB DESTINATION	IT Cincinnati
PROJECT MANAGER	Jeffrey Ruchesam	LABORATORY CONTACT	Laurel Torgesson
BILL TO	James Scalabrini G.E. Company 100 Woodlawn Ave., Pittsfield, MA	SEND LAB REPORT TO	Jeffrey Ruchesam General Electric Company 100 Woodlawn Ave. Bldg. 11 250 Pittsfield, MA 01201
PURCHASE ORDER NO.	834-PX-3023181	DATE REPORT REQUIRED	3 weeks
		PROJECT CONTACT	Jeffrey Ruchesam
		PROJECT CONTACT PHONE NO.	413-494-3228

Sample No.	Sample Type	Sample Volume	Preservative	Requested Testing Program	Special Instructions
204-080191	Air	120 m^3	Blue Ice	BaP and PAH	
213-080191	"	120 m^3	" "	using TO-13	
215-080191	"	120 m^3	" "	GC/MS and GC/FI	
221-080191	"	120.2 m^3	" "	"	
224-080191	"	115.2 m^3	" "	"	
212-080191	Blank		" "	"	
			" "		

TURNAROUND TIME REQUIRED: (Rush must be approved by the Project Manager.)

Normal X0 Rush _____ (Subject to rush surcharge)

POSSIBLE HAZARD IDENTIFICATION: (Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances)

Nonhazard _____ Flammable _____ Skin Irritant _____ Highly Toxic _____ Other _____ (Please Specify)

SAMPLE DISPOSAL: (Please indicate disposition of sample following analysis. Lab will charge for packing, shipping, and disposal.)

Return to Client _____ Disposal by Lab _____

FOR LAB USE ONLY

Received By _____ Date/Time _____

WHITE - Original, to accompany samples
YELLOW - Field copy

APPENDIX III

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

GE Corporation
100 Woodlawn Avenue
Pittsfield, MA 01201

Date: October 28, 1991

Attn: Mr. Jeffrey Ruebesam

Job Number 41062

P.O. Number 834-PX-3023181

This is the Certificate of Analysis for the following samples:

Client Project ID:	GE Pittsfield
Date Received:	August 3, 1991
Work Order:	X1-08-021
Number of Samples:	6
Sample Type:	PUF and Filter

I. Introduction

Six samples arrived at ITAS Cincinnati on August 3, 1991. The samples were were collected on August 1, 1991 and were labeled as follows:

PUF and Filter Z04-080191
PUF and Filter Z13-080191
PUF and Filter Z15-080191
PUF and Filter Z21-080191
PUF and Filter Z24-080191
PUF and Filter Z12-080191

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested were PCB's.

The samples were extracted with dichloromethane and analyzed by Gas Chromatography/ Mass Spectrometry according to EPA SW846 Method 8270.

Reviewed and Approved by:

Laurel Tomassoni
Project Manager
108021

cc:
Ms. Maura Hawkins
Zorex Corporation
247 South Street
2nd Floor
Pittsfield, MA 01202

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

Client: GE Pittsfield
Work Order: X1-08-021
10802101

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organics

Client Sample ID: PUF and Filter Z04-080191

Lab Sample ID: X1-08-021-01

Analysis Date: August 20, 1991

Dilution Factor: 5

CAS Number		ug/PUF
91-20-3	Naphthalene	50 U
91-57-6	2-Methylnapthalene	50 U
208-96-8	Acenapthylene	50 U
83-32-9	Acenaphthene	50 U
86-73-7	Fluorene	50 U
85-01-8	Phenanthrene	50 U
120-12-7	Anthracene	50 U
206-44-0	Fluoranthene	50 U
129-00-0	Pyrene	50 U
56-55-3	Benzo(a)anthracene	50 U
218-01-9	Chrysene	50 U
205-99-2	Benzo(b)fluoranthene	50 U
207-08-9	Benzo(k)fluoranthene	50 U
50-32-8	Benzo(a)pyrene	50 U
193-39-5	Indeno(1,2,3-cd)pyrene	50 U
53-70-3	Dibenzo(a,h)anthracene	50 U
191-24-2	Benzo(g,h,i) perylene	50 U

Client: GE Pittsfield
Work Order: X1-08-021
10802102

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organics

Client Sample ID: PUF and Filter Z13-080191

Lab Sample ID: X1-08-021-02

Analysis Date: August 20, 1991

Dilution Factor: 5

CAS Number		ug/PUF
91-20-3	Naphthalene	50 U
91-57-6	2-Methylnapthalene	50 U
208-96-8	Acenapthylene	50 U
83-32-9	Acenaphthene	50 U
86-73-7	Fluorene	50 U
85-01-8	Phenanthrene	50 U
120-12-7	Anthracene	50 U
206-44-0	Fluoranthene	50 U
29-00-0	Pyrene	50 U
56-55-3	Benzo(a)anthracene	50 U
218-01-9	Chrysene	50 U
205-99-2	Benzo(b)fluoranthene	50 U
207-08-9	Benzo(k)fluoranthene	50 U
50-32-8	Benzo(a)pyrene	50 U
193-39-5	Indeno(1,2,3-cd)pyrene	50 U
53-70-3	Dibenzo(a,h)anthracene	50 U
191-24-2	Benzo(g,h,i) perylene	50 U

