# ABSTRACT

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Particles and gases emitted by diesel vehicles can be toxic to human health. Polycyclic aromatic hydrocarbons (PAHs) and nitrated-PAHs (NPAHs) can be used as tracers to identify the contribution of diesel exhaust to the atmosphere. Air samples were collected near the Peace Bridge in Buffalo, NY, where studies have shown an association between asthma patients and traffic on the Peace Bridge. Positive Matrix Factorization (PMF) was used to estimate the source profile and the relative contribution of unknown emission sources. Four PAH sources identified were regional-scale volatilization, vehicle particulate matter, tar/asphalt volatilization, and diesel exhaust. Three NPAH sources identified were $NO_3$ radical reaction, diesel exhaust and mixed sources. Volatilization was the major source of PAHs and $NO_3$ radical reactions were the largest source of NPAHs in Buffalo, NY. Diesel exhaust accounted for approximately 30% of PAH and 18% of NPAH at the sampling site closest to the Peace Bridge.

# CHARACTERIZATION OF PAH COMPOSITION PATTERNS IN DIESEL EMISSION

By

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# Chapter 1

# Executive Summary

## 1.1 Introduction

Polycyclic aromatic hydrocarbons (PAHs) and nitrated-PAHs (NPAHs) are organic compounds with more than 2 fused benzene rings in different combinations. PAHs are by-products of incomplete combustion and also occur in fossil fuels. They enter the environment from anthropogenic and natural sources (Seinfeld and Pandis, 1997; Rogge et al., 1993b, d; Schauer et al., 1999, 2001, 2002a, b). NPAHs are not only formed during combustion, but are also formed by gas phase reactions in the atmosphere (Havey et al., 2006; Paputa-Peck et al., 1983; Arey et al., 1986; Atkinson and Arey, 1994; Atkinson et al., 1990). PAHs have been measured in higher concentration in urban areas relative to rural areas (Greenberg et al., 1985; Offenberg and Baker, 1999; Dachs et al., 2002) which is consistent with their dominant sources being vehicle exhaust, coal combustion, natural gas, oil combustion and wood burning (Crimmins, 2006; Larsen and Baker, 2003; Lee et al., 2004; Harrison et al., 1996; Simcik et al., 1999). Primary NPAHs have been reported in higher concentration in urban areas, but species formed via atmospheric reaction (secondary) has been reported in higher concentration in suburban/rural areas as well (Feilberg et al., 2001; Bamford and Baker, 2003a; Reisen and Arey, 2005). As PAH and NPAH are known threats to human health (Pitts, 1987; Phillips, 1983; Grimmer et al., 1991; Talaska, et al., 1996; Durant et al., 1996), research have focused on identifying the sources and their contribution to the atmosphere.

A common method of source identification is calculating the ratio of two or more PAHs. The ratio method is a commonly used to identify their major source in samples

(Nielsen, 1996; Li and Kamens, 1993; Khalili et al., 1995; Daisey et al., 1986), but ratio values are somewhat non-specific and may not be applicable in all cases. Multivariate analysis characterizes PAH patterns in samples to identify their sources. The alternative factor analysis technique, positive matrix factorization (PMF) has been successful in characterizing the sources which are hard to distinguish in conventional factor analysis. For example, the PAH profile of gasoline and diesel exhaust overlap significantly. Principal component analysis (PCA) followed by multi-linear regression analysis (MLRA) has not been able to separate the two sources (Simcik et al., 1999; Harrison et al., 1996; Larsen and Baker, 2003; Crimmins, 2006). Using PMF, Larsen and Baker (2003), Crimmins (2006) and Lee et al. (2004) has successfully identified the difference between gasoline and diesel exhaust. Vehicle emission is one of the dominant sources of PAHs in urban areas. In order to manage PAH emission from anthropogenic sources, comprehensive source characterizations are necessary. Therefore, it is important to differentiate the PAH contribution between gasoline and diesel vehicles.

## 1.2 Rational

PAH profiles collected from diesel tailpipes have been used as a fingerprint of diesel exhaust to estimate their PAH contribution in the ambient air (e.g. chemical mass balance models; Schauer et al., 1996). Once released into the atmosphere, photochemistry and atmospheric mixing can change the chemical composition of diesel exhaust (Kamens et al., 1988; McDow et al., 1994). Also, the PAH profiles can vary among individual vehicles (Shah et al., 2005; Lim et al., 2005, Zienlinska et al., 2004), and the tailpipe studies represent a small portion of vehicles on the road. Tunnel studies capture the general PAH compositions from a variety of vehicles, but are usually highly proportioned by gasoline exhaust. Both tailpipe and tunnel studies do not reflect the influences of photochemistry in their profile. Therefore, there was a need for a PAH profile which characterized the diesel exhaust mixed in the atmosphere.

In summer 2004, Bernard Crimmins and I were invited to the Oak Ridge National Laboratory for a workshop on a topic of diesel emission, “Third Review: Watt Road Environmental Laboratory Intitiative”. Dr. John Storey graciously allowed us to collect air samples from a truck stop in Knoxville, TN. From these samples, my goal was:

1. To characterize the PAH and NPAH composition in ambient air highly influenced by diesel exhaust.

Buffalo, NY is the third most popular border crossing state for trucks in North America (Bureau of Transportation Statistics, 2006). The Peace Bridge serves as a major transportation pathway for diesel vehicles between Canada and the United States. The public is concerned with how the vehicle traffic on the bridge affects the air quality in their neighborhood. The Harvard School of Public Health (HSPH) was funded by the Health Effects Institute (HEI) to assess the exposure of air toxins from vehicle emissions nearby the Peace Bridge. The P.I. Dr. John Spengler graciously allowed me to participate in their sampling campaign. Diurnal patterns of PAH and NPAH were characterized by intensive sampling during Summer 2005. Seasonal variations were described by samples collected in Winter 2005, Summer 2005 and Winter 2006. The main objectives were:

1. Characterize the seasonal and diurnal pattern of PAH and NPAH in Buffalo, NY

2. Determine the sources and their contribution of PAH and NPAH using the multivariate receptor model Positive Matrix Factorization.
3. Compare the PAH and NPAH profile characterized by the truck stop samples with the diesel exhaust profile resolved by PMF analysis.

### 1.3 Strategy

Four day intensive sampling was conducted at a truck stop in Knoxville, TN in July, 2004. A Hi-Volume air sampler (Hi-vol) was placed on top of a concrete base which was approximately 2m above the ground to collect ambient samples which were highly influenced by diesel exhaust.

Ambient air samples were collected in Buffalo, NY. Five day intensive sampling was conducted in July 2005 using Hi-vols to characterize the diurnal patterns of PAH and NPAH. Seasonal samples were collected in 12h increments with Harvard Impactors (HIs) during Winter 2005, Summer 2005 and Winter 2006. Hi-vols and HIs were located at three locations (Marina, Residential and Highway) at different distances and directions from the Peace Bridge. Bernard Crimmins assisted me with both Knoxville, TN and Buffalo, NY sampling and Brian Morris assisted me with the drive back from Buffalo, NY. The seasonal samples were collected by Jose Vallarino and Scott Newberg of HSPH and the data was organized by Steve Melly of HSPH.

All of the samples were Soxhlet extracted with DCM and analyzed for PAH by a gas chromatograph/mass spectrometer (GC/MS). Then samples were processed through a clean up procedure for NPAH analysis. NPAH were analyzed by GC/MS equipped with

Programmed Temperature Vaporization (PTV) injection port. These laboratory procedures were assisted by Bernard Crimmins, Eileen Beard and Kristin Bunales.

Source contribution in Buffalo, NY was determined using a Windows based Positive Matrix Factorization (PMF) program developed by EPA (EPA PMF 1.1). PMF resolved the chemical (PAH) composition of a source and its contribution in each sample. Throughout sampling procedures, instrumental techniques and statistical analysis, Bernard Crimmins has assisted me tremendously. All of these analyses were not possible without his method development and technical assistances.

## 1.4 Summary of Results

### *1.4.1 Chapter 2*

Gas and particle phase PAH and NPAH were collected from ambient air at a truck stop in Knoxville, TN. The total PAH and NPAH concentration varied among samples but did not show any diurnal patterns. The PAH profiles were relatively consistent among the samples but the NPAH profiles showed diurnal variations due to production of NPAHs via gas phase PAH reaction with OH radicals. High concentration of NO indicated little production of NPAH via $NO_3$ radical reactions. Thus, the night samples better characterized non-transformed diesel exhaust. The truck stop profiles were compared with previously measured tailpipe profiles of diesel vehicles, which were inconsistent among different vehicles. Generally, the truck stop profiles showed characteristics of diesel exhaust. The truck stop samples characterized the PAH and NPAH composition of diesel exhaust in the atmosphere.

### *1.4.2 Chapter 3*

Seasonal patterns of PAH concentration in Buffalo, NY showed a higher abundance of lighter molecular weight (MW) compounds in the summer and heavier MW compounds in the winter. The diurnal variation in Summer 2005 indicated that PAH concentrations were higher during the day, and no specific diurnal change in PAH fingerprint was observed except at the residential site. The NPAH concentration was higher at night, and a common diurnal pattern was observed at all three sampling sites. The highest PAH and NPAH concentration was observed at the Residential site.

PMF analysis of the seasonal data identified three PAH sources in Buffalo, NY. The three sources were 1) the general summer source, 2) the unique summer source at the Residential site and 3) a winter source. The summer profiles were dominated with lighter MW PAHs and the winter profile was loaded by heavier MW PAHs.

Four PAH sources were identified from the diurnal, Summer 2004 samples. 1) regional-background, 2) vehicle particulate matter, 3) local (tar/asphalt) volatilization and 4) diesel exhaust. The dominant source of PAHs at the Marina site was coal tar/asphalt volatilization during the day and regional background at night. The Highway site was highly influenced by diesel exhaust during the day and the regional background source at night. The Residential site was dominated with local volatilization during the day and night.

For NPAH, three sources were resolved, 1) NPAH production via $NO_3$ radicals ($NO_3$), 2) diesel exhaust and 3) mixed. Overall, $NO_3$ radical reactions were the largest contributor of NPAH at all of the sites. The contribution of diesel exhaust was highest at the Highway site.

The truck stop PAH and NPAH profiles collected in Knoxville, TN were compared with the diesel exhaust profile resolved by PMF analysis of ambient air samples in Buffalo, NY. The PAH profiles were similar between the truck stop and the PMF profiles. The NPAH profiles were somewhat variable, but the contribution of their dominant compounds, 9-nitroanthracene and 1-nitropyrene were in similar proportions.

## 1.5 Implications

The implications of this body of work are as follows;

1) The ambient air samples at the truck stop were a good representative of diesel exhaust in the atmosphere.
2) This study was the first to measure the PAH and NPAH distribution in Buffalo, NY. Diesel exhaust was an important contributor of PAH and NPAH close to the Peace Bridge. Gas phase reaction was the dominant source of NPAH in Buffalo, NY.
3) Volatilization was the most abundant source of PAH at the residential area in Buffalo, NY. The contribution of PAH from volatilization was an order of magnitude higher than the diesel exhaust, which could be a greater health concern than diesel exhaust.

# Chapter 2

# Characterization of Diesel Exhaust Using PAH and NPAH Compounds

## 2.1 Introduction

Vehicle exhaust is one of the major sources of fine particulate matter to the air in urban and suburban areas (Park and Kim, 2005; Almeida et al., 2006; Morishita et al., 2006). Diesel vehicles emit 4 – 25 times more particulate matter than gasoline vehicles (Rogge et al., 1993a; Schauer et al., 1999; Schauer et al., 2002). Even if there are fewer diesel vehicles than gasoline (Bureau of Transportation Statistics, 2006), diesel may be the dominant source of particulate matter to the atmosphere. A study in California estimated that diesel vehicles are responsible for greater than 75% of particulate matter emitted by vehicle exhaust (Pope et al., 1995). Particulate matter causes serious health problems to humans. Inhaled fine particulate matter can penetrate into the lungs and cause cardiopulmonary diseases, lung cancer and mortality (Dockery et al., 1993; Pope et al., 1995). Increases in diesel traffic have been associated with increased hospital visits for asthma patients (Lwebuga-Mukasa, 2004). Although diesel vehicle emissions are associated with negative health effect, diesels have higher fuel efficiency and lower $CO_2$ emission than gasoline (Sullivan et al., 2004), and are essential assets to our lifestyle.

Polycyclic aromatic hydrocarbons (PAH) are organic compounds emitted by various combustion sources such as diesel (Schauer et al., 1999; Rogge et al., 1993a) and gasoline exhaust (Schauer et al., 2002), coal combustion (Simcik et al., 1999), wood burning (Freeman and Cattell, 1990; Schauer et al., 2001; Ramdahl, 1983), incinerators (Grimmer et al., 1991) and natural gas combustion (Rogge et al., 1993b). PAHs are semi-volatile compounds which partition between gas and particle phases depending on their vapor pressure and the ambient temperature (Tsapakis and Stephanou, 2005). PAHs contribute to a small fraction (less than 1%) of the total organic matter emitted by diesel exhaust (Schauer et al., 1999) and are known carcinogens (Phillips, 1983; Grimmer et al., 1991; Talaska et al., 1992) and mutagens (Durant et al., 1996). Studies have shown that vehicle exhaust is one of the dominant sources of PAH in many cities (Larsen and Baker, 2003; Harrison et al., 1996; Nielsen, 1996; Lim et al., 1999; Crimmins, 2006). PAHs associated with particulate matter have been found in respirable sizes (Venkataraman et al., 1994; Miguel et al., 1998; Offenberg and Baker, 1999; Crimmins, 2006).

Nitro-substituted PAH (NPAH) compounds are also semi-volatile organic compounds emitted by various combustion sources such as diesel (Paputa-Peck et al, 1983; Schuetzle et al., 1982) and gasoline exhaust (Gibson, 1982) and coal-fired power plants (Harris et al., 1987). NPAHs directly emitted by combustion sources are formed via electrophilic nitration of PAH in the presence of nitrogen dioxide ($NO_2$; Nielsen, 1984). Some of the most abundant NPAH emitted by diesel exhaust are 1-nitropyrene and 9-nitroanthracene (Schuetzle et al., 1982; Paputa-Peck et al., 1983; Havey et al., 2006).

The ambient concentrations of NPAHs are typically 2 – 1000 times less than those of PAHs (Feilberg et al., 2001, Bamford and Baker, 2003a). However, NPAHs are direct mutagens while PAHs are promutagens, which requires exogenous activation to show mutagenic potency (Pitts, 1987). Studies had focused on the particle phase as a threat to human health, however Harger et al. (1992) showed that gas phase NPAH has a higher mutagenicity than those on particles. Therefore, it is important to understand the contribution of both gas and particle phase PAH and NPAH in the atmosphere.

While all PAH compounds are formed via direct emission, NPAHs are also formed in the atmosphere by reactions with PAH and hydroxyl (OH) and nitrate ($NO_3$) radicals in the presence of nitrogen oxides ($NO_x$; Arey et al., 1986; Atkinson and Arey, 1994; Atkinson et al., 1990). Hydroxyl radicals are formed during the day via photolysis of ozone ($O_3$; Seinfeld and Pandis, 1997; Atkinson and Arey, 1994) and react with gas phase PAHs such as fluoranthene and pyrene to form 2-nitrofluoranthene and 2-nitropyrene (Arey et al., 1986). The nitrate radicals ($NO_3$) react with gas phase PAHs such as fluoranthene to form 2-nitrofluoranthene at night since $NO_3$ is rapidly photolyzed during the day (Atkinson and Arey, 1994). While OH radicals react with both fluoranthene and pyrene, $NO_3$ radicals do not react with pyrene (Atkinson et al., 1990; Atkinson and Arey, 1994; Arey et al., 1986). Neither 2-nitrofluoranthene nor 2-nitropyrene have been reported in diesel exhaust and are only formed by gas phase reactions (Paputa-Peck et al., 1983). In addition to gas phase reactions, laboratory studies have reported NPAH production via heterogeneous reactions (Pitts et al., 1985; Kamens et al., 1990).

PAHs can be used as tracers of emission sources. For example, retene is a tracer of soft wood combustion (Ramdahl, 1983) and coronene (Greenberg et al., 1981) is found in gasoline exhaust. Source apportionment studies have used PAH as a tool to estimate the contribution from sources (Larson and Baker, 2003; Harrison et al., 1996; Simcik et al., 1999; Kavouras et al., 2004; Crimmins, 2006). Due to significant overlap in their PAH profiles between gasoline and diesel exhaust, most source apportionment studies cannot separate the contribution between the two (Harrison et al. 1996; Simcik et al., 1999; Kavouras, et al. 2004). In order to determine the environmental and health impacts due to diesel exhaust, a refined assessment of their PAH composition is necessary. NPAH compounds are additional tools to characterize diesel exhaust. Their unique formation processes can provide information such as how and when certain species were formed.

Currently, PAH profile of diesel exhaust is based on measurements from tailpipes or from tunnels (Schauer et al., 1999; Rogge et al., 1993a). Studies have shown diesel emission can change depending on the age of the vehicle/engine, operation mode (e.g. idling, cruse), vehicle conditions (e.g. deterioration) and vehicle weights (e.g. loadings) (Yanowitz et al., 2000; Shah et al., 2006; Zielinska et al., 2004). The PAH profile observed from a tailpipe may not represent the diesel exhaust in the atmosphere. Tunnels represent a mixture of vehicle exhausts (Benner and Gordon, 1989; Venkataraman et al., 1994), but gasoline vehicles are the dominant source of PAH. Some tunnel studies were conducted under controlled traffic, where diesel vehicles were restricted to certain part of the tunnel (bore) at a certain time. These studies were successful in characterizing the differences between diesel and gasoline profiles (Miguel et al., 1998, Phuleria et al., 2006). The tailpipe and tunnel studies both indicate diesel exhaust have a higher proportion of lighter molecular weight (MW) PAH compounds, such as methylphenanthracenes and anthracenes (Rogge et al., 1993a; Schauer et al., 1999; Benner and Gordon, 1989; Phuleria et al., 2006), higher total PAH emission (Rogge et al., 1993a; Schauer et al., 1999; Schauer et al., 2002) and higher elemental carbon (EC) emission (Schauer et al., 1999, Schauer et al., 2002, Miguel et al., 1998) than gasoline exhaust.

Since photodegradation is one of the dominant pathways of PAH decay (Kamens et al., 1988), atmospheric mixing can influence the PAH composition. Therefore, neither tailpipe nor tunnel profiles represent the diesel exhaust in the atmosphere. In this study, with the purpose of characterizing PAH profile of diesel exhaust in the atmosphere, ambient air was collected from a truck stop which was highly influenced by diesel exhaust. The truck stop was used by a variety of diesel vehicles from all over the United States. The PAH and NPAH profile characterized by the ambient air samples collected at the truck stop represent a broad range of diesel exhaust in the atmosphere.

### 2.2 Sampling Methods

Ambient air samples were collected at two stations in Summer 2004. The sampling sites were located approximately 20 miles west of Knoxville, TN. The first site was in a grass field next to the Interstate 40 (Highway; latitude 35°52’38.22”N, longitude 84°14’16.06”W) and the second station was in a truck stop nearby the highway. At the truck stop, the sampler was placed on a concrete base which was approximately 2m above ground (Truck Stop; latitude 35°52’36.29”N, longitude 84°14’03.97”W). The two sites were approximately 300m apart, surrounded by small ridges which trapped air pollution. Interstate 40 is one of the major west-east highways in the United States. The Highway site was heavily impacted by vehicle (gasoline and diesel) exhaust and the Truck Stop site was mainly influenced by diesel exhaust.

Samples were collected for 3 consecutive days at the Highway site and for 4 consecutive days at the Truck Stop site between July 29th and August 2nd, 2004. Highway samples were collected in 12 hour increments and Truck stop samples were collected in 6 or 12 hour increments. Day samples were collected between 7am and 7pm EDT and night samples were collected between 7pm and 7am EDT. The 12h incremented samples were designed to evaluate the differences between day and night samples. The 6h incremented samples were taken in the daytime between 7am and 1pm EDT, and 1pm and 7pm EDT to collect morning rush hour traffic at the Truck Stop.

Modified Hi-Volume (Hi-Vol) air samplers (General Metal Works, Village of Cleves, OH) were used to collect both gas and particle phase samples at both sites. The particles were collected on 30 x 20 cm glass fiber filter (GFF; Schleicher and Schuell #25) and gases were collected in polyurethane foam (PUF). The flow rate was calibrated using the anemometer (Airflow Instruments, Evansville, IN) at the beginning and at the end of each sample. The flow rate of the air sampler was approximately $0.68 m^3 min^{-1}$. After collection, all the filters were sealed in ashed aluminum foil and the PUFs were sealed in ashed glass jars and kept frozen and stored in dark at -20°C until analysis.

Organic carbon (OC), elemental carbon (EC), particulate matter up to 2.5 aerodynamic diameter ($PM_{2.5}$), nitrogen monoxide (NO), nitrogen dioxide ($NO_2$), nitrogen oxides ($NO_x$) and metrological data were collected and analyzed by Oak Ridge National Laboratory and associated institutions.

## 2.3 Analytical Methods

Samples were Soxhlet extracted in the dark with dichloromethane (DCM) for 24 hours. After Soxhlet extraction, samples were concentrated to approximately 150 ml by roto-evaporation (Brinkmann Instruments, Inc., Westbury, NY) then with a Turbo Vap II (Zymark, Hopkinton, MA) further concentrated to approximately 1ml. During the concentration process sample extracts were exchanged into hexane.

*2.3.1 PAH Analysis:* Extracts were analyzed for 52 PAHs using a gas chromatograph equipped with mass spectrometer (GC/MS) in electron ionization (EI) and selective ion monitoring mode. Two microliters of each extract was eluted through a 25m x 0.2mm i.d. x 0.33µm film thickness (DB-5MS; J & W Scientific, Inc. Folson, CA) column equipped with a splitless injector at 250°C. The oven temperature was programmed to hold at 40°C for 1 min, then ramped to 280°C at 10°C /min and finally to 310°C at 5°C/min until the end of the run. Each PAH compound was identified based on the retention time of a mixed standard solutions and ion fragmentation. Internal standards consisting acenaphthene-$d_{10}$, phenanthrene-$d_{10}$, benzo[a]anthracene-$d_{12}$, benzo[a]pyrene-$d_{12}$ and benzo[g,h,i]perylene-$d_{12}$, were added just prior to instrumental analysis. The internal standards and mixed standard solutions were run every 20 samples to determine the relative response factor of each PAH compound in order to calculate the mass of compound and to determine the precision of the instrument.

*2.3.2 NPAH Analysis:* After PAH analysis, the samples were further processed to analyze NPAHs. The extracts were eluted through a conditioned aminopropyl SPE cartridge (Sep-Pak, Waters, Milford, MA) with 40ml of 20% DCM in hexane (Bamford et al., 2003b). The cartridges were conditioned with 50ml of 20% DCM in hexane. Then extracts were concentrated to approximately 200µl using the Turbo Vap II and transferred into hexane. This was followed by normal phase liquid chromatography (LC) which separated the NPAH compounds into two fractions, mono- and dinitro-PAHs. A 5µm, 30cm x 9.6mm Chromegabond amino cyano column (ES Industries, West Berlin, NJ) was used with a mobile phase of 20% DCM in hexane at a flow rate of 5ml/min. For every 10 samples, the column was back flushed with 300ml of DCM and then conditioned with 300ml of 20% DCM in hexane at a flow rate of 5ml/min. The first fraction (mono-NPAHs) was collected between 4min (20ml) and 13mins (45ml) and the second fraction (di-NPAHs) was collected between 13 mins (45ml) and 25 mins (125ml). The fractions were concentrated to approximately 1ml and transferred into hexane using the Turbo Vap II. Extracts were analyzed for 19 NPAH compounds using the GC/MS operated in negative ion/chemical ionization (NCI) and selective ion monitoring mode. 50ul of extract was eluted through a 30m x 0.25 i.d. x 0.25µm film thickness (DB-17MS; J & W Scientific, Inc. Folson, CA) column equipped with programmed temperature vaporization (PTV) injector. The initial inlet temperature was at 45°C during injection, then ramped to 280°C at the rate 600°C /min. The oven temperature was programmed to hold 40°C for 1.5 mins; 20°C /min to 150°C for 10 mins; 10°C /min to 220°C for 10 mins, and 5°C /min to 310°C until end of the run. Each NPAH compound was identified based on the retention time of a mixed standard solutions and ion fragmentation. Internal standards consisting 5-nitroacenaphthene-$d_9$, 2-nitrofluorene-$d_9$, 3-nitrofluoranthene-$d_9$ and 6-nitrochrysene-$d_{11}$ were added to all samples just prior to instrumental analysis. The internal standards and mixed standard solutions were run every 20 samples to determine the relative response factor of each NPAH compound in order to calculate the mass of compound and to determine the precision of the instrument.

*2.3.3 Quality Assurance:* Parallel to the samples, 3 field blanks were collected to measure any background contamination due to sampling and analytical equipments. The detection limit of PAH and NPAH compounds were defined as three times the average mass measured in the field blanks. PAH detection limit of an average air sample of 450 m$^3$ (12h) ranged between 0.0001 – 0.02 ng/m$^3$ for GFF and 0.0003 – 0.78 ng/m$^3$ for PUF. NPAH detection limit for an air sample of 450 m$^3$ (12h) ranged between 0.001 – 0.38 pg/m$^3$ for GFF and 0.002 – 0.62 pg/m$^3$ for PUF. Prior to extraction, 4 deuterated PAH and 3 deuterated NPAH compounds were spiked into all samples (GFF and PUF) as laboratory surrogates. The variation in surrogate recoveries reflected the overall method precision. The mean surrogate recoveries for particle phase PAH compounds were 35% ± 21% for naphthalene-$d_8$, 81% ± 18% for fluorene-$d_{10}$, 57% ± 12% for fluoranthene-$d_{10}$ and 57% ± 15% for perylene-$d_{12}$. For gas phase PAH compounds the recoveries were 36% ± 65% for naphthalene-$d_8$, 73% ± 26% for fluorene-$d_{10}$, 74% ± 33% for fluoranthene-$d_{10}$ and 78% ± 25% for perylene-$d_{12}$. The mean surrogate recoveries for particle phase NPAH compounds were 24% ± 20% for 1-nitronaphthalene-$d_7$, 34% ± 26% for 9-nitroanthracene-$d_9$ and 71% ± 26% for perylene-$d_{12}$. For gas phase NPAH compounds the recoveries were 35% ± 25% for 1-nitronaphthalene- $d_7$, 12% ± 39% for 9-nitroanthracene-$d_9$ and 29% ± 27% for 1-nitropyrene-$d_9$. Due to consistent low recoveries of NPAH surrogates in gas and particle phase, each sample was corrected based on their surrogate recoveries.

## 2.4 Results and Discussions

*2.4.1 Concentration Results:* A total of 52 PAH compounds (Table 2.1) were detected in either GFF or PUF. Studies have reported breakthrough of highly volatile PAH with PUF (Arey et al., 1987; McConnel and Bidleman, 1998) and lower surrogate recovery of naphthalene-$d_8$ indicated a substantial loss of these compounds during analytical

Table 2.1 List of 52 PAH compounds and 19 NPAH compounds analyzed in this study with their molecular weight (MW).

| | PAH Compounds | MW |
|---|---|---|
| 1 | Naphthalene | 128 |
| 2 | 2-Methlynaphthalene | 142 |
| 3 | Azulene | 128 |
| 4 | 1-Methlynaphthalene | 142 |
| 5 | Biphenyl | 154 |
| 6 | 2,7-Dimethylnaphthalene | 156 |
| 7 | 1,3-Dimethylnaphthalene | 156 |
| 8 | 1,6-Dimethylnaphthalene | 156 |
| 9 | 1,4-Dimethylnaphthalene | 156 |
| 10 | 1,5-Dimethylnaphthalene | 156 |
| 11 | Acenaphthylene | 152 |
| 12 | 1,2-Dimethylnaphthalene | 156 |
| 13 | 1,8-Dimethylnaphthalene | 156 |
| 14 | Acenaphthene | 154 |
| 15 | 2,3,5-Trimethylnaphthalene | 170 |
| 16 | Fluorene | 166 |
| 17 | 1-Methylfluorene | 180 |
| 18 | Dibenzothiophene | 184 |
| 19 | Phenanthrene | 178 |
| 20 | Anthracene | 178 |
| 21 | 2-Methyldibenzothiophene | 198 |
| 22 | 4-Methyldibenzothiophene | 198 |
| 23 | 2-Methylphenanthrene | 192 |
| 24 | 2-Methylanthracene | 192 |
| 25 | 4,5-Methylenephenanthrene | 190 |
| 26 | 1-Methylanthracene | 192 |
| 27 | 1-Methyphenanthrene | 192 |
| 28 | 9-Methylanthracene | 192 |
| 29 | 9,10-Dimethylanthracene | 206 |
| 30 | Fluoranthene | 202 |
| 31 | Pyrene | 202 |
| 32 | 3,6-Dimethylphenanthrene | 206 |
| 33 | Benzo[a]fluorene | 216 |
| 34 | Retene | 234 |
| 35 | Benzo[b]fluorene | 216 |
| 36 | Cyclopenta(c,d)pyrene | 226 |
| 37 | Benz[a]anthracene | 228 |
| 38 | Chryene+Triphenylene | 228 |
| 39 | Napthacene | 228 |
| 40 | 4-Methylchrysene | 242 |
| 41 | Benzo[b]fluoanthene | 252 |
| 42 | Benzo[k]fluoranthene | 252 |
| 43 | Dimethylbenz[a]anthracene | 256 |
| 44 | Benzo[e]pyrene | 252 |
| 45 | Benzo[a]pyrene | 252 |
| 46 | Perylene | 252 |
| 47 | 3-Methylcholanthrene | 268 |
| 48 | Indone[1,2,3-cd]pyrene | 276 |
| 49 | Dibenz[a,h+a,c]anthracene | 278 |
| 50 | Benzo[g,h,i]perylene | 276 |
| 51 | Anthanthrene | 276 |
| 52 | Corenene | 300 |

| | NPAH Compounds | MW |
|---|---|---|
| 1 | 1N-Naphthalene | 173 |
| 2 | 2N-Naphthalene | 173 |
| 3 | 2N-Biphenyl | 199 |
| 4 | 3N-Biphenyl | 199 |
| 5 | 4N-Biphenyl | 199 |
| 6 | 1,3-Dinitro-Naphthalene | 218 |
| 7 | 1,5-Dinitro-Naphthalene | 218 |
| 8 | 5N-Acenaphthene | 199 |
| 9 | 2N-Fluorene | 211 |
| 10 | 9N-Anthracene | 223 |
| 11 | 2N-Anthracene | 223 |
| 12 | 9N-Phenanthrene | 223 |
| 13 | 3N-Phenanthrene | 223 |
| 14 | 4N-Phenanthrene | 223 |
| 15 | 2N-Fluoranthene | 247 |
| 16 | 3N-Fluoranthene | 247 |
| 17 | 1N-Pyrene | 247 |
| 18 | 2N-Pyrene | 247 |
| 19 | 6N-Chrysene | 273 |

procedures. Thus, naphthalene, methylnaphthalenes, biphenyl, acenaphthylene and acenaphthene were removed and total of 38 PAH compounds were used for analysis. A total of 19 NPAH compounds (Table 2.1) were detected in either GFF or PUF. Total (gas + particle) concentrations of individual compounds were calculated to eliminate the concentration variation due to gas and particle partitioning. Most of the gas phase samples collected from the Highway were lost during laboratory procedures, and the Highway samples were not included in the following discussion. For the 6h incremented samples, their weighted average was calculated and total of 8 (4 day and 4 night), 12 hour incremented samples were used to identify the PAH and NPAH composition at the Truck Stop.

The total concentration of 38 PAHs ranged between 260 – 730 ng/m$^3$ and the total of 19 NPAH ranged between 570 – 1300 pg/m$^3$ (Figure 2.1). The NPAH concentrations are 10 – 10,000 times lower than those of their parent PAH. For example, the concentration of 2-nitrofluoranthene was approximately 400 – 2,000 times less than that of fluoranthene. In general, the total PAH concentration was higher during the day and the NPAH concentration was higher at night, but no particular diurnal pattern was observed. The higher PAH concentration during daytime can be explained by higher diesel emissions at the Truck Stop and/or more volatilization of PAH from fuel and surface materials (e.g. asphalt) under higher ambient temperature. The higher NPAH concentration at night can be due to lower atmospheric boundary layer, NPAH production via $NO_3$ radical initiated reaction or less photolysis.

The PAH and NPAH concentrations measured at the Truck Stop were compared with those collected in tunnels and urban areas, where vehicles were the dominant source

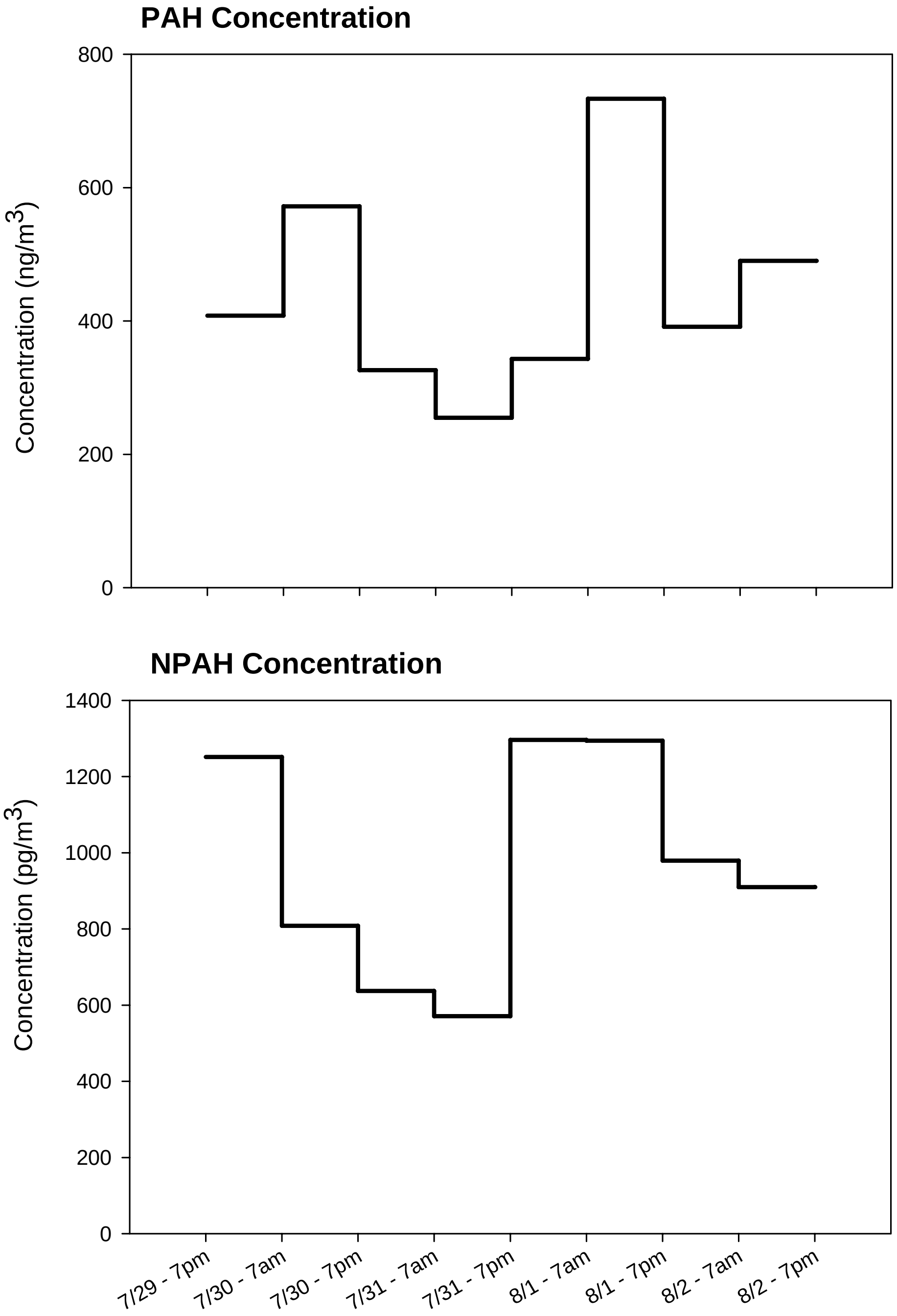


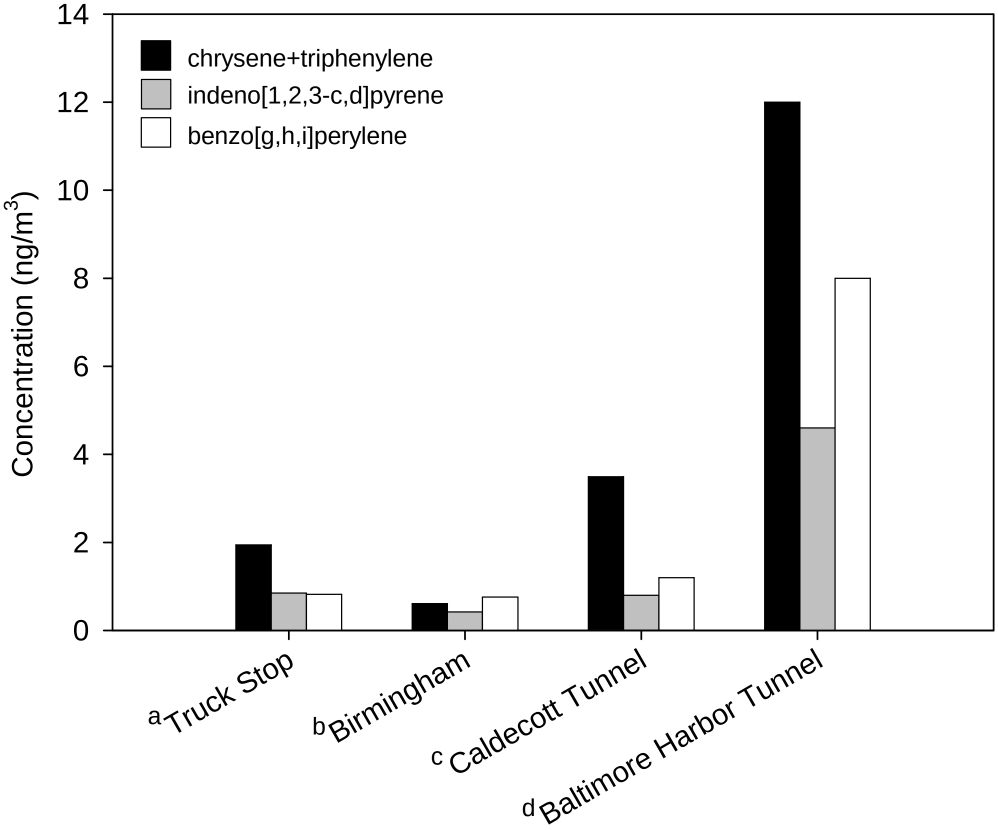
**Figure 2.1** Total PAH and NPAH concentration during the 4 day consecutive sampling period (July 29th - August 2nd, 2004) at the Truck Stop.

of PAH and NPAH. As shown in Figure 2.2, the PAH concentrations at the Truck Stop were similar to the values reported in Birmingham, U.K. (Harrison et al., 1996) and in the Caldecott Tunnel in California (Miguel et al., 1998). The concentration measured in the Baltimore Harbor Tunnel was 4 – 8 times higher than all the other locations (Benner and Gordon, 1989). Baltimore Harbor Tunnel study was conducted in 1985 which was 10 years earlier than any of the other studies, and fuel composition and engine technologies have improved since then.

The daytime total NPAH concentration at the Truck Stop was similar to the values reported in Copenhagen, Denmark (Feilberg et al., 2001) and in Birmingham, U.K. (Damashki et al., 2000). The concentration at night was similar to the values reported in Baltimore Harbor Tunnel (Figure 2.3). At night, the atmospheric boundary layer decreased and trapped the NPAH in a smaller volume which increased the concentration at the Truck Stop. Also, less NPAH was lost through photodegradation. The day and nighttime 2-nitrofluoranthene concentrations from a study in California during a high $NO_x$ episode were 1.5 – 10 time higher than the other reported values.

Overall, the PAH and NPAH concentrations measured at the Truck Stop were comparable to the values reported in tunnels and urban areas.

*2.4.2 PAH Profiles:* The individual PAH concentrations were normalized to the total PAH concentration in order to minimize the concentration variation and to compare the profiles between samples. All of the PAH profiles collected in the Truck Stop were similar to each other, thus an average of eight profiles is presented in Figure 2.4. Phenanthrene was the most abundant compound, accounting for 30 – 40% of the total.



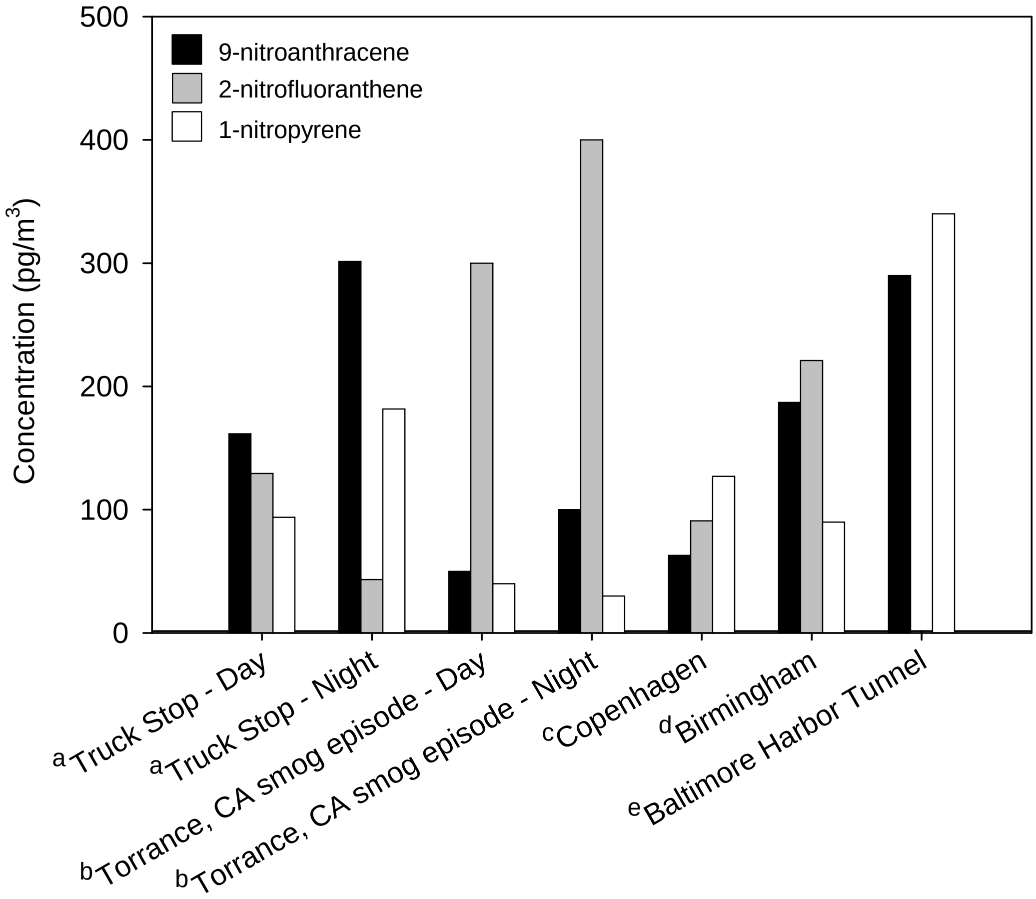
[a]This Study. Mean of 8 samples measured in Knoxville, TN.

[b]The gas+particle phase PAH concentration at Birmingham, U.K., July 27 - August 23, 1992 (Harrison et al., 1996).

[c]Caldecott Tunnel is located in Costa County, CA. PAH concentrations were determined from $PM_{1.3}$ samples. 4.8% of total tunnel vehicles were heavy duty diesel trucks during 1-3PM (Pacific Time) on August 28th, 1996 (Miguel et al., 1998).

[d]Mean of 33 filter samples, 1985-1986 (Benner and Gordon, 1989).

**Figure 2.2** Comparison of selected PAHs (ng/$m^3$) measured at the Truck Stop and those reported in other locations.



[a]This study. Mean of 4 samples measured in Knoxville, TN.
[b]Mean of 6 filter samples, Jan - Feb, 1985. Day; 6am - 6pm (Pacific Time) and Night; 6pm - 6am (Arey et al., 1987)
[c]Mean of 20 filter samples collected in Copenhagen, Denmark, winter-spring 1996 (Feilberg et al., 2001)
[d]Mean of 25 samples, Nov. 1995 - Feb. 1996 in Birmingham, U.K.(Dimashki et al., 2000)
[e]Mean of 9 filter samples, Oct. 1985 (Benner, 1988)

**Figure 2.3** Comparison of selected NPAHs (ng/m$^3$) measured at the Truck Stop and those reported in other locations.

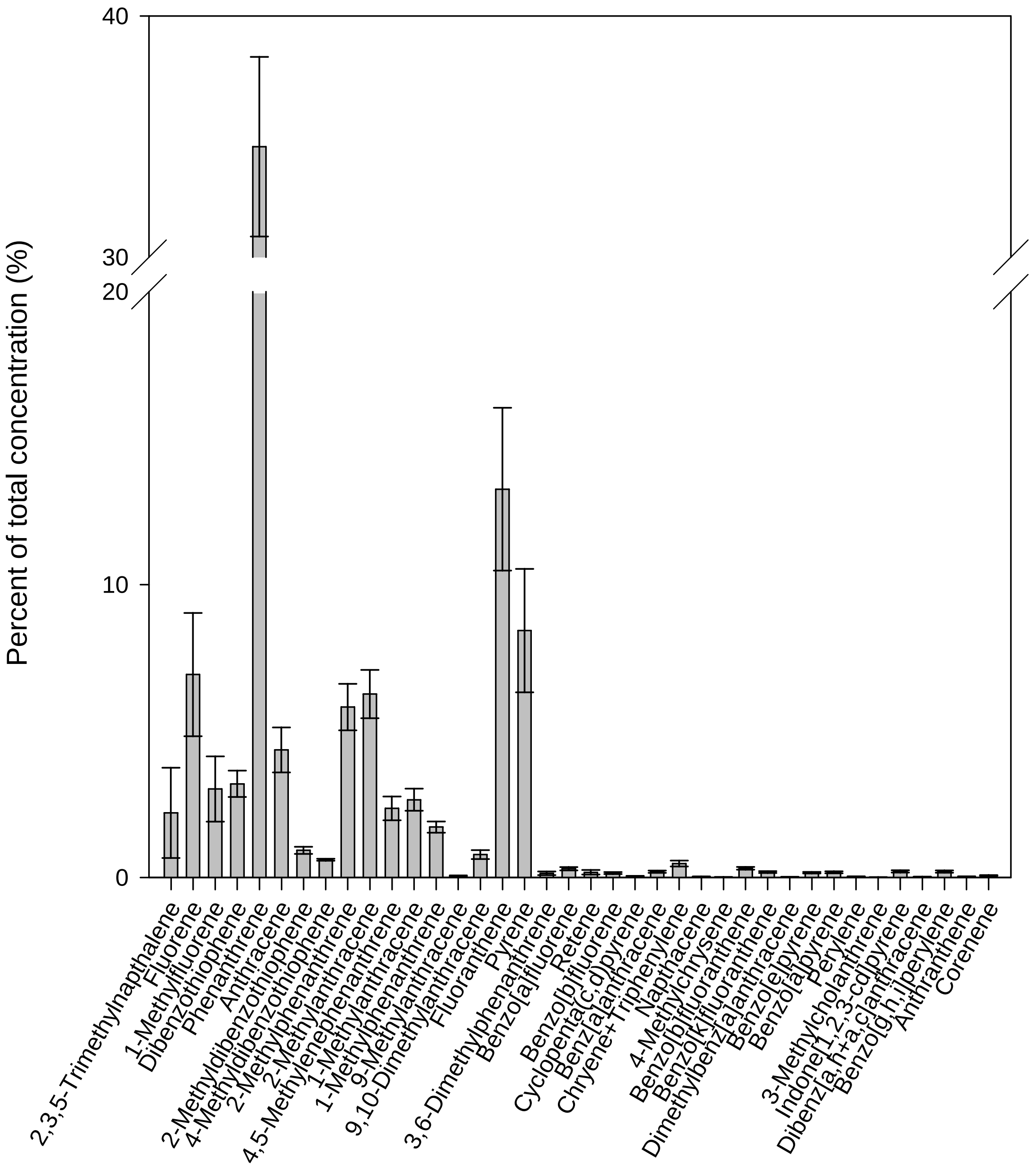


**Figure 2.4** The averaged (n=8) PAH profile (normalized to the total PAH concentration) at the Truck Stop.

Fluoranthene and pyrene contributed 11 – 17% and 6 – 12%, respectively. Also, methylated phenanthrene/anthracene isomers accounted for 16 – 21% of the total concentration. The heavier PAH compounds (MW > 202) contributed to approximately 3% of the total PAH concentration. Among the heavier PAHs, chrysene+triphenylene was most abundant and contributed 0.3 – 0.6% of the total. Benzo[a]fluorene, benzo[b]fluoranthene, indeno[1,2,3-c,d]pyerne and benzo[g,h,i]perylene were also prevalent. Though heavier MW compounds accounted for a small fraction of the total, these compounds are more carcinogenic (Grimmer et al., 1991) and are commonly used as fingerprints of diesel exhaust (Li and Kamens, 1993; Greenberg et al., 1981).

*2.4.3 NPAH profiles:* Unlike PAHs, the NPAH profiles varied among samples (Figure 2.5 and 2.6). Typically, NPAH profiles were abundant with 9-nitroanthracene and 2-nitrofluoranthene during the day, accounting for 17 – 23% and 21 – 27% of the total concentration. Also, 1 and 2-nitronaphthalene and 1-nitropyrene each contributed to approximately 10% of the total. In the nighttime NPAH profile, 32 – 34% of the concentration was contributed by 9-nitroanthracene. 1-nitropyrene and 1-nitronaphthalene was also prevalent at night accounting for 18% and 20% of the total. The nitrobiphenyl isomers and nitrophenanthrene isomers were less abundant in both day and night profiles.

A significant correlation between 1-nitropyrene and NO concentration at the Truck Stop (r = 0.82, p value < 0.01) implied 1-nitropyrene was predominantly due to diesel exhaust (Crimmins, 2006). 9-nitroanthracene had a relatively higher correlation coefficient (r = 0.57) with NO but was not statistically significant. 9-nitroanthracene was

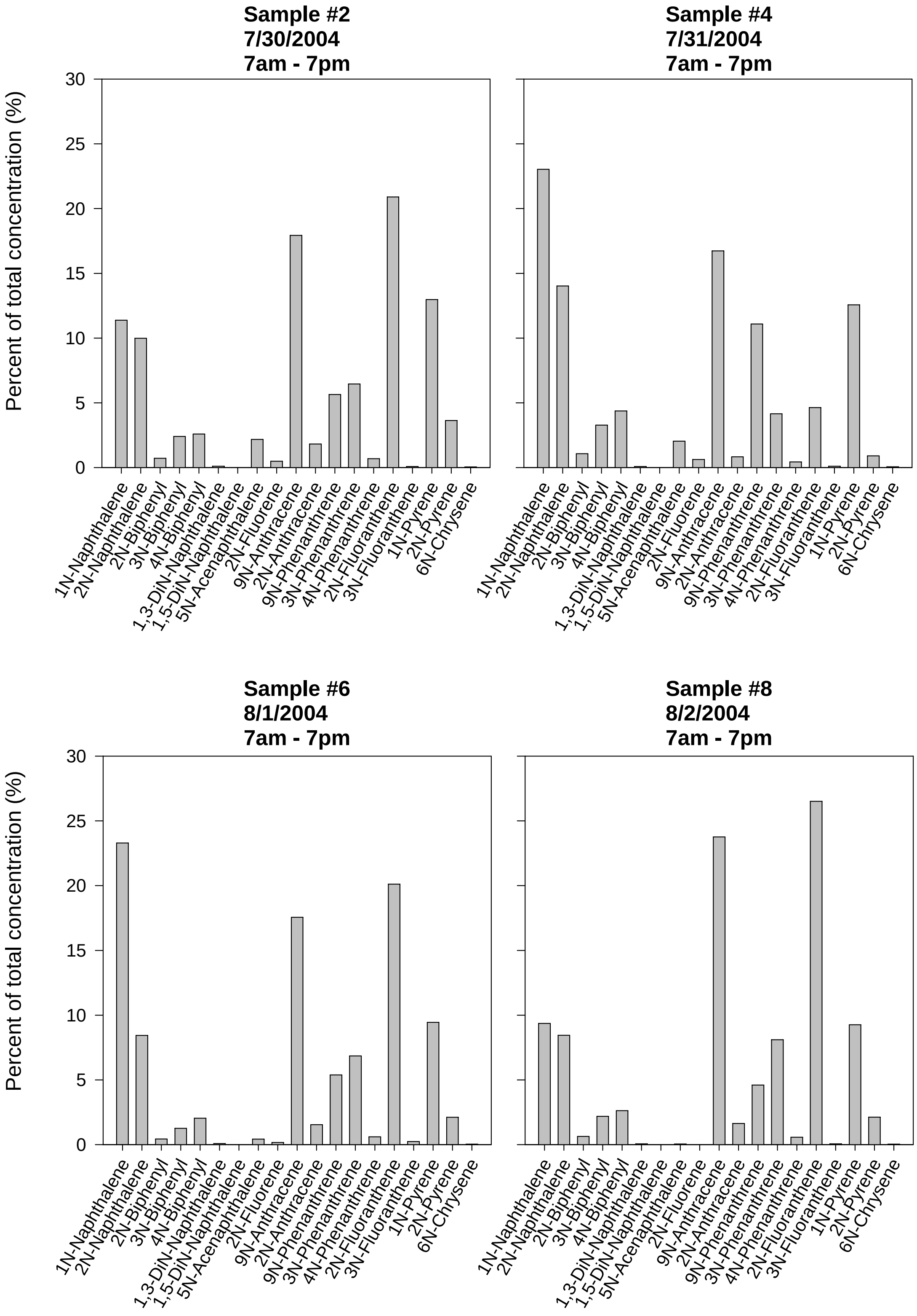


**Figure 2.5** The daytime NPAH profiles (normalized to the total NPAH concentration) at the Truck Stop.

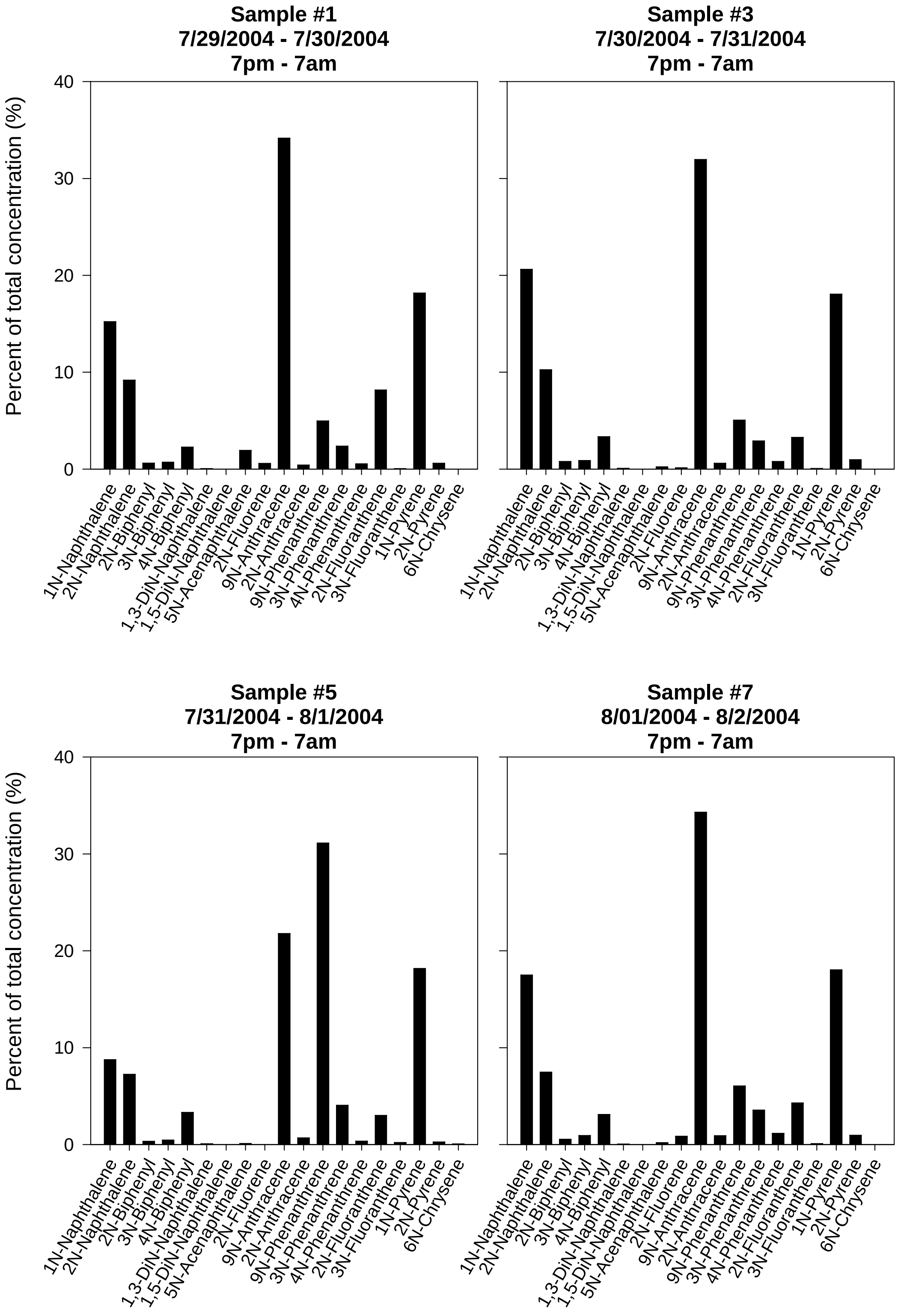


**Figure 2.6** The nighttime NPAH profiles (normalized to the total NPAH concentration) at the Truck Stop.

mainly due to diesel exhaust and some atmospheric formation via heterogeneous reaction (Bamford and Baker, 2003a; Feilberg et al., 2001).

2-nitrofluoranthene has been reported as one of the most abundant compounds in ambient atmosphere (Bamford and Baker, 2003a; Feilberg et al., 2001). In the Truck Stop profiles, 2-nitrofluoranthene accounted for approximately 25% of the total concentration during the day. However, the contribution decreased dramatically at night (5%). The two possibilities that could explain the lower abundance of 2-nitrofluoranthene at night are less production of 2-nitrofluoranthene at night and/or higher contribution of 9-nitroanthracene and 1-nitropyrene, which suggests higher emission of diesel exhaust at night. Compared to urban areas such as Baltimore, MD [10 – 50 ppb] (Crimmins, 2006) the NO concentrations measured at the Truck Stop were considerable higher [150 – 300 ppb]. NO rapidly reacts with $NO_3$ radicals to produce $NO_2$ (Seinfeld and Pandis, 1997) and diminish the $NO_3$ radical concentration in the atmosphere. The ratio of 2-nitrofluoranthene and 2-nitropyrene (2NF/2NP) is used to assess the formation pathway of 2-nitrofluoranthene. Since 2-nitropyrene is only formed via OH radical reaction (Atkinson et al., 1990; Atkinson and Arey, 1994; Arey et al., 1986), the ratio of 2NF/2NP increases at night when 2-nitrofluoranthene is produced via $NO_3$ radical reaction. The 2NF/2NP of the Truck Stop samples ranged between 5 – 12 during the day and 3 – 14 at night. The similar values of 2NF/2NP between day and night indicated there was little production of 2-fluoranthene at night. Since PAH concentration was generally higher during the day, a greater emission of diesel exhaust at night was unlikely. Therefore, the lower abundance of nighttime 2-nitrofluoranthene at the Truck Stop was due to lack of $NO_3$ radical reaction. The Truck Stop nighttime NPAH profile was more representative of diesel exhaust than the daytime because less NPAH are formed in the atmosphere at night.

3 and 4-nitrobiphenyls were the dominant nitrobiphenyl isomers measured in the Truck Stop profiles. Both isomers were reported in diesel exhaust, but their relative abundances were not determined (Paputa-Peck et al., 1983). The proportions of 3 and 4-nitrobiphenyl in the Truck Stop profiles were relatively similar during the day but the abundance of 3-nitrobiphenyl decreased at night. Direct emission is the only formation pathway for 4-nitrobiphenyl while 3-nitrobiphenyl is also formed in gas phase reaction with OH radicals, which is consistent with the higher contribution of 3-nitrobiphenyl in the daytime profile. This also suggested that 4-nitrobiphenyl is emitted in higher concentration than 3-nitrobiphenyl in diesel exhaust.

*2.4.4 Additional source of NPAH at the Truck Stop:* The NPAH emission from diesel exhaust and NPAH production via OH radical reaction did not explain some of the high abundances of 1-nitronaphthalene and 9-nitrophenanthrene observed in the Truck Stop profiles. The relative abundances of 1-nitronaphthalene and 2-nitronaphthalene in the Truck Stop profiles varied among the samples. 1 and 2-nitronaphthalene are formed by gas phase reaction with OH and $NO_3$ radicals (Sasaki et al., 1997) and are also emitted by diesel exhaust (Bamford et al., 2003b; Campbell et al., 1984). The proportion of 1 and 2-nitronaphthalene formed via OH radical reaction was reported as 1:1 (Sasaki, et al., 1997), which was consistent with some of the daytime profiles. However, the other profiles showed a higher proportion of 1-nitronaphthalene than 2-nitronaphthalene. Higher concentration of 2-nitronaphthalene relative to 1-nitronaphthalene was reported in diesel exhaust (Bamford et al., 2003b; Campbell et al., 1984), which contradicted with the Truck Stop profiles.

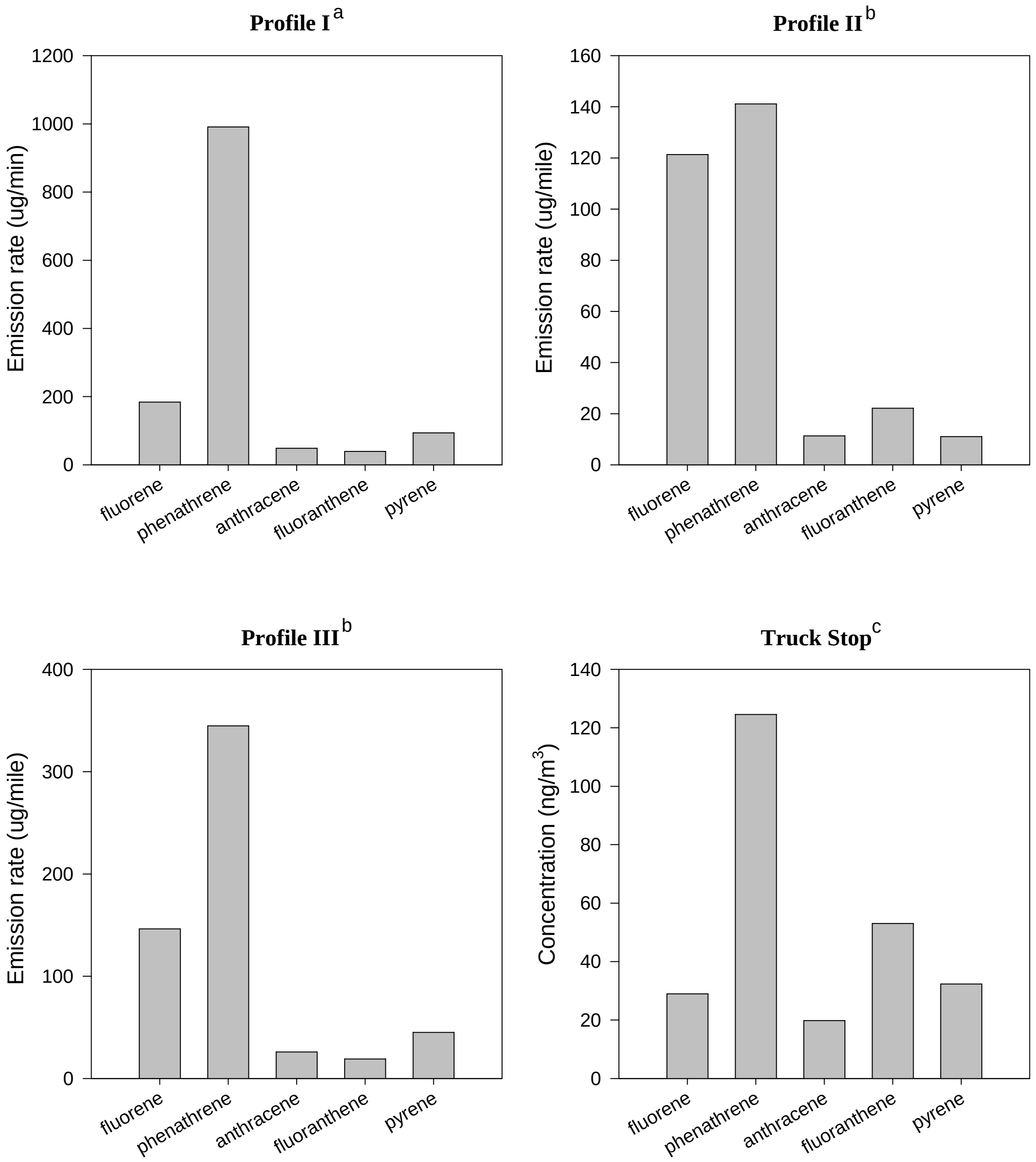
Among the nitrophenanthrene isomers, 3-nitrophenanthrene was the dominant species during the day and 9-nitrophenanthrene was more prevalent at night. 3-nitrophenanthrene was measured in higher concentration compared to 9-nitrophenanthrene in diesel exhaust (Bamford et al., 2003b; Campbell et al., 1984). Trace level of 9-nitrophenanthrene was formed via $NO_3$ radical reaction in laboratory studies (Arey et al., 1989), but with high concentration of NO at the Truck Stop, the gas phase $NO_3$ radical initiated reaction could not be accounted for the higher abundance of 9-nitrophenanthrene at night.

The contribution of 9-nitrophenanthrene in Sample #5 (Figure 2.6) was approximately 5 times greater than the other nighttime profiles and 1-nitronaphthalene in Sample #4 and #6 (Figure 2.5) was twice as higher than the other daytime profiles. Since these samples were collected in sequential order, an emission source enriched in these NPAHs was speculated. The PAH profile on 7/31/04 7pm – 8/01/04 7am was loaded with higher retene compared to the other samples. The higher abundance of 9-nitrophenanthrene and 1-nitronaphthalene could be due to woodburning at the vicinity of the Truck Stop. NPAH profile of most combustion sources, including woodburning has not been identified in the literature, thus the non-diesel emission source(s) of 9-nitrophenanthrene and 1-nitronaphthalene in the Truck Stop samples could not be determined.

*2.4.5 Ambient influences on PAH and NPAH profiles:* Rain had a significant impact on some of the PAH and NPAH concentrations. Rain showers were observed during 7/30/04 7pm – 7/31/04 7pm with an average percent relative humidity (%RH) over 80%. This coincided with the lowest total PAH and NPAH concentration throughout the sampling period (Figure 2.1). The negative correlation between %RH and some of the gas phase PAHs were significant (p-value < 0.01). The NPAHs negatively correlated with %RH were compounds formed via gas phase reaction with OH radicals (p-value < 0.01). The rain diminished the concentrations of parent PAHs available to react with OH radicals and heavier cloud coverage also inhibited the formation of OH radicals. Since approximately 25% of the total concentration in daytime NPAH profiles were accounted for 2-nitrofluoranthene, the rain depressed the total NPAH concentration on 7/31/04 7am – 7pm. Nighttime NPAH profiles were composed mostly by 9-nitroanthracene and 1-nitropyrene, the lower concentration during 7/31/04 7pm – 8/01/04 7am were not caused by rain, but perhaps a lower diesel emission at the Truck Stop.

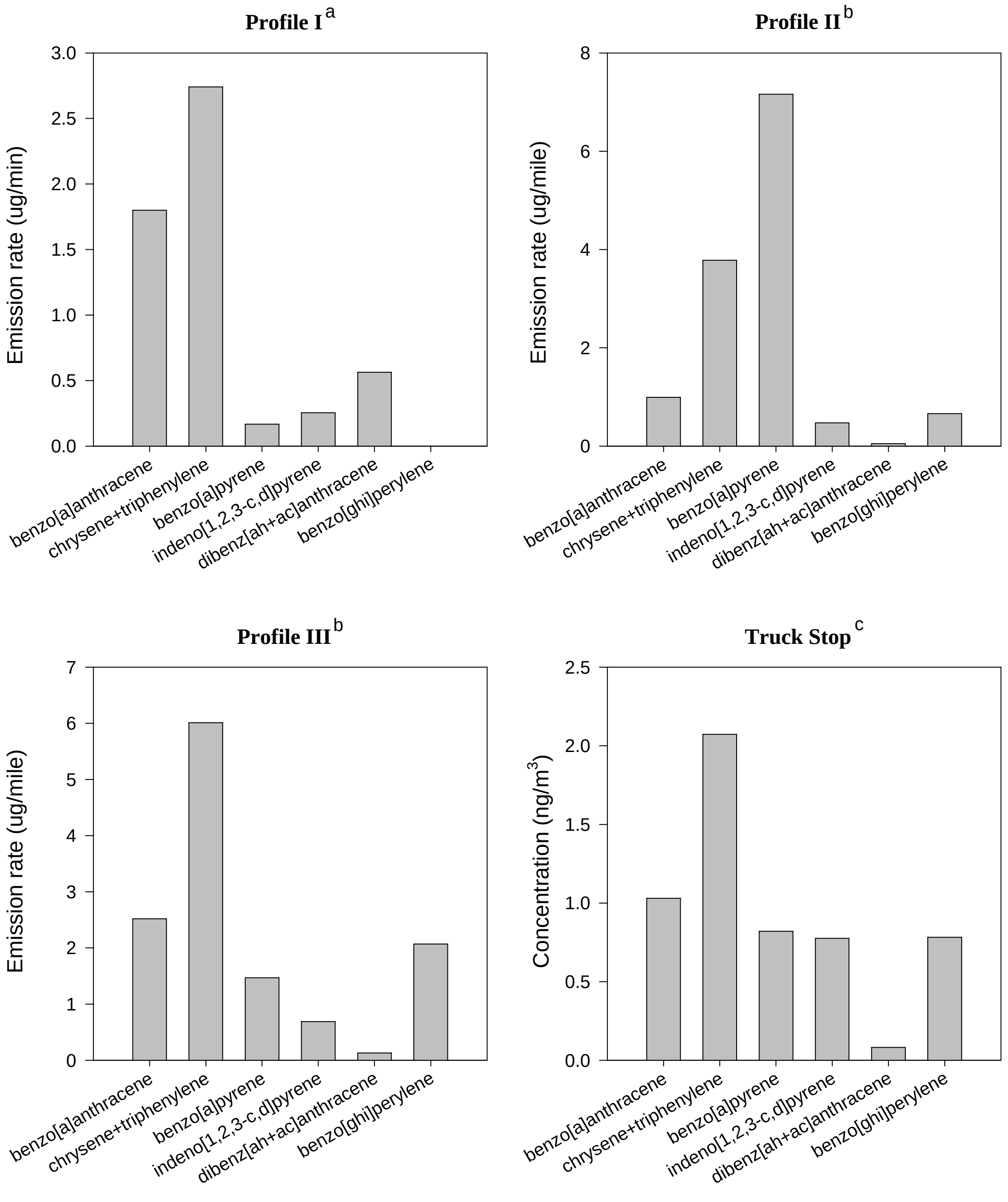
*2.4.6 Comparison with diesel tailpipe profiles:* The ambient samples collected at the Truck Stop were highly influenced by diesel exhaust, and their profiles were expected to have similar characteristics of diesel exhaust. Figures 2.7-1 and 2.7-2 present PAH profiles collected from diesel tailpipes. Though the profiles were measured in different units, the profile patterns are comparable between profiles.

The profile patterns of lighter MW PAHs were relatively consistent between different profiles; phenanthrene was the most abundant compound and fluorene was highly loaded in all of the profiles. The relative proportion of fluorene to phenanthrene



[a]Shah et al., 2005
[b]Zielinska et al., 2004
[c]This study, sample on 8/01/04 7pm - 8/02/04 7am

**Figure 2.7-1** Comparison of lighter MW PAH profiles. Profile I: 1998 diesel engine, ultra low sulfur fuel, cold start/idling state; Profile II: mixture of 1998, 1999, 2000 diesel engines, typical diesel fuel, California Unified Driving Cycle (CA UDC); Profile III: 1991 (high PM emitter) diesel engine, typical diesel fuel, CA UDC.



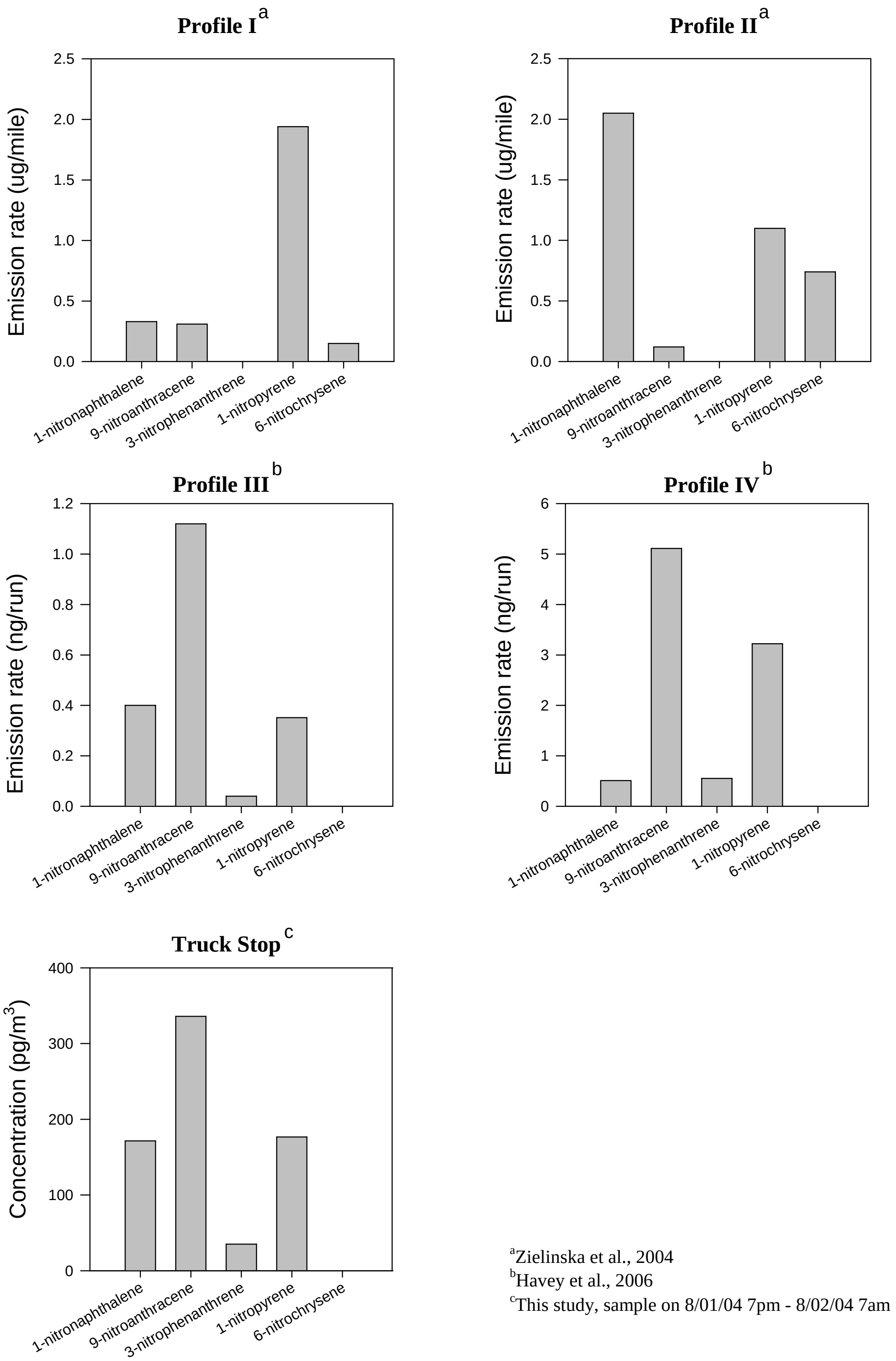
[a]Shah et al., 2005
[b]Zielinska et al., 2004
[c]This study, sample on 8/01/04 7pm - 8/02/04 7am

**Figure 2.7-2** Comparison of heavier MW PAH profiles. Profile I: 1998 diesel engine, ultra low sulfur fuel, cold start/idling state; Profile II: mixture of 1998, 1999, 2000 diesel engines, typical diesel fuel, California Unified Driving Cycle (CA UDC); Profile III: 1991 (high PM emitter) diesel engine, typical diesel fuel, CA UDC.

and the relative contribution between anthracene, pyrene and fluoranthene were different among the all of the profiles. For the heavier MW PAHs, chrysene+triphenylene was the most abundant compound in two of the profiles; Profile I and III. Benzo[a]pyrene was the most prevalent PAH in Profile II. The Truck Stop profile was relatively similar to Profile III, except that the Truck Stop profile had a higher abundance of indeno[1,2,3-c,d]pyrene. Profile III was collected from a 1991 diesel engine, which could be similar to the average age of diesel engines at the Truck Stop. The different patterns between tailpipe profiles could be associated with difference in the age of the vehicle, fuels and driving conditions.

Similarly, the Truck Stop NPAH profiles were compared with diesel exhaust profiles (Figure 2.8). Studies from the 1980s reported 1-nitropyrene as the most abundant NPAH in diesel exhaust (Paputa-Peck et al., 1983; Schuetzle et al., 1982). Surprisingly, profile I was the only profile with 1-nitropyrene as the dominant compound. Profile III and IV were predominantly loaded with 9-nitroanthracene and 1-nitronaphthalene was abundant in Profile II. Profile III and IV were collected from the same diesel vehicle with different fuel type. The resemblance of their profile suggested that the NPAH profile patterns are more strongly influenced by vehicle conditions than by fuels. The Truck Stop profile was relatively similar to Profile III, but 1-nitronaphthalene in the Truck Stop profile was due to atmospheric reaction and emission sources other than diesel exhaust close to the Truck Stop.

Overall, the Truck Stop profile was consistent with some of the diesel exhaust profiles. The diesel exhaust profiles in the literature are rather inconsistent due to variations in age of the vehicle, fuel types and the conditions of the vehicle. The difference between the Truck Stop and tailpipe profiles could be due to mixing of



[a]Zielinska et al., 2004
[b]Havey et al., 2006
[c]This study, sample on 8/01/04 7pm - 8/02/04 7am

**Figure 2.8** Comparison of NPAH profiles. Profile I: mixture of 1998, 1999, 2000 diesel engines, typical diesel fuel, California Unified Driving Cycle (CA UDC); Profile II: 1991 (high PM emitter) diesel engine, typical diesel fuel, CA UDC; Profile III: 2002 diesel engine, ultra low sulfur fuel, Federal Heavy-Duty Transient Cycle; Profile IV: 2002 diesel engine, typical diesel fuel, Federal Heavy-Duty Transient Cycle.

multiple diesel exhaust, mixing with ambient air and influences of non-diesel combustion sources.

## 2.5 Summary

The PAH profiles were relatively consistent throughout the 4 day sampling period at the Truck Stop. Atmospheric conditions were the important factors in determining the PAH and NPAH concentration. Some PAHs were sensitive to humidity and precipitation which also affects the concentration of NPAH formed by gas phase reaction with OH radicals. The high concentration of NO at the Truck Stop diminished the concentration of $NO_3$ radicals, thus, the nighttime NPAH profiles were dominated with diesel emitted NPAH compounds.

The diesel exhaust profiles from different vehicles were rather variable due to difference in engine age, fuel type, and driving conditions. Therefore, tailpipe PAH and NPAH profiles may not be the most reliable source of diesel exhaust. The Truck Stop samples were heavily influenced by diesel exhausts and their PAH and NPAH profile were in good agreement with the characteristics of diesel exhaust. The PAH and NPAH profile characterized by the Truck Stop is suggested to be a good representative of diesel exhaust in the atmosphere.

# Chapter 3

# The Sources of PAH and NPAH Compounds to the Buffalo, NY Atmosphere

## 3.1 Introduction

The Peace Bridge is one of most important border crossings for commercial vehicles between the United States and Canada. In 2005, a daily average of 20,000 vehicles crossed the US and Canadian border across the Peace Bridge and of those 80% were gasoline vehicles and 20% were diesel (Peace Bridge Authority, 2006). A bridge expansion plan was proposed to accommodate higher volumes of traffic, which raised concerns from the public regarding the degradation of air quality in the area. Studies conducted near the Peace Bridge have associated an increase in truck traffic on the Peace Bridge with an increase in hospital visits for asthma patients (Lwebuga-Mukasa et al., 2004; Oyana et al., 2004a, b).

Polycyclic aromatic hydrocarbons (PAHs) and nitrated-PAHs (NPAHs) are semi-volatile organic compounds, and many are known carcinogens (Phillips, 1983; Grimmer et al., 1991; Talaska et al., 1996) and mutagens (Durant et al., 1996). PAH and NPAH can be used as tracers to characterize emission sources to the ambient air. PAH and NPAH are emitted by vehicle emission (Schauer et al., 1999, 2002a; Paputa-Peck et al., 1983; Gibson, 1982), coal combustion (Simcik et al., 1999; Harris et al., 1987), natural gas combustion (Rogge et al., 1993b), oil combustion (Rogge et al., 1997b; Kavouras et al., 2001) and woodburning (Schauer et al., 2001). PAH and NPAH can partition between gas and particle phase depending on the ambient temperature and pre-deposited PAH can be regenerated into the atmosphere via volatilization from land and water (Dimashki et al., 2001; Dachs et al., 2002; Lee et al., 2004). In addition to direct emission and volatilization, some NPAHs are produced in the atmosphere from gas-phase PAHs with hydroxyl (OH) and nitrate ($NO_3$) radicals in the presence of nitrogen oxides ($NO_x$) (Arey et al., 1986; Atkinson and Arey, 1994; Atkinson et al., 1990). Also, photolysis is an important degradation pathways for PAH and NPAH (Fan et al., 1996; Kamens et al., 1988). Therefore, the PAH and NPAH composition of ambient air is likely to vary seasonally and diurnally.

Positive Matrix Factorization (PMF) is a factor analysis method which estimates source profiles and relative contributions when emission sources are unknown. PMF does not require scaling of the data, which may lead to distortion in the analysis (Paatero and Tapper, 1993). Also, the output of PMF in concentration units is directly interpretable. PMF has been successfully applied to ambient air source apportionment studies using PAHs and NPAHs (Larsen and Baker, 2003; Crimmins, 2006; Lee et al., 2004) to distinguish between gasoline and diesel exhaust.

Seasonal and diurnal samples of PAHs and NPAHs were collected from the ambient air of Buffalo, NY. The seasonal samples were collected by the Harvard School of Public Health (HSPH; P.I. John D. Spengler) during Winter 2005, Summer 2005 and Winter 2006. The diurnal samples were collected by the Chesapeake Biological Laboratory (CBL; P.I. Joel E. Baker) during Summer 2005. PMF was applied to these samples to identify the sources of PAH and NPAH to the air of Buffalo, NY. A truck stop PAH and NPAH profile collected in Knoxville, TN (Chapter 1) is compared to the diesel exhaust profile resolved by PMF analysis of ambient air from Buffalo, NY. If the Truck

Stop profile truly represents the diesel exhaust in the ambient air, the Truck Stop profile and diesel exhaust profile resolved by PMF should be similar.

## 3.2 Sampling

*3.2.1 Site:* Ambient air samples were collected at three sites within 1km$^2$ near the Peace Bridge in Buffalo, NY (Figure 3.1). The sampling stations were located at different distances and directions from the Peace Bridge. The first station is the closest site to the Peace Bridge, in the grass yard of a church across the street from a ramp to the Peace Bridge (Highway; latitude 42°54'18.58"N, longitude 78°53'56.95"W). NW from this site is the Peace Bridge and SW is a toll booth, custom and immigration office and duty free shopping center. The second site is approximately 700m east of the Peace Bridge in a residential area. The sampler was placed on the ground in front of a parking lot of a community center (Residential; latitude 42°54'19.97"N, longitude 78°53'32.00W). The third station was approximately 800m south of the Peace Bridge in the Great Lake Center of Buffalo State, the State University of New York (Marina; latitude 42°53'56.23"N, longitude 78°54'06.34"W), located next to Lake Erie. In addition to the Peace Bridge, heavy traffic was observed on Interstate 190, which is a major highway connecting traffic between NY and the Peace Bridge.

*3.2.2 Diurnal Sampling (CBL Samples):* Samples were collected in July 2005 (20 – 26th) for 6 consecutive days. Samples from the Marina and Residential sites were collected in 12h increments between 7am – 7pm and 7pm – 7am. Some of the Highway daytime samples were collected in 6h increments (7am – 1pm and 1pm – 7pm) to measure the

Figure 3.1 Map indicating the three sampling locations (Marina, Residential and Highway) in Buffalo, NY.

morning rush hour traffic on the Peace Bridge. Modified Hi-Volume (Hi-Vol) air samplers (General Metal Works, Village of Cleves, OH) were used to collect both gas and particle phase samples at the three sites. The particles were collected on 30 x 20 cm glass fiber filter (GFF; Schleicher and Schuell #25) and gases were collected in polyurethane foam (PUF). The flow rate was calibrated using the anemometer (Airflow Instruments, Evansville, IN) at the beginning and at the end of each sample. The flow rate of the air samplers were approximately $0.69 m^3 min^{-1}$. After collection, all the filters were sealed in ashed aluminum foil and the PUFs were sealed in ashed glass jars and kept frozen and stored in dark at -20°C until analysis.

*3.2.3 Seasonal Sampling (HSPH Samples):* Samples were collected in Winter 2005 (January 9 -18), Summer 2005 (July 18 – 31) and Winter 2006 (January 6 – 20). Samples were collected only during the daytime for 12 hours each day, roughly between 7am and 7pm. Harvard Impactors (HI; Air Diagnostics and Engineering Inc., Harrison, ME) modified with two-stage PUF impaction heads were used to collect both gas and particle phase samples. The particle phase was collected on a Teflon filter (2µm pore size, Gelman Sciences, Ann Arbor, MI) and gases were collected in a glass tube filled with PUF/XAD/PUF (PUF: Thermo Fisher Scientific, Inc., Waltham, MA; XAD: Sigma-Aldrich, St. Louis, MO). The flow rate of the air samplers were approximately 0.017 $m^3 min^{-1}$. Particulate matter up to 2.5 aerodynamic diameter ($PM_{2.5}$) and black carbon (BC) were measured in parallel at all sampling sites by the HSPH group. Wind direction, wind speed, ambient temperature, and percent relative humidity (% RH) were measured at the

Marina site. The traffic count on the Peace Bridge was provided by the Peace Bridge Authority.

## 3.3 Analytical Methods

CBL samples were Soxhlet extracted in the dark with dichloromethane (DCM) for 24 hours. After Soxhlet extraction, samples were concentrated to approximately 10 ml by roto-evaporation (Brinkmann Instruments, Inc., Westbury, NY) and transferred into hexane. Then, extracts were further concentrated to approximately 1ml using a N-Evap Model III (Organomation Association Inc., Berlin, MA).

For HSHP samples, individual Teflon filter and PUF/XAD/PUF for each sample were combined prior to Soxhlet extraction. After Soxhlet extraction, samples were concentrated to approximately 150 ml by roto-evaporation then transferred to Turbo Vap II (Zymark, Hopkinton, MA) and further concentrated to approximately 1ml and exchanged into hexane.

*3.3.1 PAH Analysis:* Extracts were analyzed for 38 PAH compounds using a gas chromatograph and mass spectrometer (GC/MS) in electron ionization (EI) and selective ion monitoring mode. PAH compounds less than molecular weight of 2,3,5-trimethylnaphthalene (MW 188) were not reliably detected in laboratory analysis. Fifty microliters of extract was eluted through a 25m x 0.2mm i.d. x 0.33µm film thickness (DB-5MS; J & W Scientific, Inc. Folson, CA) column equipped with programmed temperature vaporization (PTV) injector. The temperature in the inlet was at 45°C during injection and ramped to 280°C at 700°C/min. The oven temperature was programmed to hold 40°C for 1 min, ramped to 280°C at 10°C /min, then to 310°C at 5°C/min until the end of the run. Each PAH compound was identified based on the retention time of a mixed standard solutions and ion fragmentation. Internal standards consisting of phenanthrene-$d_{10}$, benzo[a]anthracene-$d_{12}$, benzo[a]pyrene-$d_{12}$ and benzo[g,h,i]perylene-$d_{12}$ were added just prior to instrumental analysis. The internal standards and mixed standard solutions were run every 20 samples to determine the relative response factor of each PAH compounds in order to calculate the mass of compounds and to determine the precision of the instrument.

HSHP samples were analyzed with the same instrumental method with different internal standards consisting phenanthrene-$d_{10}$, benzo[a]anthracene-$d_{12}$, perylene-$d_{12}$ and benzo[g,h,i]perylene-$d_{12}$.

*3.3.2 NPAH Analysis:* NPAH analysis was performed as described in Chapter 1. Extracts were analyzed for 19 NPAH compounds using the GC/MS operated in negative ion/chemical ionization (NCI) and selective ion monitoring mode. Each NPAH compound was identified based on the retention time of a mixed standard solution and by ion fragmentation. Internal standards consisting 5-nitroacenaphthene-$d_9$, 2-nitrofluorene-$d_9$, 3-nitrofluoranthene-$d_9$ and 6-nitrochrysene-$d_{11}$ were added to all samples just prior to instrumental analysis.

All CBL and HSPH samples were analyzed for NPAH, except those from Winter 2006 samples (HSPH).

### 3.4 Quality Assurance

*3.4.1 CBL Samples:* Parallel to the samples, 3 field blanks were collected to measure any background contamination due to sampling and analytical equipments. The detection limit of PAH and NPAH compounds were defined as three times the average mass measured in the field blanks. PAH detection limit of an average air sample of 500 $m^3$ (12h) ranged between 0.00006 – 0.02 $ng/m^3$ for GFF and 0.00003 – 0.10 $ng/m^3$ for PUF. NPAH detection limit for an air sample of 500 $m^3$ (12h) ranged between 0.0008 – 0.07 $pg/m^3$ for GFF and 0.001 – 0.14 $pg/m^3$ for PUF. Prior to extraction, 3 deuterated PAH and 3 deuterated NPAH compounds were spiked into all samples (GFF and PUF) as laboratory surrogates. The laboratory surrogate detected compound losses during laboratory procedures and variation in surrogate recoveries reflected the overall method precision. The surrogate recoveries for particle phase PAH were 80% $\pm$ 6% for fluorene-$d_{10}$, 70% $\pm$ 5% for fluoranthene-$d_{10}$ and 67% $\pm$ 6% for perylene-$d_{12}$. Gas phase PAH recoveries were 101% $\pm$ 8% for fluorene-$d_{10}$, 78% $\pm$ 9% for fluoranthene-$d_{10}$ and 69% $\pm$ 7% for perylene-$d_{12}$. The surrogate recoveries for particle phase NPAH compounds were 27% $\pm$ 18% for 1-nitronaphthalene-$d_7$, 35% $\pm$ 14% for 9-nitroanthracene-$d_9$ and 67% $\pm$ 11% for 1-nitropyrene-$d_9$. Gas phase NPAH recoveries were 40% $\pm$ 43% for 1-nitronaphthalene- $d_7$, 30% $\pm$ 14% for 9-nitroanthracene-$d_9$ and 46% $\pm$ 11% for 1-nitropyrene-$d_9$. Due to consistent low recoveries of NPAH surrogates in gas and particle phase, the mass of each sample was corrected based on their surrogate recoveries.

Of the 38 PAH compounds, 37 were detected in either particle or gas phase. Nineteen NPAH compounds were measured and 14 were detected in either particle or gas phase. Total (gas + particle) concentrations of individual compounds were calculated to eliminate the concentration variation due to gas and particle partitioning. For the 6h incremented samples, their weighted average was calculated and total of 12 (6 day and 6 night), 12 hour incremented samples were used to characterize the diurnal differences of PAH and NPAH composition in Buffalo, NY.

*3.4.2 HSHP Samples:* Parallel to the samples, 10 field blanks were collected in each sampling session (Winter 2005, Summer 2005 and Winter 2006) to measure any background contamination during sampling and analysis. The detection limit of total (gas + particle) PAH and NPAH were defined as three times the average mass measured in the field blanks. The detection limit of an average air sample of $11\text{m}^3$ (12h) ranged between 0.002 – 5.6 $\text{ng/m}^3$ for PAH and 0.04 – 3.4 $\text{pg/m}^3$ for NPAH. Prior to field sampling, 4 (2 for winter 2005) deuterated PAH compounds were spiked onto the sampling medium as field surrogate. Two deuterated PAH compounds were spiked into the samples just before extraction as a laboratory surrogate. For NPAH, 3 deuterated NPAH compounds were spiked prior to extraction as laboratory surrogate. The field surrogate was used to detect compound losses during field sampling and laboratory procedures while laboratory surrogate represents the losses in laboratory procedures. The variation in surrogate recoveries reflected the overall method precision. Surrogate recoveries for field surrogates were 51% ± 30% for anthracene-$d_{10}$, 64% ± 32% for fluoranthene-$d_{10}$, 104% ± 18% for benzo[a]pyrene- $d_{12}$ and 89% + 32% for indeno[1,2,3-c,d]pyrene-$d_{12}$. The PAH laboratory surrogate recoveries were 28% ± 49% for fluorene-$d_{10}$ and 64% ± 20% for pyrene-$d_{10}$.

The NPAH surrogate recoveries were 11% ± 55% for 1-nitronaphthalene-$d_7$, 43% ± 17% for 9-nitroanthracene-$d_9$ and 57% ± 15% for 1-nitropyrene-$d_9$. Due to consistent low recoveries of NPAH surrogates, each sample was corrected based on their surrogate recoveries.

Of the 38 PAH compounds, four were detected in all HSPH samples and 19 were measured in more than 85% of the samples. The number of species detected in each sample varied, the percent of PAH detected in each sample ranged between 40 – 90%. For NPAH, 19 compounds were measured and 3 compounds were measured in more than 80% of the samples. The percent of NPAH detected in each sample varied between 0 – 74%. Low detection of NPAH was due to high field blank values in Winter 2005. The field blank values of Winter 2005 was 1 – 8 times higher than Summer 2006. The number of species detected in each sample was less in Winter 2005 compared to the Summer 2005 samples.

*3.4.3 CBL versus HSPH sampling:* Twelve pairs of samples (4 samples at 3 sites) were collected in parallel using the HSPH (HI) and CBL (Hi-vol) samplers. The concentration difference between the parallel samples is summarized in Appendix D. A paired t-test indicated that some of the twelve samples were significantly different between HSPH and CBL (p-value < 0.05). Generally, the ratio of individual compound indicated the lighter molecular weight (MW) PAHs and NPAHs were detected in higher concentration with the HI sampler than in the Hi-vol sampler. XAD resin used in HI has higher collection efficiency for the lighter MW PAHs than the PUF (Chuang et al., 1987). On the other hand, the higher sampling volume of Hi-vol (50 times greater than HI) decreased their method detection limit (MDL), which increased the number of species detected in each sample. The difference in concentration and detection limits between HSPH and CBL were due to differences in sampling medium and volume.

### 3.5 PMF Analysis

Windows – based PMF software developed by EPA (EPA PMF 1.1) is used as a receptor model to solve a least square problem using the measured concentration and concentration uncertainties. PMF solves the following equation:

$$x_{ij} = \sum g_{ik} f_{kj} + e_{ij} \tag{1}$$

where $x_{ij}$ is the concentration of species *j* in sample *i*, $f_{kj}$ is the chemical profiles of *j* species in *k*th factor and $g_{ik}$ is the source contribution of *k*th factor in sample *i*, and $e_{ij}$ is the model generated error of species *j* in sample *i*. This equation is solved to minimize the sum of squares described as:

$$Q=\sum \sum (e_{ij} / s_{ij})^2 \tag{2}$$

where $s_{ij}$ is the input error estimate of species *j* in sample *i* (concentration). EPA PMF 1.1, is set in robust mode to prevent the outliers from influencing the fitting of the contribution and profiles (Eberly, 2005). Species not detected in each sample is replaced by one half of the method detection limit (MDL). The MDL is three times the average mass of analyte in the field blanks divided by sample volume. Error estimates are determined based the equation described by Brinkman et al. (2006):

$$s_{ij} = [(\alpha_i\, x_{ij})^2 + (\beta_i\, DL_i)^2]^{1/2} \qquad (3)$$

where $\alpha_i$ is the measurement uncertainty for species *j* (fraction), $\beta_i$ is the method detection limit uncertainty for species *j* (fraction) and $DL_i$ is the method detection limit for species *j* (concentration). The standard deviation of blank and sample surrogate recovery values are used for $\alpha$ and $\beta$. In this study, equation (3) was modified to incorporate the error associated with GFF and PUF in addition to the error associated with volume measurement in each sample i. The propagation of error was used to modify the equation to:

$$s_{ij} = x_{ij}\ \{[\{s'_{ij} / (GFF_{ij} + PUF_{ij})\}]^2 + (\gamma_i / v_{ij})^2\}^{1/2} \qquad (4)$$

where $s'_{ij}$ is the error estimate of mass (GFF + PUF) for species *j* in sample *i*, $GFF_{ij}$ is the mass measured on the filter for species *j* in sample *i*, $PUF_{ij}$ is the mass measured in the PUF for species *j* in sample *i*, and $\gamma_i$ is the volume measurement uncertainty for species *j* and $v_{ij}$ is the volume of species *j* in sample *i*. The error estimate for values below detection limit was multiplied by a factor of 10 to down weight their influence.

The theoretical optimum Q value equals the number of data points in the concentration data set. The Q value is used as a guide to determine if the model is appropriate for the data and if the uncertainties specified truly reflect the data (Eberly, 2005). The optimum number of sources is a balance between the Q value and the explainable source profile. As the number of sources increases, the calculated Q value decreases (i.e. closer to the theoretical Q value). However, this also increases the number of unexplainable sources. The identity of each PMF factor is determined using their profile and temporal patterns.

### 3.6 Results

*3.6.1 Seasonal trends in Buffalo, NY:* Ambient temperature, wind direction and wind speed were measured at the Marina in parallel with the HSPH sampling. The average temperature during the HSPH sampling in the winter (January 2005 and 2006) ranged between -7°C and 12°C, and the wind direction changed daily between the E, S and W with an average wind speed of 10 km/h. The summer temperature ranged between 20°C and 26°C with relatively consistent SW winds at an average wind speed of 18km/h. The traffic pattern on the Peace Bridge was different between summer and winter (Figure 3.2). Diesel traffic was steady throughout the year with an average of 200 vehicles per hour, but the gasoline traffic doubled from 600 vehicles per hour during the winter to 1200 vehicles per hour in the summer.

The concentration of $PM_{2.5}$ was relatively similar among the sampling sites (Table 3.1). The concentration (geometric mean) ranged between 9 – 11 ug/m$^3$ in the winter and 15 - 18 ug/m$^3$ in the summer. The BC concentration was similar among seasons but the variation among the sampling sites was relatively large. The concentration was 0.6 ug/m$^3$ at the Marina site, 0.9 ug/m$^3$ at the Residential site and 2 ug/m$^3$ at the Highway site. The concentration of BC measured at the Highway site was approximately twice as high as at the Marina and Residential sites.

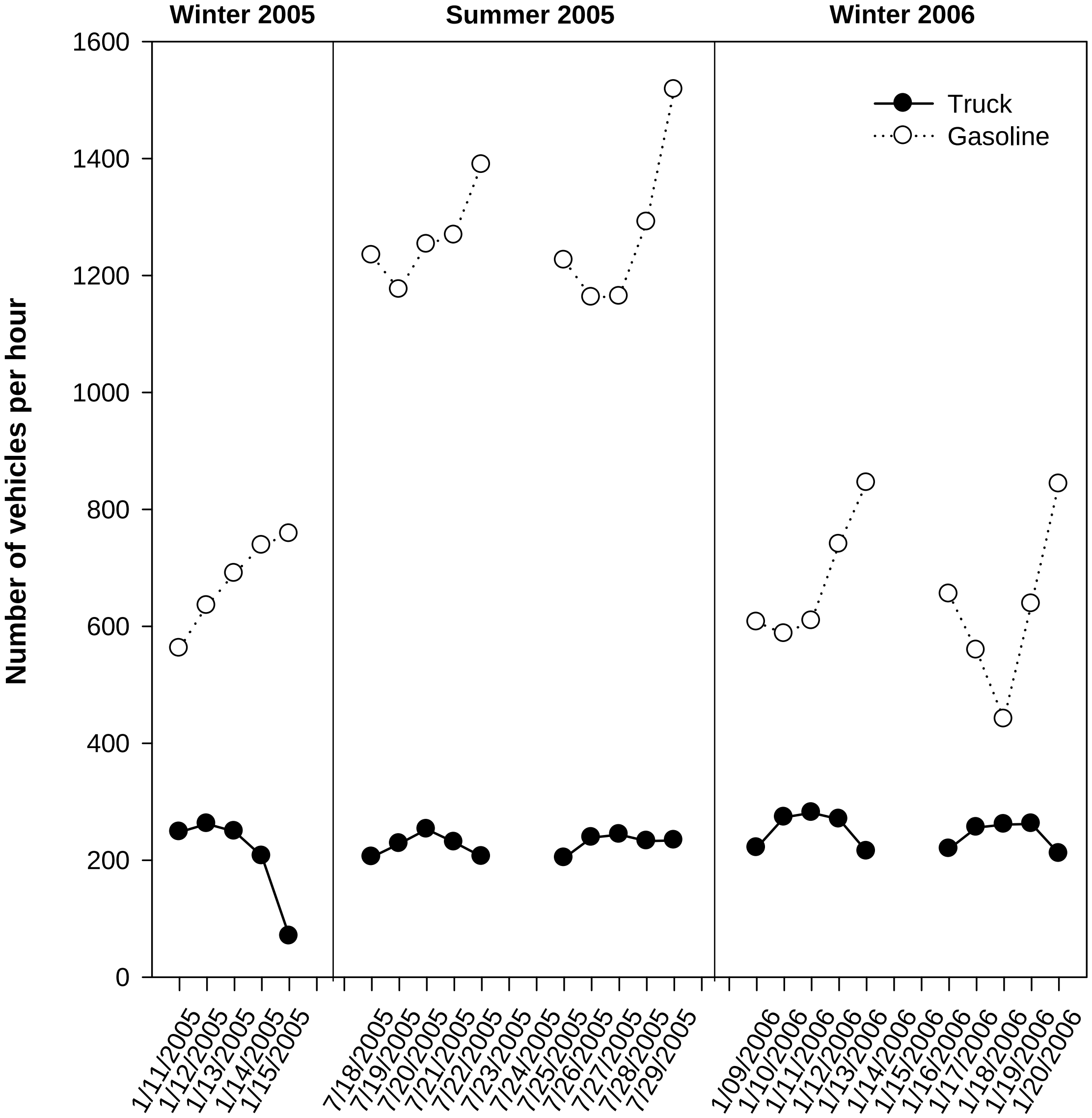


Figure 3.2 Seasonal pattern of vehicle (gasoline and diesel) traffic on the Peace Bridge during Winter 2005, Summer 2005 and Winter 2006.

Table 3.1 PM2.5 and Black Carbon concentration measured at the three sampling sites (Marina, Residential and Highway) during the Winter (2005 and 2006) and Summer (2005)[a].

| PM 2.5 ($ug/m^3$) | Winter | | Summer | |
|---|---|---|---|---|
| | Mean | Range | Mean | Range |
| Marina | 9 | 4 – 16 | 15 | 8 – 44 |
| Residential | 10 | 4 – 18 | 16 | 6 – 62 |
| Highway | 11 | 4 – 21 | 18 | 9 – 56 |
| | | | | |
| **BC ($ug/m^3$)** | Mean | Range | Mean | Range |
| Marina | 0.5 | 0.1 – 2 | 0.6 | 0.1 – 2 |
| Residential | 0.8 | 0.6 – 2 | 0.9 | 0.3 – 1 |
| Highway | 2 | 1 – 3 | 2 | 1 – 3 |

[a] The geometric mean of 15 samples in the winter and 10 samples in the summer (Residential site, 9 samples).

*3.6.2 Seasonal PAH and NPAH concentration:* The number of PAH and NPAH species detected in each HSPH sample varied. Therefore, the concentration of individual PAHs and NPAHs detected in more than 80% and 75% of the samples were used to characterize the seasonal variation and the different concentration among the sampling sites. Three PAHs are described here to show the general trend in Buffalo, NY. Phenanthrene (MW 178) was one of the most abundant compounds, accounting for approximately 40% of the total PAH concentration (Table 3.2). The concentration (geometric mean) in the winter was similar among the sampling sites, which ranged between 2.8 – 3.8 ng/m$^3$. In the summer, the phenanthrene concentration was five times higher at the Marina and Highway sites and 15 times greater at the Residential site than in the winter. Chrysene+triphenylene (MW 228) and benzo[g,h,i]perylene (MW 276) accounted for approximately 1% each of the total PAH concentration. The concentration of chrysene+triphenylene during the winter was similar among the sampling sites which ranged between 0.10 – 0.13 ng/m$^3$. The concentration was similar between the summer and winter at the Marina and Residential sites. However, the concentration at the Residential increased approximately 3 times in the summer than in the winter. The concentration of benzo[g,h,i]perylene was similar among the sampling sites, but the concentration observed in the winter was relatively higher than in the summer. The concentration ranged between 0.13 – 0.19 ng/m$^3$ in the winter and 0.7 – 0.8 ng/m$^3$ in the summer.

The NPAH concentration was measured in the Winter and Summer 2005 (Table 3.3). 9-nitroanthracene was the most abundant compound accounting for approximately 60% of the total concentration during the winter and 2-nitrobiphenyl was the dominant

Table 3.2 PAH[a] (gas + particle) concentration (ng/m$^3$) measured at the three sampling sites (Marina, Residential and Highway) during the Winter (2005 and 2006) and Summer (2005)[b].

| | Marina | | | | Residential | | | | Highway | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Winter | | Summer | | Winter | | Summer | | Winter | | Summer | |
| | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range |
| Fluorene | 1.2 | ND–7.9 | 5.3 | ND–19 | 1.0 | 0.33–10 | 6.0 | 1.8–18 | 1.2 | 0.36–12 | 4.9 | 2.6–10 |
| Phenanthrene | 2.8 | 0.90–38 | 15 | 3.6–59 | 3.7 | 1.4–42 | 57 | 19–118 | 3.6 | 1.1–26 | 16 | 7.9–30 |
| Anthracene | 0.17 | ND–4.4 | 0.93 | 0.27–3.4 | 0.39 | ND–4.8 | 3.8 | 1.1–10 | 0.27 | ND–2.9 | 1.2 | 0.65–2.7 |
| 2-MethylDBT | 0.15 | 0.073–0.90 | 0.33 | 0.14–0.95 | 0.18 | ND–1.5 | 0.65 | 0.28–1.4 | 0.20 | ND–0.68 | 0.53 | 0.35–1.1 |
| 4-MethylDBT | 0.10 | 0.50–0.62 | 0.23 | 0.10–0.70 | 0.12 | ND–0.90 | 0.51 | 0.23–0.98 | 0.12 | ND–0.45 | 0.32 | 0.21–0.67 |
| 2-MethylPh | 0.65 | 0.13–6.7 | 0.99 | 0.40–2.7 | 0.67 | ND–9.6 | 3.1 | 1.3–6.9 | 0.77 | ND–9.5 | 1.7 | 1.2–3.0 |
| 2-MethylAnth | 0.48 | 0.21–2.6 | 1.4 | 0.64–3.4 | 0.58 | ND–2.9 | 4.3 | 1.9–8.7 | 0.72 | ND–2.4 | 2.4 | 1.6–4.1 |
| 1-MethylAnth | 0.20 | ND–1.2 | 0.54 | 0.25–1.4 | 0.22 | ND–1.3 | 1.4 | 0.67–3.0 | 0.28 | ND–1.1 | 1.0 | 0.75–1.8 |
| 1-MethylPh | 0.16 | 0.071–0.86 | 0.47 | 0.21 –1.2 | 0.18 | ND–0.93 | 1.3 | 0.62–2.9 | 0.23 | ND–0.75 | 0.79 | 0.52–1.3 |
| 9,10-DimethylAnth | 0.59 | ND–0.21 | 0.11 | 0.062–0.24 | 0.054 | ND–0.20 | 0.24 | 0.13–0.41 | 0.072 | ND–0.20 | 0.23 | 0.19–0.36 |
| Fluoranthene | 0.53 | ND–2.1 | 6.1 | 3.1–18 | 0.85 | 0.40–2.1 | 28 | 13–61 | 0.74 | 0.35–1.9 | 5.7 | 2.1–23 |
| Pyrene | 0.38 | 0.20–1.4 | 2.9 | 1.6–7.5 | 0.57 | 0.29–1.3 | 11 | 5.3–24 | 0.56 | 0.26–0.4 | 2.8 | 1.3–9.6 |
| Benzo[a]F | 0.032 | ND–0.11 | 0.072 | 0.040–0.14 | 0.038 | 0.016–0.11 | 0.15 | 0.086–0.29 | 0.042 | 0.017–0.11 | 0.075 | 0.048–0.13 |
| Benzo[b]F | 0.024 | 0.0085–0.072 | 0.053 | 0.035–0.090 | 0.033 | 0.015–0.034 | 0.10 | 0.060–0.17 | 0.036 | 0.013–0.075 | 0.060 | 0.033–0.10 |
| Chry+Triphyl | 0.10 | 0.030-0.31 | 0.089 | 0.042–0.18 | 0.13 | 0.056–0.32 | 0.32 | 0.18–0.65 | 0.13 | 0.039–0.30 | 0.11 | 0.054–0.17 |
| B[b]FL | 0.059 | 0.0094-0.38 | 0.067 | ND–0.12 | 0.078 | 0.020–0.36 | 0.089 | ND–0.21 | 0.077 | 0.014–0.37 | 0.075 | ND–0.20 |
| B[g,h,i]P | 0.13 | ND–0.51 | 0.073 | ND–0.19 | 0.18 | 0.072–0.50 | 0.073 | ND–0.19 | 0.19 | 0.044–0.58 | 0.084 | 0.048–0.35 |

[a] PAH compounds measured in more than 80% of samples. Geometric mean of 15 samples in the winter and 10 samples in the summer (Residential site, 9 samples).

[b] Compound abbreviations are DBT. (dibenzothiophene), Ph. (Phenanthrene), Anth. (Anthracene), F.(fluorene), Chry+Triphyl. (chyrene+triphenylene), B[b]FL. (benzo[b]fluoranthene), B[g,h,i]P.(Benzo[g,h,i]perylene. ND, not detected.

Table 3.3 NPAH[a] (gas + particle) concentration (pg/m$^3$) measured at the three sampling sites (Marina, Residential and Highway) during the Winter (2005 and 2006) and Summer (2005)[b].

| | Marina | | | | Residential | | | | Highway | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Winter | | Summer | | Winter | | Summer | | Winter | | Summer | |
| | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range | Mean | Range |
| 1-NN | 4.5 | 1.7 – 9.5 | 35 | ND – 61 | 4.1 | 1.3 – 8.3 | 62 | 41 – 96 | 4.7 | 1.6 – 9.2 | 65 | 44 – 93 |
| 2-NN | 3.3 | ND – 5.4 | 33 | ND – 57 | 4.1 | ND – 4.1 | 65 | 42 – 102 | 5.0 | 4.5 – 5.6 | 58 | 34 – 85 |
| 2-NBiphenyl | 4.7 | ND – 11 | 64 | 13 – 144 | 7.1 | ND – 12 | 196 | 107 – 307 | 6.1 | ND – 9.3 | 65 | 21 - 178 |
| 3-NBiphenyl | 1.3 | ND – 1.5 | 13 | 8 – 27 | 2.3 | ND – 2.3 | 20 | 12 – 39 | 1.5 | 1.4 – 1.8 | 20 | 12 - 54 |
| 9-NAnth | 18 | 7.4 – 46 | 40 | 23 – 132 | 14 | 5.5 – 41 | 55 | 41 – 84 | 23 | 16 – 35 | 45 | 14 – 137 |
| 2-NFL | 3.6 | 3.3 – 4.2 | 4.9 | 2.2 – 7.8 | 1.3 | 1.1 – 1.6 | 13 | 7.9 – 24 | 2.3 | 1.0 – 4.0 | 7.5 | 3.3 -14 |

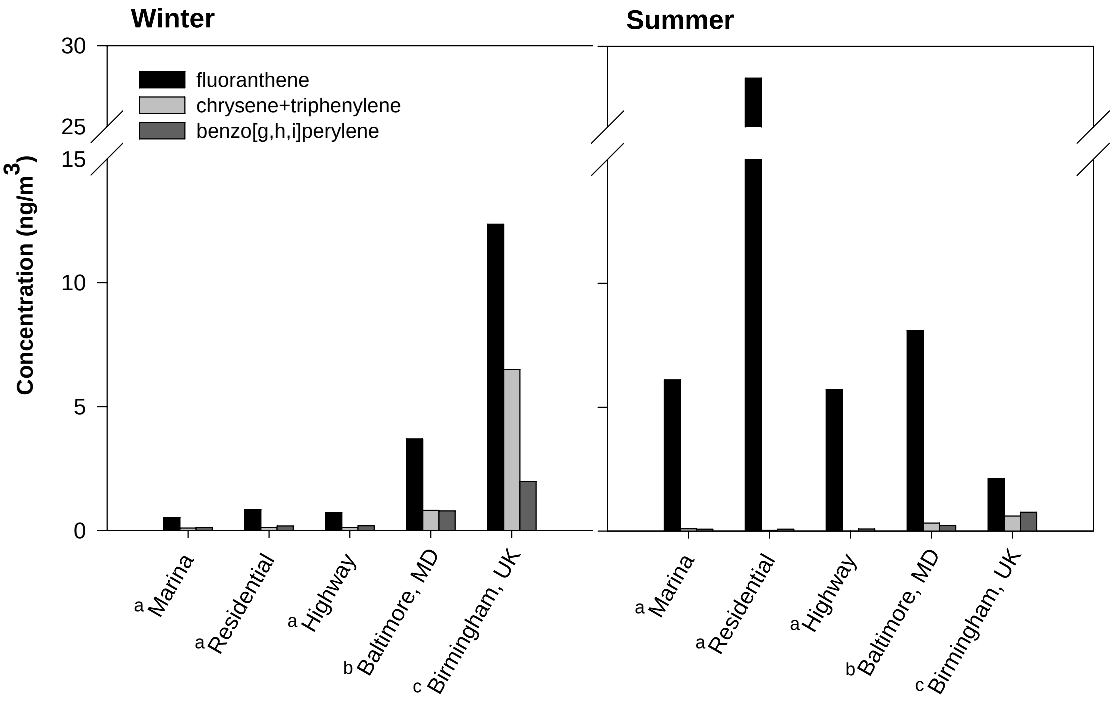
[a] NPAH compounds measured in more than 75% of samples. Geometric mean of 5 samples in the winter and 10 samples in the summer (Residential site, 9 samples).

[b] Compound abbreviations are 1-NN. (1-nitronaphthalene), 2-NN. (2-nitronaphthalene), Anth. (Anthracene), FL (Fluoranthene). ND, not detected.

compound [40%] in the summer. Generally, the concentration of NPAHs was higher in the summer than in the winter and the concentration was variable among the sampling sites during the summer. For example, the concentration of 1-nitronaphthalene in the winter ranged between 4 – 5 pg/m$^3$ among the sampling sites, but during the summer the concentrations at the Residential [96 pg/m$^3$] and Highway [93 pg/m$^3$] sites were approximately three times greater than at the Marina [35 pg/m$^3$] site.

The PAH and NPAH concentrations measured in Buffalo, NY were compared with those collected in two other cites during the summer and winter (Figure 3.3). The concentration measured in the winter at Buffalo, NY was an order of magnitude less than the concentration measured in Birmingham, U.K. (Harrison et al., 1996) and in Baltimore, MD (Crimmins, 2006). In the summer, concentrations measured in Buffalo, NY were similar to those reported in Baltimore, MD. The concentration of fluoranthene at the Residential site during the summer was approximately 3 fold higher than in either Baltimore, MD or Birmingham, U.K. Seasonal patterns varied among locations. The PAH concentration was higher during the winter than in the summer in Birmingham, U.K. In Baltimore, MD, the volatile PAHs (ex. fluoranthene) had a higher concentration during the summer and the semi-volatile PAHs (ex. benzo[a]pyrene and benzo[g,h,i]perylene) were more abundant in the winter, which was a similar trend to that in Buffalo, NY. The PAH concentration measured in Buffalo, NY was within the range of other urban areas. The seasonal pattern was different among locations, possibly due to different meteorology.

For NPAHs, the concentration of 9-nitroanthracene in Buffalo, NY was comparable to those in Los Angeles and Riverside, CA, (Reisen et al., 2005) but the



[a]This study. Mean of 15 samples measured in January 2005 and 2006. Mean of 10 samples (9 at the Residential site) measured in July 2005.

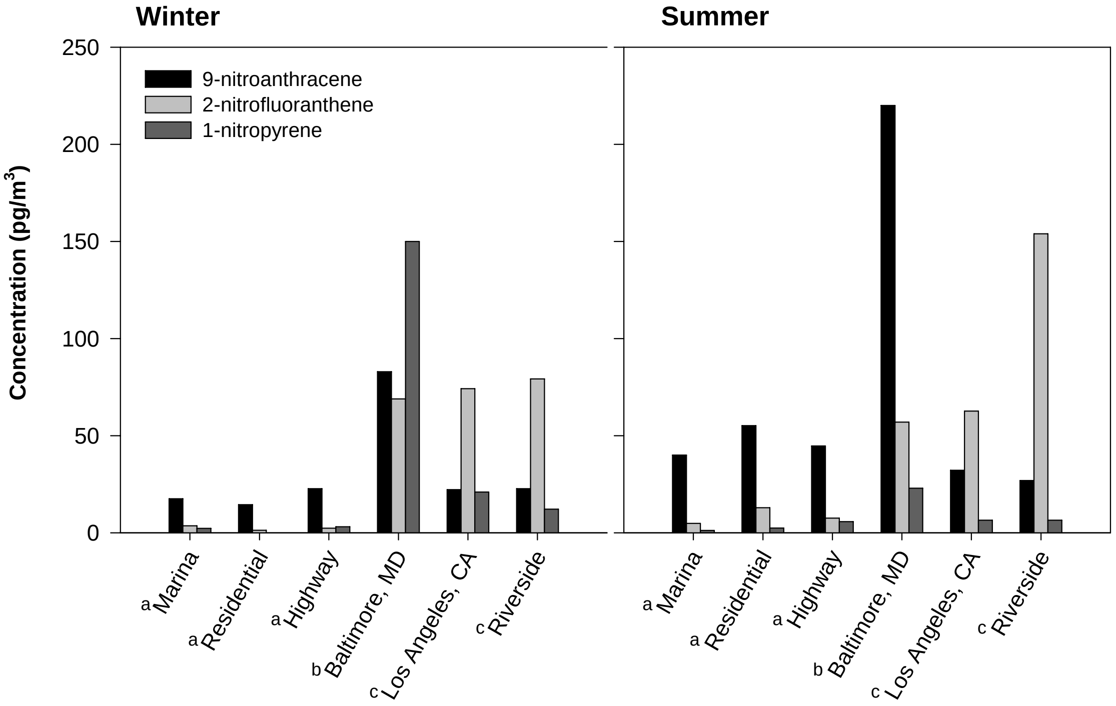
[b]Geometric mean, Summer 2002 and Winter 2003 in Baltimore, MD (Crimmins, 2006)

[c]Mean of 55 samples collected, Febuary and August in Birmingham, U.K. (Harrison et al., 1996)

Figure 3.3 Comparison of selected PAHs (ng/m$^3$) measured at the three sampling sites (Marina, Residential and Highway) during the Summer (2005) and Winter (2005 and 2006), and those reported in other locations.

concentration of 2-nitrofluoranthene and 1-nitropyrene was 10 – 100 times less during both, summer and winter (Figure 3.4). The seasonal patterns of NPAHs were different among locations. The concentration of 2-nitrofluoranthene in Riverside, CA was twice as high during the summer than in the witner. In Baltimore, MD (Crimmins, 2006) the 9-nitroanthracene was 3 times greater in the summer and 1-nitropyrene in the winter was 7 fold above the concentration measured in the summer. In Buffalo, NY, concentration of all of the NPAHs was higher during the summer. The NPAH concentrations in Buffalo, NY, were relatively lower than those in other urban areas, which could be due to less production of secondary NPAHs (e.g. 2-nitrofluoranthene) in the atmosphere and less combustion sources which emit primary NPAHs (e.g. 1-nitropyrene).

*3.6.3 Diurnal PAH and NPAH concentration:* The diurnal variations in PAH and NPAH concentrations in Buffalo, NY during Summer 2005 (July 20 – 26th) are summarized in Table 3.4. Generally, the total PAH concentration was higher during the day and NPAH was elevated at night at all of the sites. The total PAH concentration varied between sampling sites with the Residential site having the highest concentration [70 ng/m$^3$], then the Highway site [31 ng/m$^3$] and the Marina site [15 ng/m$^3$]. Figure 3.5 shows a unique diurnal pattern of PAHs at the Residential site, where the concentration was higher during the day. No diurnal trend was observed at the Marina and Highway site. Similarly, the highest NPAH concentrations were measured at the Residential site [280 pg/m$^3$] and the Highway site [180 pg/m$^3$] had a higher concentration than the Marina site [71 pg/m$^3$]. NPAH showed a strong diurnal pattern with a higher concentration during the night. These patterns were relatively consistent among sampling sites and the nighttime



[a]This study. Mean of 5 samples measured in January 2005. Mean of 10 samples (9 at the Residential site) measured in July 2005.

[b]Geometric mean, Summer 2002 and Winter 2003 in Baltimore, MD (Crimmins, 2006)

[c]Average of 5 day sampling at 4 time intervals, August 2002 and January 2003 in Los Angeles and Riverside, CA (Reisen et al., 2005)

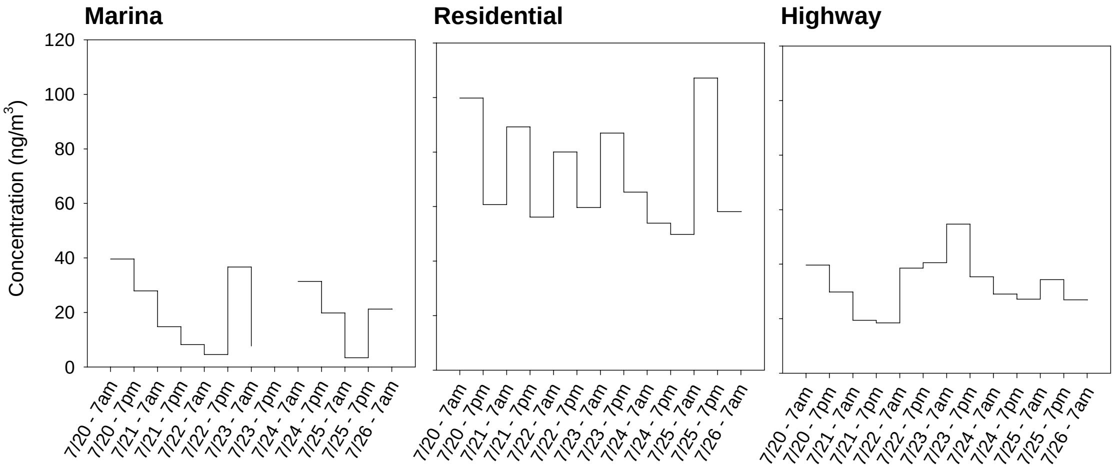
Figure 3.4 Comparison of selected NPAHs (pg/m$^3$) measured at the three sampling sites (Marina, Residential and Highway) during the summer (2005) and winter (2005 and 2006), and those reported in other locations.

Table 3.4 Total PAH and NPAH concentration measured at the three sampling sites (Marina, Residential and Highway) during July 2004[a].

| | **Day** | | **Night** | |
|---|---|---|---|---|
| **PAH ($ng/m^3$)** | Mean | Range | Mean | Range |
| Marina | 11 | 3 – 40 | 20 | 8 – 37 |
| Residential | 84 | 54 – 107 | 58 | 50 – 65 |
| Highway | 34 | 19 – 55 | 29 | 18 – 40 |
| | | | | |
| **NPAH ($pg/m^3$)** | Mean | Range | Mean | Range |
| Marina | 47 | 19 – 89 | 117 | 45 – 299 |
| Residential | 192 | 169 – 226 | 417 | 145 – 833 |
| Highway | 134 | 77 – 200 | 233 | 81 – 577 |

[a] The geometric mean of 6 samples (Marina site, 5 samples for Night).

PAH Concentration



NPAH Concentration

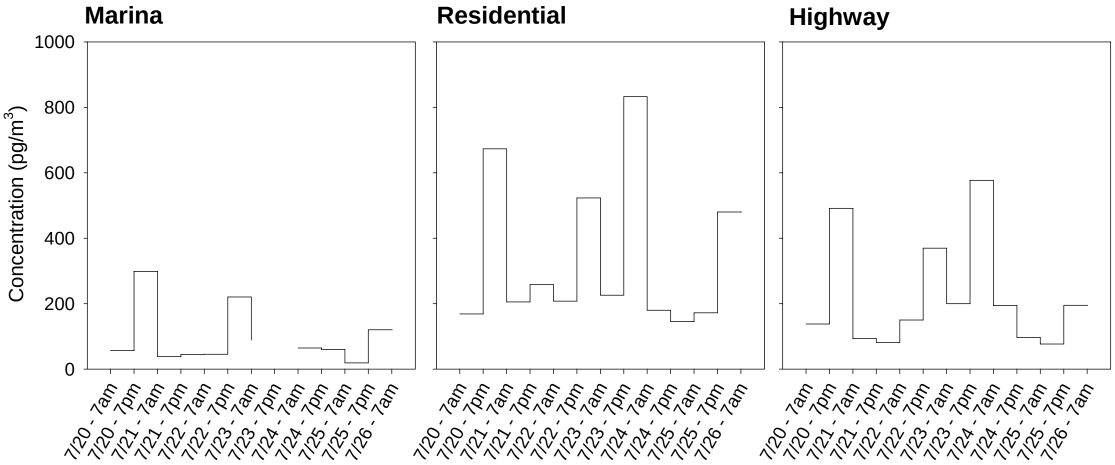


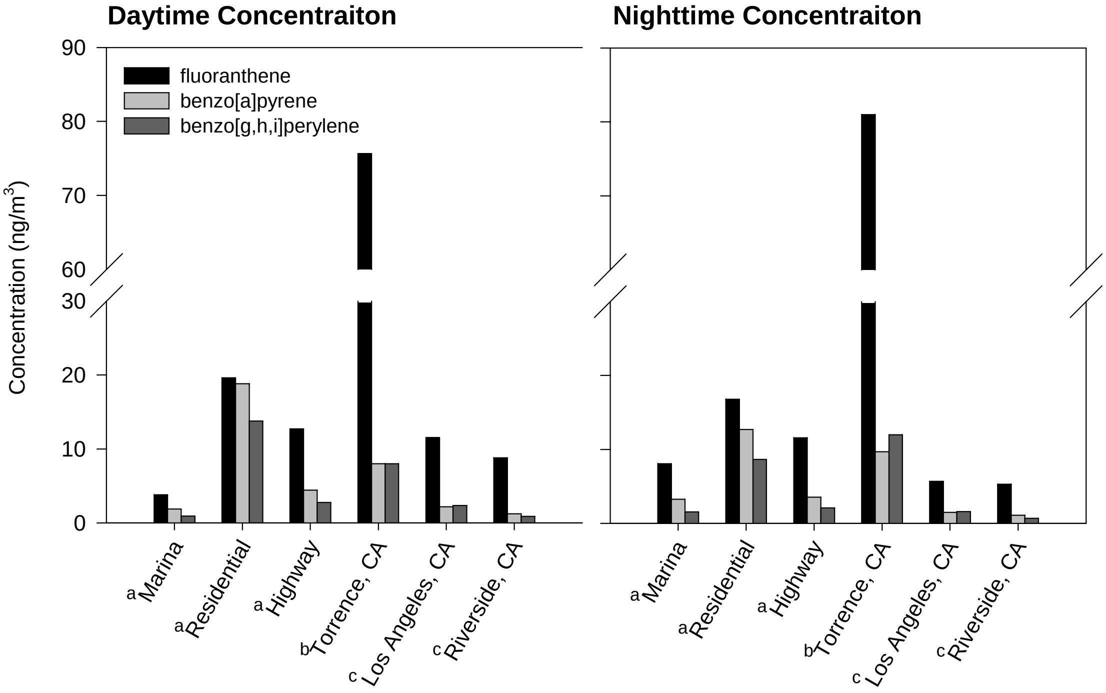
Figure 3.5 Diurnal pattern of total PAH and NPAH concentration at the three sampling sites (Marina, Residential and Highway) during July 2005.

concentration was twice as high as that in the daytime.

The concentrations measured in Buffalo, NY were compared with other studies which characterized the diurnal differences. In general, the individual PAH concentration did not change dramatically between day and night at any location (Figure 3.6). The day and night PAH concentration measured in the Highway and Marina sites were comparable with those measured in Los Angeles and Riverside, CA (Reisen et al., 2005). The concentration of benzo[a]pyrene and benzo[g,h,i]perylene at the Residential site was similar to that in Torrance, CA (Arey et al., 1987). The concentration of NPAHs was typically higher at night, but this resulted from different species at different locations (Figure 3.7). In Buffalo, NY, the concentration of 9-nitroanthracene increased 3 – 7 fold at night and in Riverside, CA, the concentration of 2-nitrofluoranthene was 2 times greater at night (Reisen et al., 2005). The concentration of 1-nitropyrene did not change between day and night at any locations. The higher NPAH concentration during the night could be due to production via gas phase reaction with $NO_3$ radicals, to a lower atmospheric boundary layer, or to less photodegradation.

## 3.7 Discussion

*3.7.1 Seasonal sources of PAHs and NPAHs to the Buffalo, NY atmosphere:* PMF was performed on the seasonal PAH data collected by HSPH. The analysis was applied separately among the sampling sites to characterize the different sources to each site. With a relatively high percentage of non detected species in the HSPH samples, species detected in less than 80% of the samples were removed from the analysis. Seventeen PAHs were used and with an additional 2% uncertainty error was added to achieve a

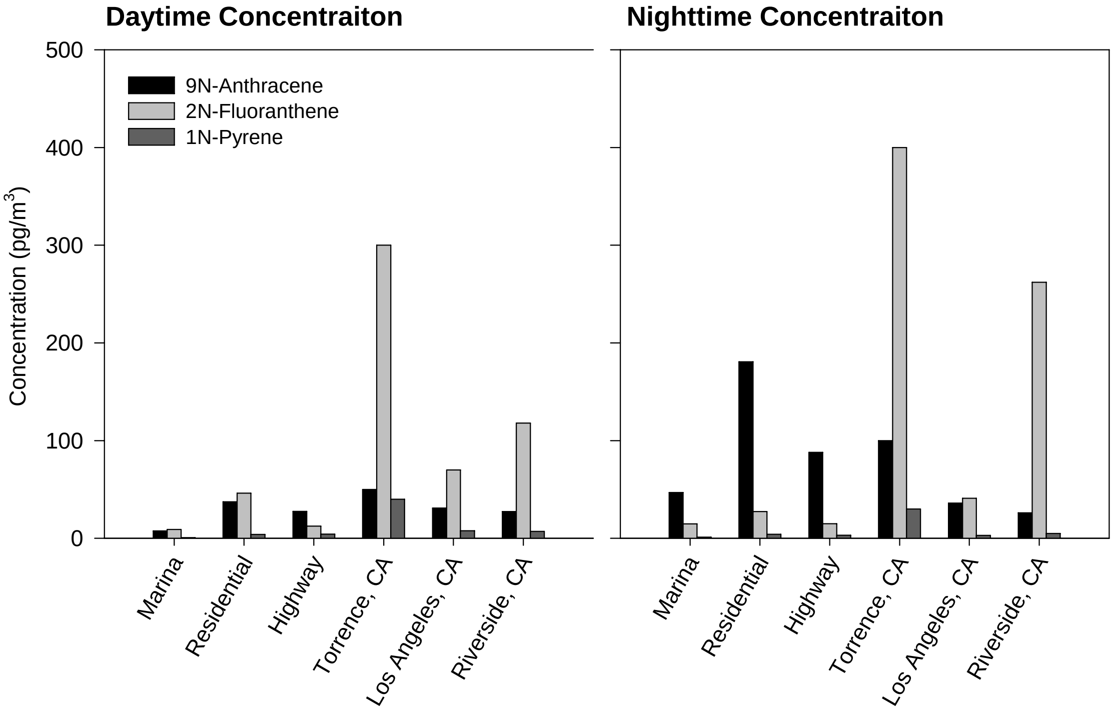


[a]This study. Mean of 4 samples measured during the daytime (7am - 7pm) in July 2004. Mean of 4 samples measured at nighttime (7pm - 7am) in July 2004.

[b]Torrance is 20km south of central Los Angeles; Mean of 6 filter samples, collected during a photochemical smog episode. Daytime (6am - 6pm) and nighttime (6pm - 6am) in Feb. 1986 (Arey et al., 1987)

[c]Average of 5 day sampling at 4 time intervals; daytime samples (7am - 6:30pm) and night samples (7pm - 6:30am) during August 2002 in Los Angeles and Riverside, CA (Reisen et al., 2005).

Figure 3.6 Comparison of selected PAHs (ng/m$^3$) measured at the three sampling sites (Marina, Residential and Highway) during the daytime and nighttime in July 2004 and those reported in California.



[a] This study. Mean of 4 samples measured during the daytime (7am - 7pm) in July 2004. Mean of 4 samples measured at nighttime (7pm - 7am) in July 2004.

[b] Torrance is 20km south of central Los Angeles; Mean of 6 filter samples, collected during a photochemical smog episode. Daytime (6am - 6pm) and nighttime (6pm - 6am) in Feb. 1986 (Arey et al., 1987)

[c] Average of 5 day sampling at 4 time intervals; daytime samples (7am - 6:30pm) and night samples (7pm - 6:30am) during August 2002 in Los Angeles and Riverside, CA (Reisen et al., 2005).

Figure 3.7 Comparison of selected NPAHs (pg/m$^3$) measured at the three sampling sites (Marina, Residential and Highway) during the daytime and nighttime in July 2004 and those reported in California.

realistic Q value. The optimum number of sources for the HSPH data in each site appeared to be two or three. The Marina was characterized by two factors, but Highway and Residential needed three factors to sufficiently characterize their sources.

*3.7.1.1 Two source PMF analysis of seasonal PAH data:* The two PAH profiles resolved by PMF were similar for the Marina, Residential and Highway sites. One of the sources is predominantly loaded with lighter MW PAHs (Light profile; Figure 3.8) and the other source is enriched with heavier MW PAHs (Heavy; Figure 3.9). The temporal patterns of the Light and Heavy profiles are consistent among the sampling sites (Figure 3.10 and 11). The Light profile is highly abundant during the summer and Heavy profile is the dominant PAH source in the winter. The two sources resolved by PMF characterize the summer and winter profiles common among the sampling sites.

*3.7.1.2 Three source PMF analysis of seasonal PAH data:* In the three source PMF analysis a Medium profile was resolved in addition to the Light and Heavy profiles (Figure 3.12-14). The Light and Heavy profiles resolved from the Marina, Residential and Highway sites were relatively similar, but the Medium profile varied among the sampling sites. As in the two source PMF analysis, the Light profile is dominated with lighter MW PAHs, especially with phenanthrene and fluorene. The Heavy profile contains phenanthrene, fluoranthene and pyrene in addition to the heavier PAHs, such as chrysene+triphenylene, benzo[b]fluoranthene and benzo[g,h,i]perylene. The Medium profiles differ among the sampling sites, but are all enriched with methylated PAHs. The profile pattern from the Residential and Highway sites are similar, but the abundance of

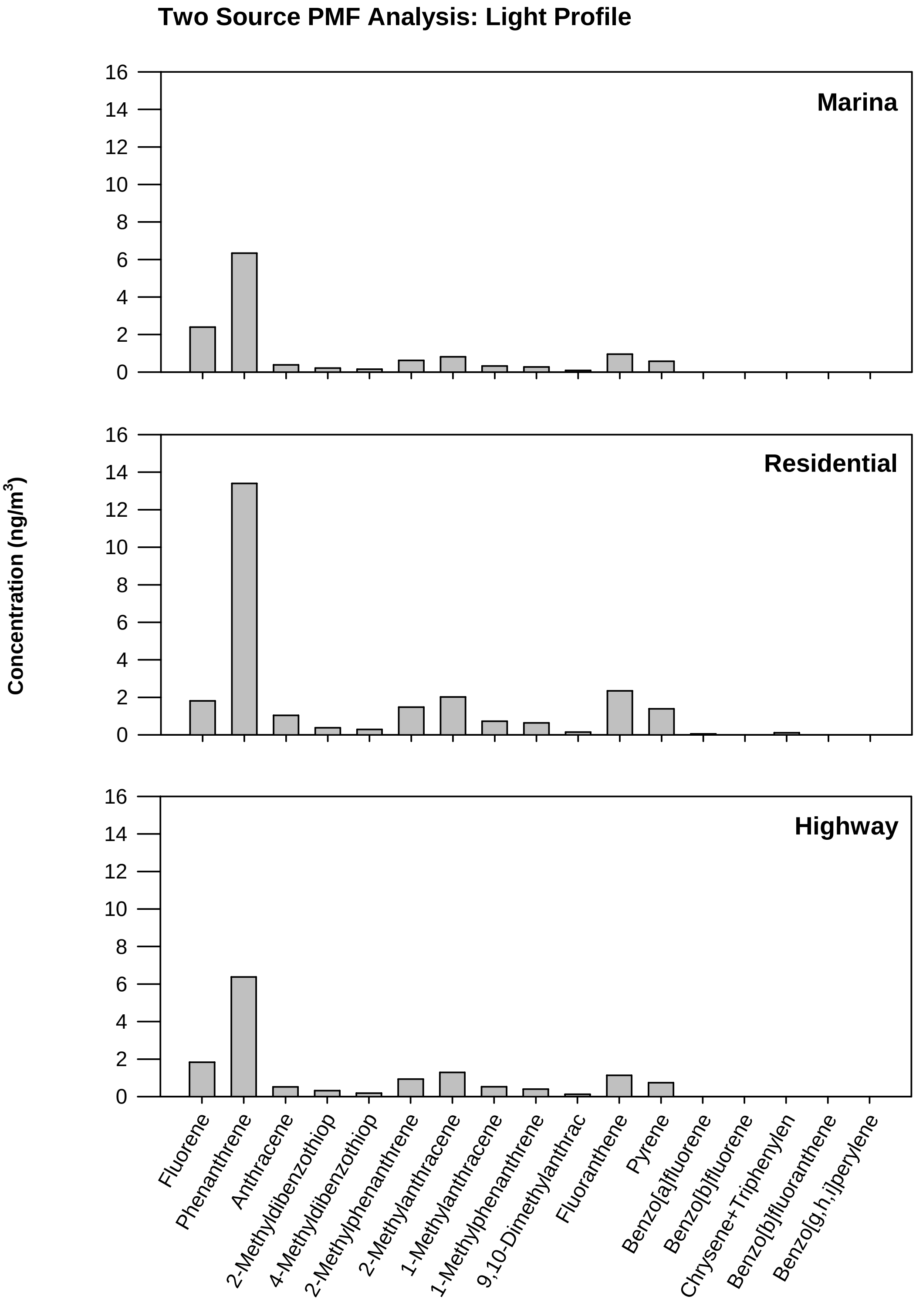


Figure 3.8 Light profile resolved by two source PMF analysis of seasonal PAH data. Samples were collected by HSPH during January 2005, July 2005 and January 2005.

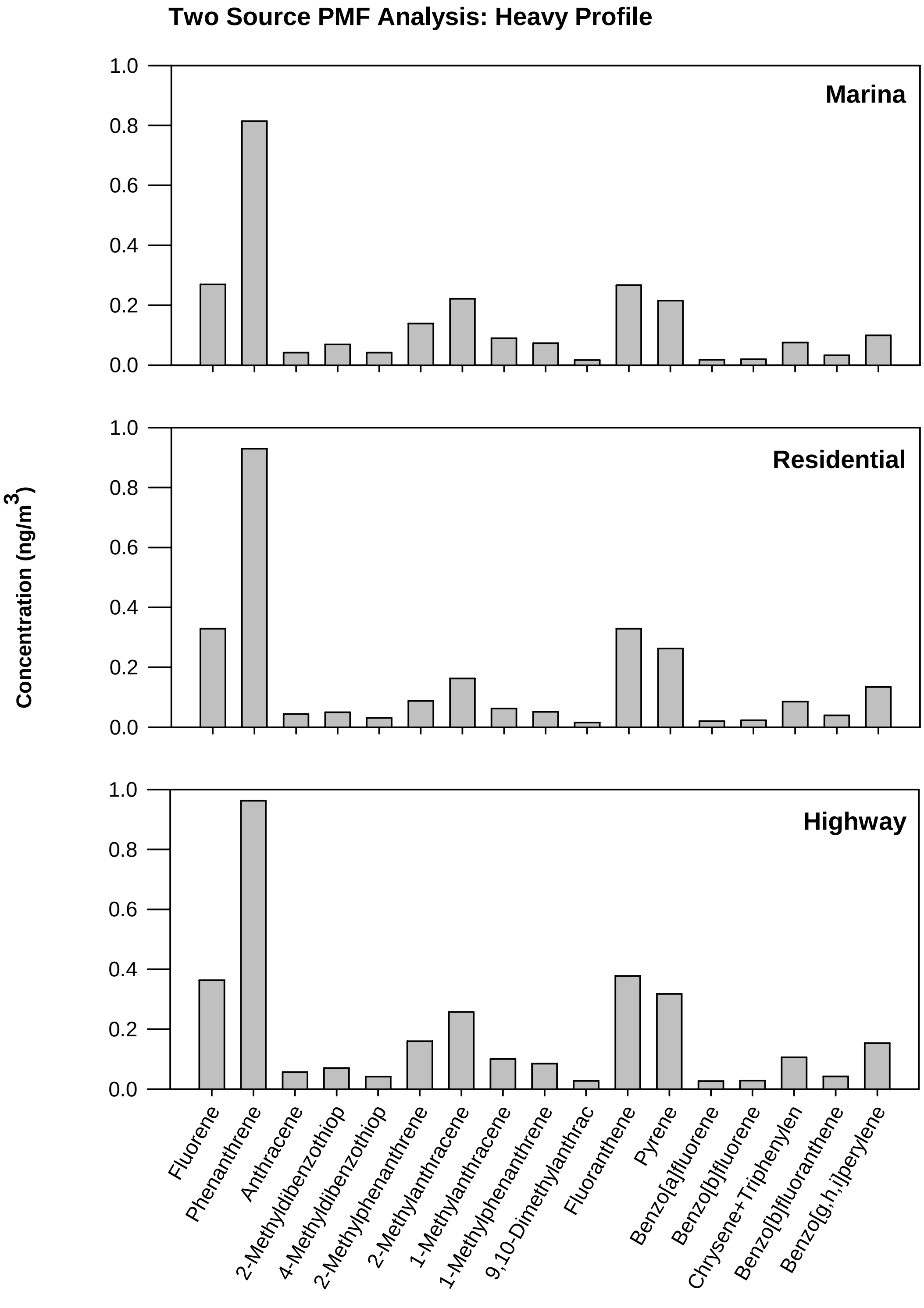


Figure 3.9 Heavy profile resolved by two source PMF analysis of seasonal PAH data. Samples were collected by HSPH during January 2005, July 2005 and January 2005.

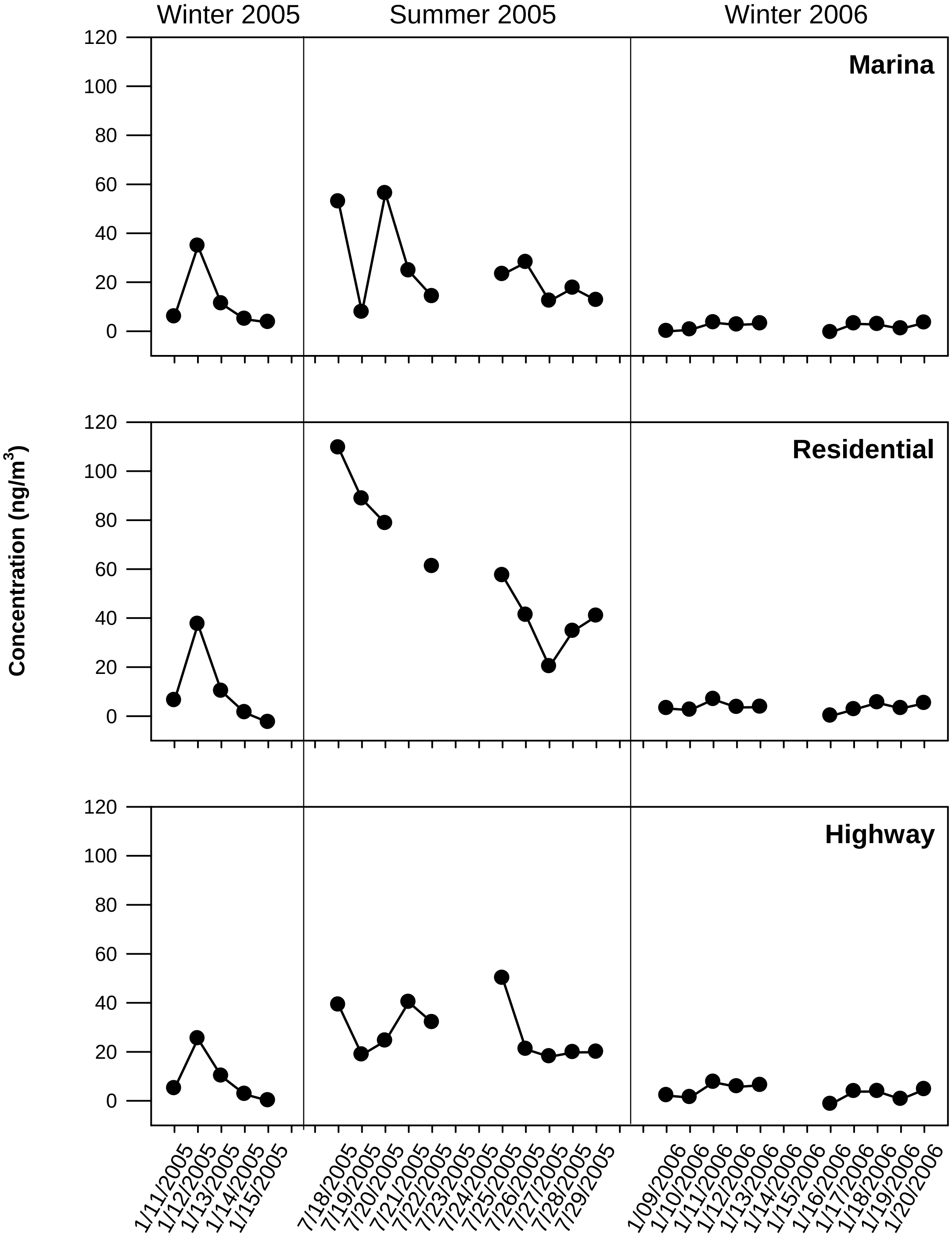


Figure 3.10 Temporal pattern of the Light profile resolved by two source PMF analysis.

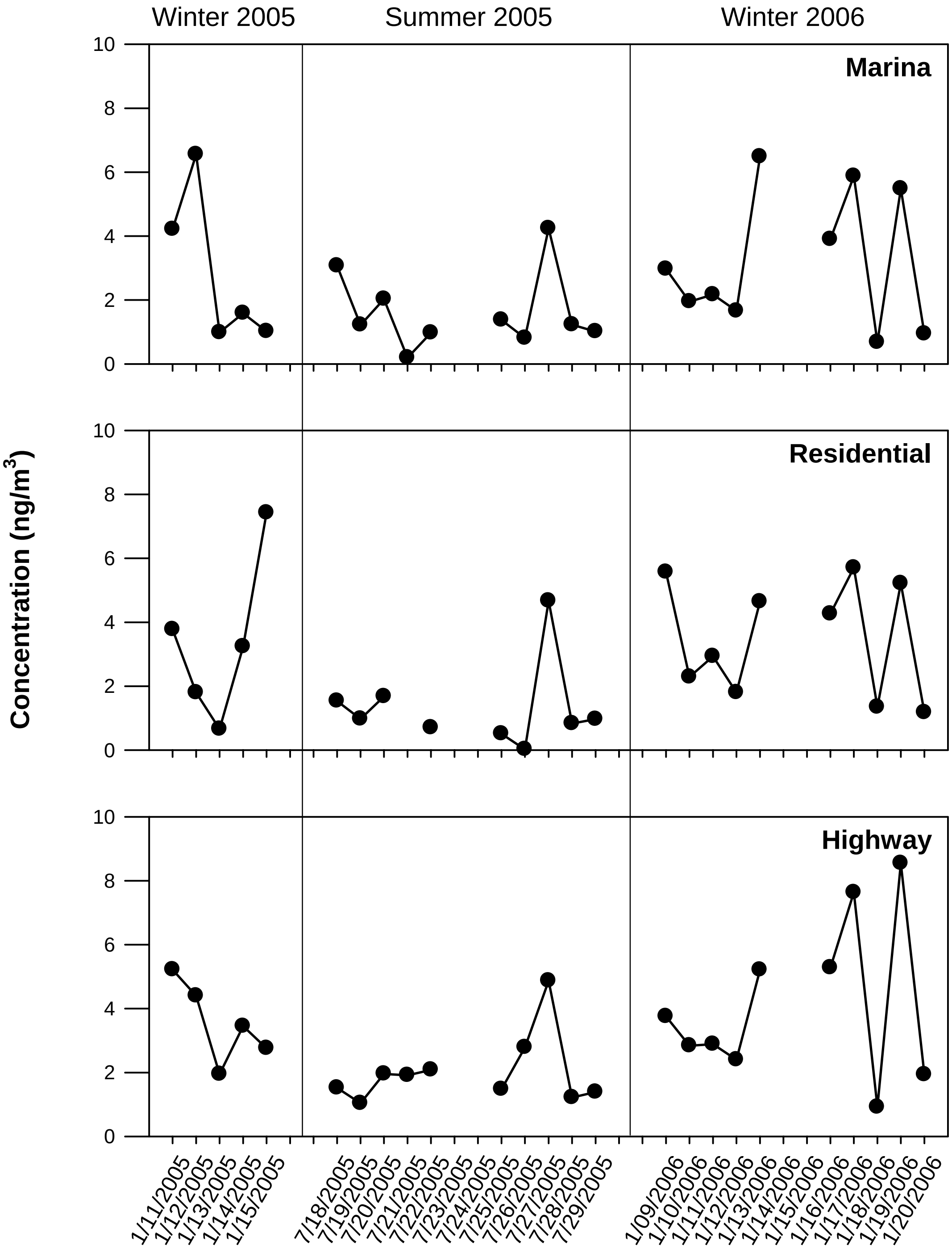


Figure 3.11 Temporal pattern of the Heavy profile resolved by two source PMF analysis.

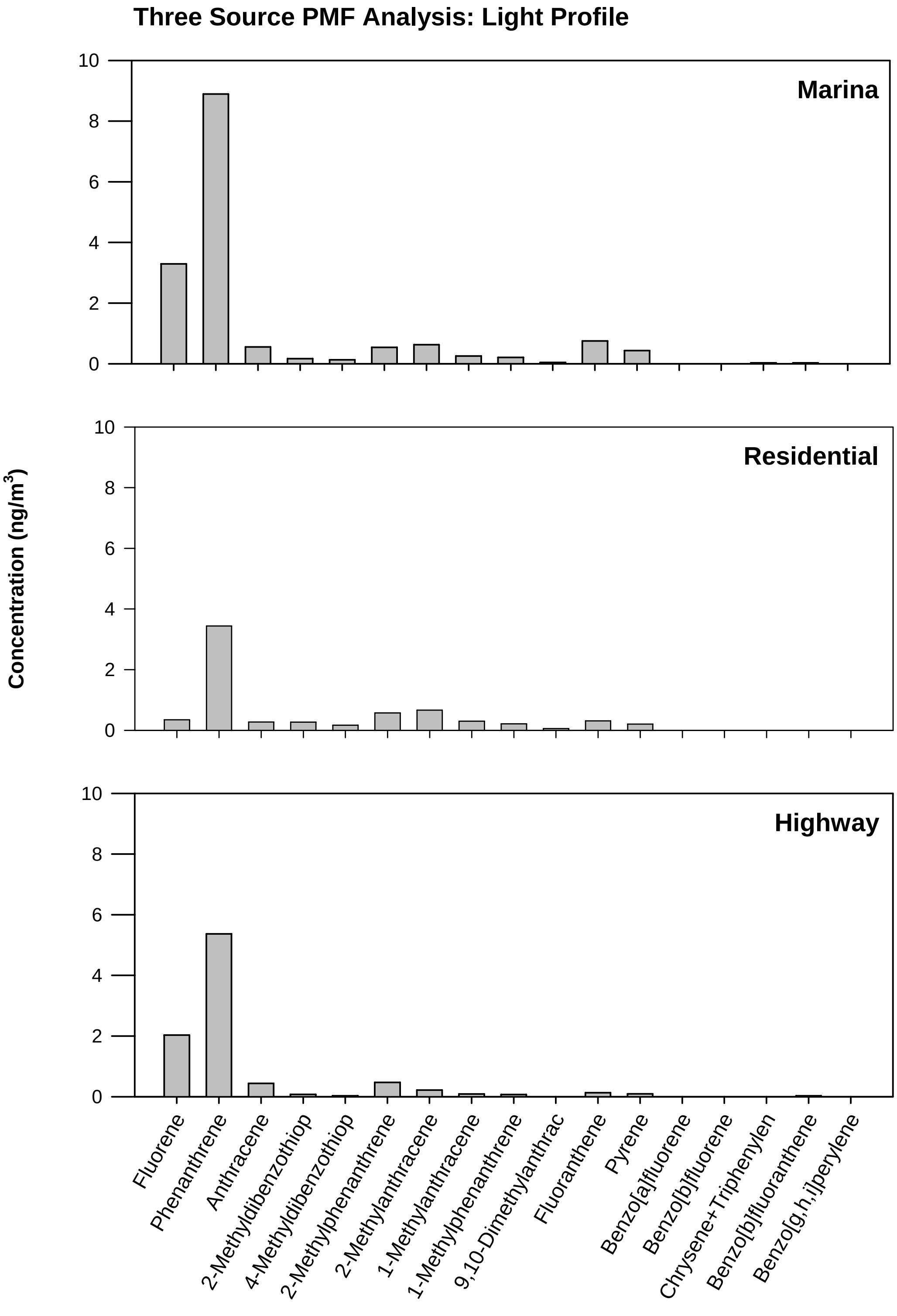


Figure 3.12 Light profile resolved by three source PMF analysis of seasonal PAH data. Samples were collected by HSPH during January 2005, July 2005 and January 2005.

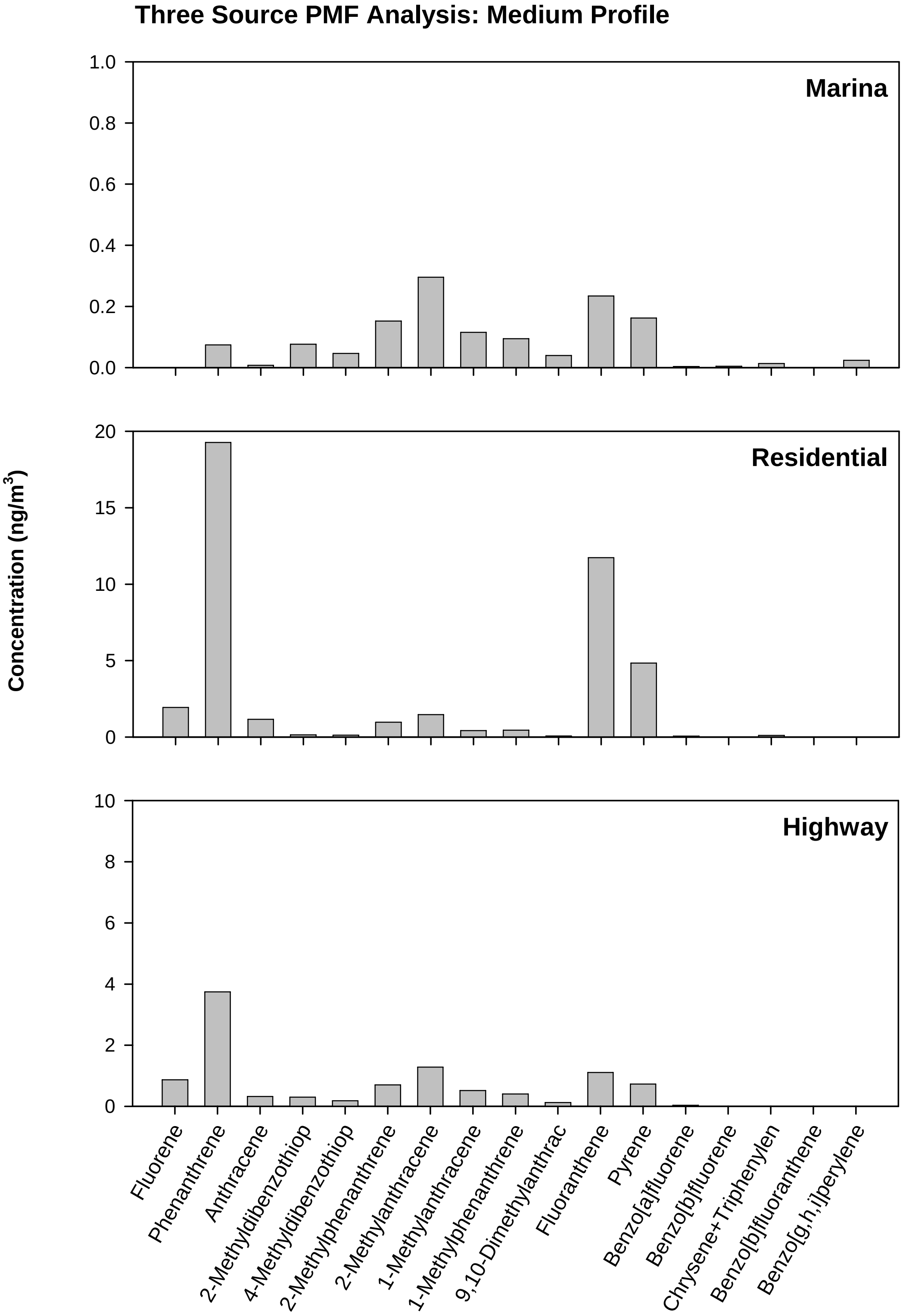


Figure 3.13 Medium profile resolved by three source PMF analysis of seasonal PAH data. Samples were collected by HSPH during January 2005, July 2005 and January 2005. Note scale difference between each profile.

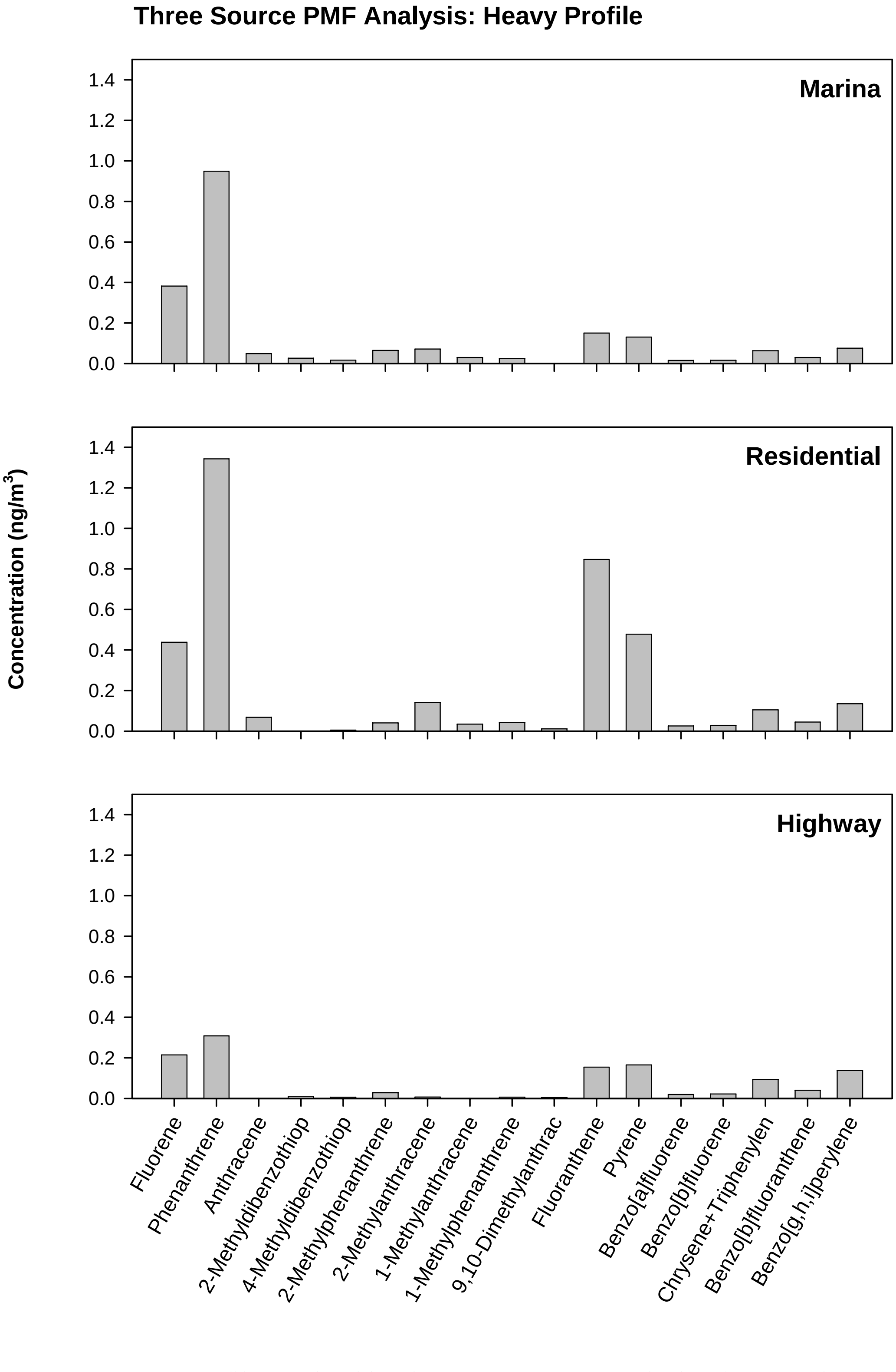


Figure 3.14 Heavy profile resolved by three source PMF analysis of seasonal PAH data. Samples were collected by HSPH during January 2005, July 2005 and January 2005.

individual species was approximately four times greater at the Residential site.

The temporal pattern showed a higher abundance of Light profile in the Marina site compared to the Residential and Highway sites (Figure 3.15-17). In all of the sampling sites, the Light profile had a higher concentration during the summer than in the winter. The correlation between ambient temperature and the PAH concentration indicated the lighter MW PAHs were positively correlated with warmer temperature ($p$ value $< 0.01$). This suggested the higher concentration of lighter MW PAHs in the summer was due to volatilization.

The Medium profile was not prevalent in Marina, but was a dominant source in the Residential and Highway sites during the summer. The concentration of the Medium profile at the Residential site was approximately 5 times greater than at the Highway site. As in the Light profile, the Medium profile is characterized by lighter MW PAHs and was highly abundant in the summer. The Medium profile is enriched with methylated PAHs and was highly abundant in the Residential site. Therefore, volatilization from surface material near the Residential site is a possible PAH source.

The Heavy profile is relatively abundant in the winter at all of the sites. A negative correlation is observed between the ambient temperature and the concentration of heavier MW PAHs ($p$ value $< 0.05$). The heavier MW PAHs are common tracers of combustion sources (Greenberg et al., 1981; Rogge et al., 1993c; Miguel et al., 1998; Kado et al., 2000; Kavouras et al., 2001). As seen in Figure 3.2, the number of vehicles on the Peace Bridge in the winter was half of that in the summer. However, with a lower atmospheric boundary layer and less mixing, vehicle emission could contribute to the heavier MW PAHs in the winter. Also, increase in usages of heating appliances during

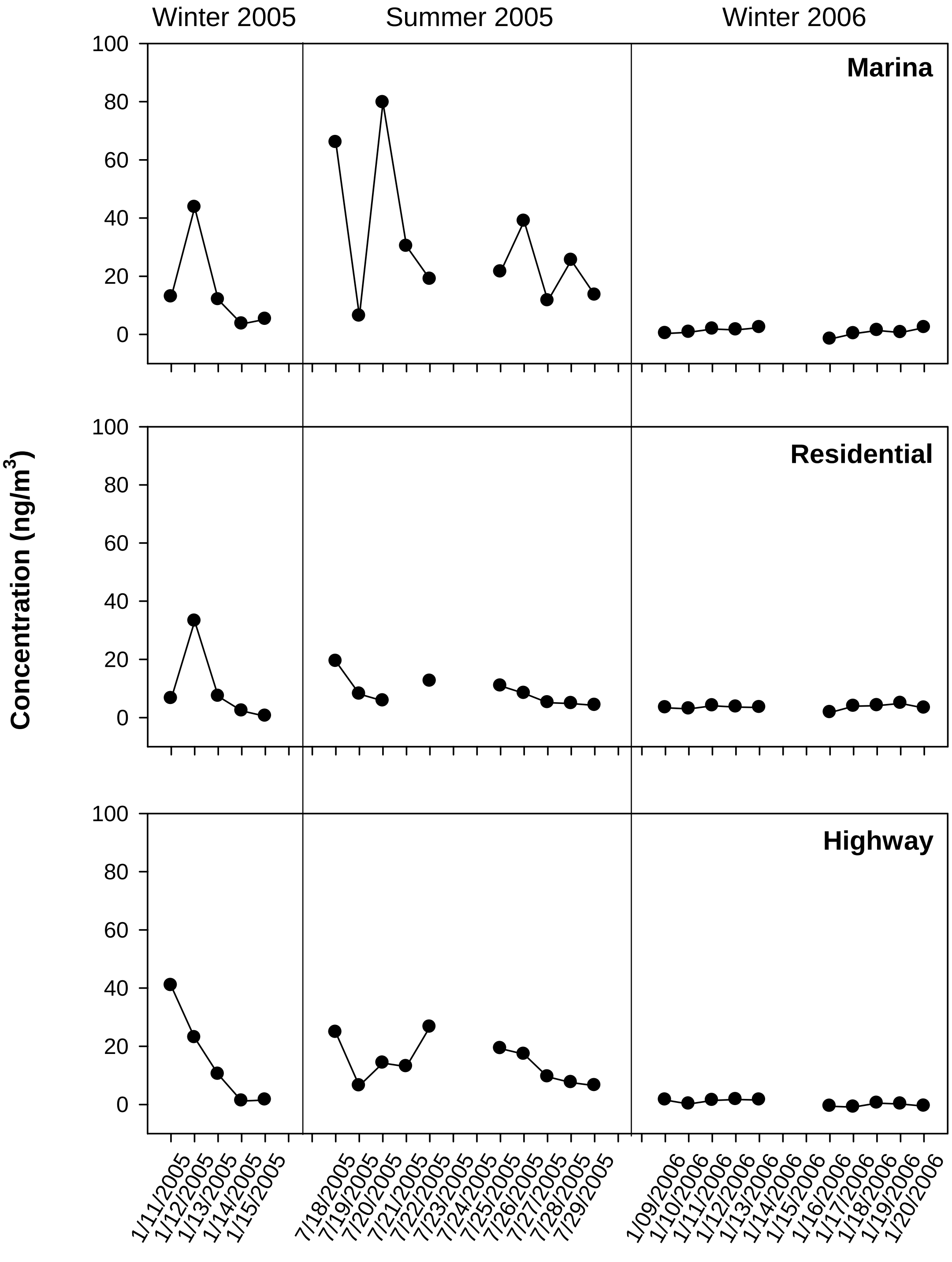


Figure 3.15 Temporal pattern of the Light profile resolved by three source PMF analysis.

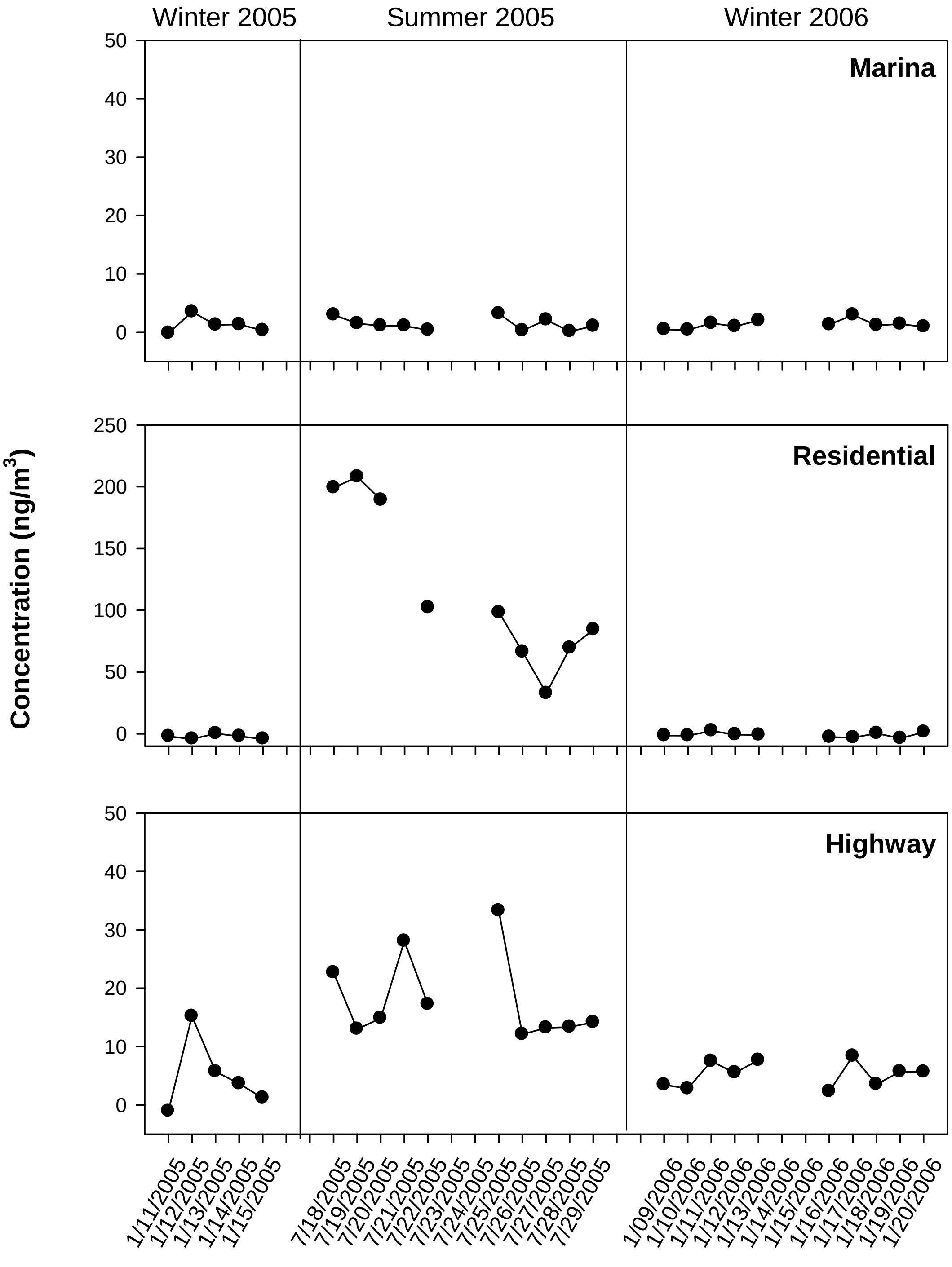


Figure 3.16 Temporal pattern of the Medium profile resolved by three source PMF analysis. Note scale difference between figures.

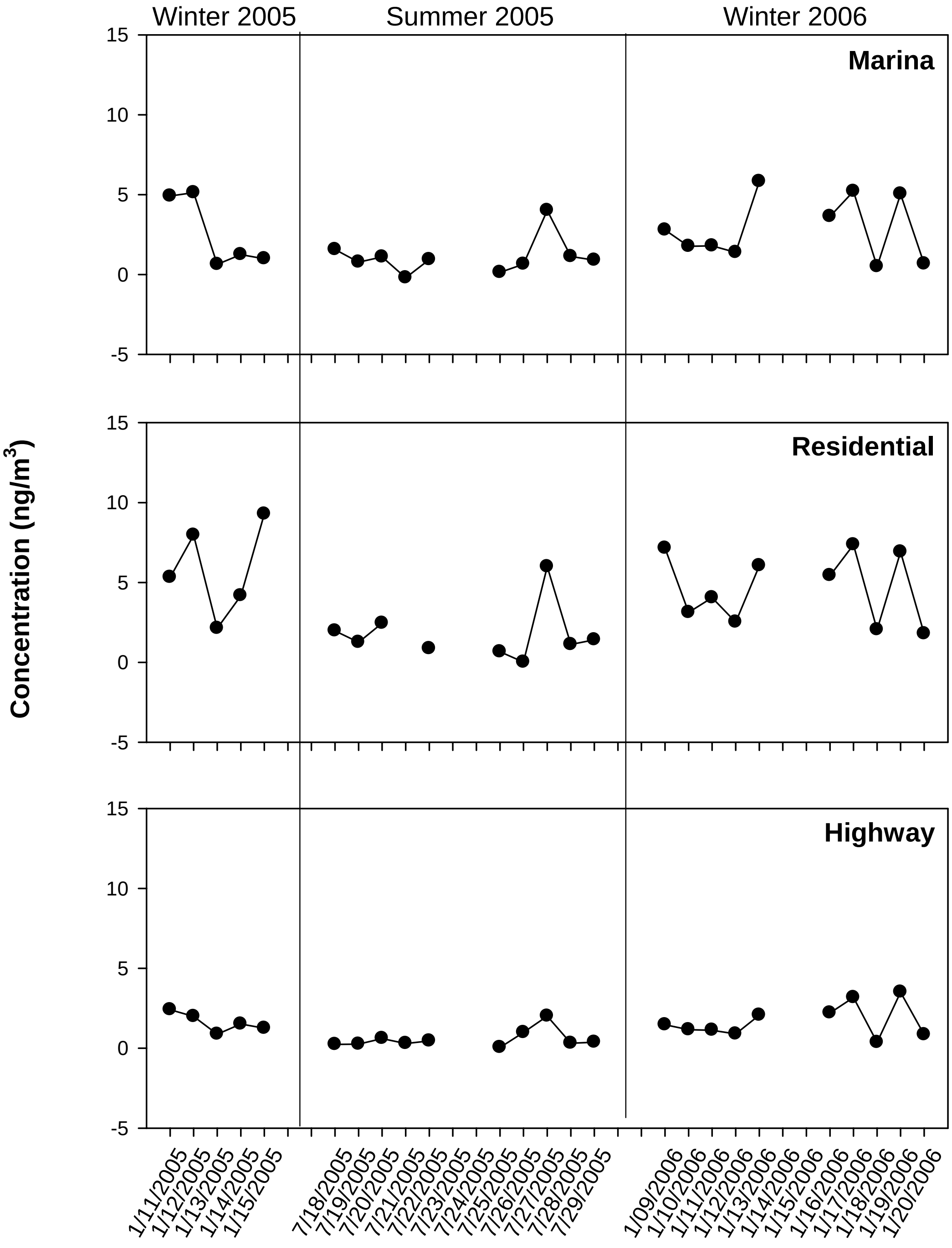


Figure 3.17 Temporal pattern of the Heavy profile resolved by three source PMF analysis.

colder temperatures could be sources of oil, wood, and coal combustion (Rogge et al., 1997b; Kavouras et al., 2001; Freeman and Cattell, 1990; Simcik et al, 1999). With limited number of PAH species in this analysis, the winter source could not be specified.

*3.7.2 Diurnal sources of PAHs to the Buffalo, NY atmosphere:* PMF analysis of the CBL data set characterized the PAH sources during Summer 2005. All of the CBL data (6 day consecutive sampling) were used, and a total of 39 samples (6 and 12h) and 37 PAH species were applied in this analysis. Due to high calculated Q values (6 times higher than theoretical), an additional 5% uncertainty error was added to achieve a more realistic Q value. As a general guide to determine the appropriate number of factors, principal component analysis (PCA) was performed for this data set and 84 and 92% of the variance was explained by 3 and 5 eigenvalues, respectively (Appendix G). With trial and error, 4 factors were resolved with a reasonable Q value of 3935 (theoretical 1443; Figure 3.18-20).

Factor 1 is highly dominated by gas phase PAHs, especially phenenthrene and fluorene. This profile is similar to the Light profile resolved in the HSPH PMF analysis (Figure 3.12). The diurnal pattern in the Summer 2005 was similar between the sampling sites, which indicated Factor 1 was a common PAH source in Buffalo, NY. The diurnal pattern showed elevated concentration at night which suggested a negative relationship with photochemistry and ambient temperature. However, the seasonal pattern showed that this source was relatively abundant in the summer (Figure 3.15). Since the wind speed decreased during the nighttime, the elevated concentration of Factor 1 during the night can be explained by less mixing. The warmer temperature in the summer enhanced

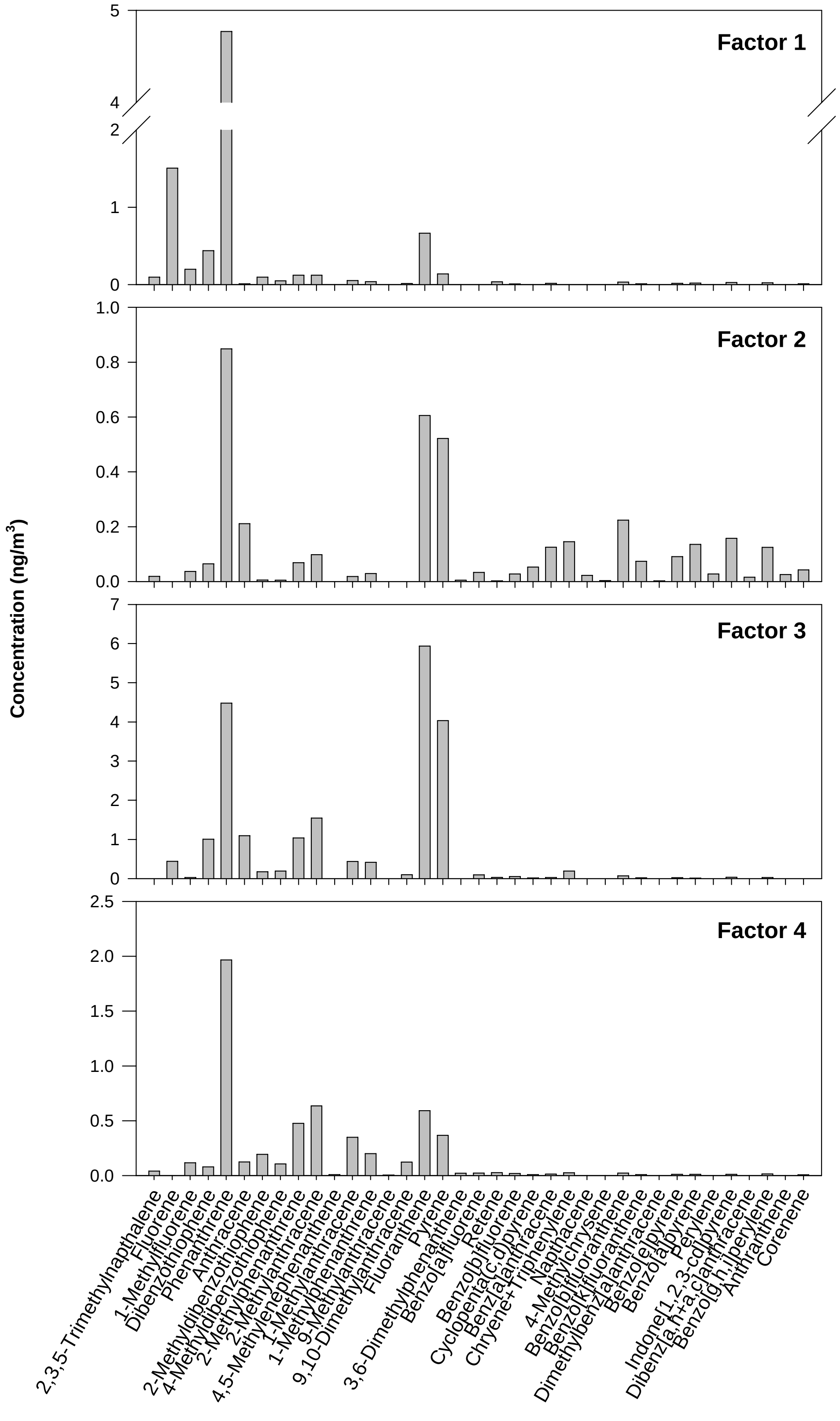


Figure 3.18 Profiles of four PAH sources resolved by PMF analysis of diurnal data. Samples were collected by CBL during July 2005.

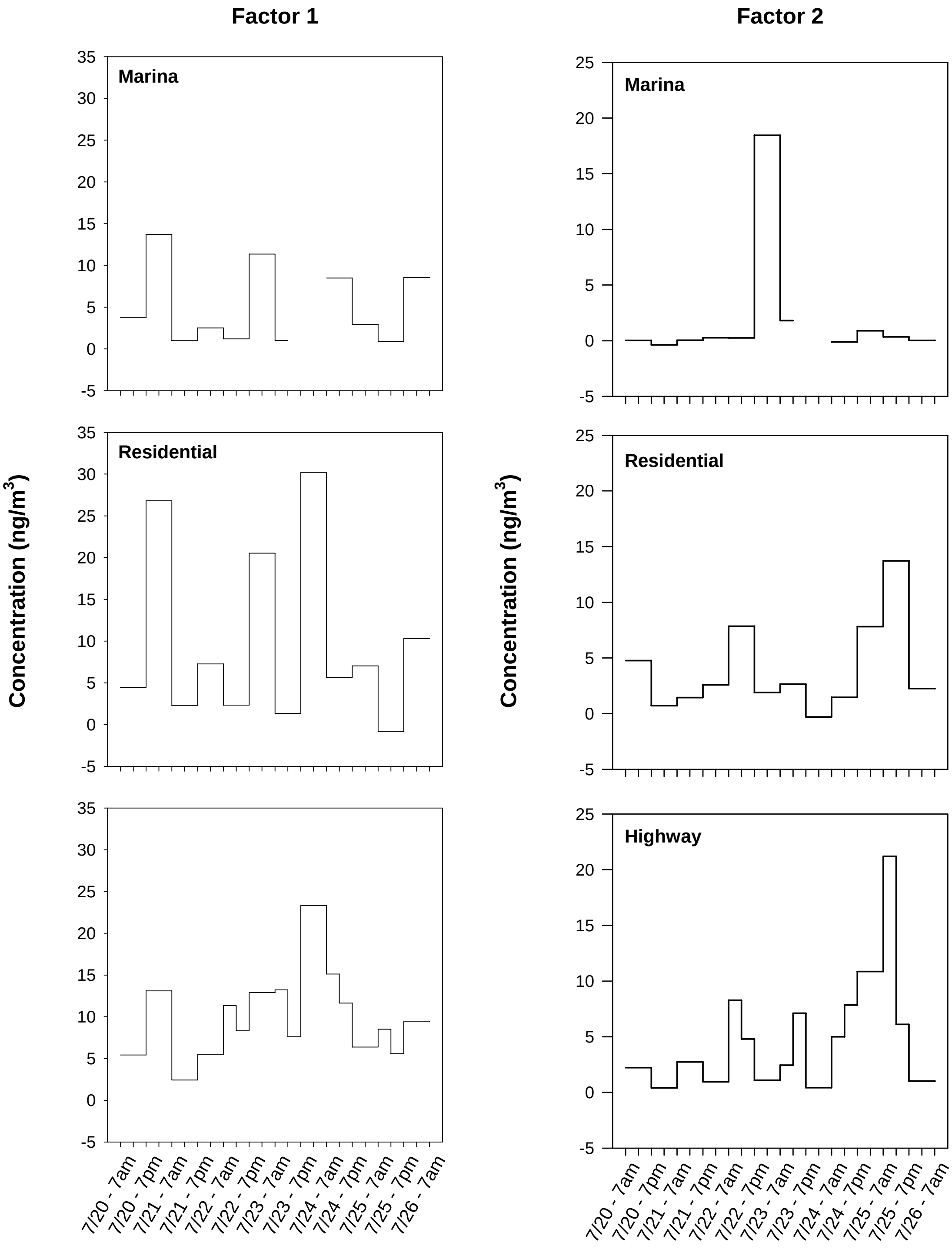


Figure 3.19 Diurnal patterns of Factor 1 and Factor 2 resolved by PAH PMF analysis.

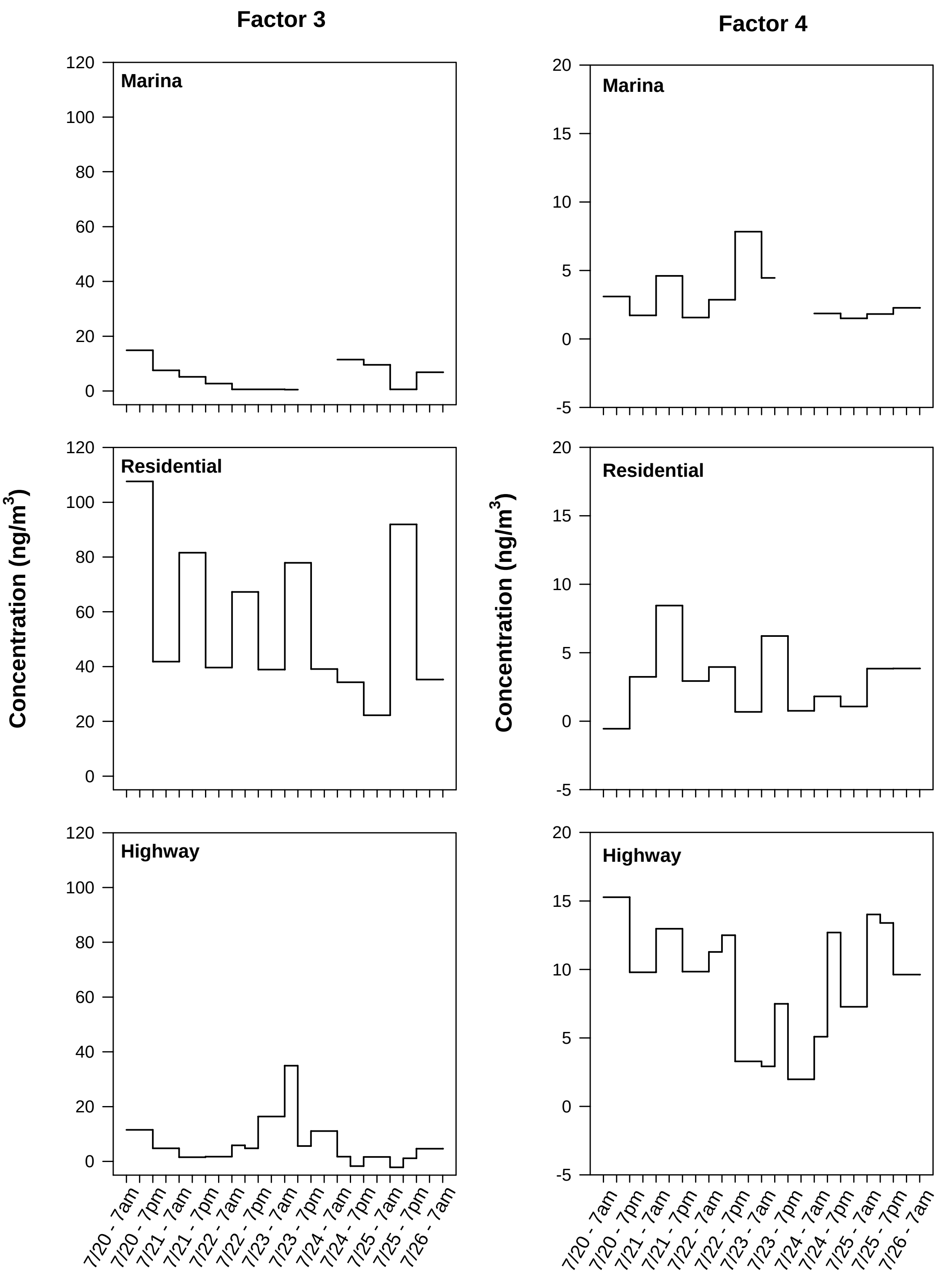


Figure 3.20 Diurnal patterns of Factor 3 and Factor 4 resolved by PAH PMF analysis.

volatilization of lighter MW PAHs from the land and the water of nearby Lake Erie (Dimashki et al., 2001; Dachs et al., 2002; Lee et al., 2004). Therefore, Factor 1 is characterized as common source to all of the sampling sites due to regional-scale volatilization (regional background).

Factor 2 is enriched in heavier MW PAHs. The profile is dominated by benzo[b]fluoranthene, indeno[1,2,3-c,d]pyrene and benzo[g,h,i]perylene, which are consistent with vehicle exhaust (Miguel and Pereira, 1989; Daisey et al., 1986; Lim et al., 1999; Benner et al., 1989; Harrison et al., 1996). High abundance of particulate phase PAHs are characteristics of vehicle exhaust, road dust and heavier oil combustion (Schauer et al., 2002a; Lee et al., 2004; Simcik et al., Rogge et al., 1993c; Kavouras et al., 2001). The diurnal pattern in Factor 2 observed in the Highway site was relatively consistent with traffic counts on the Peace Bridge (Figure 3.21). The contribution of Factor 2 was similar between the Residential and Highway sites, and minor at the Marina site. The similar concentration of $PM_{2.5}$ among the sampling sites (Table 3.1) suggested that PAHs in Factor 2 were associated with coarse (larger than 2.5 μm) particulate matter. This is consistent with road dust PAH size distributions (Yang et al, 1999). The Factor 2 spike during 7/24 7pm and 7/25 7pm in the Residential and Highway sites could be explained by higher wind speed which introduced more particulate matter into the atmosphere. The spike on 7/22 7pm – 7/23 7am at the Marina site could be due to boat engine exhaust. Two-stroke engine typically used as marine engines emit high particulate matter due to unburned fuel and oil (Kado et al., 2000). Therefore, Factor 2 is labeled as particulate matter related to motor vehicles (vehicle PM).

Factor 3 is abundant with volatile PAH compounds such as fluoranthene, pyrene,

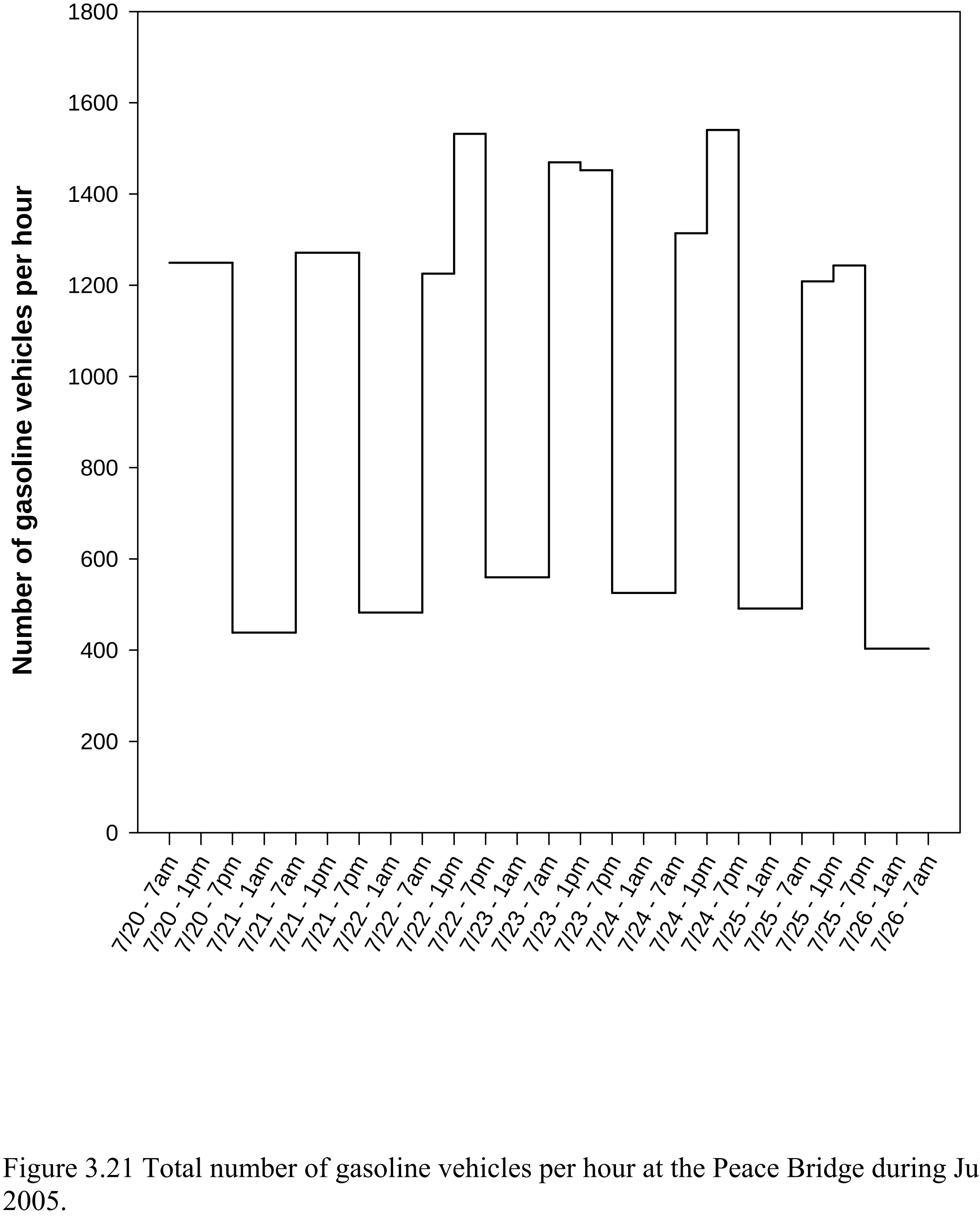


Figure 3.21 Total number of gasoline vehicles per hour at the Peace Bridge during July 2005.

phenanthrene and methlated PAHs. The concentration of Factor 3 in the Residential site was at least an order of magnitude higher than those at the Highway and Marina sites. The diurnal pattern was unique to the Residential site, which suggests this is a local source. The PAH profile and the strong association with warmer temperature (daytime) of Factor 3 was consistent with the Medium profile resolved by the HSPH PMF analysis (Figure 3.16). This source was explained by volatilization from a unique surface material in the Residential site. The community center had a flat roof which was typically coated with tar and a parking lot with asphalt surface. Rogge et al. (1997a) characterized the PAH composition of hot asphalt roofing tar fumes which was highly enriched with methylated PAH. The low concentration during 7/24 7am – 7pm in Residential coincided with the lowest daytime temperature during the sampling period. Though emission of aged roofing tar and asphalt has not been reported, volatilization from roofing tar and asphalt were consistent with the profile and temporal pattern of Factor 3.

Clausius-Clapeyron (C.C.) equation has been used to model the relationship between the atmospheric concentration of semivolatile organic compounds (SVOCs) and ambient temperature (Carlson and Hites, 2005; Hoff et al., 1998; Wania et al., 1998).

$$\ln P = a_0 + \Delta H_{AS} / RT \tag{5}$$

P is the partial pressure (atm) of the analyte, $\Delta H_{AS}$ is a heat of surface-air partitioning (kJ/mol), T is the ambient temperature (Kelvin), R is the gas constant (0.0083 kJ / K·mol), and $a_0$ is an intercept. A strong correlation of ln P and 1/T with a negative slope suggest that the SVOC concentration in the atmosphere is due to volatilization from surfaces

(Hoff et al., 1998; Wania et al., 1998). The 4 factors resolved by PMF were each considered as SVOC compounds and the molecular weight of each factor was determined by taking the weighted average of their PAH source profile. Among the 4 factors, Factor 3 had the strongest correlation ($p$ value < 0.001) between ln P and 1/T with a negative slope (Figure 3.22). This is consistent with what was suggested earlier as a source of Factor 3, volatilization of local surface area (tar roofing and asphalt).

Factor 4 contains heavier PAH along with methylated PAHs which are characteristics of diesel exhaust (Phuleria et al., 2006; Schauer et al., 1999; Miguel et al., 1998). The diurnal pattern of Factor 4 was very similar to the traffic pattern of diesel vehicle at the Peace Bridge (Figure 3.23). The Highway site was the closet sampling site to the Peace Bridge and the concentration of BC in the Highway site was twice as those at the Residential and Marina sites (Table 3.1). Black carbon is emitted by diesel exhaust (Miguel et al., 1998; Kirchstetter et al., 1999), and the higher concentration of BC indicated the Highway site was highly influenced by diesel exhaust.

During Summer 2005, four PAH sources were identified from the three sites in Buffalo, NY. The 4 sources were; regional background, vehicle PM, tar/asphalt volatilization and diesel exhaust. The two source profiles due to volatilization (regional background and tar/asphalt volatilization) were consistent with the two summer profiles resolved in seasonal PMF analysis. The average day and night concentration of each source resolved by PMF are summarized in Figure 3.24. The Residential site was highly influenced by tar/asphalt volatilization, the daytime PAH concentration was twice as high as the nighttime concentration. The Highway site was influenced by diesel exhaust during the day and by the regional background sources at night. The Marina site was least

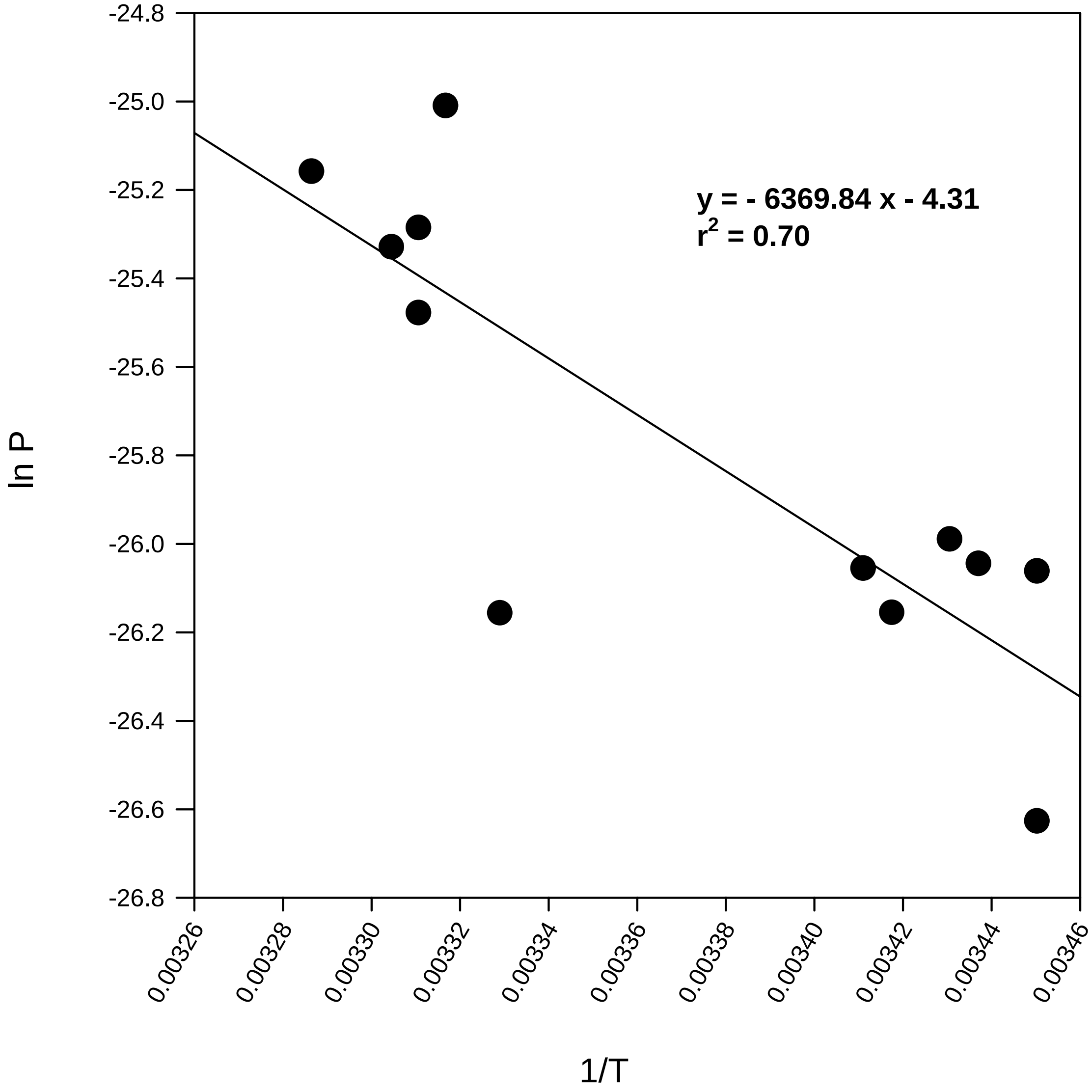


Figure 3.22 Linear regression between ln P and 1/T of Factor 3 resolved by diurnal PAH PMF analysis.

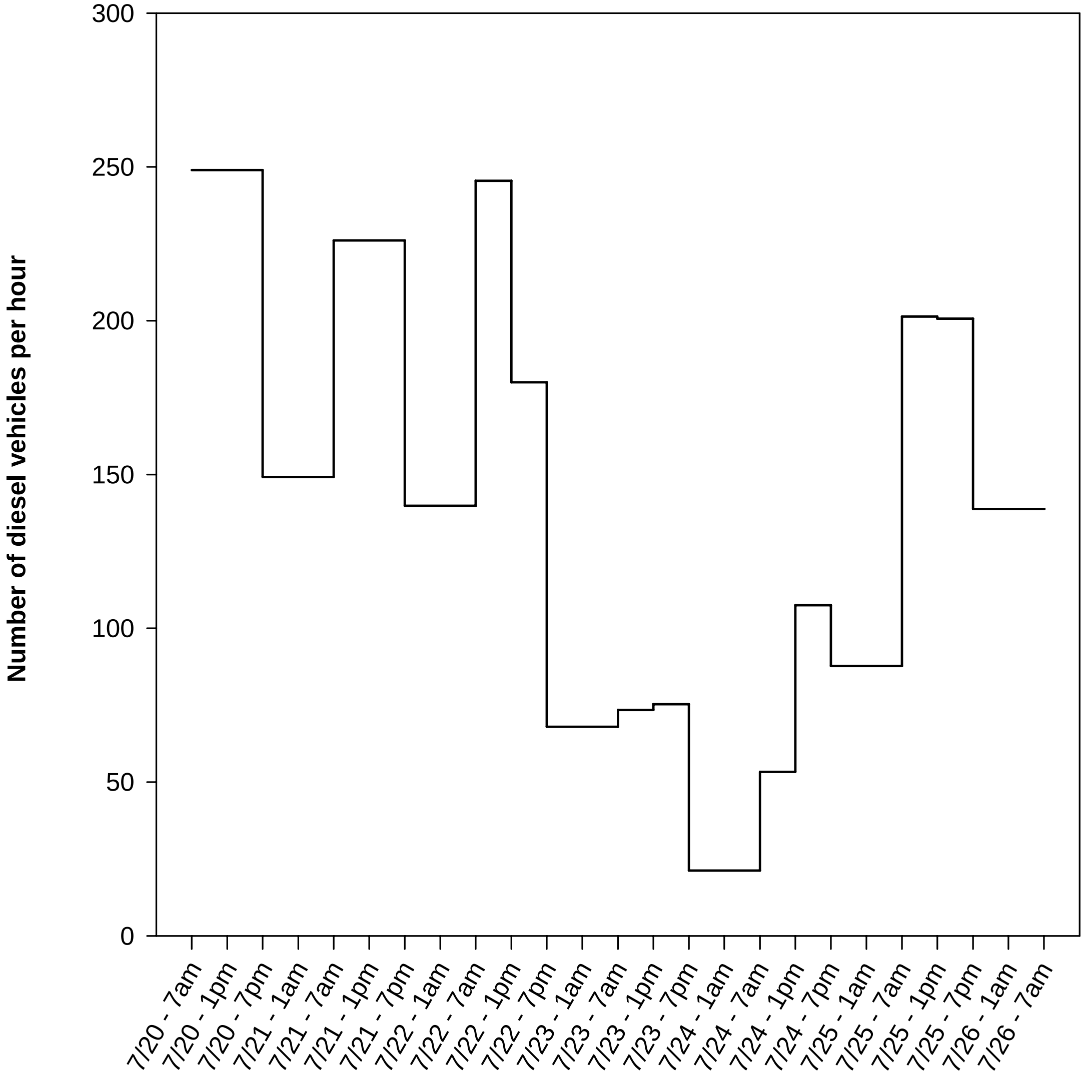
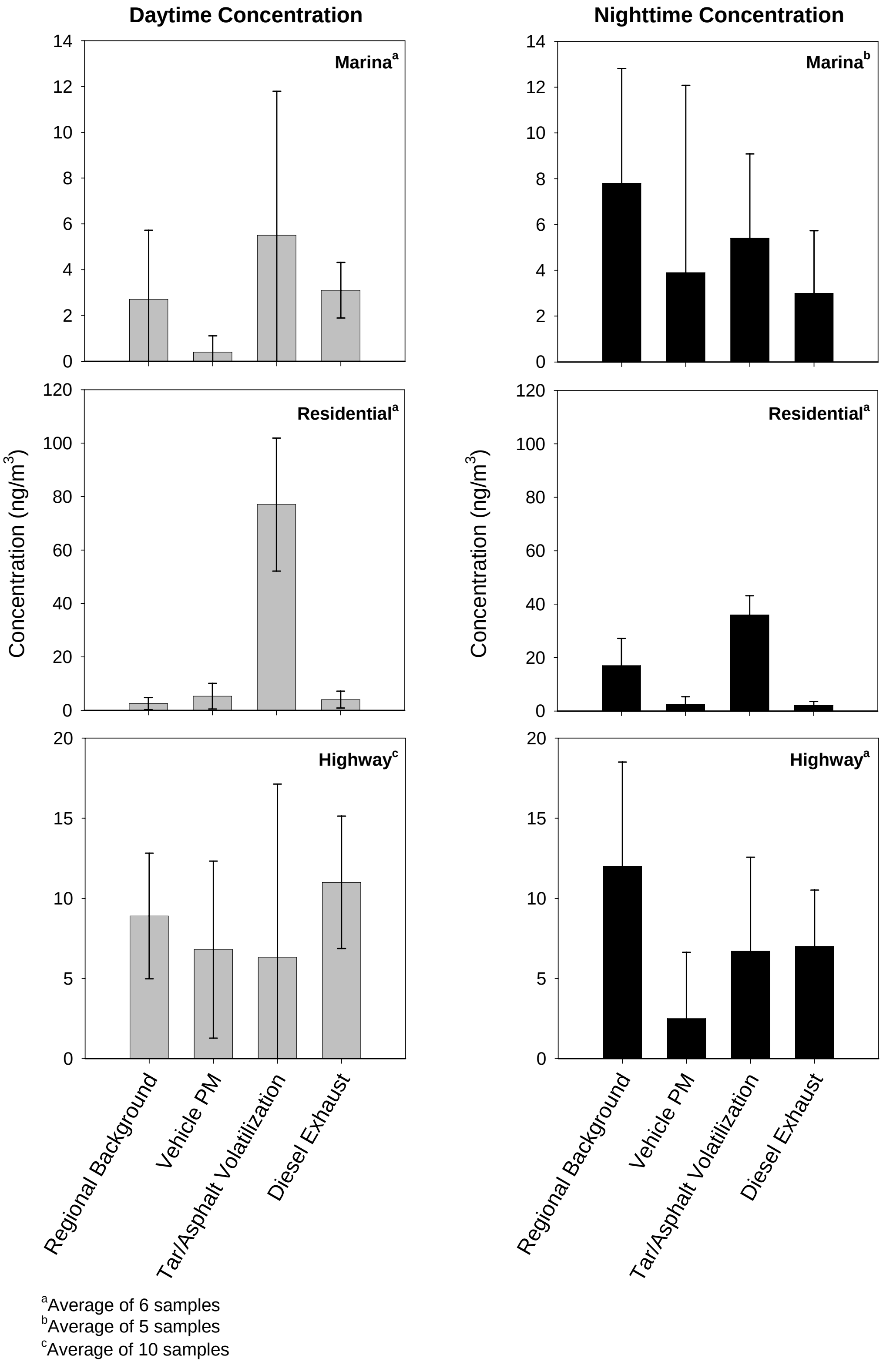


Figure 3.23 Total number of diesel vehicle per hour at the Peace Bridge during July 2005.



[a] Average of 6 samples
[b] Average of 5 samples
[c] Average of 10 samples

Figure 3.24 The average day and night concentration of each factor resolved by diurnal PAH PMF analysis. Error bar indicates 1 standard deviation.

impacted by PAH sources among the three sites, and the daytime concentration was dominated by tar/asphalt volatilization and by the regional background source at night. Overall, diurnal sources were characterized by two volatilization sources and two primary sources.

3.7.3 *Diurnal sources of NPAHs to the Buffalo, NY atmosphere:* NPAHs detected in more than 85% of the samples were included in this analysis. Species poorly fit to the PMF model (low $r^2$ values) were eliminated through trial and error. Twelve species were used and an additional 10% uncertainty was added to optimize the PMF fit (decrease the Q value). The error estimate for NPAHs was higher than that for PAHs since less mass of NPAH was loaded onto the GC/MS which increased the instrumental variability. Three factors were resolved with a Q value of 1361 (theoretical 468) (Figure 3.25-28).

Factor 1 is highly concentrated with 9-nitroanthracene, 1 and 2-nitronaphthalene and 2-nitrofluoranthene. Except for 9-nitroanthracene, these compounds are formed via gas phase reaction with $NO_3$ radicals (Arey et al., 1989; Atkinson et al., 1990; Sweetman et al., 1986; Pitts et al., 1985; Sasaki et al., 1997). 9-nitroanthracene can be formed via heterogeneous reaction with a nitrating agent (Pitts et al, 1987; Arey et al., 1989; Feilberg et al., 2001). The diurnal pattern of Factor 1 was similar between the sampling sites and the concentration was higher at night. This was consistent with $NO_3$ radical and heterogeneous reactions. The different formation processes of 2-nitrofluoranthene and 2-nitropyrene can be used to determine the dominant gas phase production of NPAH. Gas-phase fluoranthene can react with both OH and $NO_3$ radicals to form 2-nitrofluoranthene.

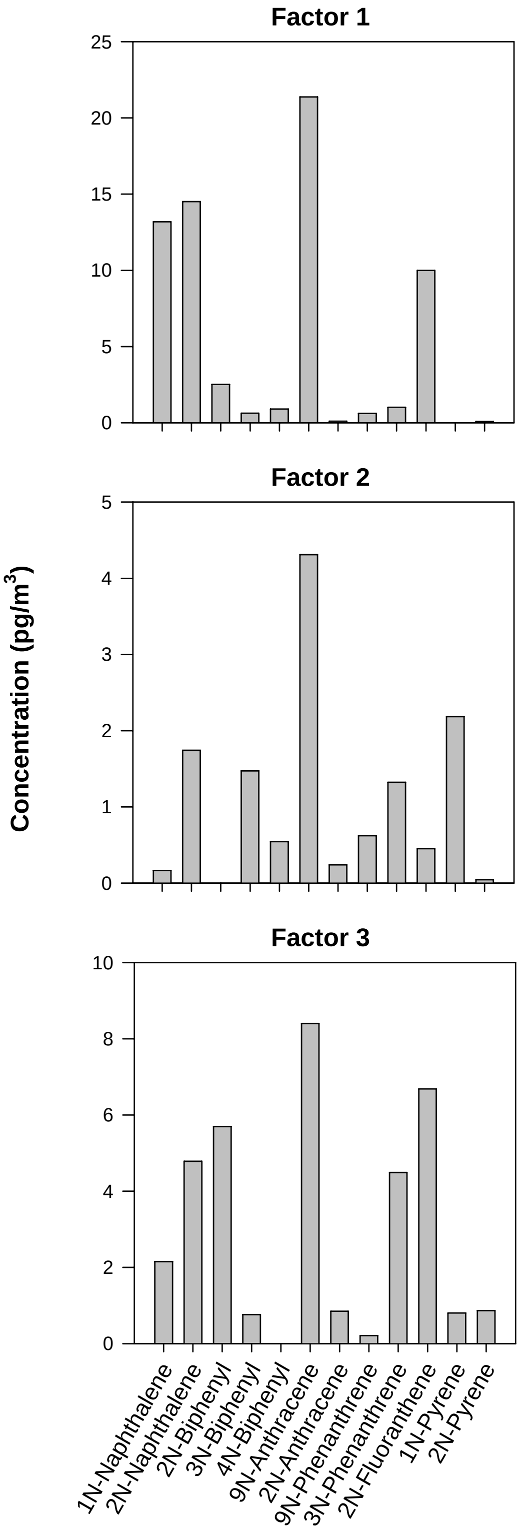


Figure 3.25 Profiles of three NPAH sources resolved by PMF analysis of diurnal data. Samples were collected by CBL during July 2005.

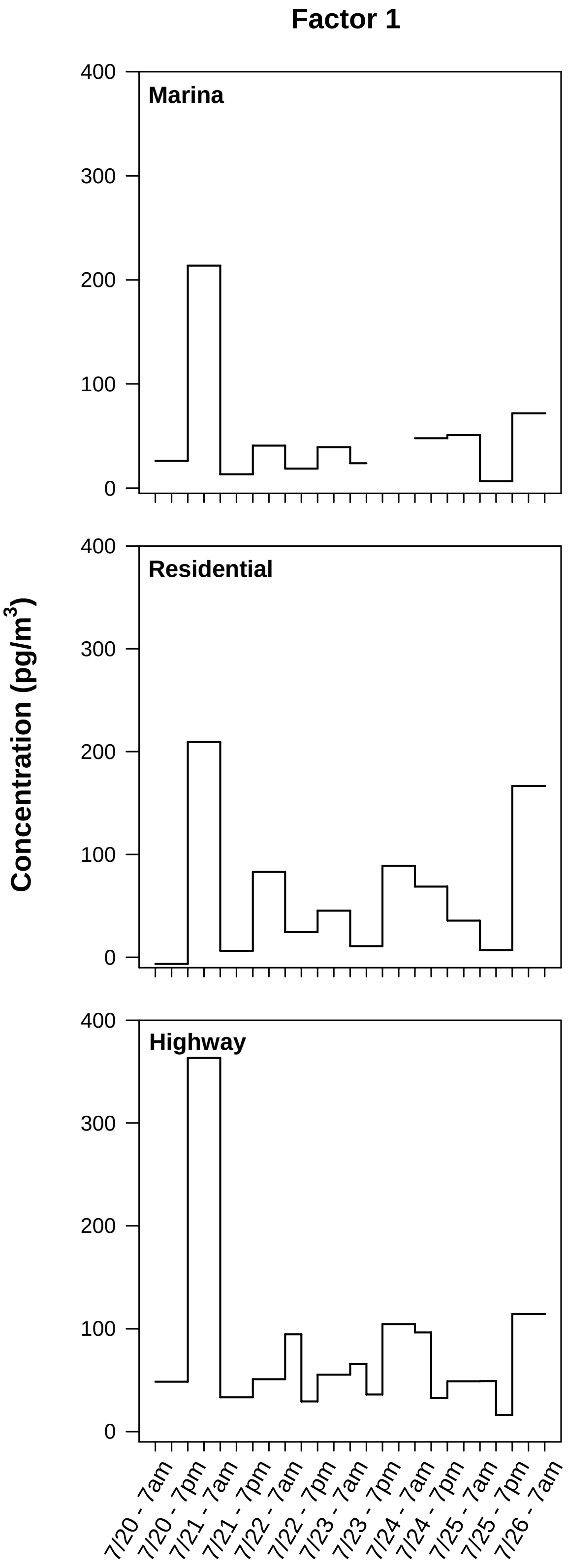


Figure 3.26 Diurnal patterns of Factor 1 resolved by NPAH PMF analysis.

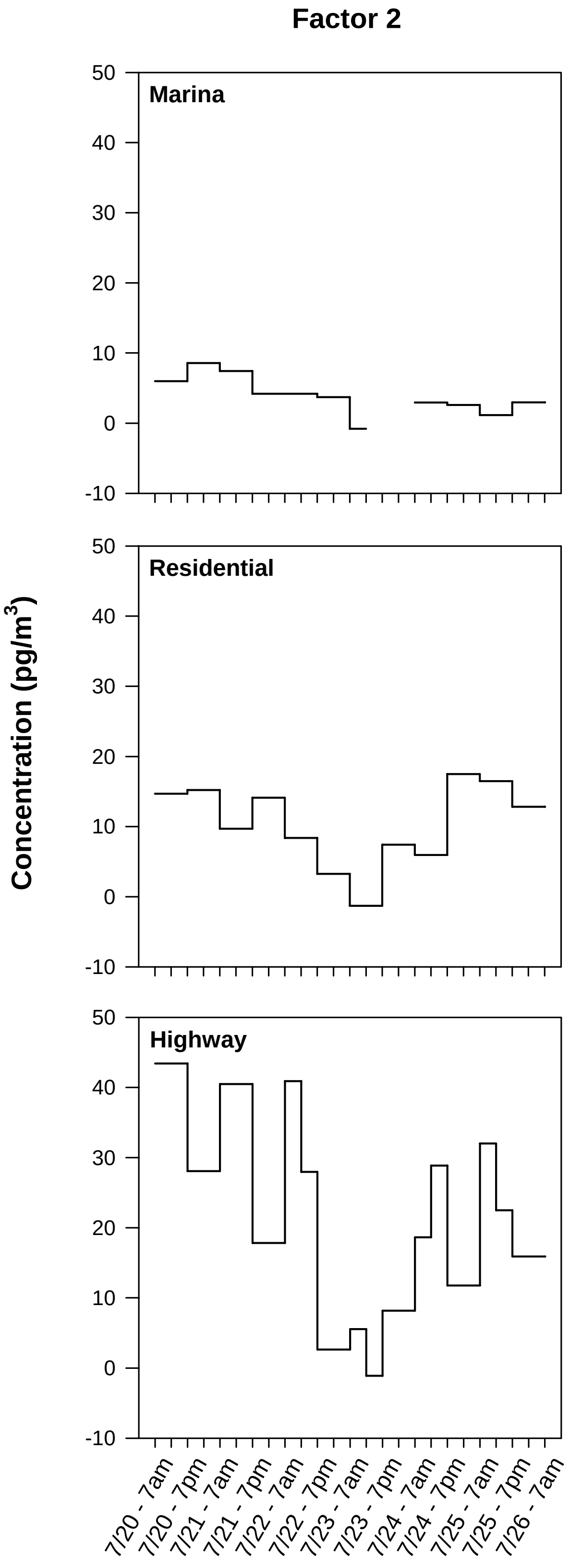


Figure 3.27 Diurnal patterns of Factor 2 resolved by NPAH PMF analysis.

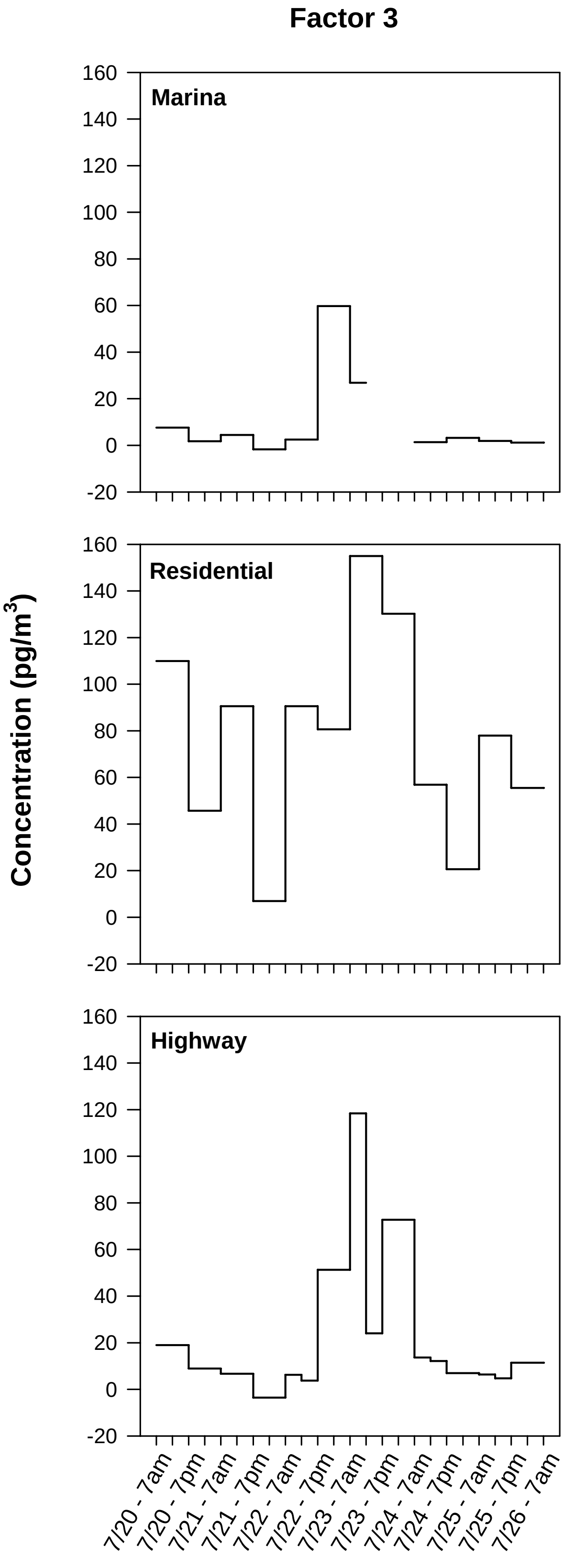


Figure 3.28 Diurnal patterns of Factor 3 resolved by NPAH PMF analysis.

However, gas-phase pyrene only reacts with OH radicals to form 2-nitropyrene. Thus, the ratio of 2-nitrofluoranthene and 2-nitropyrene (2NF/2NP) increases at night when $NO_3$ is the dominant source of NPAH production. The 2NF/2NP of Factor 1 was 125, which was consistent with the dominance of nighttime reaction with $NO_3$ radicals (Arey et al., 1989; Zielinska et al., 1989; Atkinson and Arey, 1994). Factor 1 characterized the NPAH profile at night, especially production of NPAH via $NO_3$ radical reaction.

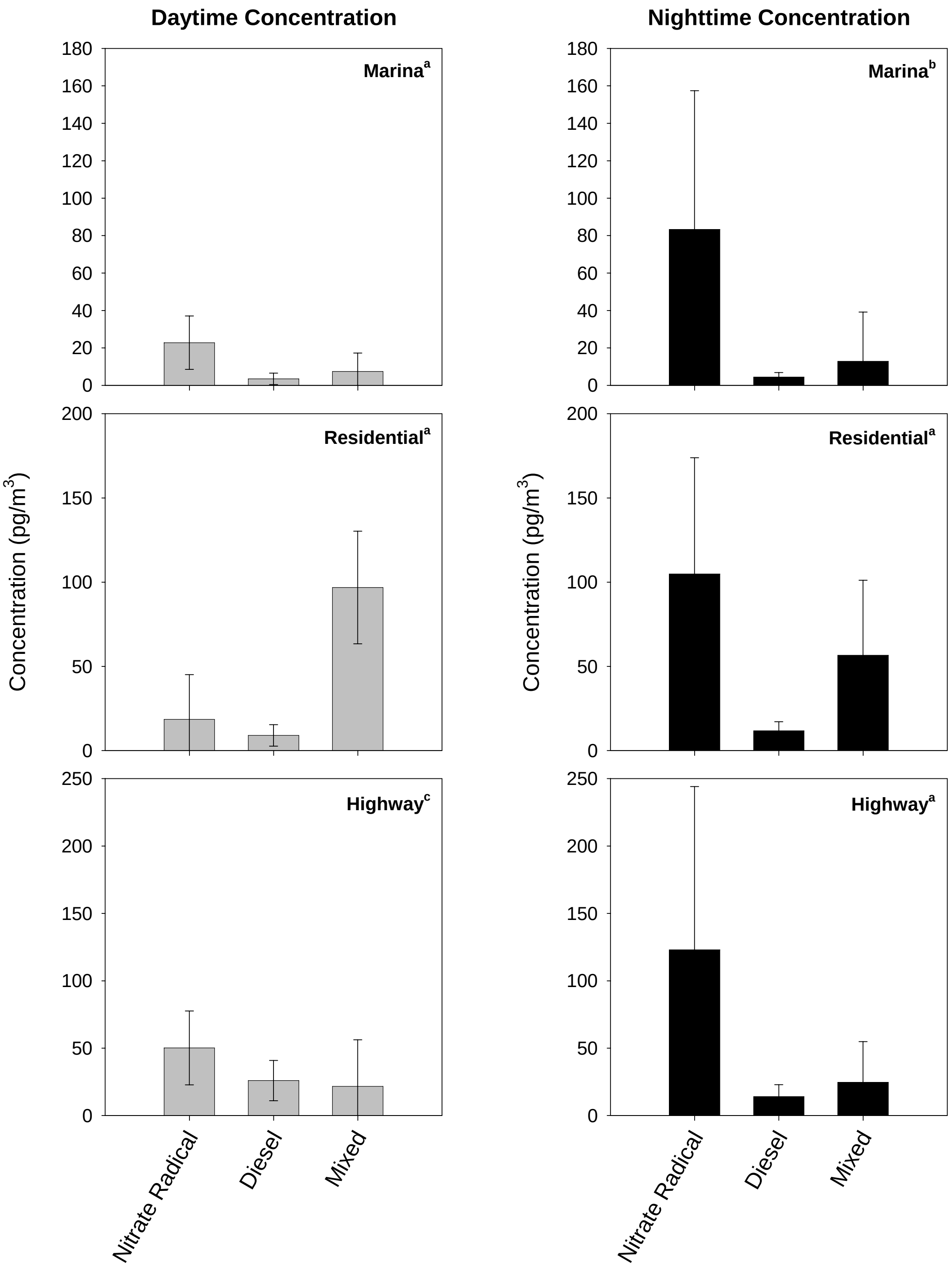
Factor 2 contains 9-nitroanthrancene and 1-nitropyrene, which are dominant NPAH emitted in diesel exhaust (Havey et al., 2006; Paputa-Peck et al., 1983). As in PAH analysis, the diurnal pattern observed at the Highway site are similar to the traffic pattern of diesel vehicles on the Peace Bridge (Figure 3.23). 2-nitronapthalene, 3-nitrobiphenyl and 3-nitrophenanthrene, which are isomers detected in diesel exhaust (Bamford et al., 2003b; Havey et al., 2006) were also abundant in Factor 2. 1-nitropyrene is only detected in direct emissions and has been suggested as a tracer for diesel exhaust (Bamford et al., 2003; Feilberg et al., 2001; Chapter 1). The significant correlation between the 1-nitropyrene concentration at the Highway site and the traffic count of diesel vehicles on the Peace Bridge indicated 1-nitropyrene as a good tracer for diesel exhaust ($r = 0.86$, $p\text{-value} < 0.01$). The NPAHs not reported in diesel exhaust such as 2-nitrobiphenyl, 2-nitrofluoranthene and 2-nitropyrene (Paputa-Peck et al., 1983) contributed little to Factor 2.

The ratio of 2-nitrofluoranthene and 1-nitropyrene (2NF/1NP) was used to evaluate the relative contribution between gas-phase formation (secondary) versus primary source, values less than five are typically observed at sites near primary emission (Ciccioli et al., 1996). The ratio of 2NF/1NP in Factor 2 was 0.2, which indicated Factor

2 was a primary source of NPAH. Also, the ratio of 2NF/1NP in all of the daytime samples at the Highway site were less than 5 except for the weekend (between 7/23 7am – 7/24 1pm), which was consistent with the diesel traffic on the Peace Bridge (Figure 3.23).

Factor 3 is highly loaded with 9-nitroanthracene, 2-nitrofluoranthene and 2-nitrobiphenyl. The diurnal pattern at the Marina and Residential sites showed a higher concentration during the day. The contribution of 2-nitrofluoranthene suggest NPAH production via OH radical reaction (Atkinson et al., 1990; Arey et al., 1986; Ciccioli et al., 1996). On the other hand, 9-nitroanthrancene and 2-nitrobiphenyl formation are not reported by OH radical reaction (Arey et al., 1989). The presence of 9-nitroanthracene, 1-nitropyrene and 3-nitrophenanthrene reported in direct emission (Paputa-Peck et al., 1983; Havey et al., 2006; Gibson, 1982; Zielinska et al., 2004), suggested Factor 3 was mixed with direct and secondary emission. Factor 3 was called a mixed source.

For NPAH, the three sources resolved by PMF were $NO_3$ radical reaction ($NO_3$), diesel exhaust and mixed (Figure 3.29). Overall, the dominant source of NPAH at the three sites in Buffalo, NY was NPAH production via $NO_3$ radical reaction. The higher concentration observed at night was consistent with the $NO_3$ radical reaction. The Highway site had the highest concentration of diesel exhaust compared to the Marina and Residential sites. The high concentration of mixed source at Residential suggested the tar/asphalt volatilization could have enhanced the concentration of NPAH. The Marina site was least impacted by NPAH sources. However, the NPAH concentration contributed by $NO_3$ radical reaction (Marina: [83 ng/m$^3$]) was relatively comparable to the Residential [105 ng/m$^3$] and the Highway [123 ng/m$^3$] concentration. Secondary



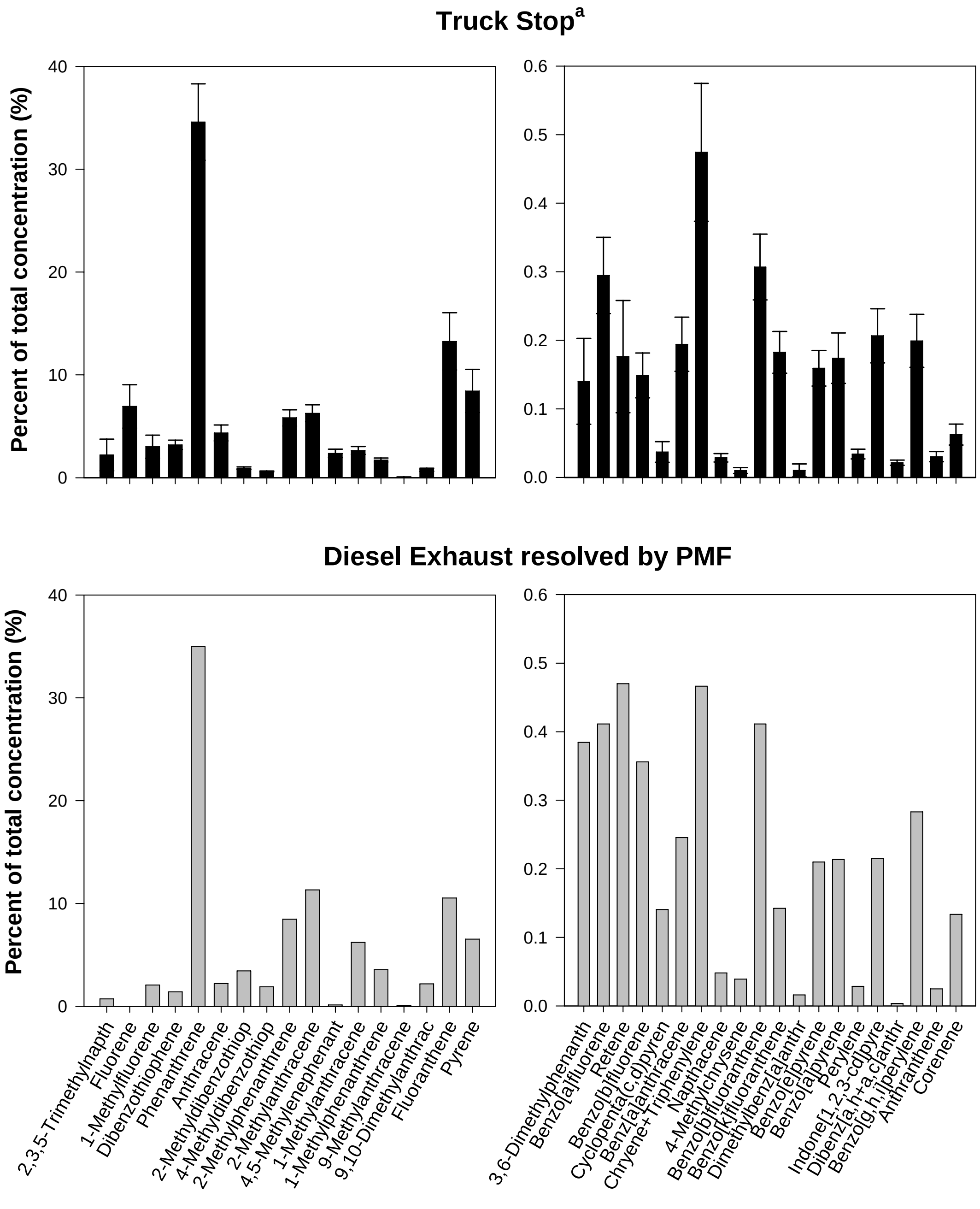
[a]Average of 6 samples
[b]Average of 5 samples
[c]Average of 10 samples

Figure 3.29 The average day and night concentration of each factor resolved by diurnal NPAH PMF analysis. Error bar indicates 1 standard deviation.

NPAHs are less affected by proximity to emission sources compared to primary NPAHs (Arey et al., 1986; Atkinson and Arey, 1994; Atkinson et al., 1990).

*3.7.4 Diesel exhaust profiles:* Chapter 1 characterized ambient samples collected in a truck stop in Knoxville, TN for 4 consecutive days between July 29th – August 2nd, 2004. These samples were highly influenced by diesel exhaust, and their profile represented the diesel exhaust in the atmosphere. The Truck Stop profile was compared with the diesel exhaust profile resolved by PMF to evaluate how closely the Truck Stop PAH and NPAH profiles represented the diesel exhaust in the atmosphere of Buffalo, NY.

The Truck Stop and PMF profiles were first normalized to the total PAH concentration (Figure 3.30). The contribution of phenanthrene, fluoranthene and pyrene were similar; 35%, 13% and 8% for Truck Stop and 35%, 11% and 7% for PMF. Methylated phenantherenes and anthracenes were also enriched in both profiles, and 2-methylphenanthrene and anthracene were the dominant isomers. However, the proportions of methylated PAHs were different between the PMF resolved diesel exhaust profile and the Truck Stop profile. The heavier MW compounds (MW > 206) accounted for 3 – 4 % of the total PAH concentration in both profiles. Chrysene+triphenylene, benzo[a]fluorene and benzo[b]fluoranthene were the dominant compounds with similar abundances. The contribution of retene was considerably higher in PMF profile. Elevated retene contribution was also observed in one of the Truck Stop profiles. Thus, sampling sites in Buffalo, NY and Knoxville, TN were both influenced with PAHs emitted by woodburning (Schauer et al., 2001). The Buffalo, NY diesel exhaust profile (resolved by PMF) were not clearly resolved with this number of samples (n=39).



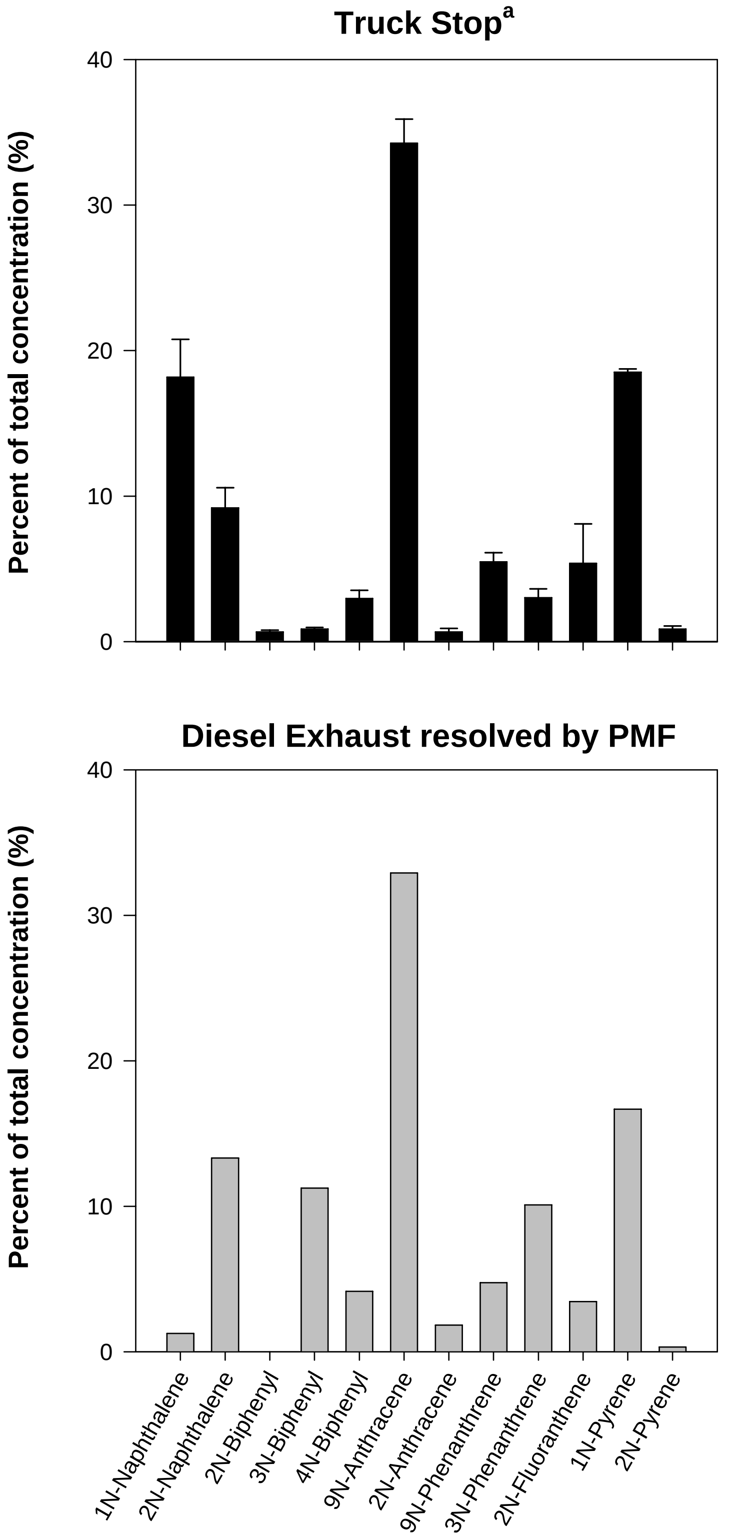
[a] Average of 8 samples, collected at a truck stop in Knoxville,TN in summer 2004 (Chapter 1)

Figure 3.30 Comparison of the Truck Stop profile and the diesel exhaust profile resolved by diurnal PAH PMF analysis.

For NPAH, the nighttime Truck Stop profile better characterized the diesel exhaust since less secondary NPAH production was observed (Chapter 1; Figure 3.31). The dominant species in the Truck Stop and PMF profiles were 9-nitroanthracene (~30%) and 1-nitropyrene (~20%). The proportion of 1 and 2-nitronaphthalene was different between the Truck Stop and PMF profiles. 2-nitronaphthalene accounted for approximately 10% in both profiles, while 1-nitronaphthalene accounted for 20% in the Truck Stop and 1% in the PMF. Diesel exhaust measured from a tailpipe and measurement of diesel particulate standard reference material (SRM 1650) reported higher concentration of 2-nitronaphthalene than 1-nitronaphthalene (Havey et al, 2006; Bamford et al, 2003b). As discussed in Chapter 1, the higher concentration of 1-nitronaphthalene in Truck Stop could be due to production via OH radical reaction during the day which was carried over into the night and/or additional emission sources such as woodburning at the vicinity of the Truck Stop in Knoxville, TN. Furthermore, the proportions of 3-nitrobiphenyl and 3-nitrophenanthrene were higher in PMF. Due to limited studies of NPAH characterization of diesel exhaust, the appropriate contribution could not be determined.

Generally, the Truck Stop and PMF resolved diesel exhaust profile from Buffalo, NY was comparable and the abundant species of PAH and NPAH were loaded in similar proportions. The minor differences between the profiles can be due to influences of atmospheric mixing and reactions.

### 3.8 Conclusions



[a] Average of 3 nighttime samples, collected at a truck stop in Knoxville,TN in summer 2004 (Chapter 1)

Figure 3.31 Comparison of the Truck Stop profile and the diesel exhaust profile resolved by diurnal NPAH PMF analysis.

The seasonal and diurnal composition of PAH and NPAH was characterized near the Peace Bridge in Buffalo, NY. The composition of PAH was different among the summer and winter, the summer sources were explained by volatilization and winter sources were characterized by combustion sources. There were two volatilization sources in the summer, the regional background source and a tar/asphalt volatilization source. These two sources were the dominant sources of PAH near the Peace Bridge. Majority of NPAH was formed by atmospheric reaction with $NO_3$ radicals at night. Overall, the Peace Bridge traffic contributed 20% of PAH and 12% of NPAH concentration. The contribution of PAH and NPAH due to traffic increased as the sampling was closer to the Peace Bridge. Vehicle exhaust was a dominant source of PAH associated with particles.

The PAH and NPAH profile of a truck stop was similar to the diesel exhaust profile resolved by PMF analysis. This indicated ambient air samples collected near diesel emission can characterize a fingerprint of diesel exhaust in the atmosphere.

# Appendix A: PAH and NPAH Mass in Knoxville, TN

| **PAH Mass (ng)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **GFF (Particle Phase)** | | | | | | | | | | |
| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Sampling Start Time | | | | 7/29/04 7pm | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am |
| Sampling End Time | | | | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am | 8/01/04 7pm |
| Volume ($m^3$) | | | | 459.9378 | 224.4618 | 223.7022 | 451.5822 | 290.9268 | 454.6206 | 432.972 |
| Surrogate | %recovery | %recovery | %recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery |
| d8-Napthalene | 54.0 | 61.2 | 62.7 | 38.2 | 79.8 | 86.4 | 60.8 | 30.0 | 26.3 | 36.1 |
| d10-Fluorene | 57.9 | 83.9 | 80.3 | 129.2 | 77.4 | 76.2 | 91.3 | 44.4 | 51.8 | 54.1 |
| d10-Fluoranthene | 68.7 | 53.6 | 60.0 | 153.9 | 76.1 | 80.6 | 81.4 | 41.6 | 47.9 | 43.7 |
| d12-Perylene | 60.0 | 74.0 | 82.5 | 146.8 | 75.8 | 82.5 | 79.8 | 72.4 | 56.7 | 62.2 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | 5.96 | 1.59 | 1.52 | 15.12 | 15.70 | 10.46 | 19.33 | ND | ND | ND |
| 2-Methylnapthalene | 5.33 | 2.42 | 1.95 | 14.90 | 18.27 | ND | 22.67 | ND | 14.39 | ND |
| Azulene | 0.09 | 0.04 | 0.02 | ND | ND | 5.82 | 3.52 | ND | ND | ND |
| 1-Methylnapthalene | 1.09 | 1.11 | 0.82 | 4.24 | 5.06 | 3.25 | 7.86 | ND | 4.10 | ND |
| Biphenyl | 0.46 | 0.63 | 0.48 | 6.00 | 4.73 | 2.53 | 6.08 | 2.26 | 4.13 | 2.42 |
| 2,7-Dimethylnapthalene | 0.63 | 1.46 | 0.72 | 79.18 | 36.80 | 22.33 | 79.49 | 11.00 | 12.65 | 12.01 |
| 1,3-Dimethylnapthalene | 0.44 | 1.34 | 1.17 | 7.37 | 4.91 | ND | 9.66 | 4.40 | 7.57 | 10.17 |
| 1,6-Dimethylnapthalene | 0.42 | 0.81 | 0.63 | 6.14 | 3.85 | 2.97 | 6.11 | 2.56 | 4.75 | 1.89 |
| 1,4-Dimethylnapthalene | 0.33 | 0.38 | 0.20 | 3.73 | 3.02 | 1.00 | 5.68 | 1.52 | 2.53 | 1.41 |
| 1,5-Dimethylnapthalene | 0.08 | 0.16 | 0.12 | 1.33 | 1.79 | 1.32 | 2.34 | 0.66 | 1.01 | 1.99 |
| Acenapthalene | 0.27 | 0.03 | 0.04 | 6.39 | 5.53 | 4.53 | 5.15 | 1.24 | 3.92 | 1.10 |
| 1,2-Dimethylnapthalene | 0.19 | 0.16 | 0.08 | 1.72 | 2.80 | 1.16 | 4.82 | 0.94 | 1.62 | 1.40 |
| 1,8-Dimethylnapthalene | 0.07 | 0.10 | 0.05 | 2.47 | 0.56 | 0.59 | 1.66 | ND | ND | ND |
| Acenapthene | 0.15 | 0.11 | 0.12 | 6.84 | 1.19 | 1.08 | 1.36 | 0.98 | 2.15 | 1.90 |
| 2,3,5-Trimethylnapthalene | 0.12 | 0.28 | 0.26 | 9.59 | 2.54 | 0.70 | 6.39 | 2.79 | 5.55 | 3.09 |
| Fluorene | 0.19 | 0.44 | 0.32 | 12.29 | 4.63 | 1.69 | 10.66 | 2.63 | 7.37 | 3.69 |
| 1-Methylfluorene | 0.04 | 0.07 | 0.29 | 15.05 | 4.85 | 1.29 | 11.81 | 3.67 | 9.12 | 2.78 |
| Dibenzothiophene | 0.11 | 0.09 | 0.09 | 5.03 | 1.86 | 0.85 | 3.93 | 1.32 | 3.12 | 1.72 |
| Phenanthrene | 0.58 | 0.85 | 0.88 | 116.80 | 34.70 | 9.11 | 95.51 | 28.71 | 73.38 | 25.51 |
| Anthracene | 0.04 | 0.05 | 0.02 | 8.60 | 3.10 | 0.85 | 8.09 | 3.06 | 8.80 | 4.03 |
| 2-Methyldibenzothiophene | 0.08 | 0.12 | 0.07 | 8.33 | 2.68 | 0.97 | 6.46 | 2.41 | 5.94 | 2.69 |
| 4-Methyldibenzothiophene | 0.01 | 0.10 | 0.08 | 5.35 | 2.09 | 0.86 | 4.52 | 1.45 | 3.93 | 1.71 |
| 2-Methylphenanthrene | 0.08 | 0.33 | 0.29 | 40.53 | 8.72 | 1.81 | 30.13 | 15.91 | 37.66 | 12.63 |
| 2-Methylanthracene | 0.09 | 0.57 | 0.46 | 59.49 | 12.08 | 3.14 | 48.24 | 26.69 | 66.79 | 21.22 |
| 4,5-Methylenephenanthrene | 0.04 | 0.02 | 0.06 | 10.01 | 2.55 | 1.09 | 9.11 | 2.01 | 4.03 | 2.05 |
| 1-Methylanthracene | 0.04 | 0.23 | 0.23 | 28.64 | 5.27 | 1.32 | 19.43 | 9.47 | 22.33 | 7.07 |
| 1-Methylphenanthrene | 0.04 | 0.19 | 0.18 | 23.18 | 4.77 | 1.06 | 17.73 | 7.14 | 16.73 | 5.38 |
| 9-Methylanthracene | 0.02 | 0.08 | 0.06 | ND | ND | 0.52 | 1.65 | 0.42 | 0.43 | ND |
| 9,10-Dimethylanthracene | 0.05 | 0.03 | 0.08 | 22.63 | 3.86 | 0.85 | 16.78 | 3.31 | 8.18 | 2.69 |
| Fluoranthene | 0.33 | 0.14 | 0.10 | 144.53 | 37.06 | 11.29 | 104.61 | 20.99 | 55.84 | 19.20 |
| Pyrene | 0.26 | 0.12 | 0.09 | 178.54 | 40.14 | 10.49 | 117.61 | 26.08 | 67.76 | 20.74 |
| 3,6-Dimethylphenanthrene | 0.03 | 0.05 | 0.02 | 70.02 | 13.16 | 1.43 | 48.73 | 8.03 | 2.23 | 6.60 |
| Benzo[a]fluorene | 0.01 | 0.02 | 0.01 | 26.66 | 4.23 | 1.20 | 14.60 | 4.20 | 15.61 | 3.33 |
| Retene | 0.10 | 0.06 | 0.05 | 37.39 | 7.74 | 1.38 | 18.46 | 3.67 | 22.97 | 2.89 |
| Benzo[b]fluorene | 0.01 | 0.01 | 0.02 | 16.46 | 2.87 | 0.80 | 9.65 | 2.41 | 6.40 | 1.91 |
| Cyclopenta(c,d)pyrene | 0.05 | 0.05 | 0.06 | 44.66 | 7.96 | 1.52 | 30.55 | 4.51 | 51.77 | 3.62 |
| Benz[a]anthracene | 0.20 | 0.02 | 0.04 | 52.52 | 17.07 | 3.71 | 30.40 | 17.53 | 80.34 | 16.42 |
| Chryene+Triphenylene | 0.09 | 0.06 | 0.02 | 107.66 | 30.18 | 8.83 | 49.73 | 22.19 | 67.85 | 20.15 |
| Napthacene | 0.00 | 0.02 | 0.07 | 4.29 | 1.58 | 1.22 | 2.25 | 2.26 | 6.98 | 1.78 |
| 4-Methylchrysene | 0.01 | 0.11 | 0.04 | 7.37 | 2.57 | 0.57 | 3.78 | 3.15 | 4.93 | 3.96 |
| Benzo[b]fluoranthene | 0.14 | 0.14 | 0.11 | 102.13 | 34.42 | 7.16 | 39.43 | 28.59 | 123.47 | 45.82 |
| Benzo[k]fluoranthene | 0.03 | 0.04 | 0.09 | 54.36 | 23.83 | 4.58 | 21.40 | 26.29 | 77.64 | 21.97 |
| Dimethylbenz[a]anthracene | 0.09 | 0.05 | 0.17 | 16.15 | 5.00 | 0.61 | 4.82 | 1.42 | 0.77 | 0.37 |
| Benzo[e]pyrene | 0.08 | 0.10 | 0.06 | 60.24 | 23.69 | 4.43 | 25.74 | 24.62 | 76.84 | 25.51 |
| Benzo[a]pyrene | 0.33 | 0.04 | 0.07 | 46.80 | 22.78 | 4.42 | 27.18 | 18.88 | 65.53 | 14.94 |
| Perylene | 0.03 | 0.05 | 0.04 | 13.00 | 5.08 | 2.18 | 5.76 | 4.87 | 14.62 | 3.32 |
| 3-Methylcholanthrene | 0.10 | 0.21 | 0.41 | 2.59 | 1.27 | ND | ND | ND | ND | ND |
| Indone[1,2,3-cd]pyrene | 0.02 | 0.08 | 0.24 | 55.42 | 26.48 | 6.45 | 26.75 | 25.57 | 150.47 | 39.58 |
| Dibenz[a,h+a,c]anthracene | 0.03 | 0.02 | 0.03 | 6.93 | 2.31 | 0.53 | 2.64 | 0.60 | 7.55 | 0.98 |
| Benzo[g,h,i]perylene | 0.07 | 0.05 | 0.05 | 78.39 | 41.58 | 7.80 | 41.69 | 48.18 | 119.84 | 36.69 |
| Anthranthene | 0.01 | 0.03 | 0.01 | 7.44 | 4.79 | 1.11 | 6.39 | ND | 14.77 | 1.91 |
| Corenene | 0.01 | 0.18 | 0.18 | 34.50 | 20.97 | 4.97 | 21.06 | 10.31 | 58.07 | 9.77 |

| **PAH Mass (ng)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **GFF (Particle Phase)** | | | | | | | | | | |
| Sampling Site | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop |
| Sampling Start Time | 7/29/04 7pm | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am |
| Sampling End Time | 7/29/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am | 8/02/04 7pm |
| Volume ($m^3$) | 463.356 | 224.8416 | 213.8274 | 429.5538 | 455.76 | 455.3802 | 211.1688 | 232.0578 | 447.7842 | 451.962 |
| Surrogate | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery |
| d8-Napthalene | 7.6 | 38.2 | 44.6 | 44.6 | 17.0 | 19.8 | 12.1 | 40.6 | 12.1 | 11.2 |
| d10-Fluorene | 79.9 | 67.2 | 59.0 | 59.0 | 77.7 | 65.0 | 80.7 | 72.9 | 76.5 | 84.5 |
| d10-Fluoranthene | 65.7 | 77.8 | 67.7 | 67.7 | 78.4 | 77.1 | 65.3 | 81.2 | 71.9 | 77.1 |
| d12-Perylene | 71.3 | 85.3 | 65.7 | 65.7 | 81.2 | 75.3 | 77.0 | 78.6 | 78.2 | 69.9 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | ND | 27.45 | 10.44 | 14.51 | ND | ND | ND | ND | 12.46 | 9.65 |
| 2-Methylnapthalene | ND | 22.58 | ND | 10.82 | 10.18 | 10.64 | ND | ND | 14.07 | ND |
| Azulene | 2.43 | 0.45 | ND | ND | 5.08 | 2.96 | ND | ND | 3.34 | ND |
| 1-Methylnapthalene | ND | 6.94 | ND | 5.75 | 3.31 | 4.19 | 3.32 | ND | 4.15 | ND |
| Biphenyl | 3.29 | 10.22 | 6.67 | 6.14 | 4.30 | 5.12 | 6.17 | 2.76 | 8.51 | 3.58 |
| 2,7-Dimethylnapthalene | 51.49 | 131.37 | 76.53 | 66.85 | 56.29 | 33.84 | 40.99 | 31.80 | 15.45 | 5.03 |
| 1,3-Dimethylnapthalene | 6.88 | 10.07 | 3.45 | 9.89 | 3.38 | 6.56 | 4.53 | 4.96 | 15.20 | 4.99 |
| 1,6-Dimethylnapthalene | 6.53 | 10.87 | 2.82 | 8.93 | 3.77 | 5.99 | 4.55 | 5.69 | 12.54 | 5.87 |
| 1,4-Dimethylnapthalene | 2.57 | 4.49 | 1.91 | 3.91 | 2.44 | 2.44 | 1.92 | 1.17 | 7.78 | 1.99 |
| 1,5-Dimethylnapthalene | 2.57 | 2.09 | 7.07 | 1.45 | 2.35 | 4.58 | 3.40 | 1.83 | 2.62 | 1.04 |
| Acenapthalene | 7.03 | 34.43 | 31.29 | 16.59 | 13.53 | 15.93 | 27.03 | 12.95 | 17.19 | 12.23 |
| 1,2-Dimethylnapthalene | 1.01 | 5.19 | 3.13 | 3.84 | 4.21 | 4.04 | 4.60 | 2.72 | 6.45 | 0.65 |
| 1,8-Dimethylnapthalene | 2.12 | 7.10 | ND | 1.54 | 2.49 | 0.72 | ND | ND | 3.03 | 1.22 |
| Acenapthene | 6.53 | 28.32 | 2.86 | 8.34 | 3.08 | 4.23 | 4.72 | 12.63 | 21.50 | 17.60 |
| 2,3,5-Trimethylnapthalene | 12.40 | 3.94 | 1.18 | 8.24 | 2.57 | 6.86 | 2.01 | 6.57 | 16.09 | 11.51 |
| Fluorene | 17.67 | 11.09 | 4.36 | 14.66 | 6.15 | 16.30 | 7.97 | 9.55 | 39.25 | 15.68 |
| 1-Methylfluorene | 19.32 | 8.62 | 3.22 | 13.71 | 5.67 | 15.23 | 4.60 | 9.36 | 23.10 | 13.97 |
| Dibenzothiophene | 12.89 | 12.45 | 5.33 | 12.97 | 6.73 | 12.59 | 8.22 | 9.11 | 18.14 | 11.71 |
| Phenanthrene | 286.46 | 264.13 | 100.01 | 275.77 | 123.46 | 281.00 | 144.76 | 182.28 | 309.84 | 242.33 |
| Anthracene | 32.13 | 28.92 | 12.47 | 36.29 | 14.96 | 33.10 | 21.00 | 25.04 | 43.83 | 32.67 |
| 2-Methyldibenzothiophene | 11.21 | 6.65 | 2.18 | 8.99 | 3.73 | 10.90 | 3.31 | 5.51 | 18.76 | 6.72 |
| 4-Methyldibenzothiophene | 11.63 | 6.23 | 3.08 | 11.12 | 3.91 | 18.18 | 4.35 | 6.19 | 11.57 | 6.82 |
| 2-Methylphenanthrene | 61.07 | 33.81 | 10.80 | 47.57 | 17.73 | 63.81 | 16.11 | 24.75 | 69.93 | 31.09 |
| 2-Methylanthracene | 82.47 | 45.33 | 14.83 | 66.41 | 25.03 | 82.88 | 22.47 | 32.51 | 89.62 | 41.63 |
| 4,5-Methylenephenanthrene | 33.00 | 24.48 | 10.70 | 31.56 | 14.10 | 44.18 | 20.83 | 26.36 | 51.06 | 36.53 |
| 1-Methylanthracene | 47.99 | 20.06 | 6.20 | 37.93 | 10.66 | 40.78 | 8.91 | 12.96 | 61.69 | 15.64 |
| 1-Methylphenanthrene | 35.81 | 19.35 | 6.66 | 28.39 | 10.50 | 37.47 | 9.80 | 14.25 | 37.70 | 18.24 |
| 9-Methylanthracene | 5.35 | ND | ND | ND | 2.80 | 3.11 | 1.68 | 2.59 | ND | 5.25 |
| 9,10-Dimethylanthracene | 35.39 | 14.19 | 4.64 | 26.84 | 8.32 | 40.92 | 7.68 | 11.54 | 56.81 | 13.59 |
| Fluoranthene | 779.63 | 1264.61 | 410.02 | 966.48 | 432.10 | 770.24 | 544.57 | 664.69 | 926.92 | 787.84 |
| Pyrene | 623.17 | 899.32 | 294.64 | 762.93 | 321.84 | 627.74 | 414.20 | 484.19 | 758.76 | 557.13 |
| 3,6-Dimethylphenanthrene | 65.59 | 28.75 | 10.98 | 3.21 | 38.02 | 134.44 | 21.45 | 19.24 | 156.74 | 3.71 |
| Benzo[a]fluorene | 55.96 | 59.55 | 22.81 | 62.91 | 25.88 | 55.67 | 33.51 | 36.66 | 75.93 | 40.87 |
| Retene | 49.63 | 13.82 | 3.75 | 23.08 | 13.35 | 46.41 | 4.81 | 6.60 | 18.72 | 7.55 |
| Benzo[b]fluorene | 44.94 | 52.82 | 22.83 | 56.30 | 22.41 | 47.91 | 35.31 | 34.78 | 72.92 | 41.01 |
| Cyclopenta(c,d)pyrene | 49.41 | 14.97 | 6.76 | 36.70 | 10.77 | 35.17 | 12.66 | 84.41 | 59.83 | 78.53 |
| Benz[a]anthracene | 193.17 | 212.40 | 107.62 | 223.11 | 121.79 | 195.56 | 180.60 | 175.11 | 264.60 | 166.45 |
| Chryene+Triphenylene | 474.39 | 587.53 | 277.85 | 491.63 | 326.01 | 408.98 | 348.64 | 440.25 | 558.68 | 494.58 |
| Napthacene | 23.76 | 27.89 | 13.76 | 32.03 | 15.27 | 30.66 | 38.08 | 26.40 | 29.41 | 30.69 |
| 4-Methylchrysene | 11.21 | 11.47 | 5.81 | 13.16 | 7.19 | 12.44 | 12.27 | 10.31 | 31.05 | 10.06 |
| Benzo[b]fluoranthene | 504.78 | 494.66 | 259.08 | 525.46 | 256.89 | 463.17 | 420.31 | 532.53 | 608.53 | 705.27 |
| Benzo[k]fluoranthene | 316.23 | 273.31 | 152.35 | 331.11 | 158.94 | 314.75 | 276.88 | 353.98 | 273.08 | 406.66 |
| Dimethylbenz[a]anthracene | 18.26 | 12.02 | 2.61 | 11.42 | 5.34 | 20.08 | 6.69 | 5.09 | 56.60 | 8.61 |
| Benzo[e]pyrene | 276.80 | 248.95 | 124.62 | 283.56 | 137.57 | 269.83 | 233.47 | 272.43 | 311.33 | 310.25 |
| Benzo[a]pyrene | 286.07 | 275.61 | 137.74 | 322.85 | 148.52 | 306.00 | 289.53 | 285.03 | 364.81 | 290.88 |
| Perylene | 54.00 | 50.20 | 25.40 | 62.45 | 30.04 | 67.08 | 61.46 | 56.63 | 63.58 | 60.92 |
| 3-Methylcholanthrene | 4.55 | 4.30 | 2.40 | 4.59 | 3.42 | 5.11 | 4.93 | 3.61 | 30.27 | 3.99 |
| Indone[1,2,3-cd]pyrene | 351.14 | 324.85 | 158.81 | 387.51 | 182.47 | 387.25 | 341.76 | 357.17 | 345.30 | 388.31 |
| Dibenz[a,h+a,c]anthracene | 40.39 | 33.91 | 16.50 | 38.52 | 19.00 | 39.72 | 38.35 | 36.94 | 36.83 | 37.30 |
| Benzo[g,h,i]perylene | 355.26 | 309.48 | 145.53 | 368.79 | 176.96 | 384.42 | 312.58 | 331.47 | 349.42 | 355.61 |
| Anthranthene | 51.54 | 42.34 | 22.96 | 55.30 | 24.27 | 58.39 | 51.40 | 48.10 | 68.02 | 49.82 |
| Corenene | 128.93 | 88.26 | 39.89 | 111.62 | 57.94 | 137.13 | 80.73 | 93.47 | 112.42 | 100.82 |

| **PAH Mass (ng)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **PUF (Gas Phase)** | | | | | | | | | | |
| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Highway | Highway | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop |
| Sampling Start Time | | | | 7/29/04 7am | 8/01/04 7am | 7/29/04 7pm | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am |
| Sampling End Time | | | | 7/29/04 7pm | 8/01/04 7pm | 7/29/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm |
| Volume ($m^3$) | | | | 459.9378 | 432.972 | 463.356 | 224.8416 | 213.8274 | 429.5538 | 455.76 |
| Surrogate | %recovery | %recovery | %recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery |
| d8-Napthalene | 43.8 | 12.8 | 25.9 | 33.4 | 38.1 | 31.7 | 40.1 | 38.2 | 38.2 | 22.2 |
| d10-Fluorene | 84.9 | 52.8 | 76.7 | 78.0 | 93.0 | 72.4 | 77.8 | 65.5 | 87.4 | 70.7 |
| d10-Fluoranthene | 70.0 | 71.2 | 65.0 | 45.0 | 52.4 | 61.4 | 65.7 | 47.2 | 57.2 | 55.3 |
| d12-Perylene | 68.9 | 72.2 | 68.4 | 59.6 | 61.5 | 56.2 | 71.6 | 37.8 | 63.1 | 61.4 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 69.74 | 3.84 | 41.37 | 881.86 | 234.98 | 1090.85 | ND | 375.50 | 261.87 | 191.02 |
| 2-Methylnapthalene | 114.91 | 3.87 | 74.79 | 1994.57 | 445.71 | 3884.50 | ND | 940.61 | 762.57 | 615.38 |
| Azulene | 0.31 | 0.09 | 0.24 | 3.46 | 1.28 | 6.98 | 1.14 | 2.31 | 6.09 | 3.34 |
| 1-Methylnapthalene | 50.71 | 1.91 | 31.77 | 920.02 | 195.86 | 1932.57 | 84.70 | 420.79 | 410.78 | 262.06 |
| Biphenyl | 29.92 | 1.15 | 20.85 | 768.98 | 160.99 | 2301.49 | 109.76 | 503.20 | 461.63 | 435.65 |
| 2,7-Dimethylnapthalene | 62.14 | 2.48 | 42.33 | 1974.45 | 364.39 | 6253.72 | 276.14 | 1225.06 | 1170.99 | 843.61 |
| 1,3-Dimethylnapthalene | 55.82 | 2.67 | 36.85 | 2237.57 | 371.34 | 7865.59 | 313.83 | 1523.99 | 1583.85 | 984.04 |
| 1,6-Dimethylnapthalene | 38.50 | 1.48 | 23.62 | 1177.95 | 211.34 | 4242.34 | 167.18 | 757.77 | 797.42 | 518.63 |
| 1,4-Dimethylnapthalene | 17.34 | 0.98 | 12.01 | 632.35 | 112.27 | 2255.28 | 102.18 | 476.53 | 521.10 | 333.04 |
| 1,5-Dimethylnapthalene | 5.76 | 0.30 | 3.83 | 295.96 | 41.37 | 992.16 | 40.81 | 182.15 | 203.52 | 126.72 |
| Acenapthalene | 3.06 | 0.50 | 1.64 | 431.13 | 84.73 | 842.33 | 39.26 | 262.54 | 390.87 | 191.59 |
| 1,2-Dimethylnapthalene | 9.72 | 0.48 | 6.86 | 417.16 | 71.98 | 1286.99 | 58.73 | 279.93 | 288.09 | 190.18 |
| 1,8-Dimethylnapthalene | 0.46 | 0.08 | 0.66 | 9.90 | 1.85 | 15.75 | ND | 3.44 | 6.23 | 2.94 |
| Acenapthene | 36.93 | 2.20 | 30.10 | 877.54 | 133.98 | 2488.59 | 634.91 | 2143.47 | 960.49 | 759.81 |
| 2,3,5-Trimethylnapthalene | 16.81 | 1.12 | 10.35 | 2559.26 | 297.69 | 8307.63 | 348.05 | 1825.77 | 1900.01 | 1888.70 |
| Fluorene | 70.98 | 3.22 | 62.19 | 4169.53 | 672.20 | 17742.39 | 3064.75 | 11332.64 | 6465.98 | 6708.41 |
| 1-Methylfluorene | 17.84 | 1.15 | 14.00 | 2667.36 | 581.79 | 7584.81 | 979.35 | 2467.17 | 3686.35 | 4063.07 |
| Dibenzothiophene | 13.32 | 0.66 | 11.93 | 603.41 | 277.54 | 5701.20 | 3092.93 | 5331.72 | 4378.68 | 3161.86 |
| Phenanthrene | 181.97 | 11.29 | 155.98 | 9586.75 | 3727.06 | 60381.47 | 43085.79 | 49816.29 | 51681.96 | 47011.85 |
| Anthracene | 8.33 | 0.64 | 2.83 | 453.54 | 153.72 | 7791.84 | 4161.88 | 6980.07 | 8026.90 | 3800.18 |
| 2-Methyldibenzothiophene | 9.01 | 0.30 | 8.42 | 649.57 | 295.34 | 1785.68 | 904.60 | 943.55 | 1238.19 | 1099.52 |
| 4-Methyldibenzothiophene | 5.06 | 0.19 | 4.67 | 337.73 | 179.13 | 1068.35 | 684.05 | 774.51 | 778.86 | 673.68 |
| 2-Methylphenanthrene | 22.36 | 1.15 | 18.32 | 4097.59 | 1535.80 | 11148.34 | 5470.95 | 5589.01 | 7121.52 | 7666.60 |
| 2-Methylanthracene | 25.02 | 1.38 | 20.81 | 3801.97 | 1320.68 | 11751.77 | 6706.55 | 6536.27 | 8150.13 | 9014.29 |
| 4,5-Methylenephenanthrene | 3.74 | 0.53 | 2.42 | 392.06 | 149.44 | 3905.98 | 2883.33 | 3706.93 | 3411.79 | 2142.07 |
| 1-Methylanthracene | 8.78 | 0.82 | 7.15 | 1622.81 | 565.77 | 5182.79 | 2774.40 | 2527.13 | 3598.16 | 3150.31 |
| 1-Methylphenanthrene | 6.04 | 0.42 | 5.02 | 1142.11 | 404.68 | 3325.87 | 1880.79 | 1720.57 | 2295.80 | 1983.47 |
| 9-Methylanthracene | 0.42 | 0.14 | 0.03 | 59.79 | 13.35 | 114.29 | 50.18 | 18.53 | 69.69 | 54.24 |
| 9,10-Dimethylanthracene | 1.88 | 0.21 | 1.47 | 372.61 | 157.32 | 1555.20 | 745.54 | 690.47 | 986.79 | 894.64 |
| Fluoranthene | 16.86 | 3.80 | 9.18 | 720.59 | 454.00 | 21645.27 | 18132.95 | 22170.59 | 18553.46 | 12008.03 |
| Pyrene | 7.63 | 1.99 | 3.44 | 707.94 | 367.03 | 12873.36 | 9867.07 | 13238.73 | 10733.79 | 7081.31 |
| 3,6-Dimethylphenanthrene | 0.11 | 0.11 | 0.08 | 57.15 | 23.89 | 252.15 | 110.99 | 70.25 | 138.15 | 149.00 |
| Benzo[a]fluorene | 0.15 | 0.06 | 0.22 | 54.81 | 27.87 | 427.78 | 285.21 | 387.27 | 345.00 | 241.10 |
| Retene | 0.32 | 0.23 | 0.29 | 405.34 | 206.78 | 355.33 | 244.29 | 71.93 | 236.58 | 191.57 |
| Benzo[b]fluorene | 0.06 | 0.07 | 0.04 | 15.37 | 8.87 | 229.40 | 132.74 | 212.65 | 162.49 | 101.27 |
| Cyclopenta(c,d)pyrene | 0.12 | 0.10 | 0.05 | 2.44 | 0.53 | 20.86 | 16.19 | 7.84 | 8.47 | 8.38 |
| Benz[a]anthracene | 0.06 | 0.08 | 0.14 | 4.22 | 9.35 | 85.77 | 46.53 | 128.95 | 103.19 | 52.14 |
| Chryene+Triphenylene | 0.41 | 0.09 | 0.28 | 5.47 | 13.65 | 208.18 | 87.48 | 303.49 | 215.67 | 128.52 |
| Napthacene | 0.02 | 0.08 | 0.03 | 0.63 | 0.37 | 19.77 | 6.47 | 14.43 | 17.34 | 8.14 |
| 4-Methylchrysene | 0.13 | 0.08 | 0.06 | 0.52 | 0.62 | 1.66 | 1.51 | 2.38 | 1.38 | 1.31 |
| Benzo[b]fluoranthene | 0.08 | 0.15 | 0.29 | 1.13 | 2.27 | 5.99 | 3.20 | 6.05 | 4.66 | 3.24 |
| Benzo[k]fluoranthene | 0.06 | 0.05 | 0.08 | 0.19 | 0.29 | 2.96 | 1.47 | 2.52 | 1.82 | 1.25 |
| Dimethylbenz[a]anthracene | 0.20 | 0.10 | 0.10 | ND | ND | ND | ND | ND | ND | ND |
| Benzo[e]pyrene | 0.15 | 0.07 | 0.10 | 0.34 | 0.69 | 2.22 | 1.29 | 1.27 | 1.80 | 1.06 |
| Benzo[a]pyrene | 0.11 | 0.24 | 0.04 | ND | ND | 1.36 | 0.72 | ND | 0.99 | ND |
| Perylene | 0.07 | 0.14 | 0.10 | ND | ND | ND | ND | ND | ND | ND |
| 3-Methylcholanthrene | 0.32 | 0.19 | 0.26 | ND | ND | ND | ND | ND | ND | ND |
| Indone[1,2,3-cd]pyrene | 0.13 | 0.18 | 0.04 | ND | ND | 1.26 | ND | 0.57 | 1.39 | 0.54 |
| Dibenz[a,h+a,c]anthracene | 0.05 | 0.05 | 0.03 | ND | ND | 0.15 | ND | ND | ND | ND |
| Benzo[g,h,i]perylene | 0.11 | 0.13 | 0.03 | ND | ND | 1.46 | ND | 0.36 | 0.69 | 0.44 |
| Anthranthene | 0.07 | 0.03 | 0.03 | ND | ND | ND | ND | ND | ND | ND |
| Corenene | 0.12 | 0.28 | 0.05 | ND | ND | ND | ND | ND | ND | ND |

| **PAH Mass (ng)**<br>**PUF (Gas Phase)** | | | | | |
|---|---|---|---|---|---|
| Sampling Site | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop |
| Sampling Start Time | 7/31/04 7pm | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am |
| Sampling End Time | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am | 8/02/04 7pm |
| Volume ($m^3$) | 455.3802 | 211.1688 | 232.0578 | 447.7842 | 451.962 |
| Surrogate | % recovery | % recovery | % recovery | % recovery | % recovery |
| d8-Napthalene | 26.7 | 39.5 | 27.5 | 48.8 | 31.6 |
| d10-Fluorene | 78.1 | 119.3 | 80.7 | 69.5 | 82.4 |
| d10-Fluoranthene | 65.7 | 55.1 | 63.5 | 51.5 | 60.4 |
| d12-Perylene | 56.1 | 59.2 | 53.4 | 46.1 | 52.7 |

| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
|---|---|---|---|---|---|
| Napthalene | 864.51 | 430.36 | 334.33 | 1135.94 | 307.34 |
| 2-Methylnapthalene | 3476.84 | 1638.30 | 1201.70 | 3156.54 | 1024.11 |
| Azulene | 19.60 | 1.87 | 3.77 | 16.07 | 1.00 |
| 1-Methylnapthalene | 1774.20 | 765.21 | 582.34 | 1522.66 | 440.28 |
| Biphenyl | 2311.09 | 899.16 | 855.36 | 1950.89 | 657.06 |
| 2,7-Dimethylnapthalene | 5382.77 | 1997.48 | 1991.37 | 3393.82 | 1263.13 |
| 1,3-Dimethylnapthalene | 6785.22 | 2166.23 | 2426.30 | 4062.85 | 1360.95 |
| 1,6-Dimethylnapthalene | 3519.07 | 1293.22 | 1414.16 | 2213.57 | 762.23 |
| 1,4-Dimethylnapthalene | 1996.86 | 702.85 | 821.66 | 1242.82 | 431.67 |
| 1,5-Dimethylnapthalene | 826.05 | 271.61 | 299.26 | 530.51 | 167.44 |
| Acenapthalene | 1246.33 | 309.07 | 417.92 | 892.91 | 247.77 |
| 1,2-Dimethylnapthalene | 1150.55 | 408.17 | 470.73 | 764.78 | 247.86 |
| 1,8-Dimethylnapthalene | 20.61 | 9.82 | 14.29 | 13.42 | 5.73 |
| Acenapthene | 2634.84 | 2052.18 | 2063.03 | 2646.79 | 1924.24 |
| 2,3,5-Trimethylnapthalene | 7307.35 | 2538.00 | 2588.39 | 4233.26 | 1447.91 |
| Fluorene | 16467.96 | 9344.15 | 12852.46 | 12926.33 | 11208.11 |
| 1-Methylfluorene | 7249.80 | 3391.04 | 4440.82 | 6327.60 | 4219.57 |
| Dibenzothiophene | 3969.70 | 2610.68 | 9751.57 | 5498.75 | 8380.32 |
| Phenanthrene | 49649.97 | 47769.02 | 69799.29 | 55442.49 | 65402.15 |
| Anthracene | 5770.71 | 3047.89 | 10854.53 | 8835.87 | 9095.48 |
| 2-Methyldibenzothiophene | 1800.46 | 903.78 | 1798.99 | 1625.37 | 2059.09 |
| 4-Methyldibenzothiophene | 936.83 | 579.74 | 1459.08 | 1038.78 | 1500.00 |
| 2-Methylphenanthrene | 10411.37 | 5631.37 | 11622.42 | 10607.88 | 13918.85 |
| 2-Methylanthracene | 10979.75 | 5742.06 | 12036.29 | 10341.91 | 13991.06 |
| 4,5-Methylenephenanthrene | 2841.23 | 1884.18 | 6654.62 | 4040.18 | 6567.17 |
| 1-Methylanthracene | 5217.46 | 2597.06 | 4703.55 | 4906.97 | 5645.44 |
| 1-Methylphenanthrene | 3217.84 | 1632.31 | 3346.24 | 2997.70 | 3952.57 |
| 9-Methylanthracene | 136.79 | 36.65 | 108.39 | 82.14 | 59.26 |
| 9,10-Dimethylanthracene | 1605.65 | 653.01 | 1255.08 | 1438.14 | 1763.53 |
| Fluoranthene | 13155.46 | 9112.26 | 32807.23 | 22828.79 | 36928.34 |
| Pyrene | 8546.22 | 5564.89 | 24232.06 | 13717.23 | 26956.38 |
| 3,6-Dimethylphenanthrene | 237.68 | 69.36 | 94.26 | 204.05 | 206.80 |
| Benzo[a]fluorene | 336.04 | 187.95 | 635.48 | 562.05 | 819.27 |
| Retene | 506.67 | 185.06 | 121.19 | 226.33 | 234.27 |
| Benzo[b]fluorene | 120.35 | 72.38 | 277.06 | 259.76 | 375.12 |
| Cyclopenta(c,d)pyrene | 19.61 | 13.60 | 39.40 | 40.66 | 41.24 |
| Benz[a]anthracene | 73.47 | 58.52 | 210.41 | 196.96 | 271.19 |
| Chryene+Triphenylene | 129.39 | 123.11 | 775.95 | 369.46 | 924.18 |
| Napthacene | 13.04 | 9.97 | 50.98 | 24.11 | 32.64 |
| 4-Methylchrysene | 1.84 | 2.06 | 4.83 | 4.18 | 9.11 |
| Benzo[b]fluoranthene | 2.91 | 4.45 | 8.77 | 9.82 | 24.62 |
| Benzo[k]fluoranthene | 1.39 | 2.12 | 3.72 | 4.19 | 8.19 |
| Dimethylbenz[a]anthracene | ND | ND | ND | ND | ND |
| Benzo[e]pyrene | 0.95 | 1.69 | 2.13 | 4.11 | 6.45 |
| Benzo[a]pyrene | 0.54 | 1.46 | 0.63 | 2.40 | 2.06 |
| Perylene | ND | ND | ND | ND | ND |
| 3-Methylcholanthrene | ND | ND | ND | ND | ND |
| Indone[1,2,3-cd]pyrene | ND | 0.94 | 0.62 | 1.97 | 0.45 |
| Dibenz[a,h+a,c]anthracene | ND | ND | ND | ND | ND |
| Benzo[g,h,i]perylene | 0.33 | 1.02 | 0.43 | 0.86 | 0.69 |
| Anthranthene | ND | ND | ND | ND | ND |
| Corenene | ND | ND | ND | ND | ND |

| **NPAH Mass (pg)**<br>**GFF (Particle Phase)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop |
| Sampling Start Time | | | | 7/29/04 7pm | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am | 7/29/04 7pm | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am |
| Sampling End Time | | | | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am | 8/01/04 7pm | 7/29/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm |
| Volume ($m^3$) | | | | 459.9378 | 224.4618 | 223.7022 | 451.5822 | 290.9268 | 454.6206 | 432.972 | 463.356 | 224.8416 | 213.8274 | 429.5538 | 455.76 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 22.0 | 43.4 | 29.8 | 36.2 | 25.6 | 29.8 | 21.0 | 18.7 | 21.4 | 17.8 | 18.8 | 25.3 | 22.6 | 21.5 | 25.9 |
| d9-9N-Anthracene | 38.0 | 46.9 | 43.4 | 42.0 | 41.1 | 45.2 | 30.6 | 37.4 | 33.5 | 38.7 | 21.0 | 37.5 | 31.1 | 24.8 | 33.6 |
| d9-1N-Pyrene | 50.9 | 60.4 | 58.9 | 135.6 | 68.9 | 69.1 | 59.0 | 76.6 | 70.8 | 77.1 | 58.2 | 70.1 | 56.2 | 73.4 | 58.6 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 5.20 | 8.52 | 5.93 | 125.56 | 30.51 | ND | 77.40 | 29.53 | 82.24 | 22.51 | 78.76 | 51.66 | ND | 77.58 | 30.68 |
| 2N-Naphthalene | 9.27 | 9.56 | 4.63 | 130.12 | 46.88 | ND | 70.29 | 44.18 | 99.61 | 39.09 | 142.23 | 90.71 | 35.91 | 95.93 | 50.67 |
| 2N-Biphenyl | 1.42 | 1.46 | 2.09 | 6.07 | ND | ND | 5.43 | ND | ND | ND | 7.24 | ND | ND | 6.78 | ND |
| 3N-Biphenyl | 3.40 | 4.25 | 2.85 | 35.15 | 13.64 | 13.99 | 19.01 | 10.98 | 24.32 | 12.98 | 47.13 | 32.04 | 15.85 | 23.07 | 15.33 |
| 4N-Biphenyl | 0.71 | 5.00 | 1.84 | 82.72 | 16.47 | ND | 97.09 | ND | 62.17 | 7.97 | 88.22 | 53.11 | ND | 79.84 | 17.56 |
| 1,3-DiN-Naphthalene | 0.35 | 0.41 | 1.11 | 12.69 | 2.19 | ND | 10.28 | 6.26 | 9.07 | 3.76 | 17.59 | 3.66 | ND | 13.48 | 4.96 |
| 1,5-DiN-Naphthalene | 0.21 | 0.13 | 0.17 | ND | 0.53 | ND | 0.61 | ND | 0.74 | 5.03 | 6.51 | 0.53 | 0.75 | 1.65 | ND |
| 5N-Acenaphthalene | 1.60 | 2.03 | 1.33 | 224.80 | 25.36 | ND | 78.38 | 32.31 | 122.77 | 7.71 | 216.89 | 53.99 | 6.97 | 109.33 | 37.39 |
| 2N-Fluorene | 0.14 | 0.69 | 0.59 | 94.08 | 18.20 | 2.32 | 53.46 | 23.23 | 71.13 | 14.56 | 60.85 | 29.66 | 4.09 | 80.95 | 18.22 |
| 9N-Anthracene | 70.72 | 33.03 | 69.05 | 3802.40 | 528.82 | ND | 1768.42 | 674.29 | 3032.19 | 657.74 | 5286.23 | 1853.93 | 702.68 | 2342.78 | 762.94 |
| 2N-Anthracene | 0.17 | 0.62 | 0.22 | 35.53 | 9.10 | ND | 20.86 | 10.36 | 27.09 | 11.44 | 45.74 | 132.92 | 41.33 | 34.38 | 21.18 |
| 9N-Phenanthrene | 0.15 | 1.06 | 1.93 | 2019.85 | 337.72 | 16.28 | 897.05 | 253.38 | 855.84 | 189.09 | 1559.72 | 475.18 | 48.15 | 1312.27 | 429.65 |
| 3N-Phenanthrene | 2.59 | 0.92 | 0.95 | 1305.05 | 375.64 | 34.87 | 504.37 | 297.45 | 1037.61 | 235.39 | 1067.20 | 1063.19 | 214.13 | 731.57 | 524.50 |
| 4N-Phenanthrene | 1.26 | 1.61 | 4.82 | 490.19 | 87.36 | ND | 302.80 | 206.25 | 374.09 | 67.45 | 355.59 | 216.31 | 32.07 | 211.96 | 155.55 |
| 2N-Fluoranthene | 15.30 | 1.38 | 0.41 | 11768.26 | 4421.55 | 275.62 | 941.78 | 1139.86 | 9905.40 | 2634.66 | 23078.57 | 19069.95 | 10893.38 | 2972.40 | 4610.65 |
| 3N-Fluoranthene | 0.21 | 0.37 | 0.23 | 202.13 | 78.13 | ND | 54.39 | 73.96 | 206.38 | 97.40 | 129.55 | 144.10 | 17.81 | 114.35 | 118.78 |
| 1N-Pyrene | 11.49 | 1.76 | 7.90 | 47595.71 | 11628.34 | 274.20 | 13980.28 | 20579.15 | 19908.25 | 10853.57 | 59015.10 | 22908.71 | 3458.45 | 34534.03 | 16276.22 |
| 2N-Pyrene | 4.26 | 4.53 | 3.01 | 506.92 | 447.71 | 44.38 | 201.18 | 191.27 | 463.79 | 113.36 | 1614.31 | 2547.55 | 3459.95 | 1636.96 | 1220.39 |
| 6N-Chrysene | 0.59 | 0.49 | 0.00 | 103.88 | 31.20 | ND | 33.21 | 74.72 | 73.32 | 72.88 | 86.55 | 86.74 | 17.46 | 60.08 | 72.26 |

| **NPAH Mass (pg)** | | | | | |
|---|---|---|---|---|---|
| **GFF (Particle Phase)** | | | | | |
| Sampling Site | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop |
| Sampling Start Time | 7/31/04 7pm | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am |
| Sampling End Time | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am | 8/02/04 7pm |
| Volume ($m^3$) | 455.3802 | 211.1688 | 232.0578 | 447.7842 | 451.962 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 20.5 | 30.7 | 25.1 | 25.9 | 29.5 |
| d9-9N-Anthracene | 21.3 | 39.4 | 47.7 | 15.4 | 34.6 |
| d9-1N-Pyrene | 59.9 | 70.8 | 86.5 | 61.2 | 60.1 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 47.36 | 28.25 | 38.47 | 213.70 | 64.72 |
| 2N-Naphthalene | 105.80 | 36.14 | 83.64 | 227.52 | 111.48 |
| 2N-Biphenyl | 7.53 | ND | ND | 17.62 | 13.44 |
| 3N-Biphenyl | 23.61 | 13.90 | 16.17 | 49.69 | 12.32 |
| 4N-Biphenyl | ND | 21.35 | 50.66 | 223.16 | 16.76 |
| 1,3-DiN-Naphthalene | 27.89 | 2.73 | 58.74 | 31.58 | 9.16 |
| 1,5-DiN-Naphthalene | 1.21 | 4.95 | 8.09 | 6.95 | 3.80 |
| 5N-Acenaphthalene | 122.88 | 13.32 | 14.33 | 221.94 | 48.74 |
| 2N-Fluorene | 36.21 | 14.07 | 13.96 | 59.24 | 24.12 |
| 9N-Anthracene | 3934.79 | 945.91 | 2110.52 | 5086.36 | 5287.91 |
| 2N-Anthracene | 54.94 | 117.46 | 192.50 | 97.69 | 292.18 |
| 9N-Phenanthrene | 3787.08 | 275.05 | 274.47 | 1129.49 | 234.21 |
| 3N-Phenanthrene | 1639.03 | 493.26 | 502.61 | 739.55 | 602.63 |
| 4N-Phenanthrene | 12.61 | 14.01 | 115.39 | 356.84 | 143.09 |
| 2N-Fluoranthene | 8078.10 | 7559.63 | 33602.27 | 5848.43 | 39231.82 |
| 3N-Fluoranthene | 646.05 | 210.69 | 658.09 | 156.65 | 80.20 |
| 1N-Pyrene | 61214.88 | 18443.33 | 11120.75 | 43233.50 | 14949.50 |
| 2N-Pyrene | 852.43 | 1228.31 | 5979.09 | 1998.81 | 3532.29 |
| 6N-Chrysene | 193.58 | 110.58 | 34.76 | 60.91 | 65.40 |

| **NPAH Mass (pg)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUF (Gas Phase)** | | | | | | | | | | | | | | | |
| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Highway | Highway | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop | Truck Stop |
| Sampling Start Time | | | | 7/29/04 7am | 8/01/04 7am | 7/29/04 7pm | 7/30/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am |
| Sampling End Time | | | | 7/29/04 7pm | 8/01/04 7pm | 7/29/04 7am | 7/30/04 1pm | 7/30/04 7pm | 7/31/04 7am | 7/31/04 7pm | 8/01/04 7am | 8/01/04 1pm | 8/01/04 7pm | 8/02/04 7am | 8/02/04 7pm |
| Volume ($m^3$) | | | | 459.9378 | 432.972 | 463.356 | 224.8416 | 213.8274 | 429.5538 | 455.76 | 455.3802 | 211.1688 | 232.0578 | 447.7842 | 451.962 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 35.6 | 14.4 | 10.2 | 28.5 | 23.7 | 40.6 | 23.1 | 26.0 | 39.2 | 30.0 | 54.9 | 41.5 | 33.1 | 50.3 | 29.4 |
| d9-9N-Anthracene | 26.2 | 28.5 | 25.0 | 14.7 | 21.9 | 11.0 | 16.5 | 9.6 | 11.9 | 11.8 | 9.2 | 12.6 | 14.9 | 3.4 | 7.9 |
| d9-1N-Pyrene | 30.9 | 42.5 | 36.8 | 33.5 | 37.3 | 34.5 | 42.2 | 13.5 | 29.8 | 30.9 | 29.0 | 24.1 | 26.9 | 20.9 | 24.5 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 208.76 | 13.35 | 56.60 | 21891.18 | 5852.42 | 35684.02 | 5497.48 | 4250.67 | 21998.46 | 17949.17 | 28230.59 | 46525.73 | 7009.61 | 38209.89 | 11255.98 |
| 2N-Naphthalene | 147.51 | 4.66 | 55.82 | 13516.36 | 6546.57 | 21318.90 | 5571.81 | 2803.70 | 10843.34 | 10898.05 | 23193.85 | 11308.47 | 6847.77 | 16042.33 | 10117.31 |
| 2N-Biphenyl | 13.70 | 1.73 | 5.19 | 646.73 | 353.51 | 1422.33 | 431.07 | 177.40 | 826.69 | 831.29 | 1027.13 | 558.83 | 376.67 | 1159.05 | 753.41 |
| 3N-Biphenyl | 30.84 | 2.25 | 16.72 | 1480.98 | 1273.65 | 1585.15 | 1465.11 | 513.96 | 907.69 | 2537.26 | 1430.50 | 1398.82 | 1233.29 | 1934.36 | 2638.40 |
| 4N-Biphenyl | 51.96 | 0.74 | 11.32 | 2553.59 | 1107.03 | 5127.08 | 1977.53 | 100.70 | 3445.19 | 3396.49 | 10745.21 | 3212.35 | 1209.90 | 6398.85 | 3155.25 |
| 1,3-DiN-Naphthalene | 0.35 | 0.84 | 1.22 | 47.15 | 22.89 | 71.34 | 86.68 | ND | 57.08 | 61.55 | 176.51 | 59.16 | 31.15 | 54.30 | 61.59 |
| 1,5-DiN-Naphthalene | 0.26 | 0.45 | 0.47 | 3.80 | 4.58 | 2.62 | 4.10 | 5.70 | 2.65 | 2.26 | 3.80 | 2.52 | 5.56 | 2.29 | ND |
| 5N-Acenaphthalene | 7.87 | 2.65 | 19.67 | 3068.88 | 834.82 | 4058.14 | 1726.24 | ND | 45.07 | 1543.38 | ND | 918.63 | 32.89 | ND | ND |
| 2N-Fluorene | 0.56 | 0.64 | 0.27 | 264.82 | 122.37 | 335.42 | 271.87 | ND | 3.74 | 185.61 | 5.50 | 106.54 | 2.27 | 114.56 | 3.55 |
| 9N-Anthracene | 16.52 | 11.05 | 36.93 | 11393.43 | 2495.06 | 18932.49 | 4799.64 | 2631.70 | 9260.87 | 4859.86 | 10180.74 | 5825.65 | 7085.41 | 3963.46 | 6472.54 |
| 2N-Anthracene | 0.09 | 0.29 | 0.45 | 139.56 | 102.58 | 244.14 | 320.93 | 387.21 | 174.40 | 250.13 | 350.53 | 187.28 | 983.51 | 113.40 | 460.91 |
| 9N-Phenanthrene | 0.48 | 0.63 | 0.49 | 1215.63 | 1138.28 | 2340.44 | 2558.26 | 298.99 | 1011.34 | 3249.70 | 15338.10 | 2623.72 | 1305.96 | 648.39 | 1432.42 |
| 3N-Phenanthrene | 4.29 | 1.27 | 3.71 | 556.59 | 636.68 | 947.83 | 1294.13 | 1112.63 | 593.96 | 1090.22 | 1494.58 | 983.75 | 4342.58 | 364.63 | 2476.73 |
| 4N-Phenanthrene | 5.35 | 2.68 | 3.38 | 51.60 | 57.13 | 155.98 | 103.96 | 106.61 | 151.67 | 79.12 | 188.09 | 149.90 | 301.39 | 92.17 | 153.77 |
| 2N-Fluoranthene | 2.17 | 1.06 | 7.56 | 251.91 | 464.94 | 2671.96 | 1221.44 | 3318.71 | 1467.12 | 1295.35 | 1242.42 | 961.10 | 16616.83 | 1925.54 | 10679.78 |
| 3N-Fluoranthene | 0.15 | 0.32 | 0.25 | ND | 23.81 | 25.13 | 19.34 | 3.23 | 4.94 | 18.16 | 39.32 | 65.39 | 10.61 | 20.26 | 27.25 |
| 1N-Pyrene | 6.20 | 5.18 | 3.73 | 364.91 | 2275.99 | 1372.18 | 1816.01 | 385.58 | 716.49 | 1519.50 | 1476.85 | 2469.56 | 1345.08 | 1762.87 | 3223.58 |
| 2N-Pyrene | 1.73 | 3.85 | 2.67 | ND | ND | 235.89 | 128.12 | 374.79 | 121.07 | 84.01 | 25.89 | 22.86 | 906.64 | 196.97 | 695.31 |
| 6N-Chrysene | 0.45 | 0.85 | 0.60 | ND | ND | 1.95 | ND | 2.03 | 2.32 | 2.54 | 2.74 | 2.45 | ND | 3.19 | 5.70 |

# Appendix B: PAH and NPAH Mass in Buffalo, NY (Diurnal Samples collected in Summer 2005)

| **PAH Mass (ng)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GFF (Particle Phase)** | | | | | | | | | | | | | | | |
| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina |
| Sampling Start Time | | | | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm |
| Sampling End Time | | | | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am |
| Volume (m3) | | | | 482.28 | 494.40 | 456.70 | 490.67 | 447.20 | 507.15 | 472.05 | 47.55 | 482.07 | 509.51 | 491.10 | 508.95 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 62.6 | 51.9 | 61.1 | 66.2 | 66.9 | 66.8 | 65.9 | 74.2 | 67.2 | 65.9 | 70.8 | 68.5 | 58.0 | 61.4 | 59.6 |
| d10-Fluorene | 87.4 | 83.9 | 79.6 | 80.8 | 83.8 | 81.1 | 83.3 | 87.8 | 85.7 | 82.5 | 86.5 | 78.8 | 70.9 | 76.8 | 73.5 |
| d10-Fluoranthene | 74.4 | 71.3 | 71.8 | 75.1 | 75.9 | 75.1 | 73.0 | 76.5 | 74.9 | 72.3 | 69.7 | 70.6 | 61.9 | 68.9 | 66.3 |
| d12-Perylene | 71.6 | 73.6 | 66.6 | 72.7 | 72.8 | 73.4 | 71.2 | 75.0 | 68.4 | 72.8 | 71.3 | 70.1 | 64.1 | 68.3 | 65.7 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 0.54 | 0.67 | 0.67 | 3.69 | 3.27 | 2.14 | 2.28 | 2.58 | 62.57 | 10.90 | ND | 4.03 | 1.97 | ND | 2.56 |
| 2-Methylnapthalene | 0.49 | 0.48 | 0.45 | 3.31 | 3.30 | 2.31 | 1.89 | 2.06 | 37.73 | 4.08 | ND | 3.15 | 1.89 | ND | 2.38 |
| Azulene | 0.01 | 0.01 | 0.01 | 0.81 | 0.81 | 0.48 | 0.71 | 0.47 | 1.23 | 1.05 | 0.15 | 0.85 | 0.67 | 0.64 | 0.89 |
| 1-Methylnapthalene | 0.14 | 0.10 | 0.06 | 2.53 | 2.57 | 1.72 | 1.63 | 1.26 | 17.22 | 4.62 | 0.63 | 2.93 | 1.24 | 0.96 | 2.23 |
| Biphenyl | 0.27 | 0.22 | 0.18 | 0.90 | 1.12 | 0.71 | ND | ND | 6.85 | 0.97 | ND | 0.91 | ND | ND | 0.68 |
| 2,7-Dimethylnapthalene | 0.07 | 0.06 | 0.03 | 0.36 | 0.53 | 0.42 | 0.45 | 0.36 | 5.47 | 0.76 | ND | 0.39 | 3.75 | 8.20 | 0.33 |
| 1,3-Dimethylnapthalene | 0.10 | 0.12 | 0.07 | 1.06 | 1.23 | 0.96 | 0.71 | 0.62 | 12.06 | 1.45 | ND | 0.71 | 0.54 | 0.47 | 0.86 |
| 1,6-Dimethylnapthalene | 0.11 | 0.12 | 0.16 | 0.87 | 1.23 | 0.80 | 0.66 | ND | 7.20 | 1.38 | ND | 1.00 | 0.69 | 0.52 | 0.91 |
| 1,4-Dimethylnapthalene | 0.03 | 0.01 | 0.04 | 0.90 | 1.13 | 0.33 | 0.54 | 0.15 | 5.73 | 1.01 | ND | 0.58 | 0.28 | 0.24 | 0.34 |
| 1,5-Dimethylnapthalene | 0.08 | 0.09 | 0.06 | ND | 0.26 | ND | ND | ND | 1.81 | 0.31 | ND | ND | ND | ND | ND |
| Acenapthylene | 0.02 | 0.04 | 0.03 | 1.71 | 1.50 | 1.73 | 1.85 | 1.34 | 7.23 | 1.13 | ND | 2.09 | 1.13 | 1.24 | 2.12 |
| 1,2-Dimethylnapthalene | 0.05 | 0.05 | 0.01 | 0.25 | 0.72 | 0.20 | 0.53 | 0.29 | 2.34 | 0.21 | ND | 0.54 | 0.48 | 0.17 | 0.28 |
| 1,8-Dimethylnapthalene | 0.16 | 0.11 | 0.13 | 0.44 | 0.53 | ND | 0.54 | 0.54 | 1.15 | ND | ND | 0.58 | 0.77 | ND | 0.45 |
| Acenapthene | 0.08 | 0.08 | 0.14 | 2.15 | 1.88 | 0.90 | 0.84 | 0.66 | 84.95 | 3.73 | 0.40 | 2.21 | 0.74 | 0.36 | 1.00 |
| 2,3,5-Trimethylnapthalene | 0.07 | 0.04 | 0.10 | 0.53 | 0.58 | 0.42 | 0.46 | 0.39 | 4.34 | 0.64 | ND | 0.26 | 0.44 | 0.37 | 0.45 |
| Fluorene | 0.19 | 0.20 | 0.30 | 6.61 | 4.41 | 1.85 | 2.56 | 1.49 | 118.70 | 6.40 | 0.71 | 6.52 | 2.15 | 2.31 | 2.57 |
| 1-Methylfuorene | 0.08 | 0.10 | 0.14 | 0.79 | 0.78 | 0.84 | 0.49 | 0.76 | 10.82 | 1.28 | 0.32 | 1.01 | 0.42 | 0.48 | 1.40 |
| Dibenzothiophene | 0.09 | 0.14 | 0.17 | 1.56 | 1.41 | 0.61 | 0.77 | 0.59 | 44.20 | 2.09 | ND | 1.46 | 0.88 | ND | 0.82 |
| Phenanthrene | 0.91 | 1.68 | 3.12 | 35.33 | 26.16 | 12.34 | 13.51 | 8.96 | 905.70 | 39.67 | ND | 28.85 | 16.59 | 6.17 | 15.11 |
| Anthracene | 0.02 | 0.10 | 0.47 | 2.86 | 1.99 | 1.18 | 0.84 | 0.79 | 184.40 | 7.67 | ND | 2.95 | 1.05 | ND | 1.27 |
| 2-Methyldibenzothiophene | 0.08 | 0.10 | 0.10 | 0.62 | 0.81 | 0.40 | 0.61 | 0.48 | 6.90 | 0.80 | ND | 0.52 | 0.46 | 0.37 | 0.44 |
| 4-Methyldibenzothiophene | 0.02 | 0.02 | 0.03 | 0.49 | 0.68 | 0.25 | 0.46 | 0.35 | 8.76 | 0.71 | 0.10 | 0.44 | 0.46 | 0.31 | 0.36 |
| 2-Methylphenanthrene | 0.14 | 0.20 | 0.31 | 3.00 | 3.10 | 1.64 | 1.64 | 1.40 | 64.55 | 3.72 | ND | 2.40 | 2.20 | 0.97 | 1.82 |
| 2-Methylanthracene | 0.18 | 0.32 | 0.48 | 5.09 | 5.03 | 2.59 | 2.58 | 2.23 | 91.30 | 5.69 | ND | 3.82 | 3.68 | 1.40 | 2.83 |
| 4,5-Methylenephenanthrene | 0.04 | 0.01 | 0.01 | 0.06 | 0.17 | 0.06 | 0.09 | ND | 2.59 | 0.15 | ND | ND | 0.08 | 0.09 | 0.06 |
| 1-Methylanthracene | 0.09 | 0.14 | 0.20 | 1.37 | 2.13 | 1.09 | 1.09 | 0.92 | 34.56 | 2.25 | ND | 1.25 | 1.72 | 0.66 | 1.10 |
| 1-Methylphenanthrene | 0.12 | 0.16 | 0.25 | 1.91 | 1.95 | 1.09 | 1.01 | 0.82 | 41.41 | 2.62 | ND | 1.46 | 1.65 | 0.60 | 1.17 |
| 9-Methylanthracene | 0.01 | 0.03 | 0.02 | 0.18 | 0.19 | 0.06 | ND | 0.10 | 2.77 | 0.48 | ND | 0.12 | 0.12 | 0.06 | 0.33 |
| 9,10-Dimethylanthracene | 0.02 | 0.05 | 0.06 | 0.41 | 0.59 | 0.24 | 0.31 | 0.23 | 7.63 | 0.63 | ND | 0.35 | 0.34 | 0.15 | 0.33 |
| Fluoranthene | 0.30 | 4.23 | 5.38 | 66.88 | 42.93 | 20.30 | 22.55 | 13.15 | 939.54 | 52.12 | ND | 50.00 | 39.99 | 12.75 | 28.35 |
| Pyrene | 0.35 | 2.79 | 4.51 | 36.84 | 29.35 | 14.65 | 17.73 | 10.22 | 786.34 | 45.46 | ND | 29.69 | 34.96 | 10.55 | 21.00 |
| 3,6-Dimethylphenanthrene | 0.02 | 0.08 | 0.03 | 0.24 | 0.47 | 0.39 | ND | 0.41 | 4.82 | 0.49 | 0.29 | 0.37 | 0.16 | ND | 0.15 |
| Benzo[a]fluorene | 0.01 | 0.11 | 0.52 | 3.01 | 2.30 | 1.40 | 2.11 | 1.38 | 91.51 | 6.07 | ND | 3.10 | 4.98 | 1.35 | 2.26 |
| Retene | 0.13 | 0.31 | 0.13 | 0.77 | 2.30 | ND | 1.98 | 0.61 | 4.22 | 2.85 | 1.07 | 1.96 | 1.70 | 0.69 | 1.46 |
| Benzo[b]fluorene | 0.01 | 0.09 | 0.53 | 2.79 | 2.12 | 1.14 | 2.05 | 1.26 | 86.92 | 5.50 | ND | 2.73 | 4.47 | 1.27 | 2.18 |
| Cyclopenta[c,d]pyrene | 0.05 | 0.10 | 0.90 | 4.49 | 3.15 | 2.67 | 4.09 | 3.05 | 155.03 | 11.71 | ND | 4.66 | 9.28 | 2.28 | 6.12 |
| Benz[a]anthracene | 0.09 | 0.52 | 2.50 | 8.24 | 9.09 | 5.58 | 7.84 | 5.56 | 399.43 | 25.87 | ND | 9.26 | 14.24 | 3.83 | 11.45 |
| Chrysene+Triphenylene | 0.17 | 1.51 | 2.01 | 22.96 | 14.40 | 9.24 | 10.34 | 7.96 | 334.14 | 26.08 | ND | 16.42 | 27.48 | 7.81 | 14.12 |
| Napthacene | 0.01 | 0.04 | 0.63 | 1.98 | 1.38 | 0.92 | 1.19 | 0.79 | 80.38 | 5.66 | ND | 1.89 | 2.20 | ND | 1.27 |
| 4-Methylchrysene | 0.02 | 0.03 | 0.03 | 0.62 | 0.71 | 0.41 | 0.40 | 0.42 | 10.89 | 0.98 | 0.24 | 0.49 | 0.70 | 0.37 | 0.52 |
| Benzo[b]fluoranthene | 0.59 | 2.33 | 3.94 | 27.05 | 29.96 | 17.69 | 19.12 | 15.32 | 547.61 | 51.80 | ND | 26.89 | 53.97 | 15.71 | 33.49 |
| Benzo[k]fluoranthene | 0.20 | 0.78 | 1.17 | 10.55 | 10.38 | 5.74 | 6.82 | 5.45 | 199.36 | 18.03 | ND | 8.18 | 16.98 | 5.74 | 11.27 |
| Dimethylbenz[a]anthracene | 0.01 | 0.01 | 0.02 | 0.22 | 0.73 | 0.17 | 0.19 | 0.40 | 5.16 | 0.72 | 0.23 | 0.61 | 0.56 | 0.14 | 0.53 |
| Benzo[e]pyrene | 0.25 | 1.06 | 1.65 | 12.50 | 13.63 | 7.72 | 8.63 | 6.48 | 221.30 | 23.73 | ND | 10.98 | 23.31 | 6.35 | 14.07 |
| Benzo[a]pyrene | 0.28 | 1.04 | 2.70 | 11.43 | 12.47 | 7.30 | 10.08 | 6.83 | 401.13 | 31.73 | ND | 12.21 | 28.73 | 7.59 | 15.14 |
| Perylene | 0.02 | 0.14 | 0.48 | 2.11 | 1.39 | 1.00 | 1.13 | 0.91 | 78.00 | 5.19 | ND | 1.78 | 3.31 | 0.74 | 1.97 |
| 3-Methylchloanthrene | 0.03 | 0.02 | 0.04 | ND | ND | ND | ND | 0.14 | 7.38 | 0.20 | ND | ND | ND | 0.11 | ND |
| Indeno[1,2,3-c,d]pyrene | 0.05 | 1.33 | 2.24 | 20.19 | 18.35 | 12.59 | 13.08 | 10.96 | 372.11 | 41.51 | ND | 19.24 | 38.98 | 11.72 | 25.05 |
| Dibenz[a,h+ac]anthracene | 0.00 | 0.03 | 0.22 | 1.01 | 1.21 | 0.52 | 0.95 | 0.66 | 35.91 | 3.31 | ND | 1.36 | 2.66 | 3.65 | 0.63 |
| Benzo[g,h,i]perylene | 0.12 | 1.34 | 1.76 | 19.01 | 15.22 | 11.15 | 10.25 | 9.31 | 288.71 | 37.03 | ND | 14.65 | 29.67 | 9.13 | 18.73 |
| Anthanthrene | 0.01 | 0.11 | 0.35 | 2.20 | 0.97 | 1.27 | 1.61 | 1.11 | 61.51 | 6.58 | ND | 2.14 | 4.89 | 1.41 | 2.00 |
| Corenene | 0.01 | 0.33 | 0.24 | 8.07 | 7.21 | 5.02 | 3.72 | 4.51 | 95.30 | 18.23 | 1.32 | 6.55 | 10.67 | 3.59 | 8.02 |

**PAH Mass (ng)**
**GFF (Particle Phase)**

| Sampling Site | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Highway | Highway | Highway |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Start Time | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am |
| Sampling End Time | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm |
| Volume (m3) | 492.94 | 476.34 | 517.81 | 470.09 | 485.35 | 503.48 | 494.40 | 510.88 | 489.04 | 467.16 | 487.80 | 491.93 | 442.47 | 608.74 | 647.65 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 63.9 | 65.5 | 65.5 | 61.0 | 62.9 | 54.8 | 58.9 | 57.6 | 58.4 | 61.6 | 61.7 | 62.5 | 68.2 | 69.0 | 67.0 |
| d10-Fluorene | 80.3 | 81.9 | 80.6 | 78.9 | 75.8 | 79.4 | 77.3 | 73.9 | 77.2 | 76.6 | 80.0 | 75.3 | 82.3 | 86.5 | 82.8 |
| d10-Fluoranthene | 69.0 | 68.7 | 70.3 | 67.3 | 66.7 | 68.6 | 66.4 | 65.2 | 66.5 | 68.4 | 73.2 | 65.4 | 72.8 | 74.1 | 70.6 |
| d12-Perylene | 64.5 | 63.5 | 67.1 | 64.6 | 61.1 | 63.3 | 60.1 | 62.6 | 65.1 | 62.6 | 66.1 | 66.5 | 68.6 | 66.9 | 62.8 |
| | | | | | | | | | | | | | | | |
| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 4.61 | 5.33 | 4.42 | 4.10 | 5.87 | 4.16 | 8.17 | 5.15 | 3.55 | 3.19 | 8.83 | 4.82 | 21.91 | 44.67 | 28.33 |
| 2-Methylnapthalene | 3.72 | 5.39 | 3.69 | 3.60 | 4.71 | 3.78 | 4.22 | 3.23 | 2.54 | 3.17 | 5.04 | 4.68 | 23.50 | 45.42 | 32.54 |
| Azulene | 1.06 | 1.12 | 0.78 | 0.94 | 0.77 | 1.33 | 1.80 | 0.63 | 1.46 | 0.47 | 1.17 | 1.04 | 0.87 | 1.22 | 0.77 |
| 1-Methylnapthalene | 2.12 | 2.70 | 1.77 | 1.56 | 2.22 | 3.65 | 5.46 | 1.01 | 3.15 | 1.95 | 3.01 | 3.09 | 7.54 | 14.18 | 9.58 |
| Biphenyl | 1.09 | 1.48 | 0.96 | 1.00 | 1.52 | 1.04 | 1.19 | 1.16 | 0.80 | 0.96 | 1.65 | 1.42 | 5.74 | 9.26 | 7.75 |
| 2,7-Dimethylnapthalene | 3.17 | 0.84 | 0.25 | 0.88 | 0.56 | 0.60 | 0.81 | 0.65 | 0.29 | 0.68 | 1.08 | 0.93 | 4.35 | 10.07 | 7.85 |
| 1,3-Dimethylnapthalene | 2.52 | 2.18 | 1.52 | 1.06 | 1.94 | 0.97 | 1.15 | 0.94 | 0.59 | 1.08 | 1.83 | 2.41 | 8.69 | 15.51 | 9.94 |
| 1,6-Dimethylnapthalene | 1.26 | 1.46 | 0.95 | 1.20 | 1.25 | 1.11 | 1.62 | 0.83 | 1.04 | 1.09 | 1.52 | 1.67 | 5.83 | 10.57 | 7.96 |
| 1,4-Dimethylnapthalene | 3.57 | 3.33 | 2.95 | 0.73 | 1.80 | 1.12 | 1.50 | 0.75 | 0.99 | 0.30 | 2.37 | 1.13 | 7.78 | 14.17 | 10.98 |
| 1,5-Dimethylnapthalene | 0.46 | ND | ND | ND | ND | ND | 0.27 | 0.32 | ND | 0.51 | ND | 0.25 | 0.90 | 1.13 | 1.21 |
| Acenapthylene | 3.92 | 2.04 | 1.37 | 2.08 | 1.13 | 0.70 | 1.29 | 2.46 | 0.83 | 1.15 | 3.17 | 1.18 | 5.87 | 16.38 | 17.19 |
| 1,2-Dimethylnapthalene | 1.26 | 0.66 | 0.99 | 1.13 | 0.77 | 0.74 | 0.91 | 0.52 | 0.84 | 0.91 | 0.65 | 0.72 | 2.01 | 2.75 | 2.89 |
| 1,8-Dimethylnapthalene | 11.27 | 6.17 | 4.94 | 4.19 | 2.70 | 1.71 | 2.33 | 2.34 | 1.62 | 1.64 | 2.44 | 1.19 | 0.90 | 2.01 | 2.30 |
| Acenapthene | 2.88 | 2.76 | 1.80 | 1.84 | 2.95 | 2.09 | 4.47 | 2.16 | 1.77 | 2.92 | 4.52 | 1.76 | 4.90 | 9.06 | 7.34 |
| 2,3,5-Trimethylnapthalene | 0.84 | 0.96 | 0.88 | 0.68 | 0.83 | 0.42 | 0.53 | 0.27 | 0.26 | 0.64 | 1.06 | 1.02 | 3.60 | 5.75 | 5.68 |
| Fluorene | 6.23 | 5.28 | 5.09 | 5.37 | 8.35 | 5.28 | 7.98 | 3.47 | 4.24 | 6.79 | 11.96 | 4.91 | 15.41 | 31.39 | 20.07 |
| 1-Methylfuorene | 1.56 | 1.09 | 1.67 | 1.38 | 1.74 | 3.14 | 1.30 | 2.79 | 0.49 | 0.81 | 2.10 | 1.41 | 6.01 | 10.08 | 8.81 |
| Dibenzothiophene | 4.67 | 2.98 | 2.78 | 2.41 | 5.01 | 2.52 | 4.25 | 2.02 | 2.02 | 4.59 | 8.19 | 2.47 | 6.08 | 11.61 | 8.88 |
| Phenanthrene | 84.45 | 51.21 | 53.52 | 48.40 | 104.16 | 51.24 | 79.45 | 32.56 | 36.18 | 98.00 | 174.85 | 49.75 | 121.99 | 261.36 | 183.90 |
| Anthracene | 11.51 | 5.86 | 6.73 | 6.40 | 14.68 | 6.77 | 11.90 | 3.27 | 3.62 | 11.58 | 22.64 | 5.86 | 20.19 | 35.72 | 25.23 |
| 2-Methyldibenzothiophene | 1.52 | 1.14 | 1.04 | 1.04 | 1.52 | 0.86 | 1.12 | 0.72 | 0.71 | 1.24 | 2.13 | 1.20 | 4.92 | 8.86 | 7.56 |
| 4-Methyldibenzothiophene | 1.42 | 0.97 | 1.18 | 0.81 | 1.42 | 0.74 | 1.03 | 1.04 | 0.62 | 1.30 | 2.26 | 0.99 | 3.02 | 6.22 | 5.11 |
| 2-Methylphenanthrene | 8.51 | 5.97 | 5.50 | 5.18 | 9.09 | 4.51 | 7.07 | 3.40 | 3.25 | 8.58 | 14.36 | 5.79 | 22.68 | 39.26 | 38.45 |
| 2-Methylanthracene | 13.14 | 9.17 | 8.79 | 8.15 | 14.05 | 7.09 | 11.20 | 5.24 | 5.48 | 12.69 | 22.50 | 8.85 | 37.94 | 68.36 | 63.33 |
| 4,5-Methylenephenanthrene | 0.23 | 0.19 | 0.22 | 0.13 | 0.18 | 0.15 | 0.18 | 0.06 | 0.11 | 0.21 | 0.27 | 0.13 | 0.36 | 0.65 | 0.47 |
| 1-Methylanthracene | 4.74 | 3.70 | 3.19 | 3.00 | 5.45 | 2.63 | 4.41 | 2.04 | 2.12 | 5.20 | 8.74 | 3.66 | 12.88 | 22.24 | 22.91 |
| 1-Methylphenanthrene | 6.23 | 4.19 | 4.14 | 3.35 | 6.55 | 3.10 | 4.82 | 2.23 | 2.18 | 5.89 | 10.91 | 3.80 | 13.56 | 23.47 | 22.94 |
| 9-Methylanthracene | 0.71 | 0.54 | 0.31 | 0.19 | 0.63 | 0.23 | 0.82 | 0.26 | 0.42 | 0.28 | 0.55 | 0.20 | 1.34 | 1.29 | 1.28 |
| 9,10-Dimethylanthracene | 1.66 | 1.06 | 1.00 | 0.85 | 1.41 | 0.72 | 1.14 | 0.59 | 0.50 | 1.26 | 2.19 | 0.86 | 5.80 | 9.18 | 10.13 |
| Fluoranthene | 282.29 | 138.98 | 174.91 | 150.58 | 355.96 | 142.05 | 191.59 | 75.64 | 97.72 | 317.02 | 633.80 | 131.18 | 213.35 | 457.41 | 271.83 |
| Pyrene | 194.53 | 94.40 | 117.48 | 109.41 | 256.69 | 102.37 | 133.33 | 50.77 | 70.55 | 241.99 | 462.45 | 95.55 | 175.27 | 299.38 | 247.43 |
| 3,6-Dimethylphenanthrene | 1.23 | 1.37 | 0.88 | 0.99 | 1.21 | 0.61 | 1.16 | 0.98 | 0.41 | 0.86 | 1.50 | 1.14 | 14.30 | 24.77 | 30.16 |
| Benzo[a]fluorene | 12.04 | 5.73 | 6.73 | 7.25 | 15.24 | 6.13 | 10.17 | 4.13 | 4.50 | 16.21 | 27.96 | 7.41 | 19.41 | 27.82 | 28.58 |
| Retene | 2.26 | 3.32 | 1.61 | 2.36 | 1.75 | 2.34 | 3.15 | 2.90 | 2.04 | 2.32 | 2.88 | 2.15 | 3.80 | 8.07 | 6.05 |
| Benzo[b]fluorene | 9.60 | 4.58 | 5.09 | 6.30 | 12.50 | 4.62 | 8.41 | 4.02 | 3.73 | 13.31 | 21.53 | 5.79 | 16.97 | 24.90 | 23.37 |
| Cyclopenta[c,d]pyrene | 30.94 | 13.26 | 17.29 | 18.30 | 39.68 | 18.97 | 22.23 | 11.59 | 11.87 | 36.96 | 63.94 | 16.99 | 27.85 | 19.73 | 38.68 |
| Benz[a]anthracene | 71.74 | 28.36 | 42.66 | 39.91 | 96.37 | 34.84 | 50.97 | 20.51 | 25.47 | 92.24 | 161.41 | 36.69 | 61.54 | 41.23 | 78.52 |
| Chrysene+Triphenylene | 198.28 | 75.70 | 133.01 | 93.57 | 253.59 | 74.97 | 103.22 | 38.40 | 55.13 | 182.12 | 423.35 | 79.74 | 95.38 | 70.35 | 115.17 |
| Napthacene | 14.62 | 4.55 | 8.96 | 9.85 | 22.35 | 6.41 | 8.86 | 2.96 | 4.88 | 20.63 | 36.88 | 6.74 | 12.41 | 8.09 | 13.12 |
| 4-Methylchrysene | 2.39 | 1.62 | 1.74 | 1.65 | 3.12 | 1.80 | 1.80 | 1.24 | 1.10 | 2.88 | 4.95 | 1.70 | 3.24 | 2.93 | 4.86 |
| Benzo[b]fluoranthene | 360.32 | 138.96 | 188.16 | 142.33 | 361.17 | 140.19 | 172.88 | 79.38 | 99.83 | 341.36 | 674.85 | 139.13 | 108.42 | 82.35 | 149.02 |
| Benzo[k]fluoranthene | 89.56 | 39.41 | 51.85 | 40.85 | 113.45 | 43.23 | 48.60 | 23.53 | 26.26 | 98.22 | 219.43 | 41.18 | 33.03 | 23.71 | 43.78 |
| Dimethylbenz[a]anthracene | 2.16 | 3.73 | 1.60 | 1.05 | 2.71 | 1.88 | 1.24 | 2.55 | 1.40 | 2.18 | 4.16 | 4.25 | 2.81 | 2.99 | 3.57 |
| Benzo[e]pyrene | 122.31 | 56.92 | 63.00 | 55.88 | 137.81 | 58.39 | 63.28 | 33.09 | 38.01 | 132.06 | 254.82 | 55.26 | 45.48 | 36.32 | 67.34 |
| Benzo[a]pyrene | 108.34 | 50.66 | 53.88 | 61.14 | 145.13 | 61.02 | 69.65 | 31.17 | 40.76 | 148.07 | 256.18 | 59.87 | 58.48 | 38.39 | 83.75 |
| Perylene | 21.69 | 7.63 | 8.52 | 9.77 | 29.48 | 9.65 | 13.93 | 4.69 | 5.86 | 29.28 | 51.66 | 12.04 | 8.59 | 5.58 | 14.22 |
| 3-Methylchloanthrene | 1.27 | 0.19 | 0.83 | 0.76 | 2.08 | 0.25 | 0.93 | 0.16 | 0.28 | 1.79 | 3.27 | 0.91 | 0.69 | 1.26 | 0.80 |
| Indeno[1,2,3-c,d]pyrene | 177.40 | 97.65 | 88.73 | 96.43 | 233.20 | 113.72 | 105.12 | 69.08 | 69.24 | 231.73 | 418.86 | 91.56 | 68.78 | 44.93 | 90.60 |
| Dibenz[a,h+ac]anthracene | 12.09 | 6.08 | 6.58 | 8.63 | 20.19 | 6.80 | 8.23 | 5.89 | 6.13 | 21.07 | 32.49 | 6.95 | 4.21 | 3.20 | 7.44 |
| Benzo[g,h,i]perylene | 132.88 | 73.43 | 68.19 | 72.55 | 174.49 | 106.75 | 96.19 | 57.66 | 53.45 | 168.76 | 303.96 | 71.60 | 65.08 | 48.12 | 93.78 |
| Anthanthrene | 19.21 | 6.79 | 9.90 | 10.50 | 28.28 | 13.73 | 16.36 | 6.30 | 7.77 | 25.26 | 43.83 | 8.74 | 10.41 | 4.63 | 13.78 |
| Corenene | 48.86 | 31.73 | 26.96 | 26.44 | 63.00 | 49.72 | 49.16 | 27.77 | 23.85 | 56.51 | 97.18 | 27.04 | 27.06 | 19.04 | 40.12 |

**PAH Mass (ng)**
**GFF (Particle Phase)**

| Sampling Site | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Start Time | 7/21/05 7pm | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm |
| Sampling End Time | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm | 7/26/05 7am |
| Volume (m3) | 504.78 | 214.67 | 259.21 | 489.85 | 224.47 | 275.2585899 | 494.3968998 | 230.1646071 | 233.2030015 | 489.4529308 | 242.129843 | 259.7411746 | 486.5447137 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 47.4 | 64.1 | 57.0 | 62.3 | 47.8 | 62.0 | 54.5 | 68.4 | 64.2 | 50.5 | 63.2 | 57.4 | 62.4 |
| d10-Fluorene | 65.8 | 80.8 | 77.0 | 83.0 | 78.6 | 82.3 | 71.3 | 79.5 | 82.2 | 77.2 | 81.7 | 78.8 | 88.1 |
| d10-Fluoranthene | 63.4 | 71.4 | 67.0 | 69.2 | 72.6 | 70.1 | 64.3 | 69.4 | 72.4 | 69.9 | 70.5 | 66.6 | 76.6 |
| d12-Perylene | 58.6 | 70.9 | 65.9 | 69.3 | 70.9 | 69.2 | 60.5 | 69.1 | 68.0 | 64.1 | 68.4 | 66.9 | 75.0 |
| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 13.35 | 12.79 | 9.66 | 13.23 | 5.90 | 9.47 | 20.27 | 6.37 | 6.20 | 13.18 | 16.61 | 8.00 | 17.26 |
| 2-Methylnapthalene | 15.51 | 10.12 | 8.23 | 12.36 | 2.87 | 8.10 | 18.36 | 4.00 | 4.20 | 12.32 | 13.02 | 6.67 | 21.22 |
| Azulene | 0.75 | 0.77 | 0.38 | 1.17 | 0.58 | 0.70 | 0.78 | 1.19 | 0.80 | 0.65 | 1.22 | 0.98 | 1.24 |
| 1-Methylnapthalene | 5.33 | 4.53 | 3.05 | 5.58 | 1.79 | 4.65 | 6.17 | 4.33 | 4.32 | 5.21 | 6.08 | 3.23 | 8.00 |
| Biphenyl | 3.72 | 2.86 | 2.31 | 2.11 | 0.99 | 2.14 | 3.68 | 1.19 | 1.38 | 2.73 | 3.01 | 1.75 | 5.36 |
| 2,7-Dimethylnapthalene | 4.79 | 1.96 | 1.51 | 1.76 | 0.64 | 1.84 | 2.15 | 0.78 | 0.72 | 2.89 | 2.40 | 2.02 | 3.33 |
| 1,3-Dimethylnapthalene | 5.32 | 4.23 | 3.58 | 2.76 | 1.00 | 2.66 | 3.00 | 1.27 | 2.13 | 4.46 | 4.43 | 2.85 | 6.78 |
| 1,6-Dimethylnapthalene | 4.07 | 2.91 | 2.15 | 2.17 | 1.12 | 1.93 | 2.52 | 1.22 | 1.38 | 3.23 | 2.91 | 2.07 | 5.03 |
| 1,4-Dimethylnapthalene | 3.36 | 1.93 | 1.58 | 1.50 | 1.49 | 1.63 | 1.53 | 1.07 | 1.49 | 2.11 | 2.82 | 1.44 | 3.07 |
| 1,5-Dimethylnapthalene | 0.56 | 0.48 | 0.42 | 0.63 | 0.32 | 0.65 | 0.52 | 0.41 | 0.41 | 0.55 | 0.56 | 0.26 | 0.59 |
| Acenapthylene | 5.23 | 2.15 | 0.77 | 3.28 | 1.59 | 2.85 | 2.87 | 1.96 | 1.57 | 5.65 | 4.57 | 2.74 | 5.12 |
| 1,2-Dimethylnapthalene | 1.70 | 1.05 | 0.62 | 0.96 | 0.54 | 0.63 | 0.95 | 0.60 | 0.79 | 1.46 | 0.92 | 0.85 | 2.02 |
| 1,8-Dimethylnapthalene | 1.15 | 0.76 | ND | 0.63 | 0.86 | 0.52 | 0.98 | 0.64 | 0.54 | 0.78 | 0.91 | 0.63 | 0.73 |
| Acenapthene | 3.88 | 7.23 | 3.98 | 4.32 | 2.17 | 9.85 | 4.86 | 6.42 | 9.77 | 27.81 | 25.54 | 7.33 | 3.76 |
| 2,3,5-Trimethylnapthalene | 2.72 | 1.95 | 1.47 | 1.06 | 0.43 | 1.29 | 1.13 | 0.76 | 0.96 | 2.34 | 2.12 | 1.42 | 3.32 |
| Fluorene | 12.36 | 14.19 | 8.46 | 11.67 | 5.98 | 14.56 | 14.49 | 10.09 | 15.38 | 45.37 | 37.48 | 11.64 | 12.98 |
| 1-Methylfuorene | 5.38 | 4.31 | 2.48 | 2.11 | 1.22 | 2.22 | 1.93 | 1.72 | 2.19 | 5.34 | 5.17 | 2.57 | 6.50 |
| Dibenzothiophene | 4.84 | 5.32 | 3.82 | 4.71 | 2.31 | 6.34 | 4.61 | 4.16 | 6.48 | 18.54 | 16.35 | 5.24 | 5.43 |
| Phenanthrene | 101.65 | 124.46 | 90.84 | 115.68 | 54.55 | 135.12 | 103.66 | 83.77 | 136.46 | 392.20 | 332.22 | 112.85 | 114.92 |
| Anthracene | 14.35 | 20.80 | 18.48 | 15.22 | 7.97 | 20.25 | 11.23 | 10.23 | 19.77 | 62.15 | 57.87 | 18.19 | 14.49 |
| 2-Methyldibenzothiophene | 4.17 | 2.74 | 2.21 | 2.06 | 0.89 | 1.76 | 2.06 | 1.09 | 1.65 | 4.14 | 4.06 | 2.24 | 4.46 |
| 4-Methyldibenzothiophene | 2.49 | 2.23 | 1.76 | 1.72 | 1.12 | 1.64 | 1.85 | 1.43 | 1.79 | 4.56 | 4.26 | 2.16 | 2.59 |
| 2-Methylphenanthrene | 19.86 | 15.94 | 12.13 | 10.20 | 5.39 | 12.36 | 9.29 | 7.23 | 11.83 | 33.80 | 28.96 | 12.22 | 21.92 |
| 2-Methylanthracene | 33.01 | 25.62 | 19.41 | 17.96 | 8.78 | 18.39 | 16.07 | 10.95 | 17.55 | 48.54 | 42.75 | 18.60 | 36.73 |
| 4,5-Methylenephenanthrene | 0.33 | 0.41 | 0.28 | 0.24 | 0.17 | 0.32 | 0.13 | 0.17 | 0.30 | 0.94 | 0.90 | 0.36 | 0.35 |
| 1-Methylanthracene | 11.46 | 8.77 | 6.75 | 5.10 | 2.73 | 7.02 | 4.58 | 3.87 | 6.87 | 17.87 | 16.70 | 6.71 | 12.61 |
| 1-Methylphenanthrene | 12.28 | 9.94 | 7.78 | 5.92 | 3.43 | 7.97 | 5.63 | 4.43 | 7.29 | 20.89 | 18.01 | 7.39 | 11.53 |
| 9-Methylanthracene | 0.68 | 0.45 | 0.41 | 0.63 | 0.36 | 0.80 | 0.36 | 0.45 | 0.76 | 1.42 | 1.00 | 0.39 | 0.65 |
| 9,10-Dimethylanthracene | 4.93 | 3.25 | 2.89 | 1.77 | 0.98 | 2.04 | 1.54 | 1.03 | 1.62 | 4.34 | 4.24 | 2.30 | 6.03 |
| Fluoranthene | 185.02 | 197.42 | 206.37 | 210.89 | 141.54 | 184.99 | 153.14 | 109.37 | 169.66 | 495.74 | 426.43 | 155.16 | 193.50 |
| Pyrene | 150.75 | 165.73 | 168.08 | 143.70 | 92.88 | 155.65 | 96.01 | 90.30 | 144.00 | 409.93 | 362.99 | 132.34 | 150.51 |
| 3,6-Dimethylphenanthrene | 13.57 | 8.13 | 5.78 | 1.92 | 1.93 | 1.79 | 3.61 | 0.98 | 2.64 | 4.94 | 6.05 | 3.31 | 13.86 |
| Benzo[a]fluorene | 15.18 | 16.73 | 13.91 | 9.95 | 7.57 | 17.38 | 8.80 | 9.06 | 15.58 | 45.85 | 42.54 | 13.74 | 14.69 |
| Retene | 4.17 | 2.07 | 2.60 | 2.68 | 2.53 | 2.73 | 6.52 | 1.38 | 2.63 | 2.45 | 3.26 | 1.89 | 4.97 |
| Benzo[b]fluorene | 12.74 | 15.60 | 12.39 | 8.12 | 6.16 | 15.03 | 8.67 | 8.59 | 14.42 | 42.52 | 43.30 | 12.99 | 12.47 |
| Cyclopenta[c,d]pyrene | 17.53 | 29.93 | 22.09 | 18.15 | 12.63 | 29.15 | 15.55 | 17.89 | 29.16 | 79.41 | 75.01 | 25.22 | 19.91 |
| Benz[a]anthracene | 35.72 | 72.45 | 51.45 | 31.29 | 27.83 | 71.16 | 28.91 | 43.28 | 71.52 | 204.26 | 198.75 | 58.98 | 40.86 |
| Chrysene+Triphenylene | 45.58 | 79.63 | 66.92 | 62.66 | 58.39 | 82.43 | 48.41 | 42.35 | 69.03 | 192.25 | 176.32 | 71.59 | 60.01 |
| Napthacene | 6.04 | 15.48 | 8.92 | 4.46 | 5.28 | 17.24 | 3.35 | 10.80 | 16.24 | 44.19 | 43.38 | 13.96 | 5.10 |
| 4-Methylchrysene | 1.78 | 2.74 | 2.26 | 1.64 | 1.15 | 2.65 | 1.65 | 1.59 | 2.71 | 6.19 | 6.24 | 2.52 | 2.36 |
| Benzo[b]fluoranthene | 60.01 | 109.45 | 85.64 | 81.86 | 59.84 | 123.28 | 74.03 | 79.96 | 112.50 | 324.46 | 306.39 | 105.72 | 70.32 |
| Benzo[k]fluoranthene | 17.31 | 38.99 | 30.24 | 24.23 | 16.64 | 44.25 | 20.24 | 24.85 | 40.92 | 113.10 | 106.57 | 37.05 | 23.31 |
| Dimethylbenz[a]anthracene | 1.49 | 2.00 | 1.88 | 1.54 | 0.79 | 1.98 | 3.46 | 1.33 | 2.41 | 4.12 | 3.16 | 1.81 | 1.93 |
| Benzo[e]pyrene | 25.99 | 47.25 | 37.89 | 34.48 | 24.83 | 51.50 | 29.59 | 33.14 | 47.59 | 132.15 | 124.97 | 43.66 | 31.40 |
| Benzo[a]pyrene | 36.01 | 72.41 | 52.13 | 40.90 | 28.34 | 80.66 | 33.13 | 49.26 | 73.37 | 211.42 | 212.45 | 67.14 | 39.68 |
| Perylene | 5.46 | 14.17 | 10.27 | 7.31 | 4.95 | 15.63 | 5.44 | 9.62 | 14.48 | 40.52 | 42.33 | 13.02 | 6.03 |
| 3-Methylchloanthrene | 0.90 | 0.99 | 0.48 | 0.12 | 0.17 | 1.42 | 0.60 | 0.39 | 0.37 | 4.10 | 4.52 | 1.40 | 0.83 |
| Indeno[1,2,3-c,d]pyrene | 38.04 | 78.77 | 62.92 | 64.31 | 39.23 | 87.00 | 59.85 | 59.13 | 81.24 | 226.49 | 215.24 | 75.80 | 45.04 |
| Dibenz[a,h+ac]anthracene | 2.85 | 7.59 | 5.22 | 3.45 | 3.28 | 8.93 | 5.60 | 6.00 | 9.03 | 26.64 | 24.07 | 7.23 | 3.90 |
| Benzo[g,h,i]perylene | 35.84 | 67.50 | 56.70 | 74.41 | 35.83 | 71.68 | 48.89 | 49.62 | 67.65 | 168.85 | 163.53 | 64.44 | 42.55 |
| Anthanthrene | 5.20 | 13.80 | 10.52 | 9.86 | 6.34 | 14.32 | 5.94 | 9.56 | 13.34 | 36.03 | 39.21 | 13.39 | 5.25 |
| Corenene | 13.82 | 25.34 | 23.16 | 35.67 | 14.90 | 26.47 | 22.09 | 22.57 | 28.23 | 57.40 | 50.82 | 23.35 | 16.77 |

**PAH Mass (ng)**
**PUF (Gas Phase)**

| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Start Time | | | | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm |
| Sampling End Time | | | | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am |
| Volume (m3) | | | | 482.28 | 494.40 | 456.70 | 490.67 | 447.20 | 507.15 | 472.05 | 47.55 | 482.07 | 509.51 | 491.10 | 508.95 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 58.3 | 42.9 | 56.6 | 60.2 | 58.7 | 61.3 | 62.7 | 56.4 | 56.8 | 52.5 | 63.0 | 50.7 | 55.3 | 63.4 | 53.3 |
| d10-Fluorene | 99.6 | 93.0 | 94.3 | 92.5 | 106.8 | 100.6 | 99.8 | 100.8 | 99.4 | 95.7 | 96.7 | 93.6 | 106.6 | 101.6 | 108.3 |
| d10-Fluoranthene | 72.2 | 73.0 | 67.5 | 77.3 | 77.9 | 78.1 | 72.6 | 70.7 | 75.7 | 62.5 | 74.0 | 77.2 | 76.2 | 78.0 | 78.9 |
| d12-Perylene | 68.7 | 73.8 | 68.8 | 69.4 | 72.3 | 69.7 | 69.1 | 69.1 | 68.5 | 58.9 | 72.4 | 76.8 | 71.6 | 77.8 | 73.5 |
| | | | | | | | | | | | | | | | |
| PAH Compounds | mass | mass | mass | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 35.84 | 13.08 | 15.27 | 105.89 | 174.89 | ND | ND | ND | 635.81 | ND | 65.05 | 131.45 | ND | ND | 82.17 |
| 2-Methylnapthalene | 25.92 | 8.84 | 9.41 | 138.54 | 236.66 | ND | 46.07 | ND | 296.74 | 77.45 | 79.45 | 187.09 | ND | 64.70 | 118.65 |
| Azulene | 0.45 | 0.96 | 0.32 | ND | 6.08 | ND | 2.40 | ND | 7.17 | 1.89 | ND | 2.40 | 1.85 | ND | 2.95 |
| 1-Methylnapthalene | 10.85 | 3.69 | 4.00 | 47.98 | 88.39 | ND | 20.15 | ND | 116.42 | 27.14 | 28.82 | 65.64 | 18.78 | 26.90 | 45.09 |
| Biphenyl | 3.83 | 1.57 | 1.48 | 71.60 | 91.13 | 8.18 | 16.63 | 11.70 | 76.82 | 13.98 | 17.98 | 85.92 | 20.08 | 12.39 | 44.49 |
| 2,7-Dimethylnapthalene | 3.94 | 1.13 | 1.66 | 45.15 | 50.90 | 7.78 | 9.58 | 18.29 | 79.48 | 23.35 | 23.40 | 51.03 | 13.49 | 18.65 | 35.31 |
| 1,3-Dimethylnapthalene | 8.27 | 3.32 | 3.84 | 62.09 | 114.47 | 19.40 | 23.16 | 37.33 | 201.46 | 42.95 | 34.91 | 86.97 | 25.36 | 49.47 | 62.57 |
| 1,6-Dimethylnapthalene | 4.85 | 2.04 | 2.32 | 34.76 | 65.15 | 10.36 | 14.42 | 21.50 | 113.27 | 24.09 | 19.73 | 49.25 | 15.31 | 26.88 | 36.37 |
| 1,4-Dimethylnapthalene | 1.29 | 1.05 | 1.31 | 29.24 | 45.91 | 13.40 | 12.59 | 15.39 | 86.46 | 16.94 | 12.73 | 34.78 | 11.14 | 16.96 | 23.06 |
| 1,5-Dimethylnapthalene | 0.73 | 0.35 | 0.35 | 5.07 | 9.79 | 2.44 | 2.76 | 3.49 | 19.77 | 4.39 | 3.49 | 7.38 | 2.90 | 5.81 | 6.86 |
| Acenapthylene | 0.53 | 0.35 | 0.36 | 43.84 | 49.58 | 10.04 | 10.01 | 9.61 | 173.86 | 14.94 | 33.65 | 40.25 | 11.08 | 14.03 | 24.46 |
| 1,2-Dimethylnapthalene | 1.27 | 0.56 | 0.60 | 13.74 | 24.82 | 4.97 | 6.51 | 9.50 | 45.08 | 9.35 | 7.72 | 18.50 | 7.65 | 11.49 | 14.91 |
| 1,8-Dimethylnapthalene | 0.23 | 0.08 | 0.07 | 2.44 | 3.50 | 1.10 | 0.75 | 1.49 | 2.84 | 0.87 | 0.53 | 3.60 | 2.11 | 0.86 | 1.94 |
| Acenapthene | 6.19 | 2.46 | 2.11 | 668.79 | 489.91 | 41.25 | 25.36 | 12.75 | 258.13 | 12.69 | 16.68 | 614.42 | 36.60 | 11.89 | 195.63 |
| 2,3,5-Trimethylnapthalene | 2.62 | 0.80 | 0.89 | 38.08 | 76.17 | 14.96 | 14.57 | 25.41 | 209.45 | 19.46 | 17.37 | 41.21 | 17.83 | 26.37 | 42.06 |
| Fluorene | 8.91 | 3.79 | 3.50 | 2696.95 | 2391.91 | 173.10 | 276.12 | 81.85 | 1199.14 | 90.36 | 63.16 | 1814.69 | 307.39 | 85.58 | 919.59 |
| 1-Methylfuorene | 0.92 | 0.50 | 0.53 | 149.25 | 243.94 | 42.29 | 52.02 | 36.28 | 299.19 | 43.68 | 16.62 | 111.58 | 55.33 | 30.82 | 110.92 |
| Dibenzothiophene | 1.12 | 0.94 | 0.79 | 1137.03 | 751.09 | 153.03 | 136.69 | 63.77 | 441.46 | 85.74 | 12.16 | 788.35 | 327.19 | 46.44 | 502.83 |
| Phenanthrene | 12.16 | 7.53 | 5.80 | 5956.88 | 5196.73 | 2688.56 | 1745.95 | 713.35 | 4544.15 | 1100.37 | 144.31 | 5138.49 | 4375.59 | 470.33 | 4936.01 |
| Anthracene | 0.30 | 0.20 | 0.20 | 977.26 | 154.14 | 146.37 | 67.29 | 39.93 | 349.36 | 69.84 | 6.70 | 640.37 | 250.46 | 31.38 | 105.58 |
| 2-Methyldibenzothiophene | 0.77 | 0.32 | 0.38 | 163.38 | 175.60 | 91.90 | 64.04 | 56.19 | 202.77 | 74.07 | 10.55 | 133.46 | 95.21 | 45.47 | 130.44 |
| 4-Methyldibenzothiophene | 0.57 | 0.20 | 0.27 | 135.90 | 123.12 | 68.56 | 41.82 | 35.88 | 121.43 | 47.84 | 7.01 | 112.73 | 74.86 | 27.24 | 94.82 |
| 2-Methylphenanthrene | 2.32 | 0.53 | 0.46 | 701.11 | 457.68 | 358.40 | 126.34 | 104.92 | 556.41 | 210.04 | 18.22 | 518.16 | 314.40 | 86.58 | 347.56 |
| 2-Methylanthracene | 3.31 | 0.68 | 0.68 | 958.03 | 569.90 | 512.10 | 175.45 | 142.68 | 720.36 | 293.42 | 25.20 | 729.19 | 450.89 | 113.94 | 493.52 |
| 4,5-Methylenephenanthrene | 0.07 | 0.10 | 0.11 | 5.03 | 2.51 | 4.80 | 2.81 | 3.18 | 7.10 | 3.14 | 1.06 | 4.82 | 2.22 | 4.00 | 2.57 |
| 1-Methylanthracene | 1.73 | 0.42 | 0.44 | 301.79 | 211.00 | 235.12 | 81.14 | 80.23 | 319.12 | 146.25 | 13.31 | 233.53 | 154.91 | 73.49 | 174.09 |
| 1-Methylphenanthrene | 1.35 | 0.31 | 0.41 | 232.53 | 149.90 | 140.16 | 53.40 | 46.05 | 203.65 | 85.45 | 8.86 | 181.57 | 114.48 | 40.03 | 121.97 |
| 9-Methylanthracene | 0.01 | 0.04 | 0.04 | 2.51 | 1.79 | 2.68 | 1.05 | 0.86 | 2.96 | 1.29 | 0.16 | 2.42 | 1.65 | 1.05 | 1.71 |
| 9,10-Dimethylanthracene | 0.94 | 0.16 | 0.12 | 70.16 | 56.35 | 89.42 | 26.19 | 26.41 | 92.69 | 48.82 | 4.29 | 56.42 | 39.09 | 26.38 | 49.42 |
| Fluoranthene | 12.58 | 4.13 | 1.71 | 3328.90 | 2064.18 | 1239.00 | 616.44 | 266.92 | 1495.93 | 443.91 | 39.57 | 2973.22 | 2097.34 | 247.51 | 1646.71 |
| Pyrene | 8.51 | 2.92 | 1.51 | 1778.60 | 815.50 | 528.34 | 289.33 | 134.61 | 868.59 | 235.35 | 28.46 | 1257.62 | 862.06 | 130.95 | 718.15 |
| 3,6-Dimethylphenanthrene | 0.41 | 0.36 | 0.28 | 7.60 | 7.15 | 14.06 | 3.15 | 5.26 | 22.92 | 14.93 | 3.09 | 5.48 | 5.37 | 1.72 | 6.02 |
| Benzo[a]fluorene | 0.42 | 0.31 | 0.10 | 34.22 | 18.68 | 19.08 | 11.49 | 8.51 | 28.20 | 15.48 | 2.04 | 29.42 | 28.26 | 11.06 | 24.36 |
| Retene | 1.04 | 0.57 | 0.63 | 18.25 | 33.31 | 20.41 | 23.58 | 15.13 | 46.79 | 21.45 | 6.83 | 35.63 | 58.21 | 18.09 | 40.57 |
| Benzo[b]fluorene | 0.26 | 0.21 | 0.14 | 26.66 | 16.99 | 14.94 | 8.55 | 6.55 | 25.90 | 13.12 | 1.60 | 23.56 | 23.83 | 8.30 | 22.13 |
| Cyclopenta[c,d]pyrene | 0.10 | 0.06 | 0.03 | 3.04 | 1.04 | 1.71 | 0.87 | 1.29 | 12.44 | 3.98 | 0.93 | 1.63 | 2.61 | 1.62 | 3.56 |
| Benz[a]anthracene | 0.18 | 0.10 | 0.07 | 4.76 | 2.30 | 3.80 | 2.61 | 2.78 | 13.13 | 7.64 | 1.01 | 3.24 | 5.52 | 3.28 | 7.25 |
| Chrysene+Triphenylene | 1.24 | 0.72 | 0.55 | 30.32 | 17.40 | 14.75 | 11.68 | 7.74 | 26.32 | 20.21 | ND | 19.43 | 26.94 | 10.54 | 23.77 |
| Napthacene | 0.03 | 0.01 | 0.05 | 0.39 | 0.19 | 0.29 | ND | 0.10 | 0.10 | ND | ND | 0.21 | ND | 0.16 | 0.30 |
| 4-Methylchrysene | 0.05 | 0.03 | 0.03 | 0.35 | 0.45 | 0.62 | 0.58 | 0.40 | 0.52 | 0.75 | 0.13 | 0.41 | 0.49 | 0.45 | 0.64 |
| Benzo[b]fluoranthene | 0.04 | 0.15 | 0.05 | 2.81 | 2.34 | 1.34 | 1.31 | 1.27 | 7.78 | 7.83 | 0.78 | 2.63 | 5.70 | 2.82 | 7.25 |
| Benzo[k]fluoranthene | 0.00 | 0.05 | 0.01 | 0.62 | 0.69 | 0.24 | 0.25 | 0.26 | 2.28 | 1.78 | 0.21 | 0.56 | 1.51 | 0.58 | 2.31 |
| Dimethylbenz[a]anthracene | 0.03 | 0.05 | 0.01 | 0.25 | 0.21 | 0.19 | 0.18 | 0.14 | 0.15 | 0.28 | ND | 0.18 | 0.31 | 0.17 | 0.38 |
| Benzo[e]pyrene | 0.01 | 0.07 | 0.03 | 1.09 | 0.85 | 0.45 | 0.42 | 0.44 | 3.29 | 3.07 | 0.31 | 0.96 | 1.85 | 1.01 | 2.81 |
| Benzo[a]pyrene | 0.02 | 0.18 | 0.16 | 0.46 | 0.76 | ND | ND | ND | 3.49 | 0.37 | ND | ND | 0.70 | ND | 0.84 |
| Perylene | 0.22 | 0.32 | 0.34 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 3-Methylchloanthrene | 0.06 | 0.04 | 0.05 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 0.03 | 0.04 | 0.00 | 0.28 | 0.75 | ND | 0.20 | ND | 2.63 | 0.24 | 0.23 | 0.19 | 0.49 | ND | 0.61 |
| Dibenz[a,h+ac]anthracene | 0.01 | 0.01 | 0.00 | 0.13 | 0.04 | ND | ND | ND | 0.31 | 0.06 | 0.06 | ND | ND | ND | ND |
| Benzo[g,h,i]perylene | 0.01 | 0.05 | 0.14 | 0.26 | 0.72 | ND | 0.22 | ND | 2.45 | 0.31 | 0.27 | ND | 0.34 | ND | 0.71 |
| Anthanthrene | 0.01 | 0.01 | 0.01 | 0.08 | 0.03 | ND | ND | ND | 0.36 | ND | ND | ND | ND | ND | ND |
| Corenene | 0.01 | 0.00 | 0.01 | ND | 0.51 | ND | 0.04 | ND | 0.90 | ND | ND | ND | ND | ND | ND |

**PAH Mass (ng)**
**PUF (Gas Phase)**

| Sampling Site | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Highway | Highway | Highway |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Start Time | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am |
| Sampling End Time | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm |
| Volume (m3) | 492.94 | 476.34 | 517.81 | 470.09 | 485.35 | 503.48 | 494.40 | 510.88 | 489.04 | 467.16 | 487.80 | 491.93 | 442.47 | 608.74 | 647.65 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 53.5 | 56.1 | 60.6 | 53.8 | 46.5 | 55.7 | 45.3 | 46.8 | 52.9 | 53.1 | 50.8 | 48.8 | 53.5 | 47.0 | 40.3 |
| d10-Fluorene | 113.1 | 114.1 | 109.3 | 112.8 | 99.6 | 106.8 | 105.2 | 104.6 | 104.1 | 108.5 | 109.3 | 110.9 | 99.4 | 107.7 | 95.7 |
| d10-Fluoranthene | 93.7 | 81.4 | 90.9 | 80.8 | 79.3 | 78.5 | 82.6 | 75.5 | 81.8 | 81.1 | 91.0 | 80.3 | 91.3 | 79.2 | 79.3 |
| d12-Perylene | 71.4 | 71.8 | 71.1 | 72.7 | 67.5 | 68.7 | 69.1 | 67.9 | 72.1 | 68.4 | 74.4 | 72.9 | 73.4 | 62.2 | 57.3 |
| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 65.70 | 158.19 | ND | 110.10 | ND | 579.02 | ND | 535.36 | 95.07 | 104.32 | ND | 446.43 | 90.75 | 340.13 | ND |
| 2-Methylnapthalene | 112.43 | 238.41 | 97.13 | 167.20 | 101.07 | 789.68 | 115.54 | 556.18 | 137.72 | 161.30 | 108.57 | 359.35 | 147.80 | 308.06 | 147.90 |
| Azulene | 2.75 | 15.80 | 3.06 | 7.13 | 5.11 | 14.13 | 6.66 | 20.64 | 9.17 | 6.89 | 3.05 | 6.08 | 4.35 | 11.33 | 4.30 |
| 1-Methylnapthalene | 43.00 | 88.44 | 38.18 | 72.76 | 40.12 | 317.22 | 42.75 | 245.11 | 49.53 | 67.88 | 42.15 | 165.85 | 55.76 | 121.01 | 63.95 |
| Biphenyl | 34.02 | 99.69 | 35.99 | 45.67 | 27.51 | 147.42 | 33.92 | 194.93 | 47.05 | 46.37 | 29.11 | 87.57 | 49.39 | 142.95 | 51.12 |
| 2,7-Dimethylnapthalene | 32.01 | 92.03 | 24.36 | 42.68 | 31.62 | 214.88 | 29.42 | 165.47 | 31.42 | 48.15 | 31.10 | 76.56 | 57.62 | 85.09 | 87.93 |
| 1,3-Dimethylnapthalene | 67.35 | 151.32 | 66.33 | 110.39 | 64.07 | 409.13 | 57.54 | 323.07 | 53.48 | 93.79 | 61.23 | 171.62 | 126.62 | 176.60 | 160.28 |
| 1,6-Dimethylnapthalene | 34.50 | 89.39 | 34.06 | 60.90 | 34.55 | 220.01 | 31.16 | 179.24 | 31.46 | 51.47 | 33.98 | 93.19 | 69.61 | 94.49 | 88.74 |
| 1,4-Dimethylnapthalene | 33.02 | 66.57 | 49.21 | 42.67 | 31.75 | 149.16 | 22.72 | 123.65 | 25.13 | 40.91 | 30.06 | 65.10 | 54.38 | 76.04 | 63.68 |
| 1,5-Dimethylnapthalene | 5.12 | 15.41 | 5.34 | 11.69 | 5.40 | 34.92 | 5.71 | 31.65 | 4.32 | 7.96 | 4.91 | 18.77 | 15.62 | 13.16 | 16.88 |
| Acenapthylene | 47.98 | 73.41 | 45.59 | 52.36 | 39.94 | 241.70 | 33.00 | 110.21 | 31.80 | 54.77 | 31.46 | 50.32 | 45.71 | 73.02 | 48.18 |
| 1,2-Dimethylnapthalene | 14.60 | 38.84 | 16.72 | 24.51 | 15.22 | 87.90 | 13.30 | 71.94 | 14.53 | 23.33 | 14.85 | 36.49 | 27.45 | 36.36 | 33.47 |
| 1,8-Dimethylnapthalene | 1.33 | 2.61 | 16.61 | 1.19 | 1.29 | 5.62 | 2.69 | 6.22 | 5.05 | 4.02 | 1.70 | 3.56 | 1.48 | 2.81 | 2.57 |
| Acenapthene | 186.20 | 329.84 | 204.24 | 156.15 | 126.22 | 484.12 | 162.03 | 956.59 | 111.15 | 106.40 | 159.11 | 323.00 | 63.20 | 1123.28 | 30.15 |
| 2,3,5-Trimethylnapthalene | 41.45 | 146.92 | 44.31 | 71.46 | 43.84 | 239.43 | 37.43 | 235.32 | 31.71 | 61.08 | 37.51 | 86.23 | 86.37 | 131.46 | 115.52 |
| Fluorene | 1280.95 | 2550.11 | 1260.10 | 892.52 | 861.89 | 1814.42 | 945.84 | 3668.25 | 742.05 | 658.27 | 932.72 | 1101.90 | 473.89 | 2040.97 | 289.71 |
| 1-Methylfuorene | 153.66 | 334.16 | 179.66 | 155.71 | 130.80 | 263.71 | 137.51 | 386.40 | 100.61 | 122.89 | 144.24 | 160.10 | 264.72 | 356.68 | 264.40 |
| Dibenzothiophene | 2624.48 | 1529.88 | 2491.51 | 946.86 | 1663.06 | 1339.16 | 1995.83 | 1496.70 | 991.96 | 652.33 | 2003.37 | 995.04 | 465.08 | 719.90 | 219.80 |
| Phenanthrene | 8933.41 | 7450.44 | 9797.60 | 7203.45 | 9451.46 | 8658.90 | 9795.53 | 9545.38 | 8481.58 | 7444.97 | 11503.69 | 8598.07 | 6294.45 | 7221.70 | 3460.26 |
| Anthracene | 3548.67 | 941.44 | 2848.83 | 1093.30 | 1866.96 | 1375.76 | 2326.21 | 1484.41 | 869.30 | 663.77 | 2467.07 | 989.76 | 832.78 | 582.38 | 362.22 |
| 2-Methyldibenzothiophene | 506.35 | 317.57 | 459.73 | 224.38 | 335.76 | 287.58 | 384.81 | 336.76 | 210.59 | 160.77 | 411.27 | 259.75 | 290.46 | 294.54 | 272.90 |
| 4-Methyldibenzothiophene | 541.16 | 250.84 | 474.49 | 189.98 | 327.06 | 219.47 | 392.99 | 245.84 | 177.50 | 123.50 | 431.94 | 209.55 | 174.85 | 171.74 | 155.66 |
| 2-Methylphenanthrene | 2972.53 | 1193.67 | 2567.50 | 1028.71 | 1776.97 | 1079.89 | 2231.53 | 1174.42 | 878.19 | 633.92 | 2401.39 | 1029.96 | 877.20 | 763.83 | 896.94 |
| 2-Methylanthracene | 4303.87 | 1762.35 | 3875.37 | 1492.04 | 2633.91 | 1525.87 | 3323.33 | 1656.03 | 1248.87 | 896.37 | 3630.77 | 1427.83 | 1115.39 | 970.32 | 1146.60 |
| 4,5-Methylenephenanthrene | 22.66 | 7.51 | 15.59 | 7.49 | 13.37 | 8.59 | 17.05 | 10.64 | 6.03 | 4.78 | 17.82 | 7.11 | 10.41 | 8.61 | 8.81 |
| 1-Methylanthracene | 1322.35 | 543.11 | 1125.02 | 463.17 | 794.64 | 494.19 | 967.57 | 553.41 | 399.40 | 290.28 | 1077.58 | 488.58 | 525.40 | 433.24 | 575.38 |
| 1-Methylphenanthrene | 1240.27 | 514.02 | 1067.54 | 411.01 | 713.36 | 416.26 | 923.23 | 467.98 | 337.65 | 244.73 | 998.42 | 416.84 | 337.56 | 285.74 | 348.96 |
| 9-Methylanthracene | 1.62 | 6.41 | 6.67 | 3.94 | 5.86 | 5.49 | 7.42 | 4.60 | 3.19 | 1.91 | 4.78 | 3.56 | 5.13 | 5.66 | 4.89 |
| 9,10-Dimethylanthracene | 336.07 | 136.60 | 282.70 | 112.73 | 191.18 | 114.31 | 231.10 | 133.38 | 89.85 | 70.00 | 267.44 | 126.06 | 176.99 | 137.94 | 215.55 |
| Fluoranthene | 9803.30 | 5363.94 | 9627.53 | 6162.74 | 8218.20 | 6121.48 | 9485.50 | 6368.20 | 6519.72 | 5727.77 | 11316.11 | 6431.80 | 2641.48 | 1396.16 | 1339.67 |
| Pyrene | 7383.09 | 4073.83 | 7248.20 | 4363.04 | 6249.44 | 4492.81 | 7140.95 | 4457.90 | 4115.86 | 2796.25 | 8625.13 | 4595.00 | 1491.28 | 678.44 | 872.62 |
| 3,6-Dimethylphenanthrene | 34.97 | 32.01 | 29.03 | 15.30 | 23.43 | 12.94 | 20.83 | 17.61 | 11.32 | 11.71 | 30.71 | 20.12 | 15.21 | 18.26 | 33.98 |
| Benzo[a]fluorene | 328.43 | 102.84 | 250.78 | 92.80 | 235.72 | 75.99 | 189.45 | 77.42 | 84.25 | 45.62 | 215.58 | 79.30 | 32.09 | 13.32 | 22.43 |
| Retene | 79.25 | 272.21 | 91.49 | 46.05 | 61.01 | 68.75 | 58.45 | 102.49 | 53.87 | 64.90 | 67.54 | 230.59 | 34.74 | 43.93 | 45.78 |
| Benzo[b]fluorene | 206.02 | 76.31 | 150.68 | 59.42 | 87.11 | 55.16 | 119.98 | 56.09 | 33.49 | 32.65 | 136.88 | 56.05 | 29.56 | 10.35 | 19.74 |
| Cyclopenta[c,d]pyrene | 68.22 | 21.33 | 47.91 | 13.20 | 28.45 | 26.40 | 33.67 | 23.21 | 11.80 | 8.33 | 42.84 | 17.90 | 1.39 | 0.28 | 0.83 |
| Benz[a]anthracene | 157.92 | 45.14 | 113.46 | 33.68 | 61.49 | 35.58 | 72.01 | 35.05 | 22.26 | 19.24 | 97.98 | 36.02 | 3.06 | 0.89 | 0.98 |
| Chrysene+Triphenylene | 1167.81 | 202.69 | 877.10 | 231.16 | 475.00 | 167.67 | 780.81 | 164.34 | 197.37 | 143.75 | 882.48 | 183.39 | 10.75 | 5.42 | 4.28 |
| Napthacene | ND | 0.48 | 2.16 | 3.44 | 1.86 | 1.10 | 2.24 | 0.45 | 0.51 | 0.56 | 1.08 | 3.41 | 0.55 | 0.12 | 0.36 |
| 4-Methylchrysene | 3.78 | 1.52 | 2.59 | 0.81 | 1.29 | 0.90 | 2.56 | 0.98 | 0.81 | 0.85 | 2.29 | 1.22 | 0.36 | 0.18 | 0.24 |
| Benzo[b]fluoranthene | 28.84 | 27.70 | 31.76 | 8.46 | 20.32 | 21.48 | 39.97 | 20.39 | 13.86 | 15.83 | 14.45 | 9.86 | 0.49 | 0.87 | 0.82 |
| Benzo[k]fluoranthene | 6.15 | 7.71 | 8.51 | 2.39 | 5.19 | 5.13 | 6.05 | 4.28 | 2.52 | 3.33 | 2.62 | 2.20 | 0.11 | 0.18 | 0.13 |
| Dimethylbenz[a]anthracene | 0.18 | 2.60 | 0.31 | 0.40 | 0.37 | 0.67 | 0.34 | 0.83 | 0.33 | 0.49 | 0.35 | 1.16 | ND | ND | ND |
| Benzo[e]pyrene | 5.16 | 8.05 | 8.24 | 2.27 | 6.65 | 7.52 | 8.60 | 6.42 | 3.72 | 4.84 | 3.20 | 3.16 | 0.22 | 0.26 | 0.28 |
| Benzo[a]pyrene | 1.82 | 3.60 | 6.87 | 0.85 | 5.33 | 3.88 | 1.42 | 3.40 | 0.96 | 1.40 | 1.32 | 1.59 | ND | ND | ND |
| Perylene | ND | ND | 1.16 | ND | 1.04 | ND | ND | ND | ND | ND | ND | 0.97 | ND | ND | ND |
| 3-Methylchloanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 2.18 | 3.54 | 7.11 | 0.67 | 6.74 | 3.62 | 1.23 | 2.95 | 0.87 | 1.32 | 1.25 | 1.13 | 0.12 | 0.08 | 0.28 |
| Dibenz[a,h+ac]anthracene | 0.19 | 0.28 | 0.65 | 0.05 | 0.43 | 0.30 | 0.13 | 0.24 | 0.14 | 0.17 | 0.15 | 0.13 | ND | ND | 0.07 |
| Benzo[g,h,i]perylene | 1.66 | 2.94 | 5.62 | 0.62 | 5.46 | 3.91 | 1.55 | 2.85 | 0.90 | 1.04 | 1.13 | 1.14 | ND | ND | 0.24 |
| Anthanthrene | 0.16 | 0.32 | 0.67 | ND | 0.71 | 0.31 | 0.16 | 0.36 | 0.05 | 0.11 | 0.13 | 0.20 | ND | ND | 0.05 |
| Corenene | 0.54 | 0.77 | 1.37 | 0.07 | 1.35 | 1.00 | 0.29 | 0.77 | 0.17 | 0.13 | 0.04 | 0.17 | ND | ND | ND |

**PAH Mass (ng)**
**PUF (Gas Phase)**

| Sampling Site | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Start Time | 7/21/05 7pm | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm |
| Sampling End Time | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm | 7/26/05 7am |
| Volume (m3) | 504.78 | 214.67 | 259.21 | 489.85 | 224.47 | 275.2585899 | 494.3968998 | 230.1646071 | 233.2030015 | 489.4529308 | 242.129843 | 259.7411746 | 486.5447137 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 55.7 | 48.8 | 48.5 | 53.3 | 54.9 | 52.5 | 47.3 | 48.9 | 53.9 | 59.5 | 51.1 | 55.5 | 54.5 |
| d10-Fluorene | 100.2 | 84.3 | 90.9 | 89.5 | 87.6 | 89.5 | 94.9 | 93.6 | 104.7 | 108.2 | 94.7 | 87.5 | 99.8 |
| d10-Fluoranthene | 82.3 | 65.6 | 74.2 | 74.9 | 72.3 | 68.9 | 70.2 | 69.9 | 74.1 | 84.5 | 71.0 | 77.7 | 84.6 |
| d12-Perylene | 66.9 | 56.7 | 66.5 | 66.5 | 68.0 | 66.8 | 62.5 | 68.6 | 68.1 | 74.3 | 65.8 | 67.5 | 70.7 |
| | | | | | | | | | | | | | |
| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 87.74 | 120.20 | 67.73 | 228.63 | 121.48 | 96.32 | 333.45 | 166.62 | 85.35 | 92.77 | 74.98 | ND | 132.72 |
| 2-Methylnapthalene | 153.28 | 171.27 | 112.62 | 283.04 | 164.32 | 181.08 | 300.05 | 270.90 | 149.01 | 139.04 | 117.85 | 125.99 | 202.32 |
| Azulene | 4.44 | 5.11 | 3.83 | 7.04 | 3.13 | 6.87 | 12.21 | 3.85 | 4.72 | 3.96 | 3.21 | 2.60 | 3.10 |
| 1-Methylnapthalene | 64.23 | 67.06 | 44.03 | 117.29 | 54.68 | 60.62 | 119.63 | 85.06 | 59.57 | 58.80 | 47.86 | 50.62 | 86.09 |
| Biphenyl | 46.16 | 47.25 | 29.47 | 69.69 | 59.59 | 36.53 | 138.12 | 75.19 | 51.41 | 49.67 | 27.99 | 27.72 | 55.63 |
| 2,7-Dimethylnapthalene | 57.12 | 62.95 | 43.15 | 70.12 | 41.65 | 41.02 | 88.19 | 73.29 | 66.97 | 47.23 | 38.25 | 41.51 | 90.42 |
| 1,3-Dimethylnapthalene | 120.26 | 113.78 | 81.46 | 161.35 | 63.17 | 77.70 | 187.84 | 109.63 | 121.45 | 107.06 | 83.10 | 91.88 | 163.70 |
| 1,6-Dimethylnapthalene | 68.31 | 60.73 | 41.98 | 85.41 | 34.99 | 42.76 | 103.64 | 61.12 | 66.98 | 57.79 | 46.10 | 50.98 | 88.85 |
| 1,4-Dimethylnapthalene | 51.63 | 47.99 | 34.65 | 55.03 | 26.64 | 31.03 | 81.49 | 43.10 | 50.57 | 52.14 | 32.68 | 39.36 | 61.38 |
| 1,5-Dimethylnapthalene | 12.33 | 10.38 | 7.17 | 15.52 | 5.54 | 6.85 | 20.37 | 9.33 | 12.07 | 7.92 | 7.99 | 9.00 | 15.85 |
| Acenapthylene | 52.41 | 54.71 | 35.11 | 103.23 | 27.43 | 41.01 | 86.73 | 54.30 | 36.20 | 49.43 | 28.87 | 34.37 | 52.88 |
| 1,2-Dimethylnapthalene | 27.04 | 24.43 | 16.90 | 36.70 | 13.60 | 17.89 | 44.87 | 23.81 | 25.07 | 24.15 | 18.98 | 19.77 | 33.03 |
| 1,8-Dimethylnapthalene | 2.47 | 2.68 | 1.19 | 2.99 | 1.73 | 1.39 | 5.02 | 2.72 | 1.78 | 3.36 | 1.89 | 0.82 | 2.45 |
| Acenapthene | 40.35 | 57.03 | 78.35 | 298.41 | 299.06 | 44.86 | 669.71 | 91.24 | 58.65 | 88.50 | 51.26 | 33.91 | 102.21 |
| 2,3,5-Trimethylnapthalene | 95.85 | 73.37 | 49.92 | 106.10 | 31.12 | 45.54 | 162.23 | 60.03 | 83.80 | 77.24 | 54.62 | 56.68 | 118.37 |
| Fluorene | 480.86 | 474.40 | 352.20 | 1233.63 | 1523.19 | 352.13 | 2667.21 | 662.19 | 399.62 | 530.89 | 330.50 | 223.74 | 706.32 |
| 1-Methylfuorene | 211.88 | 206.60 | 148.61 | 169.91 | 116.38 | 133.40 | 235.83 | 136.47 | 216.45 | 153.87 | 196.25 | 162.18 | 240.54 |
| Dibenzothiophene | 247.33 | 268.74 | 250.21 | 729.42 | 734.89 | 221.24 | 661.59 | 220.06 | 186.95 | 301.81 | 228.61 | 188.37 | 404.16 |
| Phenanthrene | 3467.00 | 3716.87 | 3727.21 | 7874.24 | 7710.12 | 3333.84 | 7095.21 | 2848.50 | 2516.05 | 4405.53 | 3209.74 | 2281.23 | 5681.05 |
| Anthracene | 303.50 | 438.03 | 553.15 | 839.92 | 755.23 | 268.87 | 603.44 | 163.51 | 175.07 | 304.36 | 274.68 | 215.56 | 444.14 |
| 2-Methyldibenzothiophene | 202.38 | 110.86 | 130.32 | 185.64 | 125.26 | 115.52 | 164.16 | 81.30 | 126.94 | 166.39 | 142.16 | 182.57 | 227.70 |
| 4-Methyldibenzothiophene | 100.95 | 59.28 | 71.70 | 136.65 | 100.03 | 74.02 | 119.76 | 47.03 | 59.32 | 97.00 | 73.78 | 118.17 | 120.86 |
| 2-Methylphenanthrene | 549.84 | 306.75 | 335.91 | 579.00 | 424.93 | 279.56 | 462.11 | 185.62 | 294.96 | 449.05 | 372.32 | 358.24 | 591.68 |
| 2-Methylanthracene | 696.93 | 404.21 | 442.76 | 751.19 | 621.65 | 390.73 | 591.18 | 241.63 | 397.48 | 593.30 | 467.50 | 485.68 | 768.85 |
| 4,5-Methylenephenanthrene | 6.81 | 5.78 | 6.95 | 8.10 | 6.10 | 5.84 | 7.91 | 4.34 | 5.04 | 5.12 | 6.11 | 5.71 | 7.23 |
| 1-Methylanthracene | 346.81 | 176.17 | 208.91 | 269.69 | 173.58 | 162.12 | 230.38 | 102.84 | 183.18 | 279.14 | 223.30 | 244.43 | 346.14 |
| 1-Methylphenanthrene | 212.24 | 128.12 | 129.83 | 207.37 | 164.20 | 125.56 | 174.41 | 77.26 | 106.92 | 180.94 | 139.83 | 142.17 | 232.43 |
| 9-Methylanthracene | 4.29 | 2.91 | 3.91 | 4.99 | 3.29 | 2.96 | 3.06 | 1.20 | 2.98 | 3.64 | 3.45 | 2.86 | 3.87 |
| 9,10-Dimethylanthracene | 121.67 | 57.39 | 66.60 | 72.12 | 48.24 | 51.09 | 64.14 | 30.61 | 60.93 | 88.21 | 69.28 | 71.85 | 114.94 |
| Fluoranthene | 726.53 | 944.22 | 783.96 | 3511.50 | 3593.17 | 1024.87 | 2074.41 | 525.00 | 480.19 | 1280.25 | 709.73 | 614.78 | 1212.02 |
| Pyrene | 476.40 | 529.11 | 507.82 | 1929.50 | 1788.19 | 559.22 | 1107.34 | 267.96 | 309.97 | 692.61 | 446.59 | 399.05 | 707.26 |
| 3,6-Dimethylphenanthrene | 23.40 | 10.24 | 14.95 | 12.67 | 5.71 | 7.71 | 17.80 | 8.03 | 12.33 | 16.25 | 13.38 | 11.67 | 19.89 |
| Benzo[a]fluorene | 11.89 | 12.98 | 19.49 | 36.06 | 31.31 | 13.91 | 26.67 | 7.93 | 11.40 | 25.38 | 14.81 | 11.95 | 16.44 |
| Retene | 40.24 | 11.45 | 24.23 | 31.45 | 18.87 | 16.78 | 90.75 | 17.54 | 27.51 | 58.64 | 22.50 | 19.68 | 42.63 |
| Benzo[b]fluorene | 10.33 | 12.53 | 19.00 | 28.69 | 22.71 | 11.03 | 22.06 | 6.68 | 8.33 | 17.67 | 11.76 | 9.34 | 13.45 |
| Cyclopenta[c,d]pyrene | 0.28 | 0.84 | 0.80 | 5.40 | 5.41 | 0.85 | 2.69 | 1.19 | 1.21 | 1.66 | 0.40 | 0.81 | 0.50 |
| Benz[a]anthracene | 1.38 | 1.67 | 2.83 | 7.85 | 9.39 | 2.51 | 5.11 | 1.80 | 2.29 | 3.56 | 1.50 | 1.43 | 1.49 |
| Chrysene+Triphenylene | 6.43 | 3.66 | 4.41 | 26.82 | 32.56 | 10.43 | 17.06 | 5.70 | 7.42 | 13.22 | 5.10 | 4.66 | 5.20 |
| Napthacene | 0.27 | 0.28 | 0.58 | 0.34 | 0.26 | 0.12 | 0.10 | ND | 0.13 | 0.10 | 0.13 | 0.13 | 0.23 |
| 4-Methylchrysene | 0.31 | 0.14 | 0.21 | 0.33 | 0.35 | 0.18 | 0.27 | 0.16 | 0.21 | 0.27 | 0.21 | 0.18 | 0.21 |
| Benzo[b]fluoranthene | 1.17 | 0.27 | 1.85 | 1.44 | 5.29 | 0.63 | 2.00 | 0.54 | 0.81 | 0.70 | 0.68 | 0.29 | 1.04 |
| Benzo[k]fluoranthene | 0.26 | ND | 0.55 | 0.32 | 1.60 | ND | 0.51 | 0.12 | 0.16 | 0.12 | 0.12 | ND | 0.23 |
| Dimethylbenz[a]anthracene | ND | ND | ND | ND | 0.16 | ND | 0.13 | ND | ND | ND | ND | ND | ND |
| Benzo[e]pyrene | 0.37 | 0.14 | 0.71 | 0.58 | 1.95 | 0.20 | 0.77 | 0.25 | 0.32 | 0.31 | 0.26 | 0.16 | 0.38 |
| Benzo[a]pyrene | ND | ND | 0.81 | ND | 0.73 | ND | ND | ND | ND | ND | ND | ND | ND |
| Perylene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.97 | ND |
| 3-Methylchloanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 0.21 | ND | 0.94 | 0.15 | 0.59 | ND | 0.17 | ND | 0.09 | ND | ND | 0.08 | 0.27 |
| Dibenz[a,h+ac]anthracene | 0.06 | ND | 0.08 | ND | 0.06 | ND | ND | ND | ND | 0.03 | ND | ND | ND |
| Benzo[g,h,i]perylene | 0.22 | ND | 0.73 | 0.22 | 0.63 | ND | ND | ND | ND | ND | ND | ND | 0.31 |
| Anthanthrene | 0.03 | ND | 0.12 | ND | 0.07 | ND | ND | ND | ND | ND | ND | ND | ND |
| Corenene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

**NPAH Mass (pg)**
**GFF (Particle Phase)**

| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Start Time | | | | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm |
| Sampling End Time | | | | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am |
| Volume ($m^3$) | | | | 482.28 | 494.40 | 456.70 | 490.67 | 447.20 | 507.15 | 472.05 | 47.55 | 482.07 | 509.51 | 491.10 | 508.95 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 26.3 | 29.2 | 26.5 | 21.2 | 23.1 | 24.7 | 27.4 | 20.8 | 36.3 | 18.7 | 26.3 | 22.6 | 18.7 | 29.5 | 26.5 |
| d9-9N-Anthracene | 35.1 | 35.2 | 35.4 | 36.8 | 35.6 | 39.9 | 41.7 | 36.8 | 31.0 | 36.3 | 40.7 | 36.6 | 28.9 | 40.9 | 41.7 |
| d9-1N-Pyrene | 56.2 | 55.6 | 55.6 | 62.1 | 85.2 | 71.2 | 71.8 | 63.5 | 83.2 | 71.9 | 62.1 | 66.4 | 50.7 | 66.6 | 67.5 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 1.48 | 1.94 | 1.90 | 8.24 | 11.18 | 5.95 | 6.89 | 5.66 | 55.91 | 5.38 | ND | ND | 5.60 | ND | ND |
| 2N-Naphthalene | 2.57 | 3.16 | 4.15 | ND | 37.60 | 15.55 | 23.53 | ND | 73.90 | ND | ND | ND | ND | ND | ND |
| 2N-Biphenyl | 2.04 | 3.62 | 3.69 | ND | ND | ND | ND | ND | 27.32 | 37.33 | ND | ND | ND | ND | ND |
| 3N-Biphenyl | 3.99 | 1.96 | 1.33 | ND | 9.32 | ND | ND | ND | 20.87 | ND | ND | ND | ND | ND | ND |
| 4N-Biphenyl | 1.82 | 1.06 | 2.43 | ND | ND | ND | 8.47 | ND | 34.12 | 10.98 | ND | ND | ND | 6.19 | 5.48 |
| 1,3-DiN-Naphthalene | 0.85 | 2.52 | 0.33 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,5-DiN-Naphthalene | 0.16 | 0.48 | 0.23 | ND | ND | ND | ND | 1.06 | 1.64 | ND | ND | ND | ND | ND | ND |
| 5N-Acenaphthalene | 1.07 | 2.80 | 1.54 | ND | 30.51 | ND | ND | 5.72 | 44.12 | ND | 7.04 | 17.19 | ND | ND | ND |
| 2N-Fluorene | 0.49 | 0.93 | 0.60 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 9N-Anthracene | 12.75 | 8.59 | 13.43 | 256.97 | 2698.54 | 129.12 | 283.65 | 118.05 | 2285.20 | 94.08 | 59.23 | 175.96 | 104.35 | ND | 884.23 |
| 2N-Anthracene | 0.11 | 0.18 | 0.13 | 2.26 | 0.76 | 0.62 | 0.49 | ND | 41.36 | 2.41 | ND | ND | 0.42 | ND | 4.26 |
| 9N-Phenanthrene | 0.23 | 0.31 | 0.48 | 2.05 | 9.90 | 1.55 | ND | 1.14 | 24.04 | 3.80 | ND | ND | ND | ND | 5.18 |
| 3N-Phenanthrene | 0.31 | 0.80 | 0.36 | 46.81 | 74.45 | 43.04 | 23.87 | 36.37 | 393.17 | 22.50 | 21.04 | 59.09 | 26.35 | 6.74 | 34.51 |
| 4N-Phenanthrene | 3.04 | 0.80 | 0.94 | 32.99 | 7.83 | 7.79 | ND | 6.76 | 32.52 | 5.14 | ND | ND | 7.00 | 31.62 | 5.28 |
| 2N-Fluoranthene | 0.24 | 5.05 | 0.50 | 1231.91 | 11567.76 | 809.67 | 1131.06 | 1081.02 | 3417.47 | 386.87 | 74.14 | 676.98 | 592.57 | 103.72 | 2390.08 |
| 3N-Fluoranthene | 0.30 | 0.17 | 0.21 | ND | 1.06 | 0.91 | ND | ND | 1.62 | ND | ND | ND | ND | ND | 1.81 |
| 1N-Pyrene | 1.25 | 3.05 | 2.63 | 171.73 | 426.83 | 170.84 | 77.41 | 115.59 | 1322.78 | 74.33 | 8.58 | 69.21 | 40.01 | 14.95 | 86.04 |
| 2N-Pyrene | 2.22 | 3.08 | 5.60 | 17.65 | 104.33 | ND | ND | ND | 696.48 | 33.55 | ND | ND | 61.38 | ND | ND |
| 6N-Chrysene | 0.15 | 0.85 | 0.67 | ND | 1.89 | ND | ND | 1.88 | 3.14 | 4.40 | ND | 3.17 | ND | ND | ND |

| **NPAH Mass (pg)**<br>**GFF (Particle Phase)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Highway | Highway | Highway |
| Sampling Start Time | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am |
| Sampling End Time | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm |
| Volume ($m^3$) | 492.94 | 476.34 | 517.81 | 470.09 | 485.35 | 503.48 | 494.40 | 510.88 | 489.04 | 467.16 | 487.80 | 491.93 | 442.47 | 608.74 | 647.65 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 25.5 | 30.9 | 26.7 | 30.3 | 29.3 | 28.2 | 25.2 | 26.4 | 27.8 | 34.8 | 16.3 | 30.3 | 31.4 | 28.8 | 28.3 |
| d9-9N-Anthracene | 28.8 | 32.3 | 32.7 | 38.2 | 33.0 | 32.4 | 25.2 | 30.6 | 30.6 | 34.0 | 31.9 | 33.1 | 35.5 | 27.3 | 27.4 |
| d9-1N-Pyrene | 72.2 | 70.1 | 65.2 | 71.3 | 72.6 | 58.4 | 66.9 | 56.9 | 62.2 | 62.7 | 68.1 | 63.6 | 79.2 | 70.9 | 70.6 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 14.03 | 27.50 | 10.59 | 12.53 | 11.84 | 12.23 | 10.99 | 27.12 | 8.38 | 7.95 | 12.57 | 29.00 | 67.27 | 150.67 | 73.25 |
| 2N-Naphthalene | ND | 14.89 | 12.22 | ND | 21.60 | ND | ND | 24.56 | ND | ND | ND | 21.48 | 69.74 | 150.06 | 89.80 |
| 2N-Biphenyl | 18.24 | 12.47 | ND | 15.34 | 18.41 | 28.84 | 24.06 | 27.19 | ND | 11.56 | ND | 10.36 | ND | 15.26 | ND |
| 3N-Biphenyl | 7.84 | ND | ND | 16.05 | 23.68 | ND | 18.71 | 17.84 | 12.59 | 26.63 | ND | 15.60 | 24.07 | 23.85 | 19.98 |
| 4N-Biphenyl | 6.13 | 19.80 | ND | ND | ND | 5.58 | ND | 7.27 | ND | ND | ND | 6.71 | 5.52 | ND | 13.77 |
| 1,3-DiN-Naphthalene | ND | ND | ND | ND | ND | ND | 3.72 | 7.19 | 5.83 | 5.92 | ND | ND | 7.77 | 6.52 | ND |
| 1,5-DiN-Naphthalene | 10.47 | ND | ND | ND | 1.32 | ND | ND | 1.05 | ND | ND | ND | ND | ND | 6.90 | ND |
| 5N-Acenaphthalene | 8.77 | 63.90 | ND | 6.52 | 9.80 | 19.24 | 7.49 | 176.39 | 7.50 | ND | 6.16 | 31.76 | 20.34 | 309.29 | 53.93 |
| 2N-Fluorene | ND | ND | ND | ND | 50.29 | ND | ND | ND | ND | ND | 2.94 | ND | 22.41 | 17.79 | 21.38 |
| 9N-Anthracene | 1300.04 | 22672.96 | 518.80 | 2782.16 | 850.95 | 2150.66 | 606.66 | 14643.87 | 457.23 | 627.61 | 883.20 | 3206.10 | 1120.91 | 21326.46 | 1265.65 |
| 2N-Anthracene | 26.00 | 74.54 | 12.99 | 3.70 | 16.24 | 20.25 | 21.98 | 199.39 | 8.36 | 2.85 | 16.31 | 20.36 | 32.60 | 89.66 | 22.46 |
| 9N-Phenanthrene | 11.28 | 20.05 | 7.95 | 6.27 | 8.57 | 7.75 | ND | ND | ND | 1.99 | 10.74 | 7.97 | 154.46 | 390.83 | 167.96 |
| 3N-Phenanthrene | 95.83 | 187.86 | 86.44 | 71.48 | 112.00 | 118.70 | 66.62 | 454.24 | 49.80 | 47.21 | 107.24 | 119.82 | 482.04 | 904.41 | 552.18 |
| 4N-Phenanthrene | 9.83 | 10.87 | 5.02 | ND | ND | ND | ND | 6.75 | ND | ND | ND | 5.67 | 29.23 | 27.05 | 68.75 |
| 2N-Fluoranthene | 5521.14 | 13411.19 | 3393.44 | 2096.37 | 4877.11 | 1314.52 | 3092.21 | 4183.83 | 1023.29 | 1041.56 | 4642.72 | 4306.32 | 4904.04 | 25589.18 | 4689.51 |
| 3N-Fluoranthene | 12.87 | 5.51 | 2.13 | 1.01 | 11.63 | 0.77 | 0.86 | 4.81 | 0.93 | 1.98 | 16.94 | 12.13 | 2.41 | 1.57 | 2.55 |
| 1N-Pyrene | 878.30 | 1054.75 | 638.36 | 861.60 | 891.22 | 336.79 | 464.42 | 698.29 | 246.84 | 620.67 | 966.55 | 728.92 | 2668.79 | 2439.34 | 2493.38 |
| 2N-Pyrene | 674.85 | 303.05 | 218.30 | 120.00 | 483.25 | 440.56 | 695.77 | 654.11 | 61.77 | 47.34 | 378.45 | 353.66 | 316.82 | 386.91 | 180.11 |
| 6N-Chrysene | 20.32 | 18.40 | ND | ND | 6.02 | ND | 10.36 | ND | 3.21 | ND | 9.92 | ND | 18.73 | 2.81 | 2.64 |

| **NPAH Mass (pg)**<br>**GFF (Particle Phase)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Sampling Start Time | 7/21/05 7pm | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm |
| Sampling End Time | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm | 7/26/05 7am |
| Volume (m$^3$) | 504.78 | 214.67 | 259.21 | 489.85 | 224.47 | 275.2585899 | 494.3968998 | 230.1646071 | 233.2030015 | 489.4529308 | 242.129843 | 259.7411746 | 486.5447137 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.6 | 0.8 | 0.8 | 0.6 | 23.9 | 36.4 | 21.2 | 27.0 |
| d9-9N-Anthracene | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 34.6 | 43.5 | 34.8 | 36.4 |
| d9-1N-Pyrene | 0.0 | 0.1 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 2.3 | 69.9 | 56.4 | 67.9 | 62.5 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 56.89 | 45.82 | 23.22 | 29.52 | 18.79 | 17.74 | 35.35 | 14.25 | 14.52 | 16.56 | 19.70 | 11.48 | 56.87 |
| 2N-Naphthalene | 54.11 | 58.80 | 35.62 | 49.26 | 16.84 | 24.98 | 45.42 | 18.05 | 13.31 | 25.84 | 11.57 | 19.24 | 59.13 |
| 2N-Biphenyl | ND | ND | ND | 37.65 | ND | ND | 22.09 | ND | ND | ND | 11.61 | ND | ND |
| 3N-Biphenyl | 11.02 | 11.29 | ND | ND | ND | ND | 9.96 | ND | ND | 9.13 | 8.52 | ND | 8.77 |
| 4N-Biphenyl | 13.48 | ND | ND | 8.79 | ND | 17.89 | 13.95 | ND | 6.18 | 18.95 | 6.87 | 39.99 | 16.15 |
| 1,3-DiN-Naphthalene | ND | 6.20 | ND | ND | ND | ND | ND | ND | 5.23 | ND | ND | ND | ND |
| 1,5-DiN-Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 5N-Acenaphthalene | 28.08 | 19.98 | 8.68 | 103.43 | 46.73 | 6.57 | 342.72 | 22.97 | 8.26 | 16.23 | 7.47 | ND | 93.89 |
| 2N-Fluorene | 9.10 | 3.52 | 3.80 | ND | 5.17 | ND | 3.96 | 2.78 | 2.30 | 15.90 | 3.48 | ND | 7.01 |
| 9N-Anthracene | 1604.65 | 674.11 | 445.42 | 2599.87 | 317.14 | 285.90 | 12730.84 | 447.14 | 315.72 | 646.54 | 349.79 | 232.10 | 2951.46 |
| 2N-Anthracene | 6.89 | 14.66 | 11.18 | 30.68 | 44.12 | 6.81 | 135.70 | 12.00 | 8.70 | 8.88 | 5.32 | 5.95 | 22.26 |
| 9N-Phenanthrene | 127.61 | 67.99 | 48.16 | 21.46 | 50.46 | 19.26 | 61.93 | 24.23 | 24.22 | 29.71 | 23.02 | 34.18 | 96.35 |
| 3N-Phenanthrene | 203.26 | 254.33 | 161.44 | 484.16 | 318.12 | 80.66 | 1049.04 | 169.11 | 92.15 | 161.98 | 241.60 | 111.65 | 410.39 |
| 4N-Phenanthrene | 30.78 | 27.99 | 14.77 | 11.36 | ND | ND | 119.48 | 9.06 | 7.51 | 6.39 | 18.99 | 9.44 | 11.87 |
| 2N-Fluoranthene | 1684.28 | 3286.25 | 674.35 | 2678.07 | 3579.41 | 985.28 | 5735.28 | 1652.64 | 847.94 | 2202.65 | 1208.28 | 539.27 | 4849.10 |
| 3N-Fluoranthene | 4.58 | 5.58 | 1.22 | ND | 10.15 | 1.49 | 13.37 | 1.33 | 1.35 | 5.83 | 2.48 | 3.60 | 8.54 |
| 1N-Pyrene | 1098.24 | 1066.11 | 575.99 | 380.19 | 342.27 | ND | 755.75 | 396.50 | 592.58 | 849.10 | 761.31 | 527.46 | 1292.97 |
| 2N-Pyrene | 12.48 | 50.53 | 26.18 | 714.38 | 391.05 | 111.76 | 607.98 | 47.53 | 59.12 | 167.45 | 28.60 | 22.39 | 210.45 |
| 6N-Chrysene | 2.26 | 4.00 | 1.82 | 3.02 | 5.73 | 1.93 | 8.15 | ND | 2.59 | 3.57 | 19.16 | 2.74 | 4.28 |

| **NPAH Mass (pg)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUF (Gas Phase)** | | | | | | | | | | | | | | | |
| Sampling Site | Field Blank 1 | Field Blank 2 | Field Blank 3 | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina |
| Sampling Start Time | | | | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm |
| Sampling End Time | | | | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am |
| Volume (m3) | | | | 482.28 | 494.40 | 456.70 | 490.67 | 447.20 | 507.15 | 472.05 | 47.55 | 482.07 | 509.51 | 491.10 | 508.95 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 54.7 | 42.3 | 34.4 | 44.7 | 42.9 | 62.3 | 49.1 | 65.1 | 92.1 | 42.7 | | 60.0 | 44.9 | 48.7 | 85.2 |
| d9-9N-Anthracene | 37.4 | 39.1 | 31.3 | 30.7 | 28.0 | 34.4 | 31.9 | 31.9 | 27.7 | 27.3 | | 33.8 | 33.0 | 37.4 | 34.2 |
| d9-1N-Pyrene | 46.3 | 49.7 | 43.9 | 44.8 | 43.3 | 52.2 | 56.6 | 45.7 | 42.4 | 41.1 | | 46.6 | 47.1 | 49.9 | 54.1 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 11.21 | 44.95 | 7.80 | 1345.74 | 13189.70 | 537.81 | 1900.90 | 1761.13 | 8129.78 | 2775.02 | | 1802.21 | 1905.63 | 560.37 | 4897.22 |
| 2N-Naphthalene | 11.85 | 43.20 | 6.71 | 3311.63 | 9910.73 | 1531.40 | 1677.92 | 4779.54 | 8345.05 | 6901.40 | | 4016.02 | 2980.34 | 1232.10 | 4764.15 |
| 2N-Biphenyl | 6.21 | 54.87 | 6.56 | 379.26 | 1365.04 | 344.42 | 372.72 | 343.61 | 12559.92 | 555.76 | | 613.92 | 535.81 | 297.18 | 1174.11 |
| 3N-Biphenyl | 3.43 | 3.30 | 2.57 | 513.27 | 576.46 | 548.85 | 354.28 | 443.56 | 481.82 | 396.37 | | 671.71 | 767.39 | 439.85 | 400.01 |
| 4N-Biphenyl | 12.07 | 1.28 | 1.71 | 153.77 | 454.59 | 196.53 | 256.53 | 220.57 | 353.99 | 48.97 | | 284.08 | 322.06 | 66.87 | 260.28 |
| 1,3-DiN-Naphthalene | 0.47 | 0.25 | 0.11 | 25.92 | 14.09 | 24.84 | 8.45 | 29.03 | 13.51 | 46.73 | | 21.78 | 18.98 | 9.30 | 7.58 |
| 1,5-DiN-Naphthalene | 0.54 | 0.09 | 0.08 | ND | ND | ND | ND | ND | ND | ND | | ND | ND | ND | ND |
| 5N-Acenaphthalene | 1.95 | 2.36 | 1.34 | 273.39 | 3991.64 | 982.63 | 266.75 | 386.90 | 2460.20 | 564.32 | | 1422.56 | 521.86 | 369.74 | 1501.62 |
| 2N-Fluorene | 0.89 | 0.17 | 0.68 | 6.37 | 6.58 | 5.47 | ND | 4.73 | 19.18 | ND | | 6.60 | 8.77 | ND | ND |
| 9N-Anthracene | 15.63 | 6.64 | 8.87 | 1185.93 | 11631.17 | 1464.71 | 2174.47 | 758.61 | 14771.79 | 1313.07 | | 2037.19 | 2939.08 | 391.19 | 11052.79 |
| 2N-Anthracene | 0.24 | 0.21 | 0.24 | 49.69 | 74.70 | 57.16 | 14.66 | 21.71 | 211.29 | 133.41 | | 130.68 | 29.88 | 11.24 | 40.90 |
| 9N-Phenanthrene | 0.52 | 0.38 | 0.32 | 88.42 | 294.71 | 61.10 | 72.83 | 51.30 | 113.11 | 40.27 | | 156.63 | 125.99 | 19.51 | 242.04 |
| 3N-Phenanthrene | 0.20 | 0.30 | 0.57 | 399.74 | 551.75 | 484.71 | 117.41 | 187.39 | 895.10 | 637.18 | | 899.57 | 221.28 | 138.22 | 336.69 |
| 4N-Phenanthrene | 0.22 | 0.86 | 1.03 | 20.89 | 2.53 | 5.73 | 3.86 | 3.68 | 5.75 | 14.39 | | 37.89 | 8.94 | ND | 3.79 |
| 2N-Fluoranthene | 0.37 | 0.42 | 0.33 | 2101.78 | 4837.00 | 1293.30 | 1158.74 | 1094.63 | 1057.48 | 2461.69 | | 2243.81 | 1317.65 | 635.70 | 3124.47 |
| 3N-Fluoranthene | 0.22 | 0.09 | 0.19 | 1.24 | 6.59 | 0.87 | 0.79 | ND | 0.76 | 2.17 | | 1.76 | 0.83 | ND | 0.89 |
| 1N-Pyrene | 0.24 | 0.33 | 0.21 | 103.01 | 141.67 | 162.98 | 144.63 | 68.73 | 106.83 | 45.54 | | 59.34 | 85.99 | 55.50 | 75.11 |
| 2N-Pyrene | 1.85 | 2.43 | 3.21 | 33.29 | 19.63 | ND | ND | ND | 40.47 | 103.60 | | ND | ND | ND | 12.02 |
| 6N-Chrysene | 0.75 | 0.28 | 0.69 | ND | ND | ND | ND | ND | ND | ND | | ND | ND | ND | 1.84 |

**NPAH Mass (pg)**
**PUF (Gas Phase)**

| Sampling Site | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Highway | Highway | Highway |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Start Time | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/04 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/20/05 7am | 7/20/05 7pm | 7/21/05 7am |
| Sampling End Time | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm | 7/22/05 7am | 7/22/05 7pm | 7/23/05 7am | 7/23/05 7pm | 7/24/05 7am | 7/24/05 7pm | 7/25/05 7am | 7/25/05 7pm | 7/26/05 7am | 7/20/05 7pm | 7/21/05 7am | 7/21/05 7pm |
| Volume (m3) | 492.94 | 476.34 | 517.81 | 470.09 | 485.35 | 503.48 | 494.40 | 510.88 | 489.04 | 467.16 | 487.80 | 491.93 | 442.47 | 608.74 | 647.65 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 42.3 | 45.8 | 34.6 | 35.9 | 19.8 | 21.4 | 21.1 | 35.2 | 34.5 | 53.6 | 21.4 | 41.1 | 36.8 | 32.8 | 43.7 |
| d9-9N-Anthracene | 32.0 | 24.5 | 31.9 | 37.3 | 30.8 | 27.4 | 29.1 | 27.3 | 28.1 | 27.2 | 30.4 | 27.2 | 33.5 | 19.7 | 24.3 |
| d9-1N-Pyrene | 56.0 | 46.9 | 51.4 | 59.4 | 45.4 | 48.6 | 47.6 | 45.2 | 44.8 | 43.7 | 52.9 | 47.6 | 54.1 | 43.3 | 40.1 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 949.76 | 11548.34 | 1147.68 | 2327.72 | 865.07 | 4777.81 | 1257.26 | 12470.35 | 2738.89 | 1528.03 | 638.36 | 6938.08 | 3096.70 | 13227.60 | 1713.31 |
| 2N-Naphthalene | 2202.55 | 11419.57 | 2583.90 | 2551.97 | 2294.35 | 5477.43 | 2467.35 | 12644.78 | 5479.70 | 2421.41 | 1181.01 | 7791.53 | 4759.21 | 13067.13 | 2993.62 |
| 2N-Biphenyl | 4560.05 | 20302.68 | 8137.55 | 16321.01 | 5537.34 | 22766.90 | 6930.69 | 46666.25 | 5372.50 | 7611.82 | 5518.30 | 18679.38 | 704.10 | 2920.75 | 467.83 |
| 3N-Biphenyl | 548.34 | 789.49 | 706.32 | 439.71 | 384.09 | 490.18 | 565.59 | 921.30 | 945.07 | 683.66 | 383.00 | 596.16 | 1031.40 | 937.94 | 1110.58 |
| 4N-Biphenyl | 109.03 | 497.11 | 54.86 | 446.41 | 39.01 | 487.18 | 292.73 | 556.09 | 383.41 | 330.96 | 198.83 | 488.28 | 595.12 | 897.08 | 531.69 |
| 1,3-DiN-Naphthalene | 42.44 | 25.88 | 29.97 | 14.01 | 43.30 | 10.00 | 21.15 | 11.04 | 37.67 | 23.15 | 21.13 | 17.34 | 48.99 | 34.24 | 41.63 |
| 1,5-DiN-Naphthalene | ND | ND | 1.48 | ND | 6.94 | ND | ND | ND | 10.61 | ND | ND | 7.37 | ND | 3.00 | 4.05 |
| 5N-Acenaphthalene | ND | 160.99 | 7.63 | 61.27 | 136.58 | 257.80 | 10.21 | 459.10 | 723.28 | 414.90 | 26.24 | 1354.76 | 1547.79 | 8237.70 | 2063.21 |
| 2N-Fluorene | ND | ND | 19.75 | 2.72 | ND | ND | 15.72 | ND | 14.89 | 13.23 | 31.26 | 15.60 | 93.44 | 93.95 | 47.67 |
| 9N-Anthracene | 4132.77 | 27095.26 | 7582.03 | 14239.89 | 6039.42 | 21396.46 | 4376.54 | 36906.47 | 4865.36 | 7568.60 | 2809.50 | 30279.27 | 2916.67 | 8946.66 | 3984.95 |
| 2N-Anthracene | 350.73 | 136.71 | 301.47 | 70.04 | 256.83 | 256.57 | 479.92 | 436.02 | 325.20 | 87.17 | 240.21 | 265.86 | 157.71 | 97.85 | 129.36 |
| 9N-Phenanthrene | 253.81 | 306.49 | 489.09 | 225.85 | 312.96 | 121.78 | 117.67 | 224.52 | 131.13 | 158.83 | 163.67 | 431.71 | 353.34 | 685.41 | 277.68 |
| 3N-Phenanthrene | 2256.87 | 948.83 | 2327.54 | 523.66 | 1413.36 | 1351.20 | 2237.64 | 1691.92 | 1692.62 | 484.01 | 1969.54 | 1056.25 | 539.99 | 300.27 | 416.60 |
| 4N-Phenanthrene | 208.31 | 83.04 | 504.08 | 92.13 | 125.48 | 84.73 | 68.91 | 90.87 | 67.11 | 71.38 | 99.83 | 206.61 | 83.78 | 104.37 | 34.07 |
| 2N-Fluoranthene | 13267.31 | 5830.27 | 12266.47 | 3416.46 | 6282.80 | 3147.73 | 9678.38 | 3982.61 | 5295.03 | 2886.81 | 8288.11 | 4951.42 | 428.86 | 526.16 | 235.72 |
| 3N-Fluoranthene | 31.09 | 28.93 | 47.85 | 11.07 | 39.46 | 6.71 | 4.21 | 4.55 | 16.05 | 18.27 | 24.01 | 27.91 | 1.10 | 0.66 | 1.02 |
| 1N-Pyrene | 585.90 | 393.42 | 633.14 | 666.15 | 369.06 | 308.59 | 524.52 | 505.62 | 369.04 | 432.32 | 561.49 | 327.60 | 52.24 | 84.47 | 44.42 |
| 2N-Pyrene | 428.52 | 119.65 | 267.40 | 76.99 | 197.52 | 391.93 | 599.37 | 429.59 | 190.58 | 138.61 | 247.03 | 185.05 | ND | ND | ND |
| 6N-Chrysene | 6.36 | 3.17 | 4.38 | 5.10 | 3.67 | 4.74 | 4.27 | 3.99 | 3.33 | 3.34 | 4.77 | 8.10 | ND | ND | ND |

| **NPAH Mass (pg)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUF (Gas Phase)** | | | | | | | | | | | | | |
| Sampling Site | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Sampling Start Time | 7/21/05 7pm | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm |
| Sampling End Time | 7/22/05 7am | 7/22/05 1pm | 7/22/05 7pm | 7/23/05 7am | 7/23/05 1pm | 7/23/05 7pm | 7/24/05 7am | 7/24/05 1pm | 7/24/05 7pm | 7/25/05 7am | 7/25/05 1pm | 7/25/05 7pm | 7/26/05 7am |
| Volume (m3) | 504.78 | 214.67 | 259.21 | 489.85 | 224.47 | 275.2585899 | 494.3968998 | 230.1646071 | 233.2030015 | 489.4529308 | 242.129843 | 259.7411746 | 486.5447137 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 49.4 | 36.3 | 33.3 | 33.7 | 25.0 | 20.8 | 21.7 | 15.6 | 31.8 | 24.0 | 39.6 | 26.8 | 23.1 |
| d9-9N-Anthracene | 32.3 | 27.2 | 31.8 | 29.1 | 29.9 | 19.6 | 23.9 | 26.8 | 28.1 | 31.0 | 28.3 | 27.0 | 24.8 |
| d9-1N-Pyrene | 47.0 | 41.7 | 44.4 | 39.4 | 43.4 | 40.6 | 41.7 | 40.7 | 41.3 | 49.1 | 43.6 | 42.7 | 37.2 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 2594.46 | 3967.16 | 1145.76 | 3700.71 | 5112.66 | 627.80 | 7904.88 | 2034.01 | 829.28 | 1470.44 | 1057.34 | 423.45 | 3507.58 |
| 2N-Naphthalene | 2563.98 | 5454.10 | 1513.75 | 4470.68 | 5843.20 | 739.71 | 7230.11 | 2405.50 | 936.71 | 2532.95 | 1808.40 | 614.66 | 3456.29 |
| 2N-Biphenyl | 546.83 | 304.79 | 253.36 | 17703.41 | 995.16 | 203.04 | 9047.15 | 308.37 | 194.53 | 492.07 | 276.51 | 148.41 | 857.38 |
| 3N-Biphenyl | 460.54 | 428.61 | 313.19 | 374.71 | 307.29 | 181.57 | 514.30 | 287.22 | 272.97 | 837.80 | 394.94 | 218.08 | 412.49 |
| 4N-Biphenyl | 432.43 | 173.60 | 283.82 | 341.45 | 150.86 | 53.88 | 334.50 | 118.81 | 96.61 | 240.25 | 161.95 | 183.42 | 333.29 |
| 1,3-DiN-Naphthalene | 24.31 | 37.89 | 13.24 | 11.88 | 44.32 | 8.03 | 12.64 | 26.85 | 10.26 | 31.93 | 11.12 | 4.40 | 11.69 |
| 1,5-DiN-Naphthalene | 6.08 | ND | ND | ND | 3.37 | ND | ND | ND | ND | ND | ND | ND | 2.75 |
| 5N-Acenaphthalene | 653.88 | 607.06 | 483.48 | 4102.25 | 1252.28 | 525.27 | 6067.62 | 2922.78 | 702.92 | 1147.50 | 603.24 | 435.22 | 1650.69 |
| 2N-Fluorene | 52.48 | 18.97 | 19.22 | 9.33 | 25.89 | 11.16 | 31.33 | 14.03 | 23.24 | 22.23 | 18.78 | 11.70 | 19.73 |
| 9N-Anthracene | 4383.53 | 1748.00 | 1270.97 | 19585.13 | 2190.91 | 698.01 | 19722.28 | 2004.39 | 1567.36 | 2955.37 | 1694.16 | 690.14 | 6830.99 |
| 2N-Anthracene | 39.02 | 57.25 | 73.99 | 174.06 | 217.07 | 88.36 | 277.07 | 98.77 | 71.39 | 49.50 | 63.66 | 45.39 | 82.55 |
| 9N-Phenanthrene | 270.88 | 120.34 | 104.49 | 131.79 | 235.06 | 61.96 | 169.97 | 83.79 | 98.52 | 118.33 | 99.56 | 63.98 | 130.74 |
| 3N-Phenanthrene | 125.51 | 158.60 | 149.42 | 816.21 | 897.25 | 298.25 | 602.56 | 671.31 | 257.74 | 274.09 | 231.66 | 135.76 | 163.64 |
| 4N-Phenanthrene | 28.81 | 50.07 | 295.71 | 271.67 | 26.22 | 9.53 | 33.54 | ND | 5.70 | 13.40 | 12.40 | 5.60 | 22.26 |
| 2N-Fluoranthene | 245.13 | 151.51 | 102.48 | 743.05 | 1282.76 | 175.57 | 570.22 | 448.75 | 151.98 | 254.87 | 151.44 | 52.42 | 192.73 |
| 3N-Fluoranthene | 0.53 | 0.53 | ND | 1.34 | ND | ND | 1.11 | ND | ND | ND | ND | ND | 1.04 |
| 1N-Pyrene | 92.79 | 13.51 | 34.54 | 49.14 | 69.79 | 33.18 | 86.66 | 32.21 | 47.60 | 53.24 | 49.92 | 16.03 | 44.25 |
| 2N-Pyrene | ND | ND | ND | 51.01 | 66.58 | ND | 13.67 | ND | ND | ND | ND | ND | 10.61 |
| 6N-Chrysene | ND | ND | 2.59 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

# Appendix C: PAH and NPAH Mass in Buffalo, NY (Seasonal Samples collected in Winter 2005, Summer 2005 and Winter 2006)

**Winter 2005**
**PAH Mass (ng)**

| Sample Name | PBP120 | PBP120P | PBP128 | PBP143 | PBP143P | PBP147 | PBP147P | PBP153 | PBP153P | PBP154 | PBP154P | PBP124 | PBP132 | PBP134 | PBP134_P3 | PBP145 | PBP155 | PBP152 | PBP139 | PBP126 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina |
| Date | | | | | | | | | | | | 1/10/2005 | 1/10/2005 | 1/11/2005 | 1/11/2005 | 1/11/2005 | 1/11/2005 | 1/12/2005 | 1/12/2005 | 1/12/2005 |
| Sampling Time | | | | | | | | | | | | PM | PM | 5day | 5day | AM | PM | AM | PM | PM |
| Volume (m$^3$) | | | | | | | | | | | | 10.8 | 11.7 | 104.3 | 104.3 | 8.3 | 13.7 | 12 | 10.6 | 11.1 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 73.8 | 43.1 | 55.0 | 78.1 | 53.7 | 80.1 | 37.6 | 54.3 | 36.4 | 61.0 | 58.3 | 47.4 | 65.8 | 74.3 | 77.3 | 1.4 | 45.5 | 64.3 | 31.3 | 41.0 |
| d10-Fluorene | 65.1 | 39.4 | 54.4 | 69.4 | 50.8 | 73.3 | 35.9 | 53.7 | 33.8 | 58.2 | 50.8 | 43.2 | 59.1 | 58.2 | 67.6 | 75.2 | 42.9 | 50.9 | 28.2 | 40.4 |
| d10-Pyrene | 59.1 | 61.5 | 64.2 | 63.7 | 60.2 | 71.4 | 61.8 | 50.1 | 54.8 | 53.3 | 61.1 | 61.6 | 65.9 | 61.4 | 62.1 | 0.9 | 63.8 | 60.8 | 60.0 | 61.9 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 0.1 | 34.2 | 41.6 | 0.2 | 39.4 | 0.1 | 27.6 | 0.1 | 26.7 | 0.5 | 37.7 | 25.4 | 35.0 | 26.6 | 0.2 | 13.5 | 23.1 | 33.0 | 16.0 | 19.6 |
| d10-Fluoranthene | 0.0 | 54.4 | 58.5 | 0.3 | 55.6 | 0.2 | 57.0 | 0.2 | 48.5 | 0.2 | 54.2 | 54.7 | 59.8 | 53.9 | 0.0 | 50.1 | 56.4 | 54.0 | 50.7 | 55.5 |
| d12-Benz[a]pyrene | 0.2 | 102.8 | 109.3 | 0.5 | 105.7 | 0.6 | 106.8 | 0.5 | 100.6 | 0.5 | 104.9 | 103.3 | 104.6 | 94.4 | 0.1 | 102.6 | 102.7 | 102.5 | 105.3 | 106.1 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | 4.43 | 16.01 | 28.23 | 6.87 | 39.41 | 4.73 | 8.87 | 4.10 | 12.84 | 4.80 | 12.81 | 328.75 | 461.64 | 2395.50 | ND | 256.45 | 542.89 | 1158.84 | 129.07 | 148.93 |
| 2-Methylnapthalene | 1.79 | 8.34 | 13.96 | 3.23 | 24.87 | 2.34 | 4.63 | 2.26 | 6.28 | 2.71 | 6.12 | 126.76 | 174.04 | 1631.56 | 47.78 | 172.99 | 371.91 | 819.24 | 65.76 | 79.92 |
| Azulene | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.86 | ND | 3.26 | ND | 0.34 | ND | 1.21 | 1.01 | 0.42 |
| 1-Methylnapthalene | 0.89 | 3.32 | 5.35 | 1.37 | 8.78 | 1.01 | 2.04 | 0.90 | 2.33 | 1.13 | 2.31 | 55.40 | 74.56 | 593.22 | 21.00 | 69.72 | 151.07 | 300.16 | 25.44 | 30.98 |
| Biphenyl | 0.32 | 0.94 | 1.56 | 0.41 | 3.10 | 0.33 | 0.60 | 0.34 | 0.84 | 0.41 | 0.77 | 20.24 | 25.65 | 214.29 | 11.45 | 11.93 | 33.35 | 69.78 | 11.80 | 15.09 |
| 2,7-Dimethylnapthalene | 0.50 | 1.79 | 3.24 | 0.71 | 6.52 | 0.65 | 1.37 | 0.67 | 1.54 | 0.73 | 1.60 | 30.52 | 41.00 | 460.83 | 21.50 | 35.63 | 87.12 | 229.85 | 24.15 | 31.40 |
| 1,3-Dimethylnapthalene | 0.51 | 1.88 | 2.82 | 0.64 | 5.12 | 0.54 | 1.17 | 0.57 | 1.22 | 0.63 | 1.29 | 29.71 | 38.13 | 394.61 | 18.10 | 31.88 | 79.75 | 213.37 | 23.77 | 29.45 |
| 1,6-Dimethylnapthalene | 0.35 | 0.82 | 1.74 | 0.41 | 3.51 | 0.37 | 0.76 | 0.47 | 0.82 | 0.37 | 0.89 | 17.12 | 24.60 | 246.19 | 12.50 | 18.77 | 49.13 | 129.43 | 14.04 | 17.73 |
| 1,4-Dimethylnapthalene | 0.17 | 0.50 | 0.73 | 0.30 | 1.14 | 0.32 | 0.33 | 0.17 | 0.40 | 0.23 | 0.21 | 8.67 | 11.16 | 108.92 | 6.01 | 8.42 | 21.05 | 57.86 | 6.89 | 8.02 |
| 1,5-Dimethylnapthalene | 0.14 | 0.24 | 0.36 | 0.17 | 0.61 | 0.14 | 0.14 | 0.18 | 0.20 | 0.12 | 0.18 | 3.73 | 5.16 | 51.17 | 2.55 | 3.61 | 9.56 | 25.60 | 3.83 | 4.57 |
| Acenapthylene | 0.13 | 0.37 | 0.47 | 0.16 | 1.14 | 0.66 | 0.29 | 0.18 | 0.29 | 0.16 | 0.24 | 8.49 | 11.08 | 90.07 | 2.32 | 10.35 | 23.75 | 80.96 | 2.88 | 2.08 |
| 1,2-Dimethylnapthalene | 0.10 | 0.24 | 0.44 | 0.23 | 0.91 | 0.13 | 0.20 | 0.19 | 0.29 | 0.22 | 0.26 | 4.99 | 6.55 | 67.90 | 4.13 | 5.07 | 12.07 | 34.30 | 3.84 | 4.85 |
| 1,8-Dimethylnapthalene | 0.00 | 0.00 | 0.14 | 0.00 | 0.40 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.56 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenapthene | 0.17 | 1.13 | 2.19 | 0.26 | 3.59 | 0.23 | 0.78 | 0.20 | 0.99 | 0.29 | 0.79 | 13.05 | 19.35 | 121.25 | 8.61 | 7.62 | 19.46 | 47.10 | 10.77 | 10.43 |
| 2,3,5-Trimethylnapthalene | 0.05 | 0.25 | 0.78 | 0.23 | 1.17 | 0.23 | 0.19 | 0.20 | 0.32 | 0.22 | 0.18 | 9.98 | 13.49 | 112.45 | 15.62 | 6.23 | 16.23 | 46.35 | 8.55 | 8.16 |
| Fluorene | 0.30 | 1.19 | 1.78 | 1.95 | 3.58 | 0.57 | 1.05 | 0.54 | 1.26 | 0.63 | 1.19 | 74.48 | 92.07 | 355.21 | 53.79 | 32.42 | 49.53 | 94.90 | 54.71 | 30.70 |
| 1-Methylfuorene | 0.24 | 0.91 | 1.17 | 0.37 | 2.52 | 0.19 | 0.64 | 0.25 | 0.46 | 0.31 | 0.98 | 13.41 | 17.01 | 131.63 | ND | 7.63 | 26.32 | 41.08 | 22.32 | 19.01 |
| Dibenzothiophene | 13.06 | 13.03 | 12.84 | 12.67 | 0.72 | 12.76 | 0.40 | 12.54 | 13.06 | 12.80 | 0.48 | ND | ND | 98.23 | ND | ND | ND | ND | ND | ND |
| Phenanthrene | 0.97 | 2.17 | 3.55 | 1.57 | 7.34 | 1.62 | 3.05 | 1.45 | 3.05 | 1.51 | 3.16 | 121.44 | 99.72 | 1247.98 | ND | 75.38 | 197.81 | 450.25 | 295.66 | 326.29 |
| Anthracene | 0.06 | 0.17 | 0.27 | 0.08 | 0.85 | 0.10 | 0.33 | 0.09 | 0.24 | 0.08 | 0.18 | 7.63 | 6.52 | 112.28 | ND | 6.08 | 19.30 | 53.00 | 32.44 | 34.19 |
| 2-Methyldibenzothiophene | 0.07 | 0.19 | 0.26 | 0.08 | 0.37 | 0.04 | 0.36 | 0.08 | 0.27 | 0.10 | 0.20 | 1.82 | 2.72 | 34.29 | ND | 1.43 | 6.71 | 10.77 | 5.65 | 5.86 |
| 4-Methyldibenzothiophene | 0.06 | 0.10 | 0.32 | 0.07 | 0.32 | 0.04 | 0.40 | 0.04 | 0.14 | 0.06 | 0.17 | 1.18 | 1.47 | 23.10 | ND | 1.03 | 3.73 | 7.39 | 3.49 | 4.28 |
| 2-Methylphenanthrene | 0.15 | 0.95 | 2.05 | 0.27 | 6.26 | 0.21 | 3.69 | 0.21 | 3.32 | 0.28 | 2.52 | 11.43 | 10.32 | 178.62 | 28.88 | 11.11 | 66.84 | 75.56 | 34.82 | 16.08 |
| 2-Methylanthracene | 0.17 | 0.36 | 0.57 | 0.27 | 1.00 | 0.22 | 0.76 | 0.18 | 0.53 | 0.22 | 0.61 | 4.79 | 3.41 | 99.83 | ND | 4.68 | 10.34 | 31.15 | 10.40 | 14.71 |
| 4,5-Methylenephenanthrene | 0.06 | 0.17 | 0.13 | 0.05 | 0.15 | 0.05 | 0.20 | 0.06 | 0.17 | 0.06 | 0.22 | 1.87 | 1.51 | 39.29 | ND | 1.95 | 4.69 | 12.29 | 5.49 | 7.39 |
| 1-Methylanthracene | 0.13 | 0.19 | 0.30 | 0.13 | 0.48 | 0.10 | 0.31 | 0.12 | 0.29 | 0.18 | 0.26 | 1.90 | 1.73 | 51.03 | ND | 2.11 | 4.93 | 14.75 | 5.43 | 6.83 |
| 1-Methylphenanthrene | 0.07 | 0.15 | 0.28 | 0.15 | 0.45 | 0.09 | 0.26 | 0.04 | 0.18 | 0.14 | 0.21 | 1.39 | 1.17 | 35.21 | ND | 1.65 | 3.98 | 10.30 | 3.71 | 4.85 |
| 9-Methylanthracene | 0.00 | 1.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 9,10-Dimethylanthracene | 0.05 | 0.05 | 0.16 | 0.07 | 0.00 | 0.08 | 0.16 | 0.00 | 0.15 | 0.08 | 0.14 | ND | ND | 7.72 | ND | 0.60 | 0.93 | 2.56 | 0.67 | 0.76 |
| Fluoranthene | 0.21 | 0.63 | 0.77 | 0.28 | 0.62 | 0.25 | 0.64 | 0.21 | 0.74 | 0.25 | 0.59 | 5.68 | 5.22 | 95.47 | ND | 6.35 | 10.41 | 25.62 | 8.28 | 12.04 |
| Pyrene | 0.12 | 0.57 | 0.47 | 0.24 | 0.58 | 0.19 | 0.44 | 0.12 | 0.51 | 0.18 | 0.35 | 3.75 | 3.60 | 62.21 | ND | 5.29 | 7.72 | 17.36 | 5.13 | 6.39 |
| 3,6-Dimethylphenanthrene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.95 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ND | ND | ND | 0.14 | ND | ND | ND | ND | ND |
| Benzo[a]fluorene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.48 | 0.32 | 4.57 | ND | 0.54 | 0.60 | 1.37 | 0.54 | 0.48 |
| Retene | 0.11 | 0.48 | 0.32 | 0.09 | 0.00 | 0.05 | 0.30 | 0.04 | 0.24 | 0.10 | 0.18 | ND | ND | 5.50 | ND | ND | 3.10 | 1.28 | ND | ND |
| Benzo[b]fluorene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.20 | 2.59 | ND | 0.33 | 0.48 | 0.86 | 0.43 | 0.32 |
| Cyclopenta[c,d]pyrene | 0.04 | 0.03 | 0.06 | 0.03 | 0.06 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.50 | 0.33 | 3.41 | ND | 0.44 | 1.58 | 1.53 | 0.69 | 1.15 |
| Benz[a]anthracene | 0.17 | 0.03 | 0.16 | 0.04 | 0.04 | 0.18 | 0.02 | 0.02 | 0.06 | 0.16 | 0.18 | 0.99 | 0.97 | 7.00 | ND | 1.37 | 1.41 | 2.97 | 1.13 | 1.15 |
| Chrysene+Triphenylene | 0.05 | 0.08 | 0.13 | 0.10 | 0.04 | 0.05 | 0.06 | 0.02 | 0.16 | 0.03 | 0.07 | 1.73 | 1.49 | 12.68 | ND | 1.86 | 2.45 | 3.78 | 1.35 | 1.48 |
| Napthacene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.14 | 0.99 | ND | 0.20 | 0.21 | 0.38 | 0.14 | 0.13 |
| 4-Methylchrysene | 0.00 | 0.08 | 0.06 | 0.04 | 0.09 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.08 | ND | ND | 0.89 | ND | ND | 0.28 | 0.39 | ND | ND |
| Benzo[b]fluoranthene | 0.06 | 0.07 | 0.08 | 0.06 | 0.07 | 0.06 | 0.11 | 0.04 | 0.13 | 0.05 | 0.04 | 2.38 | 2.31 | 15.43 | ND | 2.19 | 3.18 | 4.62 | 1.94 | 2.04 |
| Benzo[k]fluoranthene | 0.02 | 0.04 | 0.04 | 0.02 | 0.06 | 0.05 | 0.05 | 0.07 | 0.09 | 0.03 | 0.01 | 1.77 | 1.66 | 10.37 | ND | 1.84 | 3.11 | 3.59 | 1.37 | 1.27 |
| Dimethylbenz[a]anthracene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo[e]pyrene | 0.15 | 0.49 | 0.23 | 0.04 | 0.00 | 0.07 | 0.00 | 0.03 | 0.76 | 0.04 | 0.28 | 1.38 | 1.37 | 7.79 | ND | 1.44 | 2.27 | 2.89 | 1.19 | 1.41 |
| Benzo[a]pyrene | 0.04 | 0.17 | 0.22 | 0.05 | 0.00 | 0.07 | 0.00 | 0.07 | 0.13 | 0.04 | 0.78 | 1.95 | 1.55 | 8.33 | ND | 1.98 | 3.42 | 4.05 | 1.63 | 1.93 |
| Perylene | 0.02 | 0.01 | 0.05 | 0.04 | 0.06 | 0.03 | 0.02 | 0.05 | 0.09 | 0.04 | 0.02 | 0.21 | ND | 0.91 | ND | ND | 0.34 | 0.41 | 0.23 | ND |
| 3-Methylchloanthrene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 0.00 | 0.09 | 0.09 | 0.00 | 0.00 | 0.00 | 0.19 | 0.00 | 0.00 | 0.00 | 0.14 | 2.19 | 1.89 | 15.98 | ND | 2.32 | 3.69 | 5.33 | 1.76 | 1.75 |
| Dibenz[a,h+ac]anthracene | 0.06 | 0.05 | 0.05 | 0.03 | 0.00 | 0.00 | 0.08 | 0.00 | 0.02 | 0.02 | 0.00 | 0.16 | 0.20 | 0.90 | ND | ND | ND | 0.22 | ND | 0.18 |
| Benzo[g,h,i]perylene | 0.08 | 0.43 | 0.17 | 0.11 | 0.11 | 0.06 | 0.12 | 0.00 | 0.11 | 0.11 | 0.11 | 2.27 | 2.07 | 11.48 | ND | 2.83 | 4.52 | 6.08 | 1.69 | 1.72 |
| Anthranthrene | 0.04 | 0.03 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | ND | ND | 1.45 | ND | ND | 0.77 | ND | ND | ND |
| Corenene | 0.00 | 0.08 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.55 | ND | 5.29 | ND | ND | 1.49 | 0.95 | ND | ND |

**Winter 2005**
**PAH Mass (ng)**

| Sample Name | PBP141 | PBP157 | PBP148 | PBP140 | PBP138 | PBP130 | PBP137 | PBP136 | PBP150 | PBP158 | PBP142 | PBP146 | PBP125 | PBP122 | PBP151 | PBP116 | PBP115 | PBP121 | PBP127 | PBP127_P3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Highway | Highway |
| Date | 1/13/2005 | 1/13/2005 | 1/13/2005 | 1/13/2005 | 1/13/2005 | 1/14/2005 | 1/14/2005 | 1/14/2005 | 1/14/2005 | 1/15/2005 | 1/11/2005 | 1/11/2005 | 1/12/2005 | 1/12/2005 | 1/13/2005 | 1/13/2005 | 1/14/2005 | 1/15/2005 | 1/11/2005 | 1/11/2005 |
| Sampling Time | AM | AM | AM | PM | PM | AM | AM | PM | PM | AM | AM | PM | AM | PM | AM | PM | AM | AM | 5day | 5day |
| Volume ($m^3$) | 11.7 | 10.8 | 10.2 | 11.2 | 11.6 | 10 | 10.1 | 10.9 | 10.8 | 10.7 | 6.8 | 12.3 | 10.5 | 12 | 10.9 | 13.1 | 12 | 11 | 100.3 | 100.3 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 38.7 | 65.0 | 47.7 | 60.6 | 52.6 | 44.2 | 65.3 | 53.4 | 52.0 | 59.9 | 54.0 | 31.8 | 36.4 | 25.8 | 30.4 | 33.3 | 50.3 | 16.4 | 73.0 | 22.6 |
| d10-Fluorene | 32.3 | 59.9 | 43.8 | 50.1 | 47.4 | 45.7 | 56.1 | 48.2 | 53.6 | 51.7 | 46.9 | 29.8 | 35.3 | 27.3 | 28.6 | 36.2 | 45.0 | 18.9 | 65.2 | 21.7 |
| d10-Pyrene | 57.6 | 67.4 | 63.5 | 61.8 | 72.8 | 68.6 | 65.0 | 62.8 | 64.6 | 61.8 | 63.7 | 63.4 | 61.8 | 63.6 | 60.4 | 69.4 | 64.4 | 52.0 | 63.5 | 67.3 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 28.7 | 34.4 | 21.4 | 34.6 | 34.5 | 25.3 | 22.3 | 38.1 | 33.0 | 41.5 | 28.5 | 15.5 | 17.2 | 12.4 | 14.3 | 17.5 | 40.6 | 23.8 | 17.1 | 0.2 |
| d10-Fluoranthene | 51.0 | 60.9 | 56.6 | 55.0 | 63.6 | 59.3 | 57.5 | 55.3 | 58.8 | 55.7 | 55.3 | 57.0 | 52.8 | 55.7 | 53.7 | 58.8 | 56.5 | 91.4 | 52.0 | 0.1 |
| d12-Benz[a]pyrene | 101.1 | 103.7 | 105.2 | 107.6 | 104.2 | 107.3 | 109.1 | 104.6 | 107.4 | 103.1 | 108.4 | 107.2 | 104.5 | 106.5 | 104.4 | 100.0 | 105.2 | 151.5 | 95.2 | 0.1 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | 240.47 | 235.86 | 141.53 | 233.32 | 240.59 | 110.57 | 173.67 | 132.47 | 123.41 | 217.16 | 467.33 | 469.55 | 553.28 | 116.00 | 159.12 | 213.14 | 690.81 | 160.52 | 2290.69 | ND |
| 2-Methylnapthalene | 92.62 | 177.01 | 110.09 | 97.59 | 97.50 | ND | 63.58 | ND | ND | 100.10 | 266.39 | 285.85 | 391.62 | 74.56 | 154.62 | 127.18 | 323.36 | 55.60 | 1633.84 | 58.85 |
| Azulene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.90 | 0.88 | 0.44 | ND | ND | ND | ND | ND | 4.49 | ND |
| 1-Methylnapthalene | 37.66 | 64.36 | 40.49 | 42.86 | 42.83 | 15.90 | 27.82 | 17.27 | 16.79 | 41.80 | 102.94 | 112.16 | 141.70 | 27.82 | 52.03 | 49.16 | 121.81 | 22.89 | 607.97 | 25.49 |
| Biphenyl | 5.51 | 23.19 | 15.71 | 13.86 | 13.36 | ND | 9.83 | 4.99 | 5.37 | 15.79 | 16.52 | 22.99 | 31.58 | 9.80 | 12.95 | 9.54 | 14.92 | ND | 197.73 | 5.22 |
| 2,7-Dimethylnapthalene | 10.31 | 52.84 | 36.40 | 26.76 | 26.57 | ND | 18.17 | ND | ND | 27.12 | 40.58 | 51.86 | 90.11 | 17.38 | 30.96 | 21.96 | 33.00 | ND | 436.19 | 14.14 |
| 1,3-Dimethylnapthalene | 8.91 | 46.14 | 31.49 | 25.57 | 23.44 | ND | 15.45 | ND | ND | 23.14 | 36.50 | 47.40 | 87.27 | 15.80 | 27.46 | 22.16 | 31.09 | ND | 403.42 | 12.97 |
| 1,6-Dimethylnapthalene | 5.28 | 30.31 | 20.25 | 15.65 | 15.00 | ND | 10.00 | ND | ND | 15.27 | 22.03 | 29.11 | 48.11 | 9.45 | 15.97 | 10.02 | 14.90 | ND | 235.89 | 7.48 |
| 1,4-Dimethylnapthalene | ND | 12.74 | 9.28 | 6.72 | 6.36 | ND | 4.49 | ND | ND | 7.19 | 10.50 | 13.06 | 25.00 | 4.45 | 7.52 | 5.43 | 7.69 | ND | 116.35 | 3.43 |
| 1,5-Dimethylnapthalene | ND | 5.79 | 4.24 | 3.55 | 3.37 | ND | 1.91 | ND | ND | 2.93 | 4.54 | 6.11 | 10.78 | 2.50 | 2.96 | 2.47 | 2.72 | ND | 49.91 | 1.50 |
| Acenapthylene | ND | 3.55 | 3.00 | 2.98 | 2.58 | ND | 2.65 | ND | ND | 2.95 | 17.07 | 24.28 | 41.54 | 2.89 | 5.01 | 3.57 | 6.90 | 2.70 | 106.73 | ND |
| 1,2-Dimethylnapthalene | ND | 7.43 | 5.49 | 4.04 | 3.68 | ND | 2.53 | ND | ND | 4.09 | 6.57 | 8.03 | 15.30 | 2.64 | 4.58 | 3.17 | 4.69 | ND | 69.96 | 2.12 |
| 1,8-Dimethylnapthalene | ND | ND | 4.81 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenapthene | ND | 19.22 | 15.99 | 8.22 | 8.34 | ND | 7.96 | ND | ND | 11.86 | 14.34 | 17.35 | 23.35 | 5.40 | 9.76 | 7.18 | 7.92 | ND | 97.75 | ND |
| 2,3,5-Trimethylnapthalene | ND | 10.21 | 10.97 | 5.22 | 4.83 | ND | 3.40 | ND | ND | 5.53 | 12.93 | 12.11 | 22.70 | 3.90 | 5.24 | 4.48 | 4.09 | ND | 143.63 | 6.33 |
| Fluorene | ND | 28.51 | 43.83 | 14.10 | 14.49 | ND | 12.01 | ND | ND | 40.57 | 68.57 | 79.42 | 69.10 | 20.87 | 18.74 | 14.00 | 10.45 | 10.22 | 414.89 | 14.56 |
| 1-Methylfuorene | ND | 8.82 | 18.35 | 12.10 | 8.60 | ND | ND | ND | ND | 5.58 | 15.61 | 20.51 | 39.86 | 11.33 | 5.58 | 9.05 | 5.03 | ND | 162.00 | ND |
| Dibenzothiophene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 126.04 | ND |
| Phenanthrene | ND | 80.33 | 194.99 | 78.28 | 91.78 | ND | 29.07 | ND | 14.74 | 30.34 | 119.24 | 275.12 | 436.35 | 126.97 | 68.24 | 113.37 | 23.98 | 22.86 | 1737.22 | ND |
| Anthracene | ND | 5.89 | 16.18 | 8.48 | 8.09 | ND | 1.38 | ND | ND | ND | 11.11 | 28.53 | 50.64 | 11.67 | 5.88 | 10.93 | ND | ND | 169.94 | ND |
| 2-Methyldibenzothiophene | ND | 2.46 | 3.98 | 2.80 | 2.09 | ND | 1.49 | ND | ND | 1.16 | 2.96 | 3.85 | 15.50 | 3.01 | 2.75 | 2.46 | 1.26 | ND | 39.07 | ND |
| 4-Methyldibenzothiophene | ND | 2.05 | 2.79 | 2.68 | 1.12 | ND | 1.38 | ND | ND | 0.86 | 1.70 | 2.62 | 9.47 | 2.05 | 2.02 | 1.99 | ND | ND | 23.92 | ND |
| 2-Methylphenanthrene | ND | 53.44 | 90.28 | 10.69 | 43.65 | ND | 60.91 | ND | 57.88 | 72.04 | 35.70 | 48.98 | 52.24 | ND | 104.96 | 13.72 | 24.68 | ND | 302.35 | 17.55 |
| 2-Methylanthracene | ND | 7.82 | 10.35 | 7.54 | 8.10 | ND | 4.13 | ND | 3.12 | 3.43 | 5.09 | 9.78 | 30.49 | 7.35 | 7.35 | 7.78 | 4.73 | ND | 120.86 | ND |
| 4,5-Methylenephenanthrene | ND | 2.64 | 4.15 | 3.40 | 3.23 | ND | 0.97 | ND | 0.79 | ND | 2.23 | 4.68 | 11.94 | 3.21 | 2.71 | 3.28 | 1.20 | 1.01 | 43.95 | ND |
| 1-Methylanthracene | ND | 3.38 | 4.29 | 3.61 | 3.33 | ND | 1.91 | ND | ND | ND | 2.28 | 4.39 | 14.00 | 3.62 | 3.46 | 3.45 | 1.52 | ND | 54.77 | ND |
| 1-Methylphenanthrene | ND | 2.36 | 2.91 | 2.77 | 2.48 | ND | 1.45 | ND | ND | 1.11 | 1.75 | 3.20 | 9.79 | 2.56 | 2.46 | 2.34 | 1.21 | ND | 38.92 | ND |
| 9-Methylanthracene | ND | ND | ND | 5.43 | ND | ND | ND | ND | ND | ND | ND | ND | 2.33 | 1.33 | ND | ND | ND | ND | ND | ND |
| 9,10-Dimethylanthracene | ND | 1.03 | 0.68 | 0.82 | 0.53 | ND | 0.49 | ND | ND | ND | ND | 0.66 | 2.05 | 0.53 | 0.82 | 0.52 | ND | ND | 9.42 | ND |
| Fluoranthene | 3.05 | 7.40 | 8.00 | 6.73 | 6.82 | 2.91 | 4.89 | ND | 3.76 | 3.43 | 5.58 | 12.27 | 22.05 | 10.27 | 8.61 | 7.17 | 5.24 | 9.34 | 83.89 | ND |
| Pyrene | 2.38 | 4.36 | 4.61 | 4.50 | 3.51 | 1.96 | 3.31 | ND | 2.40 | 2.20 | 4.36 | 8.84 | 13.82 | 6.36 | 4.96 | 5.12 | 4.23 | 6.63 | 64.93 | ND |
| 3,6-Dimethylphenanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo[a]fluorene | 0.28 | 0.16 | 0.30 | 0.16 | 0.27 | 0.13 | 0.13 | 0.14 | 0.34 | 0.23 | 0.34 | 0.93 | 1.08 | 0.57 | 0.26 | 0.31 | 0.37 | 1.23 | ND | ND |
| Retene | 1.10 | ND | 1.53 | ND | ND | ND | ND | 1.15 | 1.86 | ND | ND | ND | 1.31 | ND | ND | ND | ND | 2.00 | 5.42 | ND |
| Benzo[b]fluorene | 0.16 | 0.21 | 0.35 | 0.14 | 0.30 | 0.12 | 0.16 | 0.09 | 0.21 | 0.16 | 0.23 | 0.41 | 0.56 | 0.53 | 0.16 | 0.21 | 0.30 | 0.71 | ND | ND |
| Cyclopenta[c,d]pyrene | 0.55 | 0.53 | 0.63 | ND | ND | 0.38 | 0.42 | 0.28 | 0.47 | 0.37 | 0.41 | 1.72 | 1.20 | 0.90 | 0.59 | ND | 0.37 | 1.91 | 5.05 | ND |
| Benz[a]anthracene | 0.70 | 0.67 | 0.53 | ND | ND | ND | ND | ND | 0.66 | ND | 0.78 | 2.13 | 2.15 | 1.28 | ND | 0.73 | 0.86 | 2.37 | 7.23 | ND |
| Chrysene+Triphenylene | 1.17 | 1.01 | 0.81 | 0.73 | 0.62 | 0.83 | 0.77 | 0.88 | 1.01 | 0.95 | 1.30 | 3.01 | 2.97 | 1.66 | 0.86 | 1.05 | 1.42 | 3.51 | 13.30 | ND |
| Napthacene | 0.16 | ND | ND | ND | ND | ND | 0.14 | ND | ND | ND | ND | 0.28 | 0.26 | ND | ND | ND | ND | 0.18 | ND | ND |
| 4-Methylchrysene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.39 | 0.34 | ND | ND | ND | ND | ND | 1.02 | ND |
| Benzo[b]fluoranthene | 1.46 | 1.40 | 1.20 | 0.64 | 1.15 | 1.23 | 1.26 | 0.98 | 1.20 | 1.09 | 1.48 | 4.06 | 3.79 | 2.48 | 1.17 | 1.52 | 1.53 | 3.32 | 16.10 | ND |
| Benzo[k]fluoranthene | 1.05 | 0.84 | 0.82 | 0.47 | 0.29 | 0.55 | 0.78 | 0.64 | 0.79 | 0.64 | 1.36 | 3.45 | 2.85 | 1.56 | 0.81 | 1.00 | 0.88 | 3.00 | 10.35 | ND |
| Dimethylbenz[a]anthracene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.69 | ND |
| Benzo[e]pyrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.94 | 2.65 | 2.55 | 1.43 | ND | ND | 1.31 | 1.78 | 9.45 | ND |
| Benzo[a]pyrene | ND | 1.10 | 1.03 | 0.81 | ND | ND | 0.86 | ND | 0.80 | ND | 1.39 | 4.20 | 3.09 | 1.92 | 0.82 | 1.22 | 1.22 | 2.55 | 5.68 | ND |
| Perylene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.43 | 0.28 | 0.31 | ND | ND | ND | 0.25 | 0.77 | ND |
| 3-Methylchloanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 1.18 | 1.27 | 0.99 | 0.65 | 0.61 | 0.99 | 1.04 | 0.81 | 0.91 | 0.77 | 1.91 | 3.97 | 4.74 | 2.40 | 1.04 | 1.39 | 1.75 | 3.22 | 19.17 | ND |
| Dibenz[a,h+ac]anthracene | ND | ND | 0.15 | ND | ND | ND | ND | ND | ND | ND | ND | 0.25 | 0.19 | 0.17 | ND | 0.33 | 0.30 | ND | 1.21 | ND |
| Benzo[g,h,i]perylene | 1.24 | 1.15 | 0.94 | ND | ND | 0.91 | 0.95 | ND | ND | ND | 2.09 | 5.23 | 5.26 | 2.05 | 1.31 | 1.73 | 2.09 | 2.75 | 15.17 | ND |
| Anthranthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.17 | ND |
| Corenene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.57 | 1.14 | ND | ND | ND | 0.78 | 0.69 | 8.12 | ND |

**Winter 2005**
**PAH Mass (ng)**

| Sample Name | PBP118 | PBP123 | PBP131 | PBP135 | PBP149 | PBP117 | PBP156 |
|---|---|---|---|---|---|---|---|
| Sampling Site | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Date | 1/11/2005 | 1/11/2005 | 1/12/2005 | 1/13/2005 | 1/13/2005 | 1/14/2005 | 1/15/2005 |
| Sampling Time | AM | PM | AM | AM | PM | AM | AM |
| Volume ($m^3$) | 7.7 | 12.7 | 11.4 | 10.8 | 12.8 | 11.7 | 11.1 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 73.4 | 49.9 | 34.7 | 58.0 | 37.1 | 38.9 | 74.1 |
| d10-Fluorene | 59.1 | 47.4 | 31.3 | 50.4 | 34.8 | 36.4 | 65.1 |
| d10-Pyrene | 58.7 | 63.9 | 61.1 | 64.3 | 63.8 | 70.3 | 62.0 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 37.7 | 23.6 | 16.3 | 29.7 | 22.5 | 25.5 | 51.2 |
| d10-Fluoranthene | 52.1 | 56.1 | 51.3 | 56.9 | 56.3 | 58.1 | 55.7 |
| d12-Benz[a]pyrene | 104.1 | 101.8 | 101.2 | 107.3 | 103.8 | 106.3 | 105.2 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | 725.69 | 603.22 | 838.70 | 463.46 | 253.99 | 367.18 | 496.44 |
| 2-Methylnapthalene | 452.31 | 376.98 | 489.06 | 269.46 | 156.88 | 186.76 | 240.53 |
| Azulene | 2.22 | 1.25 | 0.99 | ND | ND | ND | 0.31 |
| 1-Methylnapthalene | 181.41 | 149.86 | 184.80 | 101.13 | 65.77 | 75.48 | 95.67 |
| Biphenyl | 28.76 | 32.11 | 39.81 | 32.69 | 15.37 | 11.33 | 16.07 |
| 2,7-Dimethylnapthalene | 75.03 | 66.95 | 122.88 | 92.17 | 43.16 | 29.28 | 31.99 |
| 1,3-Dimethylnapthalene | 71.93 | 66.91 | 120.38 | 83.52 | 39.89 | 28.07 | 29.14 |
| 1,6-Dimethylnapthalene | 40.15 | 34.44 | 67.97 | 54.34 | 23.93 | 13.90 | 16.49 |
| 1,4-Dimethylnapthalene | 19.56 | 18.16 | 32.13 | 21.75 | 10.52 | 7.07 | 7.16 |
| 1,5-Dimethylnapthalene | 8.29 | 6.99 | 14.16 | 10.37 | 5.32 | 2.74 | 3.01 |
| Acenapthylene | 34.23 | 35.93 | 53.93 | 11.77 | 5.27 | 4.21 | 4.01 |
| 1,2-Dimethylnapthalene | 11.41 | 10.38 | 19.22 | 13.22 | 5.93 | 3.88 | 4.00 |
| 1,8-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND |
| Acenapthene | 20.65 | 24.28 | 23.62 | 13.79 | 8.61 | 7.36 | 6.34 |
| 2,3,5-Trimethylnapthalene | 14.32 | 17.62 | 26.12 | 17.93 | 8.09 | 4.15 | 3.26 |
| Fluorene | 94.74 | 96.55 | 55.10 | 28.34 | 18.62 | 11.51 | 7.62 |
| 1-Methylfuorene | 17.76 | 27.86 | 27.97 | 12.34 | 15.07 | 4.25 | ND |
| Dibenzothiophene | ND | ND | ND | ND | ND | ND | ND |
| Phenanthrene | 156.50 | 194.93 | 293.23 | 84.29 | 147.89 | 35.80 | ND |
| Anthracene | 13.83 | 19.43 | 32.60 | 7.51 | 14.76 | 1.56 | ND |
| 2-Methyldibenzothiophene | 2.37 | 3.57 | 7.77 | 3.35 | 6.35 | 1.64 | ND |
| 4-Methyldibenzothiophene | ND | 2.10 | 5.12 | 2.10 | 4.53 | 1.12 | ND |
| 2-Methylphenanthrene | 23.34 | 21.53 | 107.82 | 30.18 | 25.00 | 39.25 | ND |
| 2-Methylanthracene | 6.94 | 8.22 | 26.90 | 9.47 | 11.67 | 5.66 | ND |
| 4,5-Methylenephenanthrene | 3.03 | 3.63 | 9.04 | 3.26 | 4.53 | 1.31 | ND |
| 1-Methylanthracene | 2.63 | 3.91 | 11.99 | 4.38 | 5.87 | 2.18 | ND |
| 1-Methylphenanthrene | 2.08 | 2.67 | 8.58 | 3.15 | 4.09 | 1.71 | ND |
| 9-Methylanthracene | ND | ND | ND | ND | ND | ND | ND |
| 9,10-Dimethylanthracene | 0.48 | 0.60 | 2.32 | 1.03 | 1.42 | 0.79 | ND |
| Fluoranthene | 6.35 | 12.93 | 21.20 | 7.56 | 10.02 | 6.22 | 3.92 |
| Pyrene | 5.86 | 10.26 | 15.56 | 5.32 | 6.26 | 4.61 | 2.93 |
| 3,6-Dimethylphenanthrene | ND | ND | 0.70 | ND | ND | ND | ND |
| Benzo[a]fluorene | 0.47 | 0.88 | 1.23 | 0.49 | 0.30 | 0.46 | 0.30 |
| Retene | ND | 0.98 | 1.15 | ND | ND | 1.23 | ND |
| Benzo[b]fluorene | 0.34 | 0.49 | 0.62 | 0.29 | 0.31 | 0.36 | 0.22 |
| Cyclopenta[c,d]pyrene | 0.69 | 2.27 | 2.07 | 0.47 | 0.48 | 0.41 | 0.60 |
| Benz[a]anthracene | 1.16 | 2.74 | 2.90 | 0.86 | 0.92 | 1.19 | 1.05 |
| Chrysene+Triphenylene | 1.71 | 3.70 | 3.43 | 1.10 | 0.97 | 1.51 | 1.51 |
| Napthacene | 0.13 | 0.50 | 0.29 | 0.18 | 0.17 | 0.13 | 0.16 |
| 4-Methylchrysene | ND | 0.34 | 0.38 | ND | ND | ND | ND |
| Benzo[b]fluoranthene | 1.97 | 4.67 | 4.27 | 1.54 | 1.25 | 1.67 | 1.73 |
| Benzo[k]fluoranthene | 1.50 | 3.94 | 3.45 | 1.11 | 0.94 | 1.10 | 1.14 |
| Dimethylbenz[a]anthracene | ND | ND | ND | ND | ND | ND | ND |
| Benzo[e]pyrene | 1.45 | 3.16 | 3.09 | 1.13 | 1.07 | 3.99 | ND |
| Benzo[a]pyrene | 1.96 | 5.24 | 5.08 | 1.22 | 1.35 | 1.56 | 0.92 |
| Perylene | ND | 0.61 | 0.53 | ND | ND | ND | ND |
| 3-Methylchloanthrene | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 2.59 | 5.24 | 4.78 | 1.31 | 1.27 | 1.58 | 1.56 |
| Dibenz[a,h+ac]anthracene | 0.16 | 0.43 | 0.30 | ND | ND | 0.21 | ND |
| Benzo[g,h,i]perylene | 3.66 | 5.79 | 6.65 | 1.38 | 1.46 | 1.81 | 1.38 |
| Anthranthrene | ND | 1.06 | 0.83 | ND | ND | ND | ND |
| Corenene | 0.63 | 1.79 | 2.30 | ND | ND | ND | ND |

**Summer 2005**
**PAH Mass (ng)**

| Sample Name | PBP303 | PBP314 | PBP329 | PBP339 | PBP351 | PBP359 | PBP370 | PBP372 | PBP375 | PBP381 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank |
| Date | | | | | | | | | | |
| Sampling Time | | | | | | | | | | |
| Volume ($m^3$) | | | | | | | | | | |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 11.6 | 29.0 | 27.0 | 30.0 | 66.5 | 29.7 | 39.8 | 44.8 | 19.6 | 20.5 |
| d10-Fluorene | 13.3 | 22.1 | 27.8 | 29.0 | 61.6 | 32.5 | 39.3 | 52.1 | 23.1 | 21.8 |
| d10-Pyrene | 87.3 | 50.3 | 64.4 | 65.5 | 72.3 | 78.5 | 61.4 | 58.2 | 66.4 | 59.1 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 2.8 | 8.4 | 9.7 | 10.9 | 20.6 | 9.8 | 11.9 | 14.4 | 6.3 | 6.4 |
| d10-Anthracene | 13.8 | 16.8 | 17.8 | 16.0 | 24.5 | 12.1 | 13.3 | 17.8 | 13.7 | 10.8 |
| d10-Fluoranthene | 25.6 | 13.7 | 17.2 | 17.4 | 19.5 | 18.7 | 14.1 | 12.7 | 15.7 | 13.1 |
| d12-Benz[a]pyrene | 29.0 | 39.9 | 37.3 | 39.0 | 37.8 | 31.8 | 31.5 | 25.2 | 30.1 | 28.2 |
| d12-Indone[1,2,3-c,d]pyrene | 26.9 | 35.2 | 33.6 | 34.8 | 33.8 | 27.4 | 27.3 | 26.5 | 24.7 | 24.5 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | 4.95 | 15.16 | 18.77 | 26.43 | 72.93 | 22.69 | 44.75 | 77.65 | 16.00 | 13.40 |
| 2-Methylnapthalene | 3.83 | 9.66 | 11.12 | 20.22 | 57.24 | 13.10 | 31.80 | 56.66 | 7.75 | 6.76 |
| Azulene | 0.14 | 0.05 | 0.11 | 0.09 | 0.53 | 0.09 | 0.27 | 0.42 | 0.06 | 0.04 |
| 1-Methylnapthalene | 1.54 | 4.15 | 4.62 | 8.30 | 23.25 | 5.58 | 13.59 | 24.22 | 3.41 | 3.03 |
| Biphenyl | 0.83 | 1.28 | 1.43 | 2.77 | 9.82 | 1.70 | 4.16 | 6.79 | 1.15 | 1.07 |
| 2,7-Dimethylnapthalene | 1.81 | 3.77 | 4.01 | 9.28 | 31.01 | 6.13 | 13.27 | 21.99 | 2.82 | 2.66 |
| 1,3-Dimethylnapthalene | 1.29 | 3.27 | 3.53 | 7.50 | 25.56 | 3.89 | 9.59 | 15.94 | 2.64 | 2.21 |
| 1,6-Dimethylnapthalene | 1.37 | 1.75 | 2.38 | 4.90 | 14.24 | 5.22 | 10.55 | 16.82 | 1.43 | 1.96 |
| 1,4-Dimethylnapthalene | 0.60 | 0.71 | 0.86 | 2.02 | 6.54 | 1.12 | 2.52 | 4.50 | 0.70 | 0.59 |
| 1,5-Dimethylnapthalene | 0.54 | 0.38 | 0.44 | 0.72 | 1.99 | 1.00 | 1.90 | 2.25 | 0.21 | 0.47 |
| Acenapthylene | 0.10 | 0.19 | 0.20 | 0.12 | 0.83 | 0.32 | 0.56 | 0.76 | 0.08 | 0.16 |
| 1,2-Dimethylnapthalene | 0.21 | 0.19 | 0.30 | 0.80 | 1.90 | 0.94 | 1.55 | 2.39 | 0.19 | 0.29 |
| 1,8-Dimethylnapthalene | 0.41 | 0.61 | 1.66 | 1.30 | 1.83 | 0.03 | 0.26 | 0.27 | 1.52 | 0.52 |
| Acenapthene | 0.91 | 1.47 | 1.43 | 3.44 | 9.58 | 2.09 | 4.66 | 7.47 | 0.91 | 1.25 |
| 2,3,5-Trimethylnapthalene | 0.68 | 1.03 | 1.15 | 2.33 | 8.32 | 1.74 | 2.75 | 4.56 | 0.92 | 0.85 |
| Fluorene | 1.59 | 2.48 | 2.56 | 4.42 | 12.25 | 2.66 | 5.06 | 8.64 | 2.42 | 1.90 |
| 1-Methylfuorene | 0.57 | 0.30 | 0.55 | 5.29 | 3.99 | 0.47 | 0.64 | 0.95 | 0.45 | 0.19 |
| Dibenzothiophene | 0.73 | 0.34 | 1.14 | 0.71 | 1.28 | 0.44 | 0.51 | 0.64 | 0.40 | 0.33 |
| Phenanthrene | 4.24 | 4.65 | 6.23 | 9.72 | 18.89 | 5.40 | 7.51 | 10.22 | 6.12 | 4.59 |
| Anthracene | 0.29 | 0.26 | 0.52 | 0.45 | 1.14 | 0.13 | 0.48 | | 0.35 | 0.23 |
| 2-Methyldibenzothiophene | 0.28 | 0.18 | 0.31 | 0.28 | 0.69 | 0.19 | 0.23 | 0.39 | 0.21 | 0.20 |
| 4-Methyldibenzothiophene | 0.19 | 0.26 | 0.29 | 0.31 | 0.52 | 0.14 | 0.17 | 0.37 | 0.15 | 0.14 |
| 2-Methylphenanthrene | 0.44 | 0.56 | 0.55 | 0.79 | 1.24 | 0.53 | 0.45 | 0.71 | 0.55 | 0.39 |
| 2-Methylanthracene | 0.77 | 0.88 | 0.91 | 0.97 | 2.18 | 0.92 | 0.91 | 1.08 | 0.84 | 0.58 |
| 4,5-Methylenephenanthrene | 0.03 | 0.07 | 0.32 | 0.08 | 0.14 | 0.07 | 0.10 | 0.16 | 0.07 | 0.03 |
| 1-Methylanthracene | 0.52 | 0.37 | 0.45 | 0.46 | 0.85 | 0.37 | 0.33 | 0.65 | 0.37 | 0.23 |
| 1-Methylphenanthrene | 0.42 | 0.25 | 0.45 | 0.42 | 0.66 | 0.27 | 0.28 | 0.45 | 0.24 | 0.21 |
| 9-Methylanthracene | 0.14 | 0.05 | 0.18 | 0.05 | 0.04 | 0.07 | 0.03 | 0.03 | 0.03 | 0.02 |
| 9,10-Dimethylanthracene | 0.18 | 0.05 | 0.14 | 0.08 | 0.09 | 0.09 | 0.07 | 0.14 | 0.08 | 0.01 |
| Fluoranthene | 1.96 | 0.88 | 1.92 | 2.30 | 2.44 | 2.48 | 1.83 | 1.36 | 1.52 | 1.16 |
| Pyrene | 1.23 | 0.53 | 0.92 | 1.03 | 1.15 | 1.22 | 0.94 | 0.74 | 0.81 | 0.66 |
| 3,6-Dimethylphenanthrene | 0.15 | 0.01 | 0.18 | 0.04 | 0.13 | 0.10 | 0.02 | 0.03 | 0.16 | 0.06 |
| Benzo[a]fluorene | 0.21 | 0.05 | 0.03 | 0.05 | 0.04 | 0.05 | 0.02 | 0.03 | 0.01 | 0.02 |
| Retene | 0.39 | 0.20 | 0.30 | 0.24 | 0.83 | 0.44 | 0.16 | 0.22 | 0.19 | 0.17 |
| Benzo[b]fluorene | 0.22 | 0.03 | 0.04 | 0.05 | 0.06 | 0.09 | 0.02 | 0.04 | 0.03 | 0.04 |
| Cyclopenta[c,d]pyrene | 0.75 | 0.08 | 0.07 | 0.11 | 0.05 | 0.12 | 0.08 | 0.03 | 0.04 | 0.06 |
| Benz[a]anthracene | 0.69 | 0.07 | 0.11 | 0.10 | 0.03 | 0.15 | 0.08 | 0.02 | 0.06 | 0.08 |
| Chrysene+Triphenylene | 0.68 | 0.06 | 0.13 | 0.14 | 0.13 | 0.06 | 0.12 | 0.05 | 0.09 | 0.06 |
| Napthacene | 0.32 | 0.07 | 0.09 | 0.08 | 0.10 | 0.05 | 0.07 | 0.03 | 0.10 | 0.02 |
| 4-Methylchrysene | 0.47 | 0.04 | 0.11 | 0.07 | 0.06 | 0.11 | 0.05 | 0.05 | 0.05 | 0.03 |
| Benzo[b]fluoranthene | 0.45 | 0.05 | 0.02 | 0.04 | 0.13 | 0.10 | 0.07 | 0.06 | 0.06 | 0.10 |
| Benzo[k]fluoranthene | 1.05 | 0.04 | 0.07 | 0.07 | 0.13 | 0.15 | 0.06 | 0.06 | 0.04 | 0.05 |
| Dimethylbenz[a]anthracene | 0.91 | 0.11 | 0.12 | 0.10 | 0.07 | 0.34 | 0.08 | 0.10 | 0.12 | 0.14 |
| Benzo[e]pyrene | 0.81 | 0.03 | 0.04 | 0.07 | 0.09 | 0.15 | 0.25 | 0.06 | 0.06 | 0.22 |
| Benzo[a]pyrene | 0.81 | 0.15 | 0.14 | 0.15 | 0.11 | 0.30 | 0.17 | 0.22 | 0.16 | 0.14 |
| Perylene | 0.40 | 0.05 | 0.08 | 0.10 | 0.09 | 0.14 | 0.15 | 0.10 | 0.12 | 0.12 |
| 3-Methylchloanthrene | 0.46 | 0.24 | 0.25 | 0.35 | 0.52 | 0.79 | 0.26 | 0.18 | 0.23 | 0.33 |
| Indeno[1,2,3-c,d]pyrene | 1.04 | 0.06 | 0.13 | 0.26 | 0.06 | 0.19 | 0.17 | 0.12 | 0.07 | 0.15 |
| Dibenz[a,h+ac]anthracene | 0.77 | 0.06 | 0.09 | 0.07 | 0.11 | 0.19 | 0.02 | 0.05 | 0.04 | 0.06 |
| Benzo[g,h,i]perylene | 0.54 | 0.03 | 0.10 | 0.03 | 0.05 | 0.20 | 0.06 | 0.06 | 0.03 | 0.08 |
| Anthranthrene | 0.85 | 0.06 | 0.04 | 0.05 | 0.08 | 0.11 | 0.04 | 0.08 | 0.10 | 0.06 |
| Corenene | 0.17 | 0.03 | 0.06 | 0.05 | 0.08 | 0.15 | 0.03 | 0.06 | 0.09 | 0.08 |

**Summer 2005**
**PAH Mass (ng)**

| Sample Name | PBP379 | PBP385 | PBP369 | PBP394 | PBP333 | PBP366 | PBP373 | PBP327 | PBP368 | PBP337 | PBP323 | PBP340 | PBP349 | PBP360 | PBP392 | PBP383 | PBP363 | PBP361 | PBP338 | PBP345 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Residential | Residential | Residential | Residential | Residential | Residential |
| Date | 7/18/2005 | 7/18/2005 | 7/19/2005 | 7/19/2005 | 7/20/2005 | 7/21/2005 | 7/21/2005 | 7/22/2005 | 7/22/2005 | 7/25/2005 | 7/26/2005 | 7/27/2005 | 7/28/2005 | 7/29/2005 | 7/18/2005 | 7/19/2005 | 7/20/2005 | 7/22/2005 | 7/25/2005 | 7/26/2005 |
| Sampling Time | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM |
| Volume ($m^3$) | 11.1 | 10.114 | 12.141 | 12.333 | 8.323 | 12.06 | 11.948 | 10.178 | 11.179 | 10.429 | 10.023 | 6.204 | 10.988 | 11.806 | 8.511 | 7.847 | 12.419 | 11.69 | 17.213 | 11.601 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 25.1 | 16.6 | 26.3 | 17.3 | 14.9 | 19.4 | 29.2 | 29.2 | 31.2 | 19.4 | 30.7 | 34.6 | 20.8 | 25.6 | 30.3 | 25.4 | 47.5 | 33.2 | 8.9 | 17.7 |
| d10-Fluorene | 24.8 | 23.0 | 24.6 | 20.2 | 26.2 | 21.8 | 28.2 | 23.7 | 25.2 | 16.8 | 27.6 | 32.8 | 20.8 | 24.1 | 22.8 | 23.5 | 42.0 | 26.9 | 14.8 | 16.0 |
| d10-Pyrene | 55.4 | 91.9 | 59.4 | 94.4 | 61.0 | 77.7 | 59.5 | 68.0 | 64.2 | 70.0 | 78.9 | 57.4 | 73.6 | 87.2 | 75.1 | 69.6 | 64.5 | 62.7 | 65.7 | 88.1 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 9.1 | 9.7 | 7.7 | 12.0 | 4.2 | 15.9 | 13.6 | 17.3 | 12.5 | 11.0 | 11.3 | 15.8 | 15.6 | 13.8 | 13.4 | 11.8 | 27.5 | 16.8 | 9.2 | 6.6 |
| d10-Anthracene | 52.9 | 54.1 | 45.4 | 48.8 | 60.6 | 39.3 | 52.5 | 39.6 | 47.9 | 100.9 | 71.6 | 73.2 | 54.2 | 59.3 | 48.1 | 46.8 | 56.1 | 52.4 | 123.8 | 48.6 |
| d10-Fluoranthene | 52.7 | 86.4 | 54.3 | 94.2 | 57.9 | 74.2 | 54.4 | 65.9 | 57.2 | 155.7 | 88.5 | 67.0 | 79.1 | 96.2 | 68.1 | 64.6 | 59.7 | 57.4 | 149.2 | 95.0 |
| d12-Benz[a]pyrene | 89.4 | 92.9 | 89.3 | 92.7 | 89.6 | 88.0 | 92.3 | 88.2 | 92.6 | 214.9 | 112.8 | 102.2 | 116.3 | 99.4 | 93.3 | 89.9 | 88.9 | 89.7 | 184.1 | 114.3 |
| d12-Indone[1,2,3-c,d]pyrene | 90.0 | 84.0 | 94.3 | 83.7 | 90.5 | 88.8 | 94.2 | 92.8 | 92.1 | 232.4 | 107.9 | 93.5 | 104.9 | 88.4 | 89.8 | 88.1 | 88.1 | 89.2 | 205.5 | 104.8 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 114.16 | 93.94 | 197.98 | 120.67 | ND | ND |
| 2-Methylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 91.99 | 82.65 | 160.41 | 91.12 | ND | ND |
| Azulene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.59 | ND | ND | ND | 0.62 | ND | ND | ND | ND |
| 1-Methylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 27.77 | ND | ND | 37.06 | 32.48 | 62.81 | 36.10 | ND | ND |
| Biphenyl | 13.91 | 11.32 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 15.17 | 11.99 | 23.73 | 12.11 | ND | ND |
| 2,7-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 37.20 | ND | ND | ND | ND | 53.33 | ND | ND | ND |
| 1,3-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 32.50 | ND | ND | 26.65 | ND | 35.32 | ND | ND | ND |
| 1,6-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 20.34 | ND | ND | ND | ND | 43.85 | 24.25 | ND | ND |
| 1,4-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 8.79 | ND | ND | 7.77 | ND | 11.14 | ND | ND | ND |
| 1,5-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 8.47 | 5.17 | ND | ND |
| Acenapthylene | 3.34 | 3.03 | ND | ND | 2.86 | 1.31 | 1.77 | 2.28 | 1.50 | 1.30 | ND | 4.91 | 1.85 | ND | 2.78 | 5.87 | 11.23 | 5.51 | 1.45 | 1.06 |
| 1,2-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 3.42 | ND | ND | ND | ND | 7.25 | 4.14 | ND | ND |
| 1,8-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 2.84 | ND | ND | ND | 3.01 | ND | ND | ND | ND | ND |
| Acenapthene | 75.08 | 58.47 | ND | ND | 40.82 | 18.61 | 23.86 | ND | ND | ND | 15.87 | ND | 22.69 | ND | 38.65 | 30.48 | 74.16 | 29.12 | 14.26 | 10.04 |
| 2,3,5-Trimethylnapthalene | ND | ND | ND | ND | ND | ND | 8.16 | ND | ND | ND | ND | 13.79 | 7.51 | ND | 10.10 | 8.63 | 19.74 | 10.86 | ND | ND |
| Fluorene | 90.32 | 112.25 | 14.96 | ND | 158.70 | 55.00 | 73.41 | 43.31 | 43.43 | 37.28 | 77.81 | 19.02 | 66.42 | ND | 103.96 | 82.47 | 223.73 | 115.52 | 72.08 | 38.02 |
| 1-Methylfuorene | 4.83 | 6.86 | ND | ND | 8.18 | 4.81 | 6.56 | ND | 4.14 | 4.04 | 5.09 | ND | 4.59 | ND | 7.14 | 6.59 | 13.58 | 12.19 | 11.28 | 9.63 |
| Dibenzothiophene | 19.46 | 28.23 | 3.14 | 2.22 | 34.49 | 14.90 | 15.15 | 5.73 | 10.39 | 9.87 | 18.76 | 3.25 | 13.54 | 3.84 | 48.17 | 42.59 | 81.57 | 48.85 | 59.06 | 21.47 |
| Phenanthrene | 335.58 | 477.24 | 43.60 | 30.35 | 487.74 | 228.99 | 202.79 | 65.52 | 120.40 | 127.82 | 248.12 | 52.67 | 178.32 | 90.05 | 1002.74 | 842.64 | 1464.22 | 810.38 | 1051.10 | 384.70 |
| Anthracene | 19.23 | 26.33 | 3.26 | 1.96 | 28.18 | 15.66 | 12.92 | 4.42 | 8.61 | 9.20 | 16.21 | 2.97 | 9.09 | 5.50 | 60.46 | 76.59 | 130.27 | 55.95 | 65.12 | 21.69 |
| 2-Methyldibenzothiophene | 6.88 | 9.64 | 1.67 | 1.70 | 6.93 | 3.77 | 4.19 | 1.67 | 2.87 | 4.21 | 4.09 | 1.51 | 3.10 | 1.67 | 11.98 | 7.44 | 11.45 | 9.13 | 13.73 | 6.42 |
| 4-Methyldibenzothiophene | 5.58 | 5.81 | 1.23 | 1.10 | 5.84 | 2.91 | 2.93 | 1.17 | 1.98 | 2.67 | 2.51 | 1.05 | 1.97 | 1.53 | 8.35 | 6.71 | 9.61 | 6.74 | 9.38 | 4.58 |
| 2-Methylphenanthrene | 22.29 | 27.11 | 4.89 | 6.11 | 20.09 | 17.09 | 12.14 | 3.99 | 6.17 | 10.78 | 12.52 | 5.27 | 8.64 | 8.55 | 58.92 | 41.98 | 56.27 | 39.53 | 55.41 | 25.55 |
| 2-Methylanthracene | 34.07 | 34.69 | 7.80 | 8.37 | 28.38 | 26.95 | 18.37 | 5.74 | 9.45 | 14.30 | 17.09 | 6.83 | 11.46 | 13.43 | 73.62 | 62.70 | 86.55 | 61.03 | 74.05 | 32.37 |
| 4,5-Methylenephenanthrene | 3.47 | 3.14 | 1.17 | 1.40 | 1.46 | 2.65 | 2.58 | 0.97 | 1.07 | 1.92 | 1.84 | 1.88 | 1.33 | 2.00 | 4.15 | 1.70 | 2.73 | 4.83 | 2.92 | 1.85 |
| 1-Methylanthracene | 13.11 | 14.19 | 3.05 | 4.07 | 10.31 | 9.25 | 6.99 | 2.30 | 3.70 | 6.89 | 6.19 | 2.60 | 4.45 | 4.42 | 25.31 | 17.65 | 24.08 | 18.74 | 24.32 | 11.80 |
| 1-Methylphenanthrene | 10.50 | 11.66 | 2.52 | 3.47 | 9.30 | 8.61 | 5.10 | 1.77 | 3.07 | 5.65 | 5.52 | 2.37 | 4.44 | 4.37 | 24.75 | 19.59 | 24.62 | 18.38 | 23.43 | 10.88 |
| 9-Methylanthracene | ND | ND | ND | ND | 0.39 | ND | 0.30 | ND | ND | ND | 0.21 | ND | ND | ND | 0.26 | ND | ND | ND | 0.32 | ND |
| 9,10-Dimethylanthracene | 1.92 | 2.03 | 0.75 | 1.67 | 2.00 | 2.87 | 1.34 | 0.62 | 0.76 | 1.50 | 1.53 | 0.65 | 0.91 | 1.03 | 3.48 | 2.55 | 3.44 | 2.73 | 4.05 | 2.79 |
| Fluoranthene | 72.64 | 84.94 | 38.43 | 33.63 | 68.04 | 330.86 | 46.65 | 29.71 | 61.51 | 32.61 | 176.15 | 36.27 | 37.92 | 162.66 | 470.85 | 477.59 | 538.86 | 281.22 | 458.76 | 234.49 |
| Pyrene | 37.63 | 39.00 | 18.94 | 19.65 | 30.16 | 140.62 | 23.12 | 13.91 | 30.75 | 18.33 | 75.53 | 16.05 | 19.13 | 63.78 | 182.25 | 191.07 | 218.76 | 108.45 | 180.89 | 95.92 |
| 3,6-Dimethylphenanthrene | ND | ND | ND | ND | ND | ND | ND | 0.29 | ND | ND | ND | ND | ND | ND | ND | ND | 0.34 | ND | 0.51 | ND |
| Benzo[a]fluorene | 0.89 | 0.94 | 0.49 | 0.54 | 0.97 | 1.75 | 0.90 | 0.38 | 0.56 | 0.70 | 1.39 | 0.32 | 0.53 | 1.16 | 1.99 | 2.28 | 2.72 | 1.47 | 2.22 | 1.47 |
| Retene | 1.50 | 1.76 | 1.55 | 1.45 | 1.95 | 1.82 | 2.31 | ND | ND | 1.32 | ND | ND | ND | 1.47 | 1.95 | 1.27 | 1.12 | 1.11 | 1.84 | 1.73 |
| Benzo[b]fluorene | 0.65 | 0.78 | 0.49 | 0.38 | 0.75 | 1.35 | 0.57 | 0.36 | 0.40 | 0.62 | 0.82 | 0.36 | 0.39 | 0.52 | 1.22 | 1.31 | 1.81 | 0.79 | 1.53 | 0.91 |
| Cyclopenta[c,d]pyrene | ND | 0.49 | ND | ND | 0.90 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 3.62 | 0.46 | ND | ND | ND |
| Benz[a]anthracene | ND | 0.93 | ND | ND | 0.60 | 0.42 | ND | ND | ND | ND | ND | 0.43 | ND | ND | 0.95 | 0.70 | 1.43 | 0.70 | 1.06 | 0.42 |
| Chrysene+Triphenylene | 0.56 | 1.83 | 0.51 | ND | 1.15 | 1.74 | 0.60 | ND | 0.76 | 0.81 | 1.08 | 0.76 | 0.97 | 1.14 | 4.29 | 4.86 | 8.01 | 3.21 | 4.96 | 2.03 |
| Napthacene | ND | 0.31 | ND | ND | 0.29 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Methylchrysene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo[b]fluoranthene | ND | 1.23 | 0.38 | ND | 0.96 | 0.57 | ND | 0.45 | ND | 0.35 | ND | 0.77 | 0.56 | ND | 0.93 | 0.45 | 2.59 | 1.05 | 1.06 | ND |
| Benzo[k]fluoranthene | ND | 0.92 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.55 | ND | ND | ND | 1.28 | ND | ND | ND |
| Dimethylbenz[a]anthracene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo[e]pyrene | ND | 1.75 | ND | ND | 0.67 | ND | ND | ND | ND | ND | ND | 0.73 | 1.04 | ND | 0.71 | ND | 1.24 | 0.54 | 0.77 | ND |
| Benzo[a]pyrene | ND | 1.58 | ND | ND | 0.95 | ND | ND | ND | ND | ND | ND | 0.80 | 0.74 | ND | ND | ND | ND | ND | 0.79 | ND |
| Perylene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 3-Methylchloanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | ND | 2.00 | ND | ND | 1.23 | 0.87 | ND | ND | ND | ND | ND | ND | 1.80 | ND | 0.89 | ND | 1.41 | ND | 1.23 | ND |
| Dibenz[a,h+ac]anthracene | ND | 0.48 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo[g,h,i]perylene | ND | 1.25 | ND | ND | 0.78 | ND | ND | 0.44 | 0.40 | 0.52 | ND | 1.15 | 0.44 | ND | 0.95 | 0.67 | 1.13 | 0.61 | 0.68 | ND |
| Anthranthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Corenene | ND | 0.36 | ND | 0.29 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

**Summer 2005**
**PAH Mass (ng)**

| Sample Name | PBP354 | PBP328 | PBP309 | PBP393 | PBP389 | PBP355 | PBP365 | PBP358 | PBP319 | PBP335 | PBP348 | PBP357 | PBP316 | PBP325 | PBP330 | PBP331 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Residential | Residential | Residential | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Date | 7/27/2005 | 7/28/2005 | 7/29/2005 | 7/18/2005 | 7/19/2005 | 7/20/2005 | 7/21/2005 | 7/22/2005 | 7/25/2005 | 7/26/2005 | 7/26/2005 | 7/27/2005 | 7/28/2005 | 7/28/2006 | 7/29/2005 | 7/29/2005 |
| Sampling Time | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM |
| Volume ($m^3$) | 11.561 | 10.779 | 11.245 | 8.28 | 9.596 | 12.2 | 12.224 | 11.068 | 10.57 | 10.332 | 8.174 | 8.937 | 9.74 | 10.379 | 10.13 | 9.911 |
| Surr | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 13.9 | 16.6 | 32.4 | 37.4 | 20.6 | 24.5 | 22.1 | 35.3 | 26.9 | 20.8 | 30.8 | 29.0 | 17.3 | 27.4 | 28.4 | 28.2 |
| d10-Fluorene | 13.7 | 17.0 | 26.4 | 29.8 | 21.3 | 30.4 | 24.6 | 34.7 | 22.9 | 24.2 | 32.1 | 27.2 | 23.1 | 22.8 | 29.9 | 29.1 |
| d10-Pyrene | 65.3 | 67.5 | 85.2 | 108.7 | 77.8 | 82.7 | 68.3 | 75.0 | 79.5 | 58.7 | 70.5 | 75.3 | 56.8 | 63.7 | 79.8 | 67.6 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 10.6 | 6.3 | 15.5 | 19.5 | 13.3 | 13.7 | 14.2 | 15.3 | 10.1 | 7.3 | 23.8 | 15.6 | 6.7 | 14.2 | 13.5 | 12.7 |
| d10-Anthracene | 44.7 | 51.8 | 62.7 | 51.8 | 39.5 | 39.2 | 51.2 | 60.4 | 66.6 | 52.9 | 64.6 | 59.1 | 66.5 | 56.9 | 62.9 | 58.6 |
| d10-Fluoranthene | 70.4 | 73.8 | 98.1 | 116.2 | 71.0 | 72.4 | 63.0 | 71.1 | 92.2 | 66.4 | 80.7 | 80.4 | 64.8 | 69.9 | 89.4 | 73.9 |
| d12-Benz[a]pyrene | 98.0 | 117.2 | 115.6 | 83.7 | 97.2 | 90.6 | 91.0 | 90.9 | 112.2 | 117.6 | 112.3 | 113.8 | 107.6 | 116.0 | 114.2 | 108.7 |
| d12-Indone[1,2,3-c,d]pyrene | 97.5 | 90.2 | 109.9 | 82.2 | 87.0 | 92.0 | 82.1 | 92.0 | 113.6 | 101.6 | 102.3 | 111.3 | 108.4 | 118.3 | 106.9 | 113.6 |
| PAH Compounds | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) | mass (ng) |
| Napthalene | ND | ND | 142.66 | 135.96 | 128.73 | 165.81 | ND | 175.85 | ND | ND | 111.54 | 165.66 | ND | 157.62 | 98.31 | 124.18 |
| 2-Methylnapthalene | ND | ND | 89.92 | 98.79 | 85.37 | 87.17 | 77.04 | 105.48 | 81.58 | ND | 86.44 | 104.84 | 69.47 | 124.51 | 80.11 | 108.38 |
| Azulene | ND | ND | 1.41 | 1.57 | 0.87 | ND | 1.95 | ND | 1.33 | ND | 2.31 | 1.14 | ND | 1.17 | 0.92 | 1.07 |
| 1-Methylnapthalene | ND | ND | 35.19 | 41.40 | 34.18 | 35.42 | 32.11 | 42.11 | 32.66 | ND | 36.07 | 41.42 | 28.48 | 49.39 | 33.78 | 45.00 |
| Biphenyl | ND | ND | ND | 17.43 | 11.88 | 12.62 | 11.24 | 14.89 | 10.66 | ND | 11.90 | 13.12 | 9.43 | 14.66 | 9.79 | 12.98 |
| 2,7-Dimethylnapthalene | ND | ND | ND | 35.64 | 29.08 | 34.08 | 32.61 | 38.54 | 37.47 | ND | 34.45 | 33.69 | 31.48 | 49.66 | ND | 39.07 |
| 1,3-Dimethylnapthalene | ND | ND | ND | 27.08 | 24.30 | 24.18 | 25.02 | 27.14 | 28.59 | ND | 27.70 | 24.60 | 26.69 | 42.09 | 24.38 | 33.29 |
| 1,6-Dimethylnapthalene | ND | ND | ND | 32.23 | 18.57 | 28.46 | 25.85 | 31.76 | 25.47 | ND | 23.79 | 24.39 | ND | 24.51 | ND | 20.71 |
| 1,4-Dimethylnapthalene | ND | ND | ND | 8.28 | 6.71 | 6.76 | 7.74 | 8.79 | 8.46 | ND | 7.73 | 7.22 | 7.47 | 11.74 | 6.91 | 8.93 |
| 1,5-Dimethylnapthalene | ND | ND | ND | 8.83 | 4.13 | 6.57 | 3.56 | 5.94 | 3.27 | 4.16 | 4.03 | 4.00 | ND | 3.68 | ND | 3.26 |
| Acenapthylene | 4.31 | 1.64 | 3.96 | 7.61 | 2.22 | 5.10 | 4.74 | 6.34 | 5.16 | 2.75 | 3.51 | 9.49 | 2.43 | 6.36 | 3.23 | 5.81 |
| 1,2-Dimethylnapthalene | ND | ND | ND | ND | 3.21 | 5.73 | 4.98 | 6.01 | 5.24 | ND | 3.89 | 3.89 | ND | 3.49 | ND | 3.81 |
| 1,8-Dimethylnapthalene | ND | ND | ND | 2.77 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenapthene | ND | ND | 22.64 | 22.87 | 16.23 | 21.23 | ND | 34.83 | 11.87 | ND | 11.68 | 11.27 | ND | 14.23 | ND | 10.47 |
| 2,3,5-Trimethylnapthalene | ND | ND | 7.72 | 14.62 | 12.34 | 16.29 | 18.25 | 18.80 | 17.41 | 11.53 | 15.36 | 13.56 | 17.40 | 20.11 | 13.98 | 18.59 |
| Fluorene | 20.81 | 43.06 | 46.65 | 83.67 | 25.23 | 53.69 | 63.23 | 114.59 | 74.72 | 60.87 | 53.13 | 29.82 | 28.41 | 30.46 | 24.39 | 29.22 |
| 1-Methylfuorene | ND | ND | 4.97 | 9.93 | 5.37 | 10.18 | 13.76 | 14.06 | 14.74 | 11.15 | 7.81 | 7.06 | 9.44 | 7.81 | 8.33 | 8.38 |
| Dibenzothiophene | 11.55 | 22.71 | 21.60 | 13.77 | 5.25 | 9.82 | 21.29 | 20.26 | 23.80 | 18.75 | 11.92 | 7.16 | 6.75 | 5.84 | 4.35 | 4.19 |
| Phenanthrene | 225.31 | 446.61 | 451.00 | 213.28 | 89.51 | 169.11 | 337.04 | 286.29 | 318.97 | 230.03 | 146.45 | 131.64 | 105.84 | 102.71 | 87.27 | 78.29 |
| Anthracene | 12.79 | 29.26 | 23.24 | 16.50 | 6.70 | 15.73 | 23.97 | 30.33 | 25.88 | 15.10 | 9.04 | 7.10 | 7.06 | 6.73 | 6.20 | 6.48 |
| 2-Methyldibenzothiophene | 3.29 | 4.73 | 4.69 | 6.85 | 3.31 | 5.46 | 8.76 | 6.62 | 11.14 | 7.04 | 4.07 | 3.81 | 4.22 | 3.91 | 4.82 | 4.11 |
| 4-Methyldibenzothiophene | 2.60 | 3.67 | 4.06 | 4.14 | 2.04 | 3.80 | 5.33 | 3.95 | 7.13 | 4.67 | 2.32 | 1.93 | 2.62 | 2.49 | 2.49 | 2.11 |
| 2-Methylphenanthrene | 14.59 | 21.27 | 25.98 | 17.60 | 11.90 | 18.74 | 33.49 | 20.94 | 32.20 | 19.12 | 10.79 | 12.32 | 16.01 | 15.06 | 17.82 | 14.52 |
| 2-Methylanthracene | 21.99 | 28.89 | 39.01 | 28.05 | 15.57 | 26.77 | 50.34 | 31.97 | 42.57 | 28.57 | 14.40 | 19.10 | 19.58 | 18.52 | 21.90 | 19.37 |
| 4,5-Methylenephenanthrene | 0.87 | 1.63 | 1.73 | 1.74 | 1.52 | 1.62 | 3.24 | 2.65 | 3.54 | 1.71 | 1.96 | 3.13 | 1.61 | 1.29 | 0.98 | 2.12 |
| 1-Methylanthracene | 7.75 | 9.67 | 11.92 | 11.47 | 7.73 | 10.28 | 18.68 | 12.02 | 18.80 | 11.40 | 6.16 | 7.31 | 9.11 | 8.72 | 10.18 | 8.70 |
| 1-Methylphenanthrene | 7.21 | 8.50 | 11.39 | 9.36 | 5.03 | 8.04 | 16.02 | 10.06 | 13.88 | 8.69 | 5.23 | 6.06 | 6.28 | 6.10 | 7.20 | 5.96 |
| 9-Methylanthracene | ND | ND | ND | 0.19 | ND | ND | 0.52 | ND | ND | 0.37 | 0.23 | ND | ND | ND | ND | 0.22 |
| 9,10-Dimethylanthracene | 1.86 | 1.36 | 2.86 | 3.00 | 1.78 | 2.90 | 3.65 | 2.66 | 3.68 | 2.02 | 1.53 | 1.76 | 2.10 | 1.99 | 2.81 | 2.09 |
| Fluoranthene | 150.96 | 187.31 | 279.41 | 94.09 | 37.95 | 50.23 | 277.11 | 126.46 | 71.65 | 30.72 | 17.55 | 43.56 | 19.64 | 35.11 | 37.82 | 31.67 |
| Pyrene | 61.74 | 73.00 | 105.70 | 26.53 | 19.93 | 29.04 | 117.59 | 60.90 | 35.81 | 17.94 | 10.93 | 23.88 | 12.29 | 17.65 | 23.26 | 19.99 |
| 3,6-Dimethylphenanthrene | ND | ND | ND | 0.27 | ND | 0.27 | ND | 0.49 | 0.29 | ND | ND | ND | 0.46 | ND | ND | ND |
| Benzo[a]fluorene | 1.00 | 1.11 | 1.47 | 0.55 | 0.91 | 0.84 | 1.26 | 0.97 | 1.41 | 0.82 | 0.50 | 0.53 | 0.34 | 0.49 | 0.59 | 0.60 |
| Retene | 1.16 | ND | ND | 1.43 | ND | 1.32 | 1.14 | 1.24 | 1.33 | 1.69 | 0.96 | ND | ND | ND | 1.04 | ND |
| Benzo[b]fluorene | 0.99 | 0.64 | 1.00 | 0.46 | 0.43 | 0.77 | 0.92 | 1.15 | 0.86 | 0.92 | 0.43 | 0.59 | 0.35 | 0.34 | 0.42 | 0.48 |
| Cyclopenta[c,d]pyrene | 0.54 | ND | ND | 0.51 | ND | ND | ND | 0.44 | ND | 1.13 | ND | ND | ND | ND | ND | ND |
| Benz[a]anthracene | 1.03 | 0.46 | 0.42 | 0.92 | 0.49 | 0.76 | 0.57 | 0.83 | 0.60 | 1.00 | 0.69 | 0.90 | 0.45 | 0.52 | 0.49 | 0.55 |
| Chrysene+Triphenylene | 2.80 | 2.52 | 2.74 | 0.98 | 0.51 | 1.15 | 1.64 | 1.27 | 0.98 | 1.98 | 1.21 | 1.51 | 0.72 | 0.84 | 0.91 | 1.03 |
| Napthacene | ND | ND | ND | 0.34 | ND | ND | ND | ND | ND | 0.51 | ND | ND | ND | ND | ND | ND |
| 4-Methylchrysene | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.83 | ND | ND | ND | ND | ND | ND |
| Benzo[b]fluoranthene | 2.40 | 0.43 | 0.71 | 0.67 | ND | 1.36 | 0.46 | 0.88 | 0.57 | 0.89 | 0.80 | 1.82 | 0.42 | 0.47 | 0.45 | 0.60 |
| Benzo[k]fluoranthene | 0.62 | ND | ND | 0.76 | ND | 0.55 | ND | ND | ND | 0.94 | 0.74 | 1.08 | ND | ND | ND | 0.63 |
| Dimethylbenz[a]anthracene | ND | ND | ND | ND | ND | ND | ND | ND | ND | 2.01 | 0.77 | ND | ND | ND | ND | ND |
| Benzo[e]pyrene | 1.64 | ND | ND | 0.57 | ND | 1.07 | ND | 0.60 | 0.58 | 1.50 | 1.00 | 1.45 | ND | ND | 0.74 | 0.63 |
| Benzo[a]pyrene | 1.63 | ND | ND | 1.47 | ND | 0.74 | ND | 1.06 | ND | 1.33 | 1.40 | 1.73 | ND | ND | ND | ND |
| Perylene | ND | ND | ND | 0.48 | ND | ND | ND | ND | ND | ND | 0.50 | ND | ND | ND | ND | ND |
| 3-Methylchloanthrene | ND | ND | ND | 2.91 | ND | ND | ND | ND | ND | 1.23 | 2.00 | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 2.04 | ND | 0.74 | 0.97 | ND | ND | ND | 0.69 | ND | ND | 0.97 | 1.40 | ND | ND | ND | 0.77 |
| Dibenz[a,h+ac]anthracene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.04 | ND | ND | ND | ND | ND |
| Benzo[g,h,i]perylene | 2.24 | 0.51 | 0.58 | 0.59 | 0.49 | 0.99 | 1.16 | 0.91 | 0.91 | 1.01 | 0.89 | 3.12 | 0.82 | 0.51 | 0.83 | 0.48 |
| Anthranthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.89 | ND | ND | ND | ND | ND | ND |
| Corenene | ND | ND | ND | 0.32 | ND | ND | ND | ND | ND | 0.31 | 0.31 | 0.63 | ND | ND | ND | ND |

**Winter 2006**

**PAH Mass (ng)**

| Sample Name | PBP503 | PBP512 | PBP517 | PBP520 | PBP522 | PBP529 | PBP544 | PBP549 | PBP552 | PBP557 | PBP566 | PBP568 | PBP513 | PBP516 | PBP527 | PBP502 | PBP523 | PBP555 | PBP560 | PBP545 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina |
| Date | | | | | | | | | | | | | 1/9/2006 | 1/10/2006 | 1/11/2006 | 1/12/2006 | 1/13/2006 | 1/16/2006 | 1/17/2006 | 1/18/2006 |
| Sampling Time | | | | | | | | | | | | | PM | PM | PM | PM | PM | PM | PM | PM |
| Volume ($m^3$) | | | | | | | | | | | | | 9.9 | 11.2 | 11.2 | 11.4 | 10.6 | 11.5 | 12.8 | 11.4 |
| Surrogates | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 41.5 | 29.2 | 11.4 | 46.3 | 25.5 | 45.0 | 8.3 | 13.9 | 22.6 | 17.6 | 34.1 | 26.7 | 4.5 | 24.5 | 34.9 | 41.3 | 41.1 | 17.4 | 18.4 | 25.4 |
| d10-Fluorene | 34.6 | 24.9 | 12.2 | 36.1 | 21.8 | 33.5 | 7.9 | 12.0 | 19.4 | 14.3 | 30.4 | 21.5 | 4.9 | 18.9 | 26.3 | 33.6 | 32.3 | 14.2 | 16.6 | 20.2 |
| d10-Pyrene | 51.1 | 55.4 | 52.2 | 48.8 | 56.9 | 46.7 | 58.7 | 61.0 | 55.3 | 52.4 | 58.4 | 58.3 | 46.6 | 49.8 | 57.0 | 54.9 | 56.5 | 62.0 | 63.9 | 61.5 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 29.1 | 22.0 | 7.5 | 28.4 | 17.0 | 25.2 | 5.4 | 8.8 | 13.3 | 10.7 | 18.3 | 20.3 | 1.6 | 6.8 | 10.3 | 9.7 | 8.7 | 6.2 | 5.8 | 6.9 |
| d10-Anthracene | 44.2 | 37.7 | 32.1 | 49.7 | 46.2 | 36.6 | 28.3 | 29.2 | 35.3 | 20.0 | 46.9 | 27.1 | 26.9 | 38.2 | 47.2 | 46.7 | 50.0 | 33.2 | 44.2 | 36.9 |
| d10-Fluoranthene | 47.3 | 50.7 | 47.8 | 45.9 | 52.1 | 42.9 | 52.2 | 54.8 | 48.0 | 45.1 | 52.6 | 51.1 | 43.2 | 46.5 | 50.9 | 49.4 | 50.4 | 55.7 | 55.8 | 55.8 |
| d12-Benz[a]pyrene | 99.9 | 100.5 | 99.6 | 100.1 | 100.4 | 99.8 | 100.1 | 99.8 | 99.6 | 100.1 | 100.0 | 100.1 | 100.1 | 99.6 | 100.5 | 100.0 | 100.2 | 100.1 | 100.1 | 100.4 |
| d12-Indone[1,2,3-c,d]pyrene | 77.2 | 75.4 | 73.8 | 69.2 | 76.9 | 79.6 | 78.7 | 77.2 | 73.4 | 82.2 | 79.7 | 79.4 | 71.7 | 62.6 | 74.9 | 77.0 | 71.3 | 75.6 | 78.1 | 79.9 |
| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 8.20 | 8.03 | 2.69 | 6.37 | 5.88 | 11.46 | 1.87 | 2.64 | 5.54 | 4.56 | 3.83 | 6.02 | ND | 73.23 | 44.76 | 38.39 | 108.04 | 63.61 | 42.12 | 29.01 |
| 2-Methylnapthalene | 7.09 | 8.21 | 2.49 | 6.24 | 5.68 | 9.25 | 1.93 | 2.21 | 4.70 | 4.09 | 3.74 | 4.64 | ND | 46.06 | 36.32 | 33.70 | 109.32 | 51.35 | 46.43 | 21.25 |
| Azulene | 0.20 | 0.20 | 0.04 | 0.05 | 0.22 | 0.09 | 0.06 | 0.04 | 0.06 | 0.05 | 0.05 | 0.13 | ND | 0.36 | ND | 0.34 | 0.83 | 0.31 | 0.30 | ND |
| 1-Methylnapthalene | 2.95 | 3.42 | 0.99 | 2.53 | 2.30 | 3.73 | 0.67 | 0.82 | 1.86 | 1.55 | 1.59 | 1.92 | ND | 18.70 | 15.79 | 14.97 | 41.82 | 20.35 | 19.02 | 9.48 |
| Biphenyl | 0.66 | 0.73 | 0.27 | 0.65 | 0.51 | 1.07 | 0.23 | 0.27 | 0.66 | 0.50 | 0.43 | 0.54 | ND | 4.40 | 8.51 | 7.06 | 12.33 | 4.03 | 8.53 | 4.41 |
| 2,7-Dimethylnapthalene | 1.63 | 2.05 | 0.50 | 1.56 | 1.05 | 2.54 | 0.46 | 0.49 | 1.32 | 0.92 | 1.07 | 1.09 | ND | 6.70 | 14.75 | 9.39 | 30.69 | 7.99 | 15.30 | 5.33 |
| 1,3-Dimethylnapthalene | 3.44 | 4.04 | 1.02 | 3.20 | 2.44 | 5.26 | 0.97 | 1.11 | 2.82 | 2.03 | 2.45 | 2.49 | ND | 14.10 | 32.68 | 21.54 | 65.29 | 15.05 | 38.15 | 12.18 |
| 1,6-Dimethylnapthalene | 1.80 | 2.34 | 0.57 | 1.73 | 1.34 | 3.01 | 0.54 | 0.58 | 1.68 | 1.16 | 1.36 | 1.34 | ND | 8.33 | 19.95 | 13.24 | 38.60 | 8.21 | 21.79 | 7.16 |
| 1,4-Dimethylnapthalene | 0.92 | 1.18 | 0.28 | 0.82 | 0.55 | 1.53 | 0.25 | 0.28 | 0.80 | 0.56 | 0.65 | 0.79 | ND | 3.96 | 9.69 | 6.41 | 19.93 | 3.79 | 10.39 | 3.25 |
| 1,5-Dimethylnapthalene | 0.41 | 0.45 | 0.12 | 0.33 | 0.33 | 0.59 | 0.15 | 0.15 | 0.35 | 0.27 | 0.30 | 0.29 | ND | 1.40 | 3.17 | 2.10 | 6.33 | 1.62 | 4.12 | 1.44 |
| Acenapthylene | 0.29 | 0.16 | 0.11 | 0.17 | 0.08 | 0.48 | 0.02 | 0.11 | 0.18 | 0.17 | 0.12 | 0.22 | ND | 4.06 | 2.94 | 2.24 | 9.92 | 2.84 | 8.48 | 1.70 |
| 1,2-Dimethylnapthalene | 0.56 | 0.64 | 0.17 | 0.57 | 0.39 | 0.83 | 0.15 | 0.17 | 0.57 | 0.33 | 0.51 | 0.42 | ND | 2.37 | 5.33 | 3.64 | 11.97 | 2.32 | 6.41 | 1.95 |
| 1,8-Dimethylnapthalene | 0.88 | 0.08 | 0.02 | 0.07 | 0.11 | 0.02 | 0.09 | 0.01 | 0.13 | 0.18 | 0.01 | 0.16 | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenapthene | 0.57 | 0.64 | 0.22 | 0.59 | 0.52 | 1.53 | 0.17 | 0.30 | 0.71 | 0.50 | 0.34 | 0.57 | ND | 2.66 | 5.17 | 3.59 | 8.04 | 2.15 | 5.13 | 2.14 |
| 2,3,5-Trimethylnapthalene | 0.56 | 0.72 | 0.27 | 0.76 | 0.47 | 0.83 | 0.24 | 0.28 | 0.69 | 0.48 | 0.45 | 0.51 | ND | 2.91 | 9.68 | 5.34 | 24.56 | 2.54 | 9.07 | 2.43 |
| Fluorene | 0.71 | 0.78 | 0.38 | 0.83 | 0.65 | 1.51 | 0.27 | 0.42 | 1.08 | 0.59 | 0.67 | 0.55 | ND | 5.10 | 9.77 | 7.73 | 17.12 | 3.67 | 10.35 | 4.69 |
| 1-Methylfuorene | 0.58 | 0.38 | 0.42 | 0.45 | 0.45 | 9.25 | 0.18 | 0.10 | 0.41 | 0.18 | 0.19 | 0.23 | ND | ND | 3.25 | ND | 6.50 | ND | 4.59 | ND |
| Dibenzothiophene | 0.14 | 0.18 | 12.65 | 0.20 | 0.18 | 0.25 | 0.17 | 0.33 | 0.29 | 0.27 | 0.20 | 0.13 | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenanthrene | 1.67 | 1.75 | 1.52 | 1.36 | 1.63 | 2.31 | 1.62 | 2.01 | 3.40 | 1.63 | 1.48 | 1.17 | 14.84 | 16.19 | 20.51 | 15.07 | 38.17 | 10.30 | 38.09 | 12.56 |
| Anthracene | 0.07 | 0.05 | 0.04 | 0.07 | 0.07 | 0.08 | 0.06 | 0.06 | 0.15 | 0.09 | 0.08 | 0.12 | 0.63 | 0.69 | 1.17 | 0.82 | 2.79 | 0.46 | 2.60 | 0.71 |
| 2-Methyldibenzothiophene | 0.15 | 0.22 | 0.19 | 0.16 | 0.12 | 0.27 | 0.25 | 0.30 | 0.35 | 0.20 | 0.17 | 0.10 | 0.90 | 0.88 | 1.54 | 1.19 | 2.72 | 0.84 | 2.72 | 1.12 |
| 4-Methyldibenzothiophene | 0.13 | 0.19 | 0.13 | 0.14 | 0.11 | 0.19 | 0.23 | 0.26 | 0.25 | 0.14 | 0.12 | 0.06 | 0.61 | 0.60 | 0.99 | 0.67 | 1.54 | 0.56 | 1.50 | 0.68 |
| 2-Methylphenanthrene | 0.28 | 0.39 | 0.30 | 0.23 | 0.27 | 0.31 | 0.45 | 0.58 | 0.53 | 0.31 | 0.21 | 0.15 | 1.38 | 1.49 | 3.59 | 2.47 | 6.06 | 2.08 | 7.84 | 2.16 |
| 2-Methylanthracene | 0.49 | 0.63 | 0.47 | 0.43 | 0.44 | 0.50 | 0.85 | 0.99 | 1.02 | 0.53 | 0.34 | 0.45 | 2.46 | 2.37 | 6.20 | 3.95 | 9.55 | 3.25 | 11.78 | 3.59 |
| 4,5-Methylenephenanthrene | 0.01 | 0.04 | 0.05 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.02 | 0.04 | 0.04 | 0.04 | ND | ND | ND | ND | 0.34 | ND | 0.26 | 0.30 |
| 1-Methylanthracene | 0.20 | 0.30 | 0.23 | 0.24 | 0.17 | 0.27 | 0.38 | 0.46 | 0.45 | 0.26 | 0.16 | 0.12 | 0.92 | 1.00 | 2.34 | 1.43 | 3.69 | 1.41 | 4.70 | 1.42 |
| 1-Methylphenanthrene | 0.17 | 0.23 | 0.19 | 0.16 | 0.14 | 0.33 | 0.30 | 0.36 | 0.37 | 0.22 | 0.12 | 0.32 | 0.79 | 0.79 | 1.89 | 1.29 | 2.85 | 1.18 | 3.78 | 1.18 |
| 9-Methylanthracene | 0.01 | 0.05 | 0.03 | 0.00 | 0.02 | 0.02 | 0.04 | 0.01 | 0.05 | 0.01 | 0.03 | 0.10 | ND | ND | ND | ND | ND | ND | ND | ND |
| 9,10-Dimethylanthracene | 0.06 | 0.09 | 0.06 | 0.05 | 0.05 | 0.07 | 0.11 | 0.15 | 0.14 | 0.07 | 0.03 | 0.13 | ND | ND | 0.59 | 0.35 | 0.79 | 0.46 | 1.21 | 0.44 |
| Fluoranthene | 0.44 | 0.41 | 0.37 | 0.26 | 0.62 | 0.43 | 0.63 | 0.76 | 0.77 | 0.83 | 0.32 | 0.51 | 3.73 | 2.81 | 5.08 | 5.27 | 7.69 | 5.30 | 10.41 | 3.38 |
| Pyrene | 0.26 | 0.45 | 0.36 | 0.34 | 0.56 | 0.44 | 0.57 | 0.70 | 0.80 | 0.74 | 0.28 | 0.47 | 2.52 | 2.29 | 3.41 | 3.28 | 5.78 | 4.59 | 8.81 | 2.50 |
| 3,6-Dimethylphenanthrene | 0.01 | 0.01 | 2.31 | 0.01 | 2.46 | 2.11 | 0.01 | 0.01 | 0.02 | 0.02 | 2.60 | 2.54 | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo[a]fluorene | 0.04 | 0.03 | 0.10 | 0.03 | 0.06 | 0.05 | 0.04 | 0.06 | 0.06 | 0.09 | 0.01 | 0.11 | 0.21 | ND | 0.29 | 0.23 | 0.55 | 0.37 | 0.66 | ND |
| Retene | 0.16 | 0.25 | 0.16 | 0.23 | 0.36 | 0.19 | 0.42 | 0.26 | 0.35 | 0.79 | 0.13 | 0.24 | ND | ND | ND | ND | ND | ND | 1.05 | ND |
| Benzo[b]fluorene | 0.01 | 0.01 | 0.03 | 0.01 | 0.07 | 0.02 | 0.03 | 0.01 | 0.03 | 0.04 | 0.00 | 0.09 | 0.20 | 0.20 | 0.25 | 0.15 | 0.59 | 0.37 | 0.63 | 0.10 |
| Cyclopenta[c,d]pyrene | 0.08 | 0.09 | 0.07 | 0.08 | 0.10 | 0.05 | 0.04 | 0.02 | 0.03 | 0.03 | 0.01 | 0.02 | 0.30 | 0.63 | 0.36 | 0.31 | 2.35 | 1.43 | 1.37 | ND |
| Benz[a]anthracene | 0.01 | 0.01 | 0.02 | 0.03 | 0.18 | 0.02 | 0.01 | 0.01 | 0.01 | 0.06 | 0.01 | 0.03 | 0.48 | 0.58 | 0.43 | 0.24 | 1.87 | 1.20 | 1.38 | 0.14 |
| Chrysene+Triphenylene | 0.04 | 0.04 | 0.04 | 0.03 | 0.13 | 0.05 | 0.06 | 0.06 | 0.06 | 0.16 | 0.03 | 0.07 | 0.80 | 0.67 | 0.77 | 0.51 | 2.05 | 1.77 | 2.50 | 0.34 |
| Napthacene | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | ND | ND | ND | 0.04 | 0.06 | ND | ND | ND |
| 4-Methylchrysene | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | ND | 0.04 | 0.03 | ND | 0.15 | 0.06 | 0.08 | ND |
| Benzo[b]fluoranthene | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.01 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.42 | 0.30 | 0.33 | 0.27 | 0.98 | 0.55 | 0.97 | 0.11 |
| Benzo[k]fluoranthene | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.11 | 0.08 | 0.10 | 0.08 | 0.31 | 0.17 | 0.29 | 0.02 |
| Dimethylbenz[a]anthracene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | ND | ND | 0.01 | ND | 0.02 | 0.01 | 0.03 | ND |
| Benzo[e]pyrene | 0.64 | 0.35 | 0.10 | 0.21 | 0.33 | 0.18 | 0.01 | 0.02 | 0.02 | 0.03 | 0.00 | 0.01 | 0.57 | ND | ND | 0.66 | 0.83 | ND | ND | ND |
| Benzo[a]pyrene | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.01 | 0.01 | 0.01 | 0.04 | 0.00 | 0.19 | 0.19 | 0.21 | 0.17 | 0.14 | 0.70 | 0.29 | 0.43 | ND |
| Perylene | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.03 | 0.02 | 0.01 | 0.09 | 0.03 | 0.04 | ND |
| 3-Methylchloanthrene | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 0.02 | 0.00 | 0.00 | 0.01 | 0.16 | 0.06 | 0.09 | 0.04 | 0.00 | 0.21 | 0.01 | 0.02 | 1.35 | 1.03 | 1.31 | 1.00 | 3.02 | 2.06 | 3.62 | 0.49 |
| Dibenz[a,h+ac]anthracene | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.10 | 0.06 | 0.11 | 0.07 | 0.26 | 0.11 | 0.21 | 0.03 |
| Benzo[g,h,i]perylene | 0.00 | 0.10 | 0.10 | 0.01 | 0.10 | 0.16 | 0.17 | 0.17 | 0.13 | 0.27 | 0.01 | 0.00 | 0.97 | 1.00 | 0.98 | 0.71 | 2.31 | 1.93 | 2.98 | 0.48 |
| Anthranthrene | 0.00 | 0.01 | 0.01 | 0.01 | 0.02 | 0.03 | 0.04 | 0.03 | 0.02 | 0.04 | 0.01 | 0.00 | 0.12 | 0.25 | 0.15 | 0.12 | 0.54 | 0.24 | 0.24 | ND |
| Corenene | 0.00 | 0.06 | 0.06 | 0.05 | 0.00 | 0.10 | 0.08 | 0.09 | 0.08 | 0.10 | 0.01 | 0.00 | 0.31 | 0.44 | 0.40 | 0.25 | 0.80 | 0.77 | 1.07 | 0.21 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Winter 2006** | | | | | | | | | | | | | | | | | | | | |
| **PAH Mass (ng)** | | | | | | | | | | | | | | | | | | | | |
| Sample Name | PBP541 | PBP570 | PBP525 | PBP514 | PBP526 | PBP509 | PBP506 | PBP546 | PBP569 | PBP559 | PBP565 | PBP567 | PBP501 | PBP508 | PBP505 | PBP515 | PBP510 | PBP511 | PBP500 | PBP504 |
| Sampling Site | Marina | Marina | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Date | 1/19/2006 | 1/20/2006 | 1/9/2006 | 1/10/2006 | 1/11/2006 | 1/12/2006 | 1/13/2006 | 1/16/2006 | 1/17/2006 | 1/18/2006 | 1/19/2006 | 1/20/2006 | 1/9/2006 | 1/9/2006 | 1/10/2006 | 1/10/2006 | 1/11/2006 | 1/11/2006 | 1/12/2006 | 1/12/2006 |
| Sampling Time | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM |
| Volume ($m^3$) | 10.8 | 10.8 | 11.5 | 12 | 12.1 | 12.1 | 11.7 | 12.2 | 12.4 | 12.3 | 11.7 | 11.4 | 10.8 | 10.8 | 11.9 | 11.8 | 10.6 | 10.7 | 11.3 | 11.5 |
| Surrogates | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 52.6 | 14.8 | 32.1 | 17.3 | 24.6 | 13.7 | 51.0 | 34.4 | 11.8 | 11.8 | 17.5 | 9.5 | 19.8 | 33.6 | 29.8 | 17.7 | 6.3 | 34.6 | 34.3 | 34.4 |
| d10-Fluorene | 41.6 | 14.4 | 25.8 | 15.3 | 20.1 | 11.0 | 37.5 | 28.7 | 11.6 | 12.8 | 21.8 | 8.9 | 15.5 | 25.9 | 23.2 | 15.9 | 7.8 | 30.7 | 28.1 | 25.4 |
| d10-Pyrene | 52.3 | 63.3 | 61.0 | 46.6 | 49.6 | 52.5 | 57.1 | 58.3 | 59.3 | 66.5 | 63.7 | 61.8 | 53.0 | 59.8 | 57.6 | 56.2 | 51.9 | 62.9 | 62.9 | 58.2 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 11.8 | 4.6 | 11.8 | 4.3 | 5.3 | 3.6 | 19.4 | 10.4 | 4.9 | 3.4 | 4.2 | 2.8 | 3.8 | 11.2 | 7.8 | 5.4 | 1.7 | 9.0 | 9.0 | 9.6 |
| d10-Anthracene | 51.5 | 45.2 | 55.8 | 35.4 | 44.1 | 32.9 | 47.9 | 40.4 | 33.0 | 51.2 | 62.8 | 33.9 | 41.2 | 52.4 | 38.2 | 44.0 | 41.6 | 61.7 | 59.9 | 44.2 |
| d10-Fluoranthene | 47.0 | 58.6 | 54.3 | 41.8 | 45.4 | 47.3 | 51.0 | 51.4 | 53.7 | 58.8 | 58.8 | 55.0 | 47.5 | 54.5 | 51.8 | 50.6 | 46.8 | 57.6 | 55.6 | 52.1 |
| d12-Benz[a]pyrene | 99.5 | 99.9 | 100.6 | 100.0 | 99.6 | 98.6 | 100.8 | 100.4 | 100.2 | 100.6 | 100.0 | 100.2 | 99.7 | 100.2 | 99.9 | 100.0 | 100.9 | 100.2 | 99.6 | 101.1 |
| d12-Indone[1,2,3-c,d]pyrene | 75.4 | 77.1 | 71.6 | 66.3 | 62.7 | 65.0 | 74.6 | 78.4 | 75.8 | 77.0 | 78.6 | 76.5 | 70.6 | 75.1 | 75.4 | 71.5 | 67.4 | 77.9 | 72.6 | 71.5 |
| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 213.58 | 17.03 | 98.80 | 57.91 | 43.48 | 25.83 | 184.41 | 115.59 | 58.21 | 25.82 | 90.49 | 20.36 | 49.41 | 74.25 | 133.82 | 73.94 | ND | 70.23 | 86.39 | 86.07 |
| 2-Methylnapthalene | 200.31 | ND | 81.71 | 55.60 | 42.37 | 23.15 | 168.36 | 104.45 | 58.04 | 22.28 | 76.23 | 20.23 | 43.37 | 62.85 | 118.22 | 67.59 | ND | 81.20 | 86.61 | 90.98 |
| Azulene | 1.15 | ND | 0.43 | ND | ND | ND | 0.88 | 0.38 | ND | ND | 0.36 | ND | ND | 0.31 | 0.67 | 0.42 | ND | 0.58 | 0.76 | 0.64 |
| 1-Methylnapthalene | 77.18 | ND | 31.26 | 20.58 | 17.16 | 8.98 | 60.89 | 39.88 | 22.19 | 9.79 | 28.58 | 7.58 | 18.10 | 25.63 | 45.80 | 27.04 | ND | 34.91 | 34.42 | 34.87 |
| Biphenyl | 16.41 | 2.49 | 9.70 | 4.88 | 6.37 | 2.92 | 14.22 | 8.02 | 5.79 | 3.54 | 5.45 | 2.22 | 6.49 | 9.67 | 10.32 | 6.70 | 2.35 | 15.97 | 12.80 | 12.85 |
| 2,7-Dimethylnapthalene | 36.57 | 4.23 | 11.70 | 7.54 | 8.14 | 3.88 | 22.34 | 12.37 | 9.32 | 4.04 | 11.02 | ND | 8.70 | 12.50 | 19.13 | 12.20 | 3.84 | 26.71 | 21.67 | 21.71 |
| 1,3-Dimethylnapthalene | 84.35 | 8.37 | 25.13 | 16.84 | 18.36 | 7.92 | 44.28 | 28.26 | 18.48 | 9.33 | 21.50 | ND | 17.62 | 26.02 | 40.36 | 26.03 | 8.48 | 58.08 | 44.35 | 43.06 |
| 1,6-Dimethylnapthalene | 46.80 | 5.01 | 14.64 | 9.33 | 10.48 | 4.64 | 24.89 | 15.16 | 10.05 | 5.32 | 11.40 | ND | 10.21 | 15.34 | 22.45 | 14.86 | 5.04 | 34.64 | 25.53 | 24.97 |
| 1,4-Dimethylnapthalene | 22.89 | 2.51 | 7.14 | 4.68 | 5.75 | 2.52 | 12.85 | 7.28 | 4.95 | 2.74 | 5.71 | 2.25 | 4.90 | 7.41 | 10.03 | 6.97 | 2.57 | 16.91 | 12.35 | 11.69 |
| 1,5-Dimethylnapthalene | 7.04 | 0.97 | 2.42 | 1.63 | 1.82 | ND | 4.30 | 2.93 | 1.78 | 1.07 | 2.11 | ND | 1.79 | 2.72 | 3.70 | 2.51 | 0.98 | 6.22 | 4.88 | 4.61 |
| Acenapthylene | 25.54 | 0.66 | 11.19 | 6.74 | 7.18 | 2.67 | 15.99 | 8.37 | 8.56 | 2.79 | 10.26 | 1.72 | 4.91 | 7.87 | 9.60 | 6.90 | 1.45 | 9.57 | 9.13 | 9.51 |
| 1,2-Dimethylnapthalene | 12.69 | 1.51 | 4.10 | 2.67 | 3.60 | 1.59 | 8.05 | 4.33 | 2.98 | 1.70 | 3.57 | 1.37 | 2.76 | 4.18 | 5.84 | 4.06 | 1.52 | 9.95 | 7.47 | 6.97 |
| 1,8-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | 0.48 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenapthene | 12.81 | 2.25 | 4.16 | 2.68 | 4.07 | 1.71 | 8.40 | 5.51 | 3.82 | ND | 4.26 | ND | 2.29 | 3.69 | 3.68 | 2.53 | ND | 5.36 | 4.88 | 4.34 |
| 2,3,5-Trimethylnapthalene | 16.78 | 2.49 | 5.55 | 3.64 | 6.17 | 2.25 | 12.24 | 4.22 | 3.81 | 1.97 | 5.50 | 1.80 | 3.66 | 5.89 | 6.99 | 5.79 | 3.41 | 16.46 | 10.85 | 10.08 |
| Fluorene | 23.56 | 6.26 | 11.16 | 7.18 | 11.38 | 4.42 | 20.19 | 8.41 | 7.62 | 4.72 | 14.08 | 3.75 | 5.70 | 9.54 | 6.53 | 6.54 | 3.88 | 15.38 | 11.66 | 10.10 |
| 1-Methylfuorene | 4.71 | ND | 3.79 | ND | ND | ND | 3.68 | ND | ND | ND | 3.53 | ND | ND | ND | ND | ND | 3.62 | 7.01 | 5.95 | 4.00 |
| Dibenzothiophene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenanthrene | 26.24 | 17.16 | 37.75 | 34.84 | 45.93 | 26.65 | 37.39 | 16.74 | 35.69 | 33.83 | 41.87 | 24.67 | 18.31 | 27.34 | 13.59 | 29.65 | 28.68 | 37.21 | 31.36 | 34.62 |
| Anthracene | 1.95 | 1.20 | 2.70 | 2.11 | 3.42 | 1.94 | 2.42 | 24.21 | 2.29 | 2.39 | 3.29 | 1.52 | 1.50 | 1.95 | 1.18 | 2.30 | 2.24 | 2.85 | 2.82 | 2.86 |
| 2-Methyldibenzothiophene | 1.74 | 1.13 | 1.67 | 1.39 | 1.94 | 1.81 | 1.66 | 0.69 | 1.61 | 1.87 | 2.20 | 1.39 | 1.31 | 1.56 | 1.14 | 2.25 | 2.79 | 3.49 | 2.93 | 2.51 |
| 4-Methyldibenzothiophene | 1.00 | 0.71 | 1.03 | 0.87 | 1.27 | 1.27 | 1.09 | 0.52 | 1.09 | 1.22 | 1.23 | 0.91 | 0.70 | 0.92 | 0.52 | 1.33 | 1.46 | 1.78 | 1.80 | 1.36 |
| 2-Methylphenanthrene | 3.32 | 2.00 | 3.74 | 2.93 | 4.88 | 3.32 | 3.76 | 1.84 | 4.47 | 4.24 | 4.35 | 3.80 | 2.68 | 3.34 | 2.89 | 4.30 | 6.40 | 7.01 | 6.11 | 5.71 |
| 2-Methylanthracene | 5.17 | 3.56 | 6.23 | 4.59 | 8.21 | 5.56 | 5.91 | 2.96 | 7.22 | 6.35 | 6.75 | 6.21 | 4.59 | 5.35 | 4.71 | 6.69 | 10.53 | 11.14 | 10.04 | 9.03 |
| 4,5-Methylenephenanthrene | 0.13 | ND | ND | ND | 0.15 | ND | 0.16 | ND | ND | 0.41 | 0.16 | ND | ND | ND | ND | ND | 0.39 | 0.31 | 0.32 | 0.17 |
| 1-Methylanthracene | 1.96 | 1.25 | 2.23 | 1.74 | 2.74 | 2.23 | 2.22 | 1.15 | 2.75 | 2.44 | 2.63 | 2.35 | 1.66 | 1.91 | 1.80 | 2.80 | 3.97 | 4.32 | 3.84 | 3.62 |
| 1-Methylphenanthrene | 1.62 | 1.08 | 1.95 | 1.42 | 2.43 | 1.79 | 1.98 | 1.02 | 2.29 | 1.94 | 2.13 | 1.94 | 1.36 | 1.69 | 1.45 | 2.21 | 3.13 | 3.38 | 2.91 | 2.61 |
| 9-Methylanthracene | ND | ND | ND | ND | ND | ND | ND | ND | 1.09 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 9,10-Dimethylanthracene | 0.51 | 0.31 | 0.51 | 0.32 | 0.69 | 0.47 | 0.51 | 0.38 | 0.77 | 0.57 | 0.69 | 0.71 | 0.34 | 0.46 | 0.53 | 0.65 | 1.04 | 1.18 | 0.96 | 0.80 |
| Fluoranthene | 6.49 | 4.63 | 15.98 | 4.76 | 21.22 | 6.54 | 14.69 | 6.57 | 12.15 | 8.64 | 8.98 | 10.67 | 4.99 | 7.38 | 4.73 | 5.04 | 7.68 | 9.12 | 5.93 | 6.70 |
| Pyrene | 5.30 | 2.63 | 8.92 | 3.50 | 11.04 | 4.21 | 8.57 | 5.42 | 10.25 | 5.16 | 6.73 | 6.41 | 3.79 | 4.91 | 4.14 | 4.51 | 5.66 | 6.72 | 5.06 | 5.23 |
| 3,6-Dimethylphenanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | 3.20 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo[a]fluorene | 0.49 | ND | 0.67 | 0.30 | 0.44 | 0.19 | 0.52 | 0.44 | 0.58 | 0.27 | 0.46 | 0.26 | 0.36 | 0.37 | 0.30 | 0.32 | 0.35 | 0.42 | 0.43 | 0.34 |
| Retene | ND | ND | ND | ND | ND | ND | ND | ND | 1.18 | ND | ND | ND | 1.03 | ND | ND | ND | 1.22 | ND | ND | ND |
| Benzo[b]fluorene | 0.57 | 0.12 | 0.67 | 0.26 | 0.45 | 0.23 | 0.57 | 0.46 | 0.65 | 0.25 | 0.52 | 0.23 | 0.38 | 0.38 | 0.31 | 0.37 | 0.35 | 0.36 | 0.36 | 0.31 |
| Cyclopenta[c,d]pyrene | 1.17 | 0.27 | 1.51 | 0.43 | 0.54 | 0.43 | 1.34 | 1.48 | 1.07 | 0.54 | 3.42 | 0.47 | 0.52 | 0.55 | 1.11 | 1.36 | 0.67 | 0.61 | 1.02 | 0.71 |
| Benz[a]anthracene | 1.22 | 0.19 | 1.78 | 0.55 | 0.81 | 0.47 | 1.50 | 1.30 | 1.41 | 0.52 | 1.79 | 0.38 | 0.99 | 1.02 | 1.01 | 1.00 | 0.73 | 0.86 | 0.80 | 0.78 |
| Chrysene+Triphenylene | 1.88 | 0.38 | 2.28 | 0.98 | 1.35 | 0.72 | 1.81 | 2.09 | 2.82 | 0.86 | 2.10 | 0.63 | 1.31 | 1.28 | 1.08 | 1.15 | 1.02 | 1.30 | 0.87 | 0.91 |
| Napthacene | 0.03 | ND | 0.03 | ND | ND | ND | 0.05 | ND | ND | ND | 0.47 | 0.09 | ND | ND | ND | ND | 0.19 | ND | ND | ND |
| 4-Methylchrysene | 0.07 | ND | 0.11 | 0.05 | 0.06 | 0.03 | 0.17 | 0.08 | 0.10 | 0.02 | 0.14 | 0.04 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 |
| Benzo[b]fluoranthene | 0.76 | 0.15 | 0.99 | 0.43 | 0.60 | 0.38 | 0.83 | 0.73 | 1.04 | 0.29 | 0.96 | 0.23 | 0.65 | 0.58 | 0.46 | 0.46 | 0.50 | 0.44 | 0.40 | 0.40 |
| Benzo[k]fluoranthene | 0.22 | 0.04 | 0.28 | 0.14 | 0.19 | 0.10 | 0.25 | 0.21 | 0.33 | 0.07 | 0.27 | 0.06 | 0.19 | 0.17 | 0.14 | 0.13 | 0.14 | 0.13 | 0.12 | 0.12 |
| Dimethylbenz[a]anthracene | 0.02 | ND | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 | ND | ND | 0.02 | ND | 0.02 | ND | 0.01 | ND | ND |
| Benzo[e]pyrene | ND | ND | 0.49 | 1.22 | ND | ND | 0.74 | ND | ND | ND | ND | ND | 0.55 | 0.55 | ND | ND | ND | ND | ND | ND |
| Benzo[a]pyrene | 0.44 | 0.09 | 0.49 | 0.23 | 0.31 | 0.20 | 0.56 | 0.34 | 0.46 | 0.13 | 0.67 | 0.14 | 0.33 | 0.33 | 0.32 | 0.32 | 0.28 | 0.27 | 0.24 | 0.24 |
| Perylene | 0.04 | 0.01 | 0.07 | 0.02 | 0.04 | 0.02 | 0.07 | 0.04 | 0.05 | 0.02 | 0.08 | 0.01 | 0.04 | 0.05 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 |
| 3-Methylchloanthrene | ND | ND | ND | 0.01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 3.09 | 0.65 | 2.92 | 1.66 | 1.84 | 1.25 | 3.04 | 2.89 | 4.03 | 1.15 | 3.86 | 1.09 | 2.17 | 2.15 | 1.78 | 1.82 | 1.54 | 1.76 | 1.56 | 1.46 |
| Dibenz[a,h+ac]anthracene | 0.18 | 0.05 | 0.21 | 0.08 | 0.13 | 0.08 | 0.22 | 0.14 | 0.22 | 0.06 | 0.22 | 0.05 | 0.16 | 0.15 | 0.10 | 0.11 | 0.11 | 0.15 | 0.11 | 0.10 |
| Benzo[g,h,i]perylene | 2.92 | 0.47 | 2.31 | 1.56 | 1.52 | 1.12 | 2.51 | 3.20 | 4.19 | 0.88 | 3.89 | 1.03 | 1.67 | 1.68 | 1.91 | 1.81 | 1.37 | 1.60 | 1.28 | 1.36 |
| Anthranthrene | 0.39 | 0.06 | 0.35 | 0.20 | 0.20 | 0.15 | 0.49 | 0.26 | 0.30 | 0.09 | 0.74 | 0.14 | 0.24 | 0.23 | 0.30 | 0.37 | 0.17 | 0.18 | 0.21 | 0.18 |
| Corenene | 1.27 | 0.18 | 0.84 | 0.61 | 0.58 | 0.46 | 0.93 | 1.42 | 1.68 | 0.33 | 1.43 | 0.39 | 0.57 | 0.60 | 0.66 | 0.68 | 0.51 | 0.50 | 0.47 | 0.51 |

**Winter 2006**
**PAH Mass (ng)**

| Sample Name | PBP518 | PBP519 | PBP547 | PBP554 | PBP553 | PBP563 | PBP561 | PBP562 | PBP550 | PBP564 | PBP542 | PBP556 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Date | 1/13/2006 | 1/13/2006 | 1/16/2006 | 1/16/2006 | 1/17/2006 | 1/17/2006 | 1/18/2006 | 1/18/2006 | 1/19/2006 | 1/19/2006 | 1/20/2006 | 1/20/2006 |
| Sampling Time | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM |
| Volume ($m^3$) | 11 | 11 | 11.2 | 11 | 12.3 | 12.5 | 10.3 | 11.6 | 8.3 | 8.4 | 11.3 | 11.5 |
| Surrogates | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Acenapthylene | 19.6 | 36.2 | 11.2 | 21.4 | 19.2 | 5.3 | 9.2 | 5.9 | 28.3 | 14.0 | 14.2 | 18.9 |
| d10-Fluorene | 15.2 | 28.8 | 9.5 | 18.3 | 16.5 | 9.9 | 13.5 | 9.0 | 22.5 | 12.7 | 16.9 | 14.9 |
| d10-Pyrene | 53.6 | 54.5 | 60.2 | 60.7 | 64.5 | 60.2 | 62.4 | 64.8 | 62.7 | 62.8 | 59.9 | 61.3 |
| Spike | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d8-Napthalene | 6.1 | 7.2 | 4.4 | 8.9 | 4.2 | 0.8 | 1.3 | 1.1 | 9.2 | 4.3 | 3.7 | 5.2 |
| d10-Anthracene | 33.5 | 46.2 | 22.6 | 43.0 | 45.2 | 55.6 | 54.8 | 48.2 | 43.2 | 39.2 | 58.3 | 32.6 |
| d10-Fluoranthene | 47.2 | 48.5 | 53.6 | 52.5 | 57.4 | 54.9 | 55.0 | 58.8 | 55.9 | 55.5 | 52.9 | 53.7 |
| d12-Benz[a]pyrene | 100.1 | 100.0 | 100.5 | 100.3 | 100.2 | 99.8 | 100.1 | 100.4 | 100.2 | 100.2 | 100.2 | 100.5 |
| d12-Indone[1,2,3-c,d]pyrene | 67.8 | 76.6 | 76.6 | 71.5 | 78.5 | 74.0 | 71.1 | 74.7 | 75.1 | 77.1 | 67.6 | 75.7 |
| | | | | | | | | | | | | |
| PAH Compounds | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) | mass(ng) |
| Napthalene | 83.58 | 152.45 | 59.64 | 88.35 | 61.05 | ND | ND | ND | 125.39 | 74.88 | 33.79 | 47.27 |
| 2-Methylnapthalene | 85.18 | 150.13 | 45.81 | 67.88 | 56.81 | ND | ND | ND | 110.37 | 58.67 | 30.42 | 43.13 |
| Azulene | 0.45 | 0.79 | ND | 0.33 | ND | ND | ND | ND | 0.62 | 0.33 | ND | ND |
| 1-Methylnapthalene | 31.22 | 55.85 | 17.38 | 26.79 | 22.58 | ND | ND | ND | 42.78 | 23.74 | 12.22 | 18.34 |
| Biphenyl | 9.21 | 16.27 | 3.01 | 4.63 | 8.71 | 1.95 | 1.83 | ND | 10.24 | 5.44 | 4.12 | 6.10 |
| 2,7-Dimethylnapthalene | 15.48 | 28.26 | 4.49 | 6.52 | 10.59 | ND | ND | ND | 15.71 | 10.39 | 6.77 | 9.08 |
| 1,3-Dimethylnapthalene | 32.26 | 59.17 | 10.46 | 15.54 | 24.94 | ND | ND | ND | 36.60 | 19.51 | 15.13 | 22.40 |
| 1,6-Dimethylnapthalene | 18.67 | 34.03 | 5.63 | 8.32 | 13.55 | ND | ND | ND | 20.01 | 10.68 | 8.70 | 12.62 |
| 1,4-Dimethylnapthalene | 9.03 | 17.09 | 2.66 | 3.85 | 6.78 | ND | ND | ND | 9.90 | 5.02 | 4.78 | 6.17 |
| 1,5-Dimethylnapthalene | 3.10 | 5.80 | 1.08 | 1.23 | 2.70 | ND | ND | ND | 3.10 | 2.00 | 1.56 | 2.58 |
| Acenapthylene | 8.88 | 16.44 | 2.30 | 4.01 | 14.38 | 3.27 | 1.15 | 0.93 | 15.44 | 8.22 | 3.26 | 4.29 |
| 1,2-Dimethylnapthalene | 5.46 | 9.86 | 1.63 | 2.36 | 4.28 | ND | ND | ND | 5.65 | 3.13 | 2.66 | 3.82 |
| 1,8-Dimethylnapthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenapthene | 3.99 | 8.54 | 1.91 | 2.72 | 5.43 | ND | ND | ND | 5.14 | 2.85 | 2.00 | 2.61 |
| 2,3,5-Trimethylnapthalene | 8.30 | 16.82 | ND | 2.33 | 4.94 | 1.96 | 1.98 | ND | 6.33 | 3.56 | 5.01 | 4.80 |
| Fluorene | 9.21 | 20.84 | 2.58 | 4.65 | 10.69 | 5.91 | 3.67 | 2.92 | 9.94 | 6.89 | 8.21 | 6.77 |
| 1-Methylfuorene | 3.44 | 6.15 | ND | ND | 3.52 | 3.49 | ND | ND | ND | ND | 4.66 | ND |
| Dibenzothiophene | ND | 4.16 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenanthrene | 24.39 | 50.13 | 8.59 | 13.87 | 49.49 | 47.70 | 21.80 | 17.64 | 21.08 | 21.37 | 31.17 | 19.18 |
| Anthracene | 1.93 | 3.53 | ND | 0.44 | 3.51 | 3.56 | 1.34 | 1.27 | 1.91 | 1.88 | 2.79 | 1.60 |
| 2-Methyldibenzothiophene | 2.26 | 3.06 | 0.63 | 0.80 | 3.05 | 2.23 | 1.43 | 1.48 | 1.49 | 1.50 | 2.83 | 1.76 |
| 4-Methyldibenzothiophene | 1.42 | 1.60 | 0.49 | 0.50 | 2.00 | 1.37 | 0.79 | 0.79 | 1.00 | 1.01 | 1.40 | 0.97 |
| 2-Methylphenanthrene | 5.97 | 6.52 | 1.87 | 1.93 | 7.48 | 5.67 | 3.11 | 3.16 | 3.69 | 4.13 | 6.44 | 4.74 |
| 2-Methylanthracene | 9.74 | 10.50 | 3.06 | 3.04 | 12.22 | 8.54 | 4.90 | 4.94 | 6.00 | 6.27 | 9.97 | 7.48 |
| 4,5-Methylenephenanthrene | 0.19 | 0.31 | ND | ND | 0.19 | 0.16 | ND | 0.13 | 0.13 | ND | 0.23 | 0.15 |
| 1-Methylanthracene | 3.71 | 3.93 | 1.28 | 1.30 | 4.96 | 3.29 | 1.67 | 1.87 | 2.38 | 2.49 | 3.79 | 3.05 |
| 1-Methylphenanthrene | 3.12 | 3.21 | 1.11 | 1.14 | 3.93 | 2.86 | 1.45 | 1.57 | 1.94 | 1.95 | 3.06 | 2.40 |
| 9-Methylanthracene | 0.10 | 0.09 | 1.29 | ND | ND | 0.15 | ND | ND | ND | ND | ND | ND |
| 9,10-Dimethylanthracene | 1.11 | 0.92 | 0.38 | 0.38 | 1.17 | 0.75 | 0.37 | 0.61 | 0.66 | 0.75 | 0.98 | 0.94 |
| Fluoranthene | 9.39 | 14.48 | 6.69 | 5.67 | 16.98 | 12.32 | 5.57 | 4.75 | 8.68 | 8.81 | 6.24 | 9.07 |
| Pyrene | 7.91 | 9.69 | 5.31 | 4.66 | 13.92 | 11.05 | 3.25 | 3.23 | 8.65 | 8.83 | 4.91 | 6.25 |
| 3,6-Dimethylphenanthrene | ND | ND | ND | ND | ND | ND | ND | 3.10 | ND | ND | ND | ND |
| Benzo[a]fluorene | 0.64 | 0.70 | 0.58 | 0.47 | 0.91 | 0.71 | 0.17 | 0.19 | 0.55 | 0.58 | 0.30 | 0.31 |
| Retene | ND | ND | 1.12 | ND | 1.37 | 1.05 | ND | ND | ND | ND | ND | ND |
| Benzo[b]fluorene | 0.69 | 0.68 | 0.56 | 0.53 | 0.92 | 0.78 | 0.14 | 0.17 | 0.61 | 0.65 | 0.28 | 0.30 |
| Cyclopenta[c,d]pyrene | 1.75 | 2.13 | 1.37 | 1.57 | 2.09 | 1.73 | 0.29 | 0.29 | 2.34 | 3.23 | 0.58 | 0.69 |
| Benz[a]anthracene | 1.81 | 1.97 | 1.43 | 1.29 | 1.83 | 1.64 | 0.25 | 0.36 | 1.94 | 1.97 | 0.54 | 0.62 |
| Chrysene+Triphenylene | 1.94 | 2.25 | 2.17 | 2.05 | 3.28 | 2.95 | 0.40 | 0.56 | 2.22 | 2.18 | 0.67 | 0.80 |
| Napthacene | ND | 0.03 | 0.05 | 0.03 | ND | 0.05 | 0.25 | ND | ND | ND | 0.04 | 0.03 |
| 4-Methylchrysene | 0.12 | 0.13 | 0.09 | 0.08 | 0.16 | 0.11 | 0.03 | ND | 0.12 | 0.11 | 0.03 | ND |
| Benzo[b]fluoranthene | 0.92 | 0.77 | 0.80 | 0.77 | 1.24 | 1.19 | 0.14 | 0.19 | 0.96 | 0.87 | 0.29 | 0.30 |
| Benzo[k]fluoranthene | 0.27 | 0.24 | 0.25 | 0.25 | 0.37 | 0.35 | 0.04 | 0.06 | 0.30 | 0.25 | 0.08 | 0.09 |
| Dimethylbenz[a]anthracene | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 | 0.01 | ND | ND | 0.01 | 0.03 | 0.01 | ND |
| Benzo[e]pyrene | 1.11 | 1.14 | ND | ND | 0.54 | 0.52 | ND | ND | ND | ND | ND | ND |
| Benzo[a]pyrene | 0.67 | 0.58 | 0.37 | 0.37 | 0.55 | 0.46 | ND | 0.10 | 0.73 | 0.67 | 0.20 | 0.21 |
| Perylene | 0.09 | 0.07 | 0.04 | 0.04 | 0.07 | 0.06 | 0.01 | 0.01 | 0.08 | 0.07 | 0.02 | 0.02 |
| 3-Methylchloanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno[1,2,3-c,d]pyrene | 2.76 | 3.04 | 2.85 | 2.73 | 5.00 | 4.49 | 0.60 | 0.79 | 3.74 | 3.87 | 1.06 | 1.25 |
| Dibenz[a,h+ac]anthracene | 0.19 | 0.21 | 0.15 | 0.14 | 0.29 | 0.24 | 0.02 | 0.05 | 0.19 | 0.19 | 0.09 | 0.08 |
| Benzo[g,h,i]perylene | 2.52 | 2.68 | 2.60 | 2.45 | 4.77 | 4.25 | 0.46 | 0.63 | 3.68 | 3.57 | 1.18 | 1.37 |
| Anthranthrene | 0.53 | 0.62 | 0.25 | 0.30 | 0.51 | 0.34 | ND | 0.06 | 0.62 | 0.71 | 0.15 | 0.19 |
| Corenene | 0.83 | 0.99 | 1.07 | 1.01 | 1.85 | 1.55 | 0.19 | 0.23 | 1.30 | 1.29 | 0.44 | 0.51 |

**Winter 2005**
**NPAH Mass (pg)**

| Sample Name | PBP120 | PBP128 | PBP147 | PBP147P | PBP153 | PBP153P | PBP154 | PBP154P | PBP124 | PBP132 | PBP134 | PBP134_P3 | PBP145 | PBP155 | PBP152 | PBP139 | PBP126 | PBP141 | PBP157 | PBP148 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina |
| Date | | | | | | | | | 1/10/2005 | 1/10/2005 | 1/11/2005 | 1/11/2005 | 1/11/2005 | 1/11/2005 | 1/12/2005 | 1/12/2005 | 1/12/2005 | 1/13/2005 | 1/13/2005 | 1/13/2005 |
| Sampling Time | | | | | | | | | PM | PM | 5day | 5day | AM | PM | AM | PM | PM | AM | AM | AM |
| Volume ($m^3$) | | | | | | | | | 10.8 | 11.7 | 104.3 | 104.3 | 8.3 | 13.7 | 12 | 10.6 | 11.1 | 11.7 | 10.8 | 10.2 |
| Surr. | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery |
| d7-1N-Naphthalene | 33.0 | 24.4 | 40.8 | 41.8 | 24.4 | 20.3 | 32.7 | 23.8 | 21.3 | 24.5 | 18.8 | 43.4 | 12.8 | 16.9 | 12.5 | 12.9 | 23.2 | 18.6 | 17.9 | 24.4 |
| d9-9N-Anthracene | 45.1 | 43.7 | 48.4 | 59.9 | 36.6 | 53.6 | 45.8 | 43.8 | 40.1 | 54.3 | 49.3 | 56.4 | 59.6 | 46.1 | 41.4 | 46.2 | 52.0 | 57.0 | 42.7 | 49.4 |
| d9-1N-Pyrene | 65.1 | 45.0 | 61.6 | 54.8 | 60.4 | 58.8 | 59.2 | 44.7 | 46.2 | 56.1 | 60.2 | 55.6 | 63.7 | 55.1 | 45.9 | 55.1 | 53.8 | 54.2 | 51.3 | 58.3 |
| | | | | | | | | | | | | | | | | | | | | |
| Name | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) |
| 1N-Naphthalene | 1.31 | 4.30 | 2.57 | 3.41 | 3.49 | 3.54 | 1.34 | 3.08 | 64.46 | 58.86 | 1003.90 | ND | 50.68 | 113.98 | 114.37 | 64.18 | 106.07 | ND | 54.08 | 105.81 |
| 2N-Naphthalene | 3.19 | 5.97 | 2.34 | 3.49 | 3.07 | 2.18 | 2.37 | 2.05 | 25.18 | 24.37 | 730.14 | ND | ND | 46.58 | 64.84 | 48.48 | 39.77 | ND | 21.80 | 49.48 |
| 2N-Biphenyl | 2.27 | 3.83 | 10.83 | 2.39 | 1.77 | 2.26 | 2.51 | 3.68 | 47.84 | 53.72 | 448.16 | ND | 40.87 | 96.02 | 135.78 | 98.56 | 128.82 | ND | 20.31 | 76.61 |
| 3N-Biphenyl | 4.61 | 1.66 | 3.73 | 1.26 | 1.16 | 1.30 | 1.55 | 0.62 | ND | 9.99 | 136.45 | ND | 12.42 | 17.69 | 14.18 | 12.58 | 15.59 | ND | ND | 13.81 |
| 4N-Biphenyl | 17.05 | 4.13 | 3.46 | 2.47 | 2.27 | 8.19 | 8.39 | 4.84 | ND | ND | 47.68 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-DiN-Naphthalene | 1.16 | 2.00 | 0.45 | 1.46 | 1.04 | 2.08 | 1.24 | 1.19 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,5-DiN-Naphthalene | 0.78 | 0.11 | 0.71 | 0.97 | 0.47 | 0.43 | 0.62 | 0.27 | ND | ND | ND | ND | 3.21 | ND | ND | ND | ND | ND | ND | ND |
| 5N-Acenaphthalene | 3.09 | 1.97 | 1.57 | 2.40 | 0.66 | 2.73 | 4.08 | 2.47 | ND | ND | 15.41 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2N-Fluorene | 1.00 | 0.41 | 0.41 | 0.75 | 0.37 | 0.73 | 1.77 | 1.40 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 9N-Anthracene | 22.00 | 18.20 | 12.96 | 4.40 | 15.24 | 12.26 | 5.45 | 10.79 | 676.38 | 1118.24 | 1285.92 | ND | 381.39 | 953.06 | 381.65 | 259.64 | 226.15 | 76.57 | 79.59 | 193.59 |
| 2N-Anthracene | 1.41 | 0.95 | 0.27 | 1.00 | 1.73 | 2.03 | 0.55 | 1.05 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 9.74 |
| 9N-Phenanthrene | 1.66 | 2.98 | 1.84 | 1.81 | 0.91 | 1.03 | 3.79 | 3.47 | ND | ND | 36.26 | ND | 10.73 | ND | ND | ND | ND | ND | ND | ND |
| 3N-Phenanthrene | 0.68 | 0.70 | 0.99 | 0.57 | 0.79 | 0.92 | 0.66 | 0.58 | ND | ND | 16.19 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4N-Phenanthrene | 18.71 | 23.06 | 9.68 | 10.97 | 19.28 | 77.84 | 8.06 | 195.07 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2N-Fluoranthene | 1.98 | 0.80 | 2.09 | 0.78 | 1.66 | 1.88 | 1.81 | 1.19 | 74.28 | 34.26 | 779.72 | 10.01 | 27.89 | 77.40 | 50.51 | 277.19 | 332.45 | 28.15 | 35.24 | 14.54 |
| 3N-Fluoranthene | 0.75 | 0.38 | 0.53 | 1.57 | 1.46 | 0.86 | 0.75 | 0.56 | ND | 5.60 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1N-Pyrene | 12.55 | 8.16 | 2.53 | 1.66 | 1.21 | 2.60 | 1.77 | 1.37 | ND | ND | 184.43 | ND | 22.47 | ND | 23.56 | ND | ND | ND | ND | ND |
| 2N-Pyrene | 3.02 | 3.42 | 2.91 | 5.27 | 3.41 | 5.50 | 2.40 | 2.90 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 6N-Chrysene | 2.29 | 3.26 | 3.38 | 3.26 | 0.77 | 3.49 | 1.65 | 2.26 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

**Winter 2005**
**NPAH Mass (pg)**

| Sample Name | PBP140 | PBP138 | PBP130 | PBP137 | PBP136 | PBP150 | PBP158 | PBP142 | PBP146 | PBP125 | PBP122 | PBP151 | PBP116 | PBP115 | PBP121 | PBP127 | PBP127_P3 | PBP118 | PBP123 | PBP131 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Residential | Highway | Highway | Highway | Highway | Highway |
| Date | 1/13/2005 | 1/13/2005 | 1/14/2005 | 1/14/2005 | 1/14/2005 | 1/14/2005 | 1/15/2005 | 1/11/2005 | 1/11/2005 | 1/12/2005 | 1/12/2005 | 1/13/2005 | 1/13/2005 | 1/14/2005 | 1/15/2005 | 1/11/2005 | 1/11/2005 | 1/11/2005 | 1/11/2005 | 1/12/2005 |
| Sampling Time | PM | PM | AM | AM | PM | PM | AM | AM | PM | AM | PM | AM | PM | AM | AM | 5day | 5day | AM | PM | AM |
| Volume ($m^3$) | 11.2 | 11.6 | 10 | 10.1 | 10.9 | 10.8 | 10.7 | 6.8 | 12.3 | 10.5 | 12 | 10.9 | 13.1 | 12 | 11 | 100.3 | 100.3 | 7.7 | 12.7 | 11.4 |
| Surr. | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery | % recovery |
| d7-1N-Naphthalene | 24.7 | 17.6 | 27.6 | 29.6 | 27.5 | 53.1 | 15.8 | 26.9 | 13.8 | 9.7 | 18.5 | 18.0 | 26.7 | 16.1 | 12.3 | 17.8 | 13.6 | 20.2 | 17.4 | 11.1 |
| d9-9N-Anthracene | 46.1 | 37.1 | 54.6 | 58.0 | 56.2 | 59.4 | 50.0 | 53.8 | 47.3 | 38.9 | 49.5 | 55.4 | 53.8 | 49.3 | 31.4 | 32.6 | 54.7 | 46.2 | 42.5 | 45.7 |
| d9-1N-Pyrene | 42.7 | 52.9 | 63.9 | 61.8 | 66.7 | 62.0 | 51.7 | 50.5 | 58.1 | 37.2 | 56.5 | 64.3 | 58.0 | 47.7 | 36.1 | 52.2 | 62.4 | 55.4 | 46.3 | 59.5 |
| Name | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) | mass (pg) |
| 1N-Naphthalene | 60.76 | 55.58 | 21.39 | 38.92 | 14.70 | 48.10 | 18.37 | 47.52 | 46.94 | 86.73 | 95.10 | 58.08 | 66.31 | 33.10 | 14.39 | 934.91 | ND | 37.53 | 70.88 | 105.03 |
| 2N-Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | 15.01 | 43.17 | 50.71 | ND | 36.63 | ND | ND | 665.35 | ND | ND | 18.88 | 51.40 |
| 2N-Biphenyl | 37.79 | 35.00 | ND | ND | ND | ND | ND | 62.41 | 103.09 | 129.15 | 76.26 | 34.54 | 67.67 | ND | ND | 510.57 | ND | 71.20 | 107.10 | 106.49 |
| 3N-Biphenyl | ND | ND | ND | ND | ND | ND | ND | ND | ND | 24.04 | 9.79 | ND | ND | ND | ND | 102.37 | ND | ND | ND | 20.19 |
| 4N-Biphenyl | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-DiN-Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,5-DiN-Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 3.06 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 5N-Acenaphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2N-Fluorene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 4.95 | ND | ND | ND | ND |
| 9N-Anthracene | 76.20 | ND | 65.36 | 89.48 | ND | 78.12 | ND | 276.27 | 952.62 | 286.71 | 296.94 | 181.71 | 152.56 | 65.67 | 67.69 | 1823.68 | ND | 196.76 | 1029.31 | 398.80 |
| 2N-Anthracene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 9N-Phenanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 60.72 | ND | ND | ND | ND |
| 3N-Phenanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 43.56 | ND | ND | ND | ND |
| 4N-Phenanthrene | ND | ND | ND | ND | ND | ND | 421.03 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2N-Fluoranthene | ND | ND | ND | ND | 14.01 | 12.27 | ND | 11.04 | 24.92 | 12.62 | 149.04 | 13.06 | 10.15 | ND | 11.88 | 592.63 | ND | ND | 69.35 | 45.73 |
| 3N-Fluoranthene | 5.55 | ND | ND | ND | ND | 4.37 | ND | ND | ND | ND | ND | ND | 5.53 | ND | ND | ND | ND | ND | ND | ND |
| 1N-Pyrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 27.13 | ND | ND | 240.20 | ND | ND | 20.86 | 59.51 |
| 2N-Pyrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 6N-Chrysene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

| | | | | |
|---|---|---|---|---|
| **Winter 2005** | | | | |
| **NPAH Mass (pg)** | | | | |
| Sample Name | PBP135 | PBP149 | PBP117 | PBP156 |
| Sampling Site | Highway | Highway | Highway | Highway |
| Date | 1/13/2005 | 1/13/2005 | 1/14/2005 | 1/15/2005 |
| Sampling Time | AM | PM | AM | AM |
| Volume ($m^3$) | 10.8 | 12.8 | 11.7 | 11.1 |
| Surr. | % recovery | % recovery | % recovery | % recovery |
| d7-1N-Naphthalene | 21.4 | 30.5 | 8.8 | 13.1 |
| d9-9N-Anthracene | 47.9 | 66.1 | 48.4 | 30.4 |
| d9-1N-Pyrene | 44.0 | 69.0 | 58.4 | 36.8 |
| Name | mass (pg) | mass (pg) | mass (pg) | mass (pg) |
| 1N-Naphthalene | 72.32 | 90.30 | 18.49 | ND |
| 2N-Naphthalene | 60.29 | 44.49 | ND | ND |
| 2N-Biphenyl | 28.01 | 112.01 | ND | ND |
| 3N-Biphenyl | 14.61 | 14.61 | ND | ND |
| 4N-Biphenyl | ND | ND | ND | ND |
| 1,3-DiN-Naphthalene | ND | ND | ND | ND |
| 1,5-DiN-Naphthalene | ND | ND | ND | ND |
| 5N-Acenaphthalene | ND | ND | ND | ND |
| 2N-Fluorene | ND | ND | ND | ND |
| 9N-Anthracene | 198.41 | 169.43 | 189.44 | ND |
| 2N-Anthracene | ND | ND | ND | ND |
| 9N-Phenanthrene | ND | ND | ND | ND |
| 3N-Phenanthrene | ND | ND | ND | ND |
| 4N-Phenanthrene | ND | ND | ND | ND |
| 2N-Fluoranthene | 33.05 | 9.76 | 12.16 | ND |
| 3N-Fluoranthene | 4.85 | ND | ND | ND |
| 1N-Pyrene | ND | ND | 22.30 | ND |
| 2N-Pyrene | ND | ND | ND | ND |
| 6N-Chrysene | ND | ND | ND | ND |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Summer 2005** | | | | | | | | | | |
| **NPAH Mass (pg)** | | | | | | | | | | |
| Sample Name | PBP303 | PBP314 | PBP329 | PBP339 | PBP351 | PBP359 | PBP370 | PBP372 | PBP375 | PBP381 |
| Sampling Site | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank | Field Blank |
| Date | | | | | | | | | | |
| Sampling Time | | | | | | | | | | |
| Volume ($m^3$) | | | | | | | | | | |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 2.8 | 4.8 | 7.1 | 6.2 | 13.7 | 7.9 | 10.3 | 14.0 | 14.7 | 8.6 |
| d9-9N-Anthracene | 29.1 | 40.0 | 41.8 | 45.5 | 48.3 | 36.0 | 35.3 | 35.7 | 44.3 | 37.0 |
| d9-1N-Pyrene | 44.3 | 55.4 | 61.2 | 68.3 | 67.6 | 55.9 | 56.6 | 66.3 | 60.9 | 58.4 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 2.48 | 3.41 | 3.84 | 5.00 | 13.60 | 4.09 | 6.03 | 9.25 | 5.58 | 3.99 |
| 2N-Naphthalene | 2.16 | 3.70 | 2.80 | 5.27 | 13.30 | 4.19 | 6.31 | 8.41 | 5.24 | 4.41 |
| 2N-Biphenyl | 2.66 | 3.52 | 1.47 | 3.67 | 8.01 | 1.93 | 3.79 | 4.59 | 6.98 | 2.43 |
| 3N-Biphenyl | 1.59 | 2.58 | 1.62 | 3.17 | 4.85 | 2.27 | 2.79 | 2.94 | 2.41 | 2.56 |
| 4N-Biphenyl | 2.07 | 1.41 | 0.78 | 0.31 | 0.72 | 1.09 | 0.85 | 0.34 | 1.01 | 0.85 |
| 1,3-DiN-Naphthalene | 0.15 | 0.32 | 0.56 | 0.30 | 0.13 | 0.16 | 0.48 | 0.26 | 0.07 | 0.24 |
| 1,5-DiN-Naphthalene | 0.22 | 0.11 | 0.18 | 0.12 | 0.07 | 0.05 | 0.04 | 0.10 | 0.03 | 0.11 |
| 5N-Acenaphthalene | 2.33 | 0.99 | 1.49 | 1.87 | 2.06 | 1.53 | 0.47 | 2.36 | 1.37 | 0.42 |
| 2N-Fluorene | 0.98 | 0.16 | 1.97 | 0.26 | 0.21 | 0.28 | 0.11 | 0.42 | 0.33 | 0.17 |
| 9N-Anthracene | 10.94 | 9.02 | 17.07 | 28.53 | 23.79 | 21.41 | 16.93 | 16.97 | 16.72 | 1.19 |
| 2N-Anthracene | 0.21 | 0.27 | 0.46 | 0.19 | 0.22 | 0.55 | 0.16 | 0.19 | 0.39 | 0.24 |
| 9N-Phenanthrene | 0.97 | 0.22 | 0.99 | 0.52 | 0.17 | 0.18 | 0.12 | 0.37 | 0.76 | 0.29 |
| 3N-Phenanthrene | 1.78 | 0.26 | 0.73 | 0.64 | 0.73 | 0.73 | 0.38 | 1.11 | 3.20 | 0.55 |
| 4N-Phenanthrene | 2.62 | 2.76 | 1.99 | 3.27 | 2.98 | 4.67 | 1.77 | 0.87 | 3.62 | 1.62 |
| 2N-Fluoranthene | 2.57 | 0.41 | 0.57 | 0.77 | 0.93 | 0.63 | 0.72 | 0.84 | 0.90 | 0.66 |
| 3N-Fluoranthene | 0.68 | 0.22 | 0.14 | 0.12 | 0.18 | 0.16 | 0.15 | 0.20 | 0.33 | 0.06 |
| 1N-Pyrene | 3.63 | 0.31 | 0.93 | 1.32 | 1.65 | 2.26 | 1.17 | 1.74 | 1.96 | 1.80 |
| 2N-Pyrene | 0.98 | 0.67 | 0.54 | 1.29 | 1.91 | 1.49 | 0.66 | 0.41 | 0.79 | 1.07 |
| 6N-Chrysene | 3.24 | 0.78 | 15.19 | 0.91 | 10.66 | 0.66 | 0.20 | 0.56 | 0.53 | 0.25 |

**Summer 2005**
**NPAH Mass (pg)**

| Sample Name | PBP379 | PBP385 | PBP369 | PBP394 | PBP333 | PBP366 | PBP373 | PBP327 | PBP368 | PBP337 | PBP323 | PBP340 | PBP349 | PBP360 | PBP392 | PBP383 | PBP363 | PBP361 | PBP338 | PBP345 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Marina | Residential | Residential | Residential | Residential | Residential | Residential |
| Date | 7/18/2005 | 7/18/2005 | 7/19/2005 | 7/19/2005 | 7/20/2005 | 7/21/2005 | 7/21/2005 | 7/22/2005 | 7/22/2005 | 7/25/2005 | 7/26/2005 | 7/27/2005 | 7/28/2005 | 7/29/2005 | 7/18/2005 | 7/19/2005 | 7/20/2005 | 7/22/2005 | 7/25/2005 | 7/26/2005 |
| Sampling Time | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM |
| Volume ($m^3$) | 11.1 | 10.114 | 12.141 | 12.333 | 8.323 | 12.06 | 11.948 | 10.178 | 11.179 | 10.429 | 10.023 | 6.204 | 10.988 | 11.806 | 8.511 | 7.847 | 12.419 | 11.69 | 17.213 | 11.601 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 9.0 | 12.6 | 11.0 | 8.8 | 5.7 | 5.2 | 10.3 | 5.6 | 9.4 | 3.8 | 7.3 | 9.2 | 5.9 | 9.8 | 9.2 | 9.0 | 9.0 | 8.1 | 4.9 | 4.6 |
| d9-9N-Anthracene | 34.4 | 41.8 | 42.6 | 41.5 | 37.9 | 37.7 | 46.2 | 42.2 | 46.4 | 36.3 | 44.7 | 33.4 | 41.4 | 40.8 | 45.4 | 41.4 | 33.4 | 41.0 | 34.4 | 42.0 |
| d9-1N-Pyrene | 54.7 | 61.5 | 67.8 | 60.7 | 59.8 | 62.6 | 65.0 | 63.1 | 69.3 | 59.5 | 66.7 | 49.9 | 63.0 | 51.8 | 73.9 | 57.9 | 55.2 | 65.8 | 49.7 | 63.7 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 28.65 | 40.29 | 28.84 | 23.78 | 19.59 | 22.46 | 44.10 | 29.77 | 44.43 | ND | 30.97 | 35.00 | 22.88 | 24.18 | 49.85 | 33.50 | 85.15 | 91.46 | 42.89 | 39.13 |
| 2N-Naphthalene | 29.82 | 38.97 | 24.96 | 20.11 | 25.20 | 23.55 | 44.53 | 32.73 | 48.35 | ND | 20.19 | 32.50 | 20.65 | 22.22 | 44.14 | 31.48 | 88.84 | 96.86 | 53.36 | 47.35 |
| 2N-Biphenyl | 41.59 | 134.35 | 29.86 | 17.40 | 68.16 | 64.41 | 85.41 | 27.96 | 92.58 | 52.66 | 83.08 | 19.26 | 53.37 | 15.23 | 159.70 | 158.06 | 119.35 | 220.51 | 249.73 | 162.57 |
| 3N-Biphenyl | 13.29 | 22.34 | 10.21 | ND | 13.01 | 11.72 | 12.27 | ND | 10.50 | ND | 9.99 | 8.99 | 12.11 | 9.77 | 17.06 | 11.21 | 13.07 | 14.71 | 15.26 | 20.78 |
| 4N-Biphenyl | 3.72 | ND | ND | ND | 3.12 | 36.75 | 39.97 | ND | ND | ND | ND | ND | ND | ND | 5.21 | 5.00 | 4.03 | 37.79 | 48.49 | 9.68 |
| 1,3-DiN-Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.68 | 0.87 | 0.83 | ND |
| 1,5-DiN-Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 0.33 | ND |
| 5N-Acenaphthalene | 18.86 | 13.46 | 16.27 | 12.83 | 21.37 | 36.30 | 34.38 | 15.35 | 17.84 | 23.10 | 26.24 | 13.69 | 11.66 | 13.33 | 36.47 | 32.49 | 36.07 | 36.16 | 67.91 | 54.10 |
| 2N-Fluorene | ND | ND | 1.56 | ND | ND | ND | ND | ND | ND | ND | 2.82 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 9N-Anthracene | 138.20 | ND | 120.69 | 97.19 | 89.67 | 239.83 | 133.18 | 104.11 | 148.90 | 500.62 | 335.21 | 122.10 | 129.42 | 167.68 | 189.77 | 188.25 | 206.76 | 233.57 | 498.47 | 262.30 |
| 2N-Anthracene | 1.23 | ND | ND | ND | ND | 5.71 | 2.17 | 1.17 | 1.46 | 1.12 | 2.15 | 1.88 | 2.25 | ND | 5.16 | ND | 4.45 | 3.57 | 5.49 | 3.50 |
| 9N-Phenanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | 2.74 | 1.93 | 1.39 | ND | ND | 1.43 | ND | ND | 1.65 | 4.37 | 2.22 |
| 3N-Phenanthrene | 5.51 | 8.64 | 6.53 | 4.38 | 8.97 | 18.76 | 14.74 | 6.77 | 11.06 | 8.59 | 14.61 | 9.45 | 7.78 | 9.83 | 33.82 | 24.44 | 34.95 | 25.71 | 33.16 | 25.57 |
| 4N-Phenanthrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 9.86 | ND | ND | ND | ND | ND | 16.20 | ND | ND |
| 2N-Fluoranthene | 35.08 | 32.72 | 44.56 | 34.49 | 29.63 | 47.21 | 43.79 | 36.38 | 39.60 | 13.87 | 28.00 | 24.21 | 41.36 | 21.64 | 93.06 | 70.29 | 167.61 | 106.21 | 67.73 | 70.06 |
| 3N-Fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1N-Pyrene | 5.64 | ND | 7.47 | 7.18 | 5.24 | 11.47 | 10.30 | ND | 8.56 | ND | ND | 7.47 | 6.60 | ND | 20.33 | 13.48 | 16.16 | 18.00 | 15.56 | 14.79 |
| 2N-Pyrene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 4.63 | ND | ND | ND | ND | ND | 10.61 | ND | ND | 2.99 |
| 6N-Chrysene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |

**Summer 2005**
**NPAH Mass (pg)**

| Sample Name | PBP354 | PBP328 | PBP309 | PBP393 | PBP389 | PBP355 | PBP365 | PBP358 | PBP319 | PBP335 | PBP348 | PBP357 | PBP316 | PBP325 | PBP330 | PBP331 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Residential | Residential | Residential | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway | Highway |
| Date | 7/27/2005 | 7/28/2005 | 7/29/2005 | 7/18/2005 | 7/19/2005 | 7/20/2005 | 7/21/2005 | 7/22/2005 | 7/25/2005 | 7/26/2005 | 7/26/2005 | 7/27/2005 | 7/28/2005 | 7/28/2006 | 7/29/2005 | 7/29/2005 |
| Sampling Time | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM | PM |
| Volume ($m^3$) | 11.561 | 10.779 | 11.245 | 8.28 | 9.596 | 12.2 | 12.224 | 11.068 | 10.57 | 10.332 | 8.174 | 8.937 | 9.74 | 10.379 | 10.13 | 9.911 |
| Surrogate | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery | %recovery |
| d7-1N-Naphthalene | 3.9 | 4.8 | 3.6 | 10.0 | 11.5 | 6.4 | 7.9 | 15.4 | 4.6 | 6.4 | 6.0 | 7.5 | 5.5 | 7.3 | 6.9 | 4.7 |
| d9-9N-Anthracene | 37.7 | 44.9 | 36.9 | 43.2 | 48.9 | 39.4 | 35.2 | 40.4 | 32.3 | 45.3 | 39.8 | 46.7 | 38.7 | 48.2 | 41.6 | 29.6 |
| d9-1N-Pyrene | 58.7 | 60.5 | 57.3 | 66.4 | 60.3 | 57.9 | 58.9 | 63.1 | 49.4 | 68.6 | 58.9 | 65.3 | 55.1 | 62.2 | 56.4 | 48.3 |
| NPAH Compounds | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) | mass(pg) |
| 1N-Naphthalene | 28.36 | 20.96 | 26.11 | 36.34 | 52.39 | 55.94 | 63.50 | 157.92 | 29.52 | 38.12 | 36.16 | 54.08 | 38.09 | 48.26 | 43.93 | 28.25 |
| 2N-Naphthalene | 33.66 | 21.60 | 24.69 | 28.31 | 39.27 | 52.18 | 58.39 | 144.62 | 31.69 | 39.30 | 37.52 | 53.36 | 30.82 | 40.84 | 36.37 | 20.73 |
| 2N-Biphenyl | 66.67 | 65.20 | 89.67 | 55.60 | 23.45 | 26.28 | 84.49 | 100.04 | 87.04 | 86.01 | 54.97 | 81.04 | 21.72 | 26.86 | 11.80 | ND |
| 3N-Biphenyl | 8.96 | 11.99 | 11.24 | 13.60 | 13.42 | 15.32 | 17.43 | 19.74 | 26.17 | 19.40 | 13.88 | 14.57 | 18.87 | 16.06 | 12.42 | 8.49 |
| 4N-Biphenyl | 3.32 | ND | ND | 3.50 | ND | 2.93 | 3.09 | 6.28 | 75.68 | ND | ND | 6.97 | 5.95 | ND | 2.85 | ND |
| 1,3-DiN-Naphthalene | ND | ND | 0.85 | ND | 1.20 | ND | ND | 2.22 | ND | ND | ND | ND | ND | 0.99 | ND | ND |
| 1,5-DiN-Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 5N-Acenaphthalene | 28.01 | 17.76 | 21.45 | 8.66 | 14.76 | 25.31 | 37.73 | 31.76 | 32.66 | 15.10 | 21.66 | 19.59 | 13.25 | 6.74 | 16.60 | 10.19 |
| 2N-Fluorene | ND | 1.56 | ND | ND | ND | 1.93 | ND | ND | ND | ND | ND | ND | ND | 1.76 | 5.11 | 3.93 |
| 9N-Anthracene | 312.95 | 196.92 | 215.57 | 71.79 | 67.03 | 144.52 | 233.73 | 209.86 | 468.73 | 387.41 | 276.43 | 301.48 | 163.17 | 199.20 | 171.35 | 126.83 |
| 2N-Anthracene | 3.37 | 5.26 | 1.92 | 0.93 | ND | 2.60 | 4.34 | 1.05 | 1.63 | 1.89 | ND | 3.64 | 1.08 | 6.62 | ND | ND |
| 9N-Phenanthrene | 5.41 | 4.92 | 2.00 | 5.28 | 10.77 | 12.41 | 8.86 | 10.02 | 5.92 | 9.89 | ND | 4.92 | 13.83 | 17.56 | 7.78 | 6.00 |
| 3N-Phenanthrene | 24.10 | 20.89 | 22.25 | 8.02 | 9.73 | 17.50 | 21.97 | 29.96 | 14.88 | 20.80 | 11.89 | 18.58 | 15.49 | 18.65 | 11.52 | 9.27 |
| 4N-Phenanthrene | ND | 75.33 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 8.62 | ND |
| 2N-Fluoranthene | 58.06 | 121.62 | 70.25 | 18.01 | 40.28 | 66.87 | 68.08 | 70.33 | 27.81 | 48.77 | 34.39 | 59.71 | 76.06 | 87.31 | 30.93 | 25.74 |
| 3N-Fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1N-Pyrene | 10.69 | 17.00 | 26.64 | 22.08 | 37.15 | 58.21 | 44.55 | 43.17 | 28.61 | 33.57 | 23.02 | 20.23 | 54.92 | 60.77 | 29.89 | 29.29 |
| 2N-Pyrene | ND | 7.53 | 3.90 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 6N-Chrysene | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 12.78 | ND |

# Appendix D: Comparison of Parallel Samples Between CBL and HSPH (Field Blanks and Samples)

| **Summer 2005** | **PAH** | | | **NPAH** | |
|---|---|---|---|---|---|
| | HSPH | CBL | | HSPH | CBL |
| | **Field Blank** | | | **Field Blank** | |
| | PUF/XAD/PUF | PUF | | PUF/XAD/PUF | PUF |
| | method detection limit (ng/m3) | | | method detection limit (pg/m3) | |
| Napthalene | 0.19 | 6.01 | 1N-Naphthalene | 0.03 | 0.14 |
| 2-Methylnapthalene | 0.13 | 4.14 | 2N-Naphthalene | 0.03 | 0.14 |
| Azulene | 0.00 | 0.16 | 2N-Biphenyl | 0.02 | 0.15 |
| 1-Methylnapthalene | 0.06 | 1.71 | 3N-Biphenyl | 0.02 | 0.03 |
| Biphenyl | 0.02 | 0.69 | 4N-Biphenyl | 0.01 | 0.04 |
| 2,7-Dimethylnapthalene | 0.06 | 0.63 | 1,3-DiN-Naphthalene | 0.00 | 0.01 |
| 1,3-Dimethylnapthalene | 0.05 | 1.43 | 1,5-DiN-Naphthalene | 0.00 | 0.00 |
| 1,6-Dimethylnapthalene | 0.04 | 0.87 | 5N-Acenaphthalene | 0.01 | 0.02 |
| 1,4-Dimethylnapthalene | 0.01 | 0.34 | 2N-Fluorene | 0.00 | 0.01 |
| 1,5-Dimethylnapthalene | 0.01 | 0.15 | 9N-Anthracene | 0.10 | 0.13 |
| Acenapthylene | 0.00 | 0.12 | 2N-Anthracene | 0.00 | 0.00 |
| 1,2-Dimethylnapthalene | 0.01 | 0.23 | 9N-Phenanthrene | 0.00 | 0.00 |
| 1,8-Dimethylnapthalene | 0.01 | 0.07 | 3N-Phenanthrene | 0.01 | 0.01 |
| Acenapthene | 0.02 | 1.01 | 4N-Phenanthrene | 0.02 | 0.01 |
| 2,3,5-Trimethylnapthalene | 0.01 | 0.41 | 2N-Fluoranthene | 0.01 | 0.01 |
| Fluorene | 0.03 | 1.54 | 3N-Fluoranthene | 0.00 | 0.00 |
| 1-Methylfuorene | 0.01 | 0.20 | 1N-Pyrene | 0.01 | 0.02 |
| Dibenzothiophene | 0.00 | 0.29 | 2N-Pyrene | 0.01 | 0.04 |
| Phenanthrene | 0.05 | 2.84 | 6N-Chrysene | 0.02 | 0.01 |
| Anthracene | 0.01 | 0.12 | | | |
| 2-Methyldibenzothiophene | 0.00 | 0.16 | | | |
| 4-Methyldibenzothiophene | 0.00 | 0.10 | | | |
| 2-Methylphenanthrene | 0.00 | 0.36 | | | |
| 2-Methylanthracene | 0.01 | 0.51 | | | |
| 4,5-Methylenephenanthrene | 0.00 | 0.03 | | | |
| 1-Methylanthracene | 0.00 | 0.28 | | | |
| 1-Methylphenanthrene | 0.00 | 0.24 | | | |
| 9-Methylanthracene | 0.00 | 0.01 | | | |
| 9,10-Dimethylanthracene | 0.00 | 0.12 | | | |
| Fluoranthene | 0.01 | 2.58 | | | |
| Pyrene | 0.01 | 1.87 | | | |
| 3,6-Dimethylphenanthrene | 0.00 | 0.11 | | | |
| Benzo-a-fluorene | 0.00 | 0.13 | | | |
| Retene | 0.00 | 0.25 | | | |
| Benzo-b-fluorene | 0.00 | 0.11 | | | |
| Cyclopent-ac,d-pyrene | 0.00 | 0.11 | | | |
| Benz-a-anthracene | 0.00 | 0.31 | | | |
| Chrysene+Triphenylene | 0.00 | 0.56 | | | |
| Napthacene | 0.00 | 0.07 | | | |
| 4-Methylchrysene | 0.00 | 0.02 | | | |
| Benzo-b-fluoranthene | 0.00 | 0.64 | | | |
| Benzo-k-fluoranthene | 0.00 | 0.20 | | | |
| Dimethylbenz-a-anthracene | 0.00 | 0.01 | | | |
| Benzo-e-pyrene | 0.00 | 0.28 | | | |
| Benzo-a-pyrene | 0.00 | 0.40 | | | |
| Perylene | 0.00 | 0.14 | | | |
| 3-Methylchloanthrene | 0.00 | 0.02 | | | |
| Indeno-1,2,3-c,d-pyrene | 0.00 | 0.34 | | | |
| Dibenz-a,h+ac-anthracene | 0.00 | 0.02 | | | |
| Benzo-g,h,i-perylene | 0.00 | 0.31 | | | |
| Anthranthrene | 0.00 | 0.04 | | | |
| Corenene | 0.00 | 0.06 | | | |

| **PAH** | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Marina | | | Marina | | | Marina | | | Marina | | | Residential | | | Residential | | |
| Sampling Method | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | |
| Date | 7/20/2006 | | | 7/21/2006 | | | 7/22/2006 | | | 7/23/2006 | | | 7/20/2006 | | | 7/22/2006 | | |
| | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** |
| 2,3,5-Trimethylnapthalene | ND | 0.08 | **NA** | ND | 0.03 | **NA** | ND | 0.06 | **NA** | ND | 0.05 | **NA** | 1.59 | 0.09 | **18.52** | 0.93 | 0.09 | **10.09** |
| Fluorene | 19.07 | 5.61 | **3.40** | 4.56 | 0.38 | **11.90** | 4.26 | 0.19 | **22.83** | 3.57 | 0.18 | **19.97** | 18.01 | 2.61 | **6.90** | 9.88 | 1.79 | **5.51** |
| 1-Methylfluorene | 0.98 | 0.31 | **3.16** | 0.40 | 0.09 | **4.22** | ND | 0.08 | **NA** | 0.39 | 0.06 | **6.07** | 1.09 | 0.31 | **3.47** | 1.04 | 0.27 | **3.82** |
| Dibenzothiophene | 4.14 | 2.36 | **1.75** | 1.24 | 0.34 | **3.67** | 0.56 | 0.14 | **3.91** | 0.95 | 0.09 | **10.01** | 6.57 | 5.33 | **1.23** | 4.18 | 3.44 | **1.22** |
| Phenanthrene | 58.60 | 12.42 | **4.72** | 18.99 | 5.91 | **3.21** | 6.44 | 1.62 | **3.98** | 12.26 | 0.97 | **12.63** | 117.89 | 18.29 | **6.44** | 69.29 | 19.69 | **3.52** |
| Anthracene | 3.39 | 2.03 | **1.67** | 1.30 | 0.32 | **4.02** | ND | 0.09 | **NA** | 0.88 | 0.06 | **13.81** | 10.49 | 7.22 | **1.45** | 4.78 | 3.88 | **1.23** |
| 2-Methyldibenzothiophene | 0.83 | 0.34 | **2.45** | 0.31 | 0.20 | **1.55** | 0.16 | 0.13 | **1.30** | 0.40 | 0.09 | **4.32** | 0.92 | 1.03 | **0.89** | 0.78 | 0.69 | **1.12** |
| 4-Methyldibenzothiophene | 0.70 | 0.28 | **2.48** | 0.24 | 0.15 | **1.60** | 0.12 | 0.08 | **1.42** | 0.26 | 0.06 | **4.57** | 0.77 | 1.10 | **0.70** | 0.58 | 0.68 | **0.85** |
| 2-Methylphenanthrene | 2.41 | 1.46 | **1.65** | 1.42 | 0.79 | **1.80** | 0.39 | 0.24 | **1.65** | 1.03 | 0.18 | **5.80** | 4.53 | 6.05 | **0.75** | 3.38 | 3.68 | **0.92** |
| 2-Methylanthracene | 3.41 | 2.00 | **1.71** | 2.23 | 1.13 | **1.98** | 0.56 | 0.32 | **1.74** | 1.37 | 0.23 | **5.84** | 6.97 | 8.76 | **0.80** | 5.22 | 5.46 | **0.96** |
| 4,5-Methylenephenanthrene | 0.18 | 0.01 | **16.65** | 0.22 | 0.01 | **20.69** | 0.10 | 0.01 | **13.41** | 0.18 | 0.01 | **22.09** | 0.22 | 0.05 | **4.73** | 0.41 | 0.03 | **14.78** |
| 1-Methylanthracene | 1.24 | 0.63 | **1.97** | 0.77 | 0.52 | **1.48** | 0.23 | 0.18 | **1.25** | 0.66 | 0.15 | **4.38** | 1.94 | 2.69 | **0.72** | 1.60 | 1.65 | **0.97** |
| 1-Methylphenanthrene | 1.12 | 0.49 | **2.30** | 0.71 | 0.31 | **2.31** | 0.17 | 0.10 | **1.66** | 0.54 | 0.08 | **6.55** | 1.98 | 2.53 | **0.78** | 1.57 | 1.48 | **1.06** |
| 9-Methylanthracene | 0.05 | 0.01 | **8.32** | ND | 0.01 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.01 | **NA** |
| 9,10-Dimethylanthracene | 0.24 | 0.15 | **1.64** | 0.24 | 0.20 | **1.21** | 0.06 | 0.06 | **1.02** | 0.14 | 0.05 | **2.66** | 0.28 | 0.69 | **0.40** | 0.23 | 0.40 | **0.59** |
| Fluoranthene | 8.17 | 7.04 | **1.16** | 27.43 | 2.76 | **9.95** | 2.92 | 0.63 | **4.66** | 3.13 | 0.53 | **5.90** | 43.39 | 20.46 | **2.12** | 24.05 | 17.67 | **1.36** |
| Pyrene | 3.62 | 3.76 | **0.96** | 11.66 | 1.19 | **9.81** | 1.37 | 0.32 | **4.22** | 1.76 | 0.29 | **6.10** | 17.61 | 15.37 | **1.15** | 9.27 | 13.41 | **0.69** |
| 3,6-Dimethylphenanthrene | ND | 0.02 | **NA** | ND | 0.03 | **NA** | 0.03 | 0.01 | **2.22** | ND | 0.00 | **NA** | 0.03 | 0.07 | **0.37** | ND | 0.05 | **NA** |
| Benzo[a]fluorene | 0.12 | 0.08 | **1.50** | 0.15 | 0.04 | **3.24** | 0.04 | 0.02 | **1.70** | 0.07 | 0.03 | **2.64** | 0.22 | 0.69 | **0.32** | 0.13 | 0.52 | **0.24** |
| Retene | 0.23 | 0.04 | **5.93** | 0.15 | 0.04 | **3.38** | ND | 0.04 | **NA** | 0.13 | 0.04 | **3.31** | 0.09 | 0.17 | **0.55** | 0.10 | 0.13 | **0.74** |
| Benzo[b]fluorene | 0.09 | 0.06 | **1.47** | 0.11 | 0.04 | **3.17** | 0.04 | 0.02 | **2.02** | 0.06 | 0.02 | **3.06** | 0.15 | 0.44 | **0.33** | 0.07 | 0.21 | **0.33** |
| Cyclopenta(c,d)pyrene | 0.11 | 0.02 | **6.94** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | 0.04 | 0.20 | **0.18** | ND | 0.14 | **NA** |
| Benz[a]anthracene | 0.07 | 0.03 | **2.69** | 0.03 | 0.02 | **1.70** | ND | 0.02 | **NA** | ND | 0.01 | **NA** | 0.11 | 0.47 | **0.25** | 0.06 | 0.33 | **0.19** |
| Chryene+Triphenylene | 0.14 | 0.11 | **1.25** | 0.14 | 0.05 | **2.75** | ND | 0.04 | **NA** | 0.08 | 0.04 | **2.09** | 0.65 | 2.77 | **0.23** | 0.27 | 1.50 | **0.18** |
| Napthacene | 0.03 | 0.00 | **7.02** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.03 | **NA** | ND | 0.05 | **NA** |
| 4-Methylchrysene | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** |
| Benzo[b]fluoranthene | 0.12 | 0.06 | **1.87** | 0.05 | 0.04 | **1.14** | 0.04 | 0.04 | **1.20** | 0.03 | 0.04 | **0.89** | 0.21 | 0.79 | **0.26** | 0.09 | 0.79 | **0.11** |
| Benzo[k]fluoranthene | ND | 0.02 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | 0.10 | 0.19 | **0.53** | ND | 0.24 | **NA** |
| Dimethylbenz[a]anthracene | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.01 | **NA** |
| Benzo[e]pyrene | 0.08 | 0.03 | **2.84** | ND | 0.02 | **NA** | ND | 0.02 | **NA** | ND | 0.01 | **NA** | 0.10 | 0.26 | **0.39** | 0.05 | 0.30 | **0.16** |
| Benzo[a]pyrene | 0.11 | 0.02 | **4.64** | ND | 0.02 | **NA** | ND | 0.02 | **NA** | ND | 0.02 | **NA** | ND | 0.22 | **NA** | ND | 0.31 | **NA** |
| Perylene | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.04 | **NA** | ND | 0.06 | **NA** |
| 3-Methylcholanthrene | ND | ND | **NA** | ND | ND | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** |
| Indone[1,2,3-cd]pyrene | 0.15 | 0.04 | **3.49** | 0.07 | 0.03 | **2.61** | ND | 0.02 | **NA** | ND | 0.02 | **NA** | 0.11 | 0.36 | **0.31** | ND | 0.49 | **NA** |
| Dibenz[a,h+a,c]anthracene | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.01 | **NA** | ND | 0.02 | **NA** | ND | 0.04 | **NA** |
| Benzo[g,h,i]perylene | 0.09 | 0.04 | **2.33** | ND | 0.02 | **NA** | 0.04 | 0.02 | **2.05** | 0.05 | 0.02 | **2.68** | 0.09 | 0.27 | **0.33** | 0.05 | 0.37 | **0.14** |
| Anthranthene | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.04 | **NA** | ND | 0.06 | **NA** |
| Corenene | ND | 0.02 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.10 | **NA** | ND | 0.13 | **NA** |
| sum | 114.75 | 39.58 | **2.90** | 74.07 | 14.74 | **5.02** | 17.75 | 4.55 | **3.90** | 28.07 | 3.40 | **8.26** | 291.69 | 99.75 | **2.92** | 166.07 | 80.05 | **2.07** |
| | | | | | | | | | | | | | | | | | | |
| *paired t-test* | | *P value* | *0.14938* | | *P value* | *0.05472* | | *P value* | *0.05581* | | *P value* | ***0.04491*** | | *P value* | *0.19132* | | *P value* | *0.68000* |

| **PAH** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Residential | | | Highway | | | Highway | | | Highway | | | Highway | | |
| Sampling Method | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | |
| Date | 7/23/2006 | | | 7/20/2006 | | | 7/21/2006 | | | 7/22/2006 | | | 7/23/2006 | | |
| | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** | Concentration (ng/m3) | | **Ratio** |
| 2,3,5-Trimethylnapthalene | ND | 0.08 | **NA** | 1.33 | 0.20 | **6.56** | 1.49 | 0.19 | **7.98** | 1.70 | 0.27 | **6.35** | 1.65 | 0.23 | **7.20** |
| Fluorene | 4.19 | 1.94 | **2.16** | 4.40 | 1.11 | **3.98** | 5.17 | 0.48 | **10.81** | 10.35 | 1.79 | **5.78** | 7.07 | 1.20 | **5.88** |
| 1-Methylfluorene | 0.66 | 0.30 | **2.18** | 0.83 | 0.61 | **1.36** | 1.13 | 0.42 | **2.67** | 1.27 | 0.76 | **1.66** | 1.39 | 0.73 | **1.91** |
| Dibenzothiophene | 3.43 | 4.12 | **0.83** | 0.80 | 1.06 | **0.76** | 1.74 | 0.35 | **4.93** | 1.83 | 1.11 | **1.64** | 2.25 | 0.87 | **2.58** |
| Phenanthrene | 61.06 | 23.94 | **2.55** | 13.86 | 14.50 | **0.96** | 27.57 | 5.63 | **4.90** | 25.87 | 16.16 | **1.60** | 30.18 | 11.83 | **2.55** |
| Anthracene | 3.78 | 5.10 | **0.74** | 1.29 | 1.93 | **0.67** | 1.96 | 0.60 | **3.28** | 2.74 | 2.17 | **1.26** | 2.45 | 1.13 | **2.17** |
| 2-Methyldibenzothiophene | 0.80 | 0.85 | **0.94** | 0.45 | 0.67 | **0.67** | 0.72 | 0.43 | **1.66** | 0.60 | 0.52 | **1.15** | 1.05 | 0.66 | **1.60** |
| 4-Methyldibenzothiophene | 0.55 | 0.89 | **0.61** | 0.31 | 0.40 | **0.77** | 0.44 | 0.25 | **1.76** | 0.36 | 0.28 | **1.25** | 0.67 | 0.40 | **1.71** |
| 2-Methylphenanthrene | 3.22 | 4.95 | **0.65** | 1.54 | 2.03 | **0.76** | 2.74 | 1.44 | **1.90** | 1.89 | 1.42 | **1.34** | 3.05 | 1.54 | **1.98** |
| 2-Methylanthracene | 4.30 | 7.49 | **0.57** | 2.19 | 2.61 | **0.84** | 4.12 | 1.87 | **2.20** | 2.89 | 1.88 | **1.53** | 4.03 | 2.02 | **1.99** |
| 4,5-Methylenephenanthrene | 0.17 | 0.04 | **4.57** | 0.13 | 0.02 | **5.46** | 0.27 | 0.01 | **18.50** | 0.24 | 0.03 | **8.44** | 0.34 | 0.03 | **12.86** |
| 1-Methylanthracene | 1.41 | 2.23 | **0.63** | 0.84 | 1.22 | **0.69** | 1.53 | 0.92 | **1.65** | 1.09 | 0.85 | **1.28** | 1.78 | 0.98 | **1.82** |
| 1-Methylphenanthrene | 1.36 | 2.07 | **0.66** | 0.66 | 0.79 | **0.83** | 1.31 | 0.57 | **2.28** | 0.91 | 0.58 | **1.56** | 1.31 | 0.61 | **2.14** |
| 9-Methylanthracene | 0.02 | 0.01 | **1.70** | ND | 0.01 | **NA** | 0.04 | 0.01 | **4.48** | ND | 0.02 | **NA** | ND | 0.02 | **NA** |
| 9,10-Dimethylanthracene | 0.24 | 0.55 | **0.43** | 0.24 | 0.41 | **0.58** | 0.30 | 0.35 | **0.86** | 0.24 | 0.27 | **0.88** | 0.35 | 0.29 | **1.18** |
| Fluoranthene | 26.65 | 24.50 | **1.09** | 4.12 | 6.45 | **0.64** | 22.67 | 2.49 | **9.11** | 11.42 | 4.50 | **2.54** | 6.78 | 3.80 | **1.78** |
| Pyrene | 10.51 | 18.63 | **0.56** | 2.38 | 3.77 | **0.63** | 9.62 | 1.73 | **5.56** | 5.50 | 2.89 | **1.90** | 3.39 | 2.67 | **1.27** |
| 3,6-Dimethylphenanthrene | 0.03 | 0.07 | **0.45** | 0.02 | 0.07 | **0.33** | ND | 0.10 | **NA** | 0.04 | 0.08 | **0.54** | 0.03 | 0.07 | **0.40** |
| Benzo[a]fluorene | 0.13 | 0.50 | **0.26** | 0.07 | 0.12 | **0.59** | 0.10 | 0.08 | **1.31** | 0.09 | 0.13 | **0.66** | 0.13 | 0.17 | **0.81** |
| Retene | 0.11 | 0.14 | **0.74** | 0.11 | 0.09 | **1.25** | 0.09 | 0.08 | **1.17** | 0.11 | 0.09 | **1.32** | 0.13 | 0.09 | **1.33** |
| Benzo[b]fluorene | 0.09 | 0.32 | **0.27** | 0.06 | 0.11 | **0.60** | 0.08 | 0.07 | **1.13** | 0.10 | 0.13 | **0.83** | 0.08 | 0.15 | **0.53** |
| Cyclopenta(c,d)pyrene | ND | 0.22 | **NA** | ND | 0.07 | **NA** | ND | 0.06 | **NA** | 0.04 | 0.11 | **0.35** | ND | 0.20 | **NA** |
| Benz[a]anthracene | 0.06 | 0.53 | **0.12** | 0.06 | 0.15 | **0.43** | 0.05 | 0.12 | **0.38** | 0.08 | 0.27 | **0.28** | 0.06 | 0.52 | **0.11** |
| Chryene+Triphenylene | 0.29 | 2.68 | **0.11** | 0.09 | 0.24 | **0.39** | 0.13 | 0.18 | **0.73** | 0.11 | 0.33 | **0.35** | 0.09 | 0.51 | **0.18** |
| Napthacene | ND | 0.08 | **NA** | ND | 0.03 | **NA** | ND | 0.02 | **NA** | ND | 0.05 | **NA** | ND | 0.11 | **NA** |
| 4-Methylchrysene | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.02 | **NA** |
| Benzo[b]fluoranthene | 0.06 | 1.41 | **0.04** | 0.11 | 0.25 | **0.45** | 0.04 | 0.23 | **0.16** | 0.08 | 0.42 | **0.19** | 0.05 | 0.82 | **0.06** |
| Benzo[k]fluoranthene | ND | 0.46 | **NA** | 0.04 | 0.07 | **0.60** | ND | 0.07 | **NA** | ND | 0.15 | **NA** | ND | 0.29 | **NA** |
| Dimethylbenz[a]anthracene | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** |
| Benzo[e]pyrene | 0.04 | 0.53 | **0.08** | 0.09 | 0.10 | **0.85** | ND | 0.10 | **NA** | 0.05 | 0.18 | **0.30** | 0.06 | 0.34 | **0.16** |
| Benzo[a]pyrene | 0.05 | 0.53 | **0.09** | 0.06 | 0.13 | **0.46** | ND | 0.13 | **NA** | 0.10 | 0.26 | **0.36** | ND | 0.56 | **NA** |
| Perylene | ND | 0.11 | **NA** | ND | 0.02 | **NA** | ND | 0.02 | **NA** | ND | 0.05 | **NA** | ND | 0.11 | **NA** |
| 3-Methylcholanthrene | ND | 0.01 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.00 | **NA** | ND | 0.01 | **NA** |
| Indone[1,2,3-cd]pyrene | 0.07 | 0.86 | **0.08** | ND | 0.16 | **NA** | ND | 0.14 | **NA** | 0.06 | 0.30 | **0.21** | ND | 0.58 | **NA** |
| Dibenz[a,h+a,c]anthracene | ND | 0.07 | **NA** | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | 0.03 | **NA** | ND | 0.06 | **NA** |
| Benzo[g,h,i]perylene | 0.04 | 0.63 | **0.06** | 0.08 | 0.15 | **0.55** | 0.09 | 0.15 | **0.65** | 0.08 | 0.26 | **0.31** | 0.09 | 0.45 | **0.19** |
| Anthranthene | ND | 0.09 | **NA** | ND | 0.02 | **NA** | ND | 0.02 | **NA** | ND | 0.05 | **NA** | ND | 0.10 | **NA** |
| Corenene | ND | 0.20 | **NA** | ND | 0.06 | **NA** | ND | 0.06 | **NA** | ND | 0.10 | **NA** | ND | 0.15 | **NA** |
| sum | 124.22 | 107.13 | **1.16** | 71.69 | 39.65 | **1.81** | 101.95 | 19.41 | **5.25** | 114.81 | 38.53 | **2.98** | 92.26 | 34.34 | **2.69** |
| | | | | | | | | | | | | | | | |
| *paired t-test* | | *P value* | *0.45938* | | *P value* | ***0.03996*** | | *P value* | ***0.03592*** | | *P value* | ***0.04039*** | | *P value* | ***0.01499*** |

| **NPAH** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Site | Marina | | | Marina | | | Marina | | | Marina | | |
| Sampling Method | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | | HSPH | CBL | |
| Date | 7/20/2006 | | | 7/21/2006 | | | 7/22/2006 | | | 7/23/2006 | | |
| | Concentration (pg/m3) | | **Ratio** | Concentration (pg/m3) | | **Ratio** | Concentration (pg/m3) | | **Ratio** | Concentration (pg/m3) | | **Ratio** |
| 1N-Naphthalene | 41.34 | 6.32 | **6.54** | 35.66 | 1.94 | **18.37** | 52.17 | 6.11 | **8.54** | ND | 2.34 | **NA** |
| 2N-Naphthalene | 53.15 | 15.36 | **3.46** | 37.40 | 5.52 | **6.78** | 57.36 | 16.41 | **3.50** | ND | 5.15 | **NA** |
| 2N-Biphenyl | 143.79 | 1.76 | **81.76** | 102.27 | 1.21 | **84.54** | 48.99 | 1.18 | **41.54** | 134.18 | 1.24 | **108.04** |
| 3N-Biphenyl | 27.45 | 2.38 | **11.53** | 18.62 | 1.93 | **9.66** | ND | 1.52 | **NA** | ND | 1.84 | **NA** |
| 4N-Biphenyl | 6.58 | 0.71 | **9.22** | 58.35 | 0.69 | **84.53** | ND | 0.76 | **NA** | ND | 0.32 | **NA** |
| 1,3-DiN-Naphthalene | ND | 0.12 | **NA** | ND | 0.09 | **NA** | ND | 0.10 | **NA** | ND | 0.04 | **NA** |
| 1,5-DiN-Naphthalene | ND | ND | **NA** | ND | ND | **NA** | ND | 0.01 | **NA** | ND | ND | **NA** |
| 5N-Acenaphthalene | 45.07 | 1.27 | **35.55** | 57.64 | 3.45 | **16.70** | 26.90 | 1.39 | **19.36** | 58.86 | 1.55 | **38.09** |
| 2N-Fluorene | ND | 0.04 | **NA** | ND | 0.03 | **NA** | ND | 0.03 | **NA** | ND | ND | **NA** |
| 9N-Anthracene | 28.41 | 9.45 | **3.01** | 52.71 | 10.04 | **5.25** | 24.25 | 6.04 | **4.01** | 132.10 | 2.13 | **62.07** |
| 2N-Anthracene | ND | 0.35 | **NA** | 1.26 | 0.37 | **3.42** | 0.27 | 0.15 | **1.79** | 0.29 | 0.06 | **4.81** |
| 9N-Phenanthrene | ND | 0.61 | **NA** | ND | 0.40 | **NA** | ND | 0.37 | **NA** | 0.72 | 0.11 | **6.80** |
| 3N-Phenanthrene | 2.84 | 2.96 | **0.96** | 4.12 | 3.32 | **1.24** | 1.58 | 1.54 | **1.03** | 2.27 | 0.79 | **2.89** |
| 4N-Phenanthrene | ND | 0.33 | **NA** | ND | 0.08 | **NA** | ND | 0.07 | **NA** | ND | 0.16 | **NA** |
| 2N-Fluoranthene | 5.96 | 13.84 | **0.43** | 6.25 | 7.92 | **0.79** | 5.66 | 9.16 | **0.62** | 2.23 | 2.91 | **0.77** |
| 3N-Fluoranthene | ND | 0.01 | **NA** | ND | 0.01 | **NA** | ND | ND | **NA** | ND | ND | **NA** |
| 1N-Pyrene | 1.05 | 1.05 | **1.00** | 1.52 | 1.21 | **1.26** | ND | 0.74 | **NA** | ND | 0.27 | **NA** |
| 2N-Pyrene | ND | 0.21 | **NA** | ND | ND | **NA** | ND | ND | **NA** | ND | ND | **NA** |
| 6N-Chrysene | ND | ND | **NA** | ND | ND | **NA** | ND | 0.01 | **NA** | ND | ND | **NA** |
| sum | 355.65 | 56.77 | **6.26** | 375.80 | 38.20 | **9.84** | 217.19 | 45.59 | **4.76** | 330.65 | 18.90 | **17.50** |
| | | | | | | | | | | | | |
| *paired t-test* | | *P value* | *0.06068* | | *P value* | ***0.01443*** | | *P value* | ***0.03755*** | | *P value* | *0.11099* |

# Appendix E: Ambient Data in Buffalo, NY

| Date | Pariculate Matter (ug/m$^3$) | | | Black Carbon (ug/m$^3$) | | | Wind Direction (0 degree = N) | Wind Velocity (miles/h) | Ambient Temperature (F) | Humidity (%) | Traffic Count on the Peace Bridge | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Marina | Residential | Highway | Marina | Residential | Highway | Marina | Marina | Marina | Marina | Truck | Auto |
| 1/11/2005 | 11.14 | | 10.02 | 1.14 | 0.00 | 1.36 | 65 | 8 | 29 | 84 | 248 | 562 |
| 1/12/2005 | 8.66 | 10.35 | 10.73 | 1.58 | 1.62 | 2.48 | 167 | 7 | 44 | 92 | 262 | 635 |
| 1/13/2005 | 10.77 | 10.75 | 12.03 | 0.54 | 1.03 | 2.10 | 188 | 16 | 53 | 71 | 249 | 690 |
| 1/14/2005 | 5.90 | 5.60 | 6.59 | 0.41 | 0.47 | 1.10 | 308 | 0 | 24 | 68 | 207 | 738 |
| 1/15/2005 | 4.36 | 6.15 | 5.07 | 0.14 | 0.38 | 0.66 | 295 | 13 | 19 | 61 | 70 | 758 |
| 7/18/2005 | 43.86 | 61.54 | 55.50 | 0.63 | 1.42 | 2.64 | 222 | 10 | 78 | 85 | 205 | 1234 |
| 7/19/2005 | 14.52 | 16.85 | 18.54 | 0.44 | 1.11 | 2.18 | 243 | 16 | 76 | 85 | 228 | 1176 |
| 7/20/2005 | 10.62 | 10.87 | 12.04 | 0.53 | 0.78 | 2.56 | 234 | 7 | 75 | 65 | 253 | 1253 |
| 7/21/2005 | 16.05 | 16.28 | 19.49 | 0.55 | 0.90 | 2.70 | 225 | 11 | 75 | 85 | 231 | 1269 |
| 7/22/2005 | 12.08 | 12.74 | 14.95 | 0.30 | 0.97 | 2.22 | 241 | 11 | 75 | 75 | 206 | 1389 |
| 7/23/2005 | | | | | | | | | | | | |
| 7/24/2005 | | | | | | | | | | | | |
| 7/25/2005 | 27.44 | 27.34 | 28.17 | 0.40 | 0.88 | 2.43 | 247 | 15 | 77 | 86 | 204 | 1226 |
| 7/26/2005 | 22.32 | 23.55 | 25.51 | 0.61 | 0.88 | 2.53 | 230 | 15 | 78 | 78 | 239 | 1163 |
| 7/27/2005 | 7.49 | 6.26 | 8.50 | 1.14 | 0.59 | 1.08 | 123 | 3 | 67 | 80 | 244 | 1164 |
| 7/28/2005 | 8.35 | 7.53 | 10.59 | 0.48 | 0.74 | 2.41 | 228 | 7 | 71 | 58 | 232 | 1291 |
| 7/29/2005 | 14.18 | 11.68 | 15.76 | 0.43 | 0.87 | 2.91 | 244 | 13 | 72 | 68 | 234 | 1518 |
| 1/9/2006 | 15.95 | 18.33 | 18.81 | 0.31 | 1.23 | 1.27 | 262 | 15 | 36 | 83 | 221 | 607 |
| 1/10/2006 | 6.07 | 7.65 | 9.49 | 0.42 | 0.89 | 1.73 | 246 | 6 | 34 | 72 | 273 | 587 |
| 1/11/2006 | 15.00 | 16.66 | 20.97 | 0.75 | 1.07 | 2.83 | 210 | 9 | 44 | 80 | 281 | 609 |
| 1/12/2006 | 9.15 | 9.40 | 12.91 | 0.59 | 0.73 | 2.00 | 215 | 12 | 41 | 72 | 270 | 740 |
| 1/13/2006 | 12.77 | 12.71 | 12.86 | 1.55 | 1.38 | 3.12 | 185 | 4 | 50 | 61 | 215 | 845 |
| 1/14/2006 | | | | | | | | | | | | |
| 1/15/2006 | | | | | | | | | | | | |
| 1/16/2006 | 4.29 | 3.94 | 4.38 | 0.64 | 0.72 | 0.74 | 72 | 6 | 21 | 52 | 219 | 655 |
| 1/17/2006 | 15.18 | 14.07 | 16.12 | 1.60 | 1.25 | 1.66 | 87 | 8 | 37 | 65 | 256 | 559 |
| 1/18/2006 | 6.60 | 7.23 | 7.79 | 0.11 | 0.31 | 0.79 | 256 | 28 | 32 | 91 | 261 | 441 |
| 1/19/2006 | 11.56 | 12.19 | 15.89 | 1.03 | 1.19 | 2.67 | 189 | 4 | 38 | 62 | 262 | 638 |
| 1/20/2006 | 9.19 | 9.34 | 11.35 | 0.58 | 1.02 | 2.00 | 238 | 9 | 43 | 78 | 211 | 843 |

# Appendix F: Positive Matrix Factorization. Parameters, Q-values, and model fit ($r^2$)

**PAH Diurnal PMF**

**Number of random starting points: 30**
**Number of factors: 4**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 5.00**
**Species included:**
2,3,5-Trimethylnapth,Fluorene,1-Methylfluorene,Dibenzothiophene,
Phenanthrene,Anthracene,2-Methyldibenzothiop,4-Methyldibenzothiop,
2-Methylphenanthrene,2-Methylanthracene,4,5-Methylenephenant,1-Methylanthracene,
1-Methylphenanthrene,9-Methylanthracene,9,10-Dimethylanthrac,Fluoranthene,
Pyrene,3,6-Dimethylphenanth,Benzo[a]fluorene,Retene,
Benzo[b]fluorene,Cyclopenta(c,d)pyren,Benz[a]anthracene,Chryene+Triphenylene,
Napthacene,4-Methylchrysene,Benzo[b]fluoranthene,Benzo[k]fluoranthene,
Dimethylbenz[a]anthr,Benzo[e]pyrene,Benzo[a]pyrene,Perylene,
Indone[1,2,3-cd]pyre,Dibenz[a,h+a,c]anthr,Benzo[g,h,i]perylene,Anthranthene,
Corenene,

**Q (Robust): 3935.11**
**Q (True): 4394.61**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| 2,3,5-Trimethylnapthalene | 0.04 | 0.64 | 0.04 | 0.82 |
| Fluorene | 0.56 | 0.60 | 0.82 | 0.64 |
| 1-Methylfuorene | 0.08 | 0.71 | 0.08 | 0.83 |
| Dibenzothiophene | 0.00 | 0.96 | 0.36 | 0.93 |
| Phenanthrene | 1.61 | 0.79 | 4.23 | 0.60 |
| Anthracene | -0.06 | 0.84 | 0.46 | 0.90 |
| 2-Methyldibenzothiophene | -0.01 | 1.03 | 0.05 | 0.95 |
| 4-Methyldibenzothiophene | 0.00 | 0.99 | 0.05 | 0.96 |
| 2-Methylphenanthrene | 0.05 | 0.95 | 0.17 | 0.98 |
| 2-Methylanthracene | 0.09 | 0.94 | 0.21 | 0.99 |
| 4,5-Methylenephenanthrene | 0.00 | 0.80 | 0.00 | 0.81 |
| 1-Methylanthracene | 0.04 | 0.94 | 0.09 | 0.97 |
| 1-Methylphenanthrene | 0.05 | 0.90 | 0.06 | 0.98 |
| 9-Methylanthracene | 0.00 | 0.73 | 0.00 | 0.73 |
| 9,10-Dimethylanthracene | 0.02 | 0.90 | 0.03 | 0.93 |
| Fluoranthene | -1.03 | 1.14 | 2.42 | 0.90 |
| Pyrene | -0.37 | 1.06 | 1.12 | 0.96 |
| 3,6-Dimethylphenanthrene | 0.01 | 0.67 | 0.01 | 0.74 |
| Benzo[a]fluorene | 0.02 | 0.82 | 0.03 | 0.95 |
| Retene | 0.06 | 0.24 | 0.04 | 0.33 |
| Benzo[b]fluorene | 0.01 | 0.83 | 0.02 | 0.92 |
| Cyclopenta[c,d]pyrene | 0.00 | 0.94 | 0.02 | 0.95 |
| Benz[a]anthracene | 0.01 | 0.85 | 0.04 | 0.95 |
| Chrysene+Triphenylene | 0.13 | 0.44 | 0.12 | 0.88 |
| Napthacene | 0.00 | 0.73 | 0.01 | 0.96 |
| 4-Methylchrysene | 0.00 | 0.92 | 0.00 | 0.96 |
| Benzo[b]fluoranthene | 0.02 | 0.91 | 0.06 | 0.96 |
| Benzo[k]fluoranthene | 0.01 | 0.88 | 0.02 | 0.97 |
| Dimethylbenz[a]anthracene | 0.00 | 0.81 | 0.00 | 0.72 |
| Benzo[e]pyrene | 0.01 | 0.95 | 0.02 | 0.97 |
| Benzo[a]pyrene | 0.01 | 0.91 | 0.02 | 0.99 |
| Perylene | 0.00 | 0.92 | 0.00 | 1.00 |
| Indeno[1,2,3-c,d]pyrene | 0.01 | 0.96 | 0.04 | 0.97 |
| Dibenz[a,h+ac]anthracene | 0.00 | 0.93 | 0.00 | 0.98 |
| Benzo[g,h,i]perylene | -0.01 | 1.03 | 0.03 | 0.97 |
| Anthanthrene | 0.00 | 0.97 | 0.00 | 0.98 |
| Corenene | -0.01 | 1.08 | 0.01 | 0.94 |

**NPAH Diurnal PMF**

**Number of random starting points: 50**
**Number of factors: 3**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 10.00**
**Species included:**
1N-Naphthalene,2N-Naphthalene,2N-Biphenyl,3N-Biphenyl,
4N-Biphenyl,9N-Anthracene,2N-Anthracene,9N-Phenanthrene,
3N-Phenanthrene,2N-Fluoranthene,1N-Pyrene,2N-Pyrene,

**Q (Robust): 1661.76**
**Q (True): 1783.03**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| 1N-Naphthalene | 5.44 | 0.43 | 9.95 | 0.52 |
| 2N-Naphthalene | 7.73 | 0.46 | 12.09 | 0.46 |
| 2N-Biphenyl | 5.45 | 0.08 | 5.45 | 0.41 |
| 3N-Biphenyl | 0.86 | 0.54 | 1.33 | 0.33 |
| 4N-Biphenyl | 0.28 | 0.58 | 0.96 | 0.34 |
| 9N-Anthracene | 20.07 | 0.19 | 17.33 | 0.51 |
| 2N-Anthracene | 0.06 | 0.84 | 0.39 | 0.84 |
| 9N-Phenanthrene | 0.47 | 0.56 | 0.48 | 0.73 |
| 3N-Phenanthrene | -0.26 | 0.99 | 2.11 | 0.84 |
| 2N-Fluoranthene | 5.23 | 0.52 | 8.12 | 0.59 |
| 1N-Pyrene | 0.14 | 0.89 | 0.72 | 0.87 |
| 2N-Pyrene | 0.08 | 0.8 | 0.26 | 0.94 |

### PAH Seasonal PMF_2 Sources_Marina

**Number of random starting points: 30**
**Number of factors: 2**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 2.00**
**Species included:**
Fluorene,Phenanthrene,Anthracene,2-Methyldibenzothiop,
4-Methyldibenzothiop,2-Methylphenanthrene,2-Methylanthracene,
1-Methylanthracene, 1-Methylphenanthrene,9,10-Dimethylanthrac,
Fluoranthene,Pyrene,Benzo[a]fluorene,Benzo[b]fluorene,
Chrysene+Triphenylene,Benzo[b]fluoranthene,Benzo[g,h,i]perylene,

**Q (Robust): 1637.04**
**Q (True): 1953.91**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| Fluorene | 0.46 | 0.61 | 1.08 | 0.86 |
| Phenanthrene | 1.62 | 0.49 | 1.42 | 0.97 |
| Anthracene | 0.14 | 0.36 | 0.2 | 0.81 |
| 2-Methyldibenzothiophene | 0.01 | 0.97 | 0.05 | 0.96 |
| 4-Methyldibenzothiophene | 0.01 | 0.98 | 0.04 | 0.95 |
| 2-Methylphenanthrene | 0.59 | 0.1 | 0.72 | 0.08 |
| 2-Methylanthracene | -0.04 | 1.06 | 0.11 | 0.99 |
| 1-Methylanthracene | 0 | 1.02 | 0.07 | 0.97 |
| 1-Methylphenanthrene | -0.01 | 1.03 | 0.04 | 0.99 |
| 9,10-Dimethylanthracene | -0.03 | 1.5 | 0.03 | 0.92 |
| Fluoranthene | 0.78 | 0.14 | 0.99 | 0.29 |
| Pyrene | 0.46 | 0.21 | 0.58 | 0.32 |
| Benzo[a]fluorene | 0.01 | 0.41 | 0.01 | 0.53 |
| Benzo[b]fluorene | 0 | 0.86 | 0.01 | 0.74 |
| Chrysene+Triphenylene | 0.01 | 0.86 | 0.03 | 0.83 |
| Benzo[b]fluoranthene | 0.02 | 0.19 | 0.02 | 0.41 |
| Benzo[g,h,i]perylene | 0.03 | 0.57 | 0.04 | 0.78 |

### PAH Seasonal PMF_3 Sources_Marina

**Number of random starting points: 30**
**Number of factors: 3**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 2.00**
**Species included:**
Fluorene,Phenanthrene,Anthracene,2-Methyldibenzothiop,
4-Methyldibenzothiop,2-Methylphenanthrene,2-Methylanthracene,
1-Methylanthracene, 1-Methylphenanthrene,9,10-Dimethylanthrac,
Fluoranthene,Pyrene,Benzo[a]fluorene,Benzo[b]fluorene,
Chrysene+Triphenylene,Benzo[b]fluoranthene,Benzo[g,h,i]perylene,

**Q (Robust): 1093.75**
**Q (True): 1315.82**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| Fluorene | 0.2 | 0.97 | 1.19 | 0.93 |
| Phenanthrene | 1.21 | 0.76 | 1.27 | 0.99 |
| Anthracene | 0.15 | 0.59 | 0.32 | 0.81 |
| 2-Methyldibenzothiophene | 0.01 | 0.94 | 0.05 | 0.96 |
| 4-Methyldibenzothiophene | 0.01 | 0.97 | 0.04 | 0.96 |
| 2-Methylphenanthrene | 0.59 | 0.1 | 0.72 | 0.09 |
| 2-Methylanthracene | -0.01 | 0.99 | 0.1 | 0.99 |
| 1-Methylanthracene | 0.01 | 0.96 | 0.05 | 0.98 |
| 1-Methylphenanthrene | 0 | 0.97 | 0.03 | 0.99 |
| 9,10-Dimethylanthracene | -0.01 | 1.05 | 0.02 | 0.93 |
| Fluoranthene | 0.74 | 0.12 | 0.91 | 0.27 |
| Pyrene | 0.45 | 0.18 | 0.52 | 0.29 |
| Benzo[a]fluorene | 0.01 | 0.52 | 0.02 | 0.6 |
| Benzo[b]fluorene | 0 | 0.91 | 0.01 | 0.74 |
| Chrysene+Triphenylene | 0.01 | 0.88 | 0.02 | 0.87 |
| Benzo[b]fluoranthene | 0.03 | 0.3 | 0.03 | 0.42 |
| Benzo[g,h,i]perylene | 0.03 | 0.55 | 0.04 | 0.77 |

## PAH Seasonal PMF_2 Sources_Residential

**Number of random starting points: 30**
**Number of factors: 2**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 2.00**
**Species included:**
Fluorene,Phenanthrene,Anthracene,2-Methyldibenzothiop,
4-Methyldibenzothiop,2-Methylphenanthrene,2-Methylanthracene,
1-Methylanthracene, 1-Methylphenanthrene,9,10-Dimethylanthrac,
Fluoranthene,Pyrene,Benzo[a]fluorene,Benzo[b]fluorene,
Chrysene+Triphenylene,Benzo[b]fluoranthene,Benzo[g,h,i]perylene,

**Q (Robust): 1709.91**
**Q (True): 1958.31**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| Fluorene | 0.66 | 0.37 | 1.21 | 0.69 |
| Phenanthrene | 2.16 | 0.41 | 3.12 | 0.96 |
| Anthracene | 0.23 | 0.38 | 0.55 | 0.82 |
| 2-Methyldibenzothiophene | 0.03 | 0.92 | 0.23 | 0.74 |
| 4-Methyldibenzothiophene | 0 | 1.05 | 0.13 | 0.86 |
| 2-Methylphenanthrene | 0.59 | 0.41 | 1.49 | 0.35 |
| 2-Methylanthracene | 0.09 | 0.94 | 0.25 | 0.99 |
| 1-Methylanthracene | -0.02 | 1.09 | 0.09 | 0.99 |
| 1-Methylphenanthrene | 0.03 | 0.94 | 0.06 | 0.99 |
| 9,10-Dimethylanthracene | -0.03 | 1.47 | 0.05 | 0.93 |
| Fluoranthene | 0.85 | 0.15 | 0.78 | 0.92 |
| Pyrene | 0.54 | 0.22 | 0.46 | 0.92 |
| Benzo[a]fluorene | 0.01 | 0.79 | 0.02 | 0.9 |
| Benzo[b]fluorene | 0.01 | 0.83 | 0.01 | 0.89 |
| Chrysene+Triphenylene | 0.04 | 0.66 | 0.04 | 0.87 |
| Benzo[b]fluoranthene | 0.04 | 0.14 | 0.02 | 0.22 |
| Benzo[g,h,i]perylene | 0.06 | 0.52 | 0.08 | 0.41 |

## PAH Seasonal PMF_3 Sources_Residential

**Number of random starting points: 30**
**Number of factors: 3**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 2.00**
**Species included:**
Fluorene,Phenanthrene,Anthracene,2-Methyldibenzothiop,
4-Methyldibenzothiop,2-Methylphenanthrene,2-Methylanthracene,
1-Methylanthracene, 1-Methylphenanthrene,9,10-Dimethylanthrac,
Fluoranthene,Pyrene,Benzo[a]fluorene,Benzo[b]fluorene,
Chrysene+Triphenylene,Benzo[b]fluoranthene,Benzo[g,h,i]perylene,

**Q (Robust): 972.35**
**Q (True): 1181.49**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| Fluorene | 0.51 | 0.55 | 1.74 | 0.7 |
| Phenanthrene | -0.12 | 0.82 | 5.61 | 0.97 |
| Anthracene | 0.14 | 0.59 | 0.74 | 0.86 |
| 2-Methyldibenzothiophene | 0.01 | 0.94 | 0.06 | 0.98 |
| 4-Methyldibenzothiophene | 0 | 0.99 | 0.04 | 0.98 |
| 2-Methylphenanthrene | 0.57 | 0.43 | 1.48 | 0.37 |
| 2-Methylanthracene | 0.02 | 1.01 | 0.18 | 1 |
| 1-Methylanthracene | 0 | 1.01 | 0.07 | 0.99 |
| 1-Methylphenanthrene | 0.02 | 0.98 | 0.08 | 0.99 |
| 9,10-Dimethylanthracene | -0.01 | 1.12 | 0.04 | 0.91 |
| Fluoranthene | 0.05 | 1.03 | 2.39 | 0.98 |
| Pyrene | 0.01 | 1.08 | 0.99 | 0.98 |
| Benzo[a]fluorene | -0.01 | 1.09 | 0.02 | 0.94 |
| Benzo[b]fluorene | 0 | 1.11 | 0.01 | 0.94 |
| Chrysene+Triphenylene | 0.01 | 0.91 | 0.03 | 0.96 |
| Benzo[b]fluoranthene | 0.04 | 0.2 | 0.02 | 0.43 |
| Benzo[g,h,i]perylene | 0.03 | 0.73 | 0.04 | 0.83 |

**PAH Seasonal PMF_2 Sources_Highway**

**Number of random starting points: 30**
**Number of factors: 2**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 2.00**
**Species included:**
Fluorene,Phenanthrene,Anthracene,2-Methyldibenzothiop,
4-Methyldibenzothiop,2-Methylphenanthrene,2-Methylanthracene,
1-Methylanthracene, 1-Methylphenanthrene,9,10-Dimethylanthrac,
Fluoranthene,Pyrene,Benzo[a]fluorene,Benzo[b]fluorene,
Chrysene+Triphenylene,Benzo[b]fluoranthene,Benzo[g,h,i]perylene,

**Q (Robust): 1088.77**
**Q (True): 1229.55**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| Fluorene | 1.03 | 0.34 | 1.31 | 0.45 |
| Phenanthrene | 1.38 | 0.56 | 2.55 | 0.83 |
| Anthracene | 0.17 | 0.46 | 0.27 | 0.71 |
| 2-Methyldibenzothiophene | -0.03 | 1.15 | 0.07 | 0.95 |
| 4-Methyldibenzothiophene | 0.01 | 1.01 | 0.04 | 0.94 |
| 2-Methylphenanthrene | 0.74 | 0.21 | 0.81 | 0.21 |
| 2-Methylanthracene | -0.02 | 1.04 | 0.18 | 0.98 |
| 1-Methylanthracene | -0.01 | 1.03 | 0.06 | 0.99 |
| 1-Methylphenanthrene | 0 | 1 | 0.05 | 0.98 |
| 9,10-Dimethylanthracene | -0.01 | 1.11 | 0.03 | 0.95 |
| Fluoranthene | 0.97 | 0.16 | 0.68 | 0.59 |
| Pyrene | 0.63 | 0.25 | 0.44 | 0.59 |
| Benzo[a]fluorene | 0.01 | 0.9 | 0.01 | 0.8 |
| Benzo[b]fluorene | 0.01 | 0.76 | 0.01 | 0.76 |
| Chrysene+Triphenylene | 0.02 | 0.79 | 0.03 | 0.83 |
| Benzo[b]fluoranthene | 0.04 | 0.13 | 0.02 | 0.2 |
| Benzo[g,h,i]perylene | 0.06 | 0.54 | 0.06 | 0.68 |

**PAH Seasonal PMF_3 Sources_Highway**

**Number of random starting points: 30**
**Number of factors: 3**
**Seed: Used random seed.**
**c3 Modeling Constant(Percent): 2.00**
**Species included:**
Fluorene,Phenanthrene,Anthracene,2-Methyldibenzothiop,
4-Methyldibenzothiop,2-Methylphenanthrene,2-Methylanthracene,
1-Methylanthracene,1-Methylphenanthrene,9,10-Dimethylanthrac,
Fluoranthene,Pyrene,Benzo[a]fluorene,Benzo[b]fluorene,
Chrysene+Triphenylen,Benzo[b]fluoranthene,Benzo[g,h,i]perylene,

**Q (Robust): 683.95**
**Q (True): 730.93**

| Species | Intercept | Slope | RMSE | r-square |
|---|---|---|---|---|
| Fluorene | 0.43 | 0.78 | 0.76 | 0.93 |
| Phenanthrene | 0.99 | 0.79 | 2.12 | 0.93 |
| Anthracene | 0.14 | 0.71 | 0.22 | 0.9 |
| 2-Methyldibenzothiophene | -0.02 | 1.11 | 0.06 | 0.96 |
| 4-Methyldibenzothiophene | 0.01 | 0.97 | 0.04 | 0.93 |
| 2-Methylphenanthrene | 0.75 | 0.27 | 0.8 | 0.31 |
| 2-Methylanthracene | -0.01 | 1.01 | 0.16 | 0.98 |
| 1-Methylanthracene | -0.01 | 1 | 0.05 | 0.99 |
| 1-Methylphenanthrene | 0.01 | 0.97 | 0.04 | 0.99 |
| 9,10-Dimethylanthracene | -0.01 | 1.01 | 0.03 | 0.94 |
| Fluoranthene | 0.91 | 0.14 | 0.6 | 0.6 |
| Pyrene | 0.6 | 0.22 | 0.38 | 0.6 |
| Benzo[a]fluorene | 0.01 | 0.83 | 0.01 | 0.8 |
| Benzo[b]fluorene | 0.01 | 0.65 | 0.01 | 0.66 |
| Chrysene+Triphenylene | 0.01 | 0.91 | 0.02 | 0.89 |
| Benzo[b]fluoranthene | 0.03 | 0.39 | 0.03 | 0.57 |
| Benzo[g,h,i]perylene | 0.05 | 0.58 | 0.05 | 0.76 |

# Appendix G: Principal Component Analysis of PAH measured at the 3 sampling sites (Marina, Residential and Highway) in Buffalo, NY. Score, Eigenvector and Variance

**Score**

| **Marina** | **PC 1** | **PC 2** | **PC 3** | **PC 4** | **PC 5** |
|---|---|---|---|---|---|
| M01 | 5.15 | -0.76 | 0.96 | -0.67 | -1.97 |
| M02 | 4.11 | 0.31 | 3.59 | 0.24 | -1.71 |
| M03 | 1.52 | 3.37 | -0.46 | -1.04 | 2.42 |
| M04 | 1.40 | 1.04 | 2.10 | 1.42 | 0.90 |
| M05 | -3.42 | 5.58 | 0.11 | 1.62 | -0.10 |
| M06 | -11.00 | -6.64 | 0.70 | 0.34 | -1.27 |
| M07 | -7.12 | 2.24 | -1.56 | -0.26 | 0.92 |
| M09 | 4.72 | -0.56 | 1.29 | -0.01 | -0.93 |
| M10 | 2.57 | -1.04 | 1.19 | 1.00 | 2.08 |
| M11 | -5.65 | 5.82 | -1.01 | 5.16 | -0.64 |
| M12 | 3.20 | 0.13 | 2.71 | 0.55 | 0.41 |
| **Residential** | | | | | |
| S01 | 1.47 | -0.19 | -6.32 | -0.35 | -1.93 |
| S02 | 2.02 | 0.39 | -0.48 | 1.58 | -0.95 |
| S03 | 2.72 | 0.11 | -4.95 | -0.35 | -1.26 |
| S04 | 2.89 | -1.50 | -1.78 | 0.11 | 0.81 |
| S05 | 1.21 | -1.85 | -3.58 | 0.10 | 0.09 |
| S06 | 2.82 | -1.24 | -0.23 | 0.11 | -0.37 |
| S07 | 2.73 | -0.45 | -4.25 | -0.36 | -0.29 |
| S08 | 3.72 | -0.49 | 0.59 | 0.19 | -1.11 |
| S09 | 4.00 | -1.76 | -0.72 | 0.36 | 1.60 |
| S10 | 0.49 | -4.26 | 0.14 | 0.57 | 2.11 |
| S11 | 0.48 | -2.61 | -3.98 | -0.15 | 0.35 |
| S12 | 2.70 | -0.93 | -0.52 | 1.33 | 1.34 |
| **Highway** | | | | | |
| C01 | -0.01 | 1.96 | -0.26 | -1.50 | 0.66 |
| C02 | 1.03 | 2.43 | 2.50 | -1.36 | -1.14 |
| C03 | -5.37 | 4.95 | -1.71 | -2.62 | 0.61 |
| C04 | -1.90 | 4.88 | 0.71 | -2.04 | -0.05 |
| C 05+06 | -2.30 | -0.56 | 1.59 | -1.41 | -0.21 |
| C07 | 2.94 | -1.14 | 1.70 | -0.27 | 0.60 |
| C 08+09 | 1.90 | -2.01 | 1.86 | -0.25 | 0.64 |
| C10 | 2.48 | -0.28 | 3.85 | 0.51 | -1.10 |
| C 11+ 12 | -4.37 | -0.76 | 3.09 | -0.61 | -0.78 |
| C13 | -8.13 | -4.31 | 0.80 | 0.22 | 0.45 |
| C 14+15 | -9.10 | -2.45 | 0.47 | -0.70 | -0.33 |

**Eigenvector**

| | **PC 1** | **PC 2** | **PC 3** | **PC 4** | **PC 5** |
|---|---|---|---|---|---|
| 2,3,5-Trimethylnapthalene | -0.14 | 0.15 | 0.17 | 0.14 | -0.24 |
| Fluorene | 0.07 | -0.01 | 0.28 | 0.06 | -0.52 |
| 1-Methylfluorene | -0.14 | 0.15 | 0.23 | -0.14 | -0.23 |
| Dibenzothiophene | 0.17 | -0.06 | -0.06 | 0.09 | -0.52 |
| Phenanthrene | 0.00 | 0.06 | 0.36 | -0.11 | 0.26 |
| Anthracene | 0.07 | -0.08 | -0.24 | -0.27 | -0.30 |
| 2-Methyldibenzothiophene | -0.14 | 0.27 | 0.05 | 0.06 | -0.03 |
| 4-Methyldibenzothiophene | -0.10 | 0.28 | -0.10 | 0.17 | -0.08 |
| 2-Methylphenanthrene | -0.08 | 0.23 | -0.25 | -0.23 | -0.06 |
| 2-Methylanthracene | -