Client: GE Pittsfield
Work Order: X1-08-021
10802103

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organics

Client Sample ID: PUF and Filter Z15-080191

Lab Sample ID: X1-08-021-03

Analysis Date: August 20, 1991

Dilution Factor: 5

CAS Number		ug/PUF
91-20-3	Naphthalene	50 U
91-57-6	2-Methylnapthalene	50 U
208-96-8	Acenapthylene	50 U
83-32-9	Acenaphthene	50 U
86-73-7	Fluorene	50 U
85-01-8	Phenanthrene	50 U
120-12-7	Anthracene	50 U
206-44-0	Fluoranthene	50 U
29-00-0	Pyrene	50 U
56-55-3	Benzo(a)anthracene	50 U
218-01-9	Chrysene	50 U
205-99-2	Benzo(b)fluoranthene	50 U
207-08-9	Benzo(k)fluoranthene	50 U
50-32-8	Benzo(a)pyrene	50 U
193-39-5	Indeno(1,2,3-cd)pyrene	50 U
53-70-3	Dibenzo(a,h)anthracene	50 U
191-24-2	Benzo(g,h,i) perylene	50 U

Client: GE Pittsfield
Work Order: X1-08-021
10802104

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organics

Client Sample ID: PUF and Filter Z21-080191

Lab Sample ID: X1-08-021-04

Analysis Date: August 20, 1991

Dilution Factor: 5

CAS Number		ug/PUF
91-20-3	Naphthalene	50 U
91-57-6	2-Methylnapthalene	50 U
208-96-8	Acenapthylene	50 U
83-32-9	Acenaphthene	50 U
86-73-7	Fluorene	50 U
85-01-8	Phenanthrene	50 U
120-12-7	Anthracene	50 U
206-44-0	Fluoranthene	50 U
29-00-0	Pyrene	50 U
56-55-3	Benzo(a)anthracene	50 U
218-01-9	Chrysene	50 U
205-99-2	Benzo(b)fluoranthene	50 U
207-08-9	Benzo(k)fluoranthene	50 U
50-32-8	Benzo(a)pyrene	50 U
193-39-5	Indeno(1,2,3-cd)pyrene	50 U
53-70-3	Dibenzo(a,h)anthracene	50 U
191-24-2	Benzo(g,h,i) perylene	50 U

Client: GE Pittsfield
Work Order: X1-08-021
10802105

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organics

Client Sample ID: PUF and Filter Z24-080191

Lab Sample ID: X1-08-021-05

Analysis Date: August 20, 1991

Dilution Factor: 5

CAS Number		ug/PUF
91-20-3	Naphthalene	50 U
91-57-6	2-Methylnapthalene	50 U
208-96-8	Acenapthylene	50 U
83-32-9	Acenaphthene	50 U
86-73-7	Fluorene	50 U
85-01-8	Phenanthrene	50 U
120-12-7	Anthracene	50 U
206-44-0	Fluoranthene	50 U
129-00-0	Pyrene	50 U
56-55-3	Benzo(a)anthracene	50 U
218-01-9	Chrysene	50 U
205-99-2	Benzo(b)fluoranthene	50 U
207-08-9	Benzo(k)fluoranthene	50 U
50-32-8	Benzo(a)pyrene	50 U
193-39-5	Indeno(1,2,3-cd)pyrene	50 U
53-70-3	Dibenzo(a,h)anthracene	50 U
191-24-2	Benzo(g,h,i) perylene	50 U

Client: GE Pittsfield
Work Order: X1-08-021
10802107

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organics

Client Sample ID:

Lab Sample ID: METHOD BLANK - SBLK730

Analysis Date: August 20, 1991

Dilution Factor: 5

CAS Number		ug/PUF
91-20-3	Naphthalene	50 U
91-57-6	2-Methylnapthalene	50 U
208-96-8	Acenapthylene	50 U
83-32-9	Acenaphthene	50 U
86-73-7	Fluorene	50 U
85-01-8	Phenanthrene	50 U
120-12-7	Anthracene	50 U
206-44-0	Fluoranthene	50 U
129-00-0	Pyrene	50 U
56-55-3	Benzo(a)anthracene	50 U
218-01-9	Chrysene	50 U
205-99-2	Benzo(b)fluoranthene	50 U
207-08-9	Benzo(k)fluoranthene	50 U
50-32-8	Benzo(a)pyrene	50 U
193-39-5	Indeno(1,2,3-cd)pyrene	50 U
53-70-3	Dibenzo(a,h)anthracene	50 U
191-24-2	Benzo(g,h,i) perylene	50 U

Client: GE Pittsfield
Work Order: X1-08-021
10802111

IT ANALYTICAL SERVICES
CINCINNATI, OH

Quality Assurance Data

Semi-Volatile
Surrogate Recovery, Percent

Client Sample ID	Lab No.	d5-Nitro benzene	2Fluoro biphenyl	d14-Terphenyl	d6-Phenol	2Fluoro phenol	2,4,6-Tribromo phenol
PUF and Filter Z04-080191	01	73	84	89	46	69	68
PUF and Filter Z13-080191	02	71	85	92	46	68	70
PUF and Filter Z15-080191	03	58	74	93	43	59	68
PUF and Filter Z21-080191	04	64	78	88	42	65	64
PUF and Filter Z24-080191	05	69	81	88	45	65	70
PUF and Filter Z12-080191	06	70	82	83	41	68	60
Method Blank	SBLK730	78	82	92	78	71	54

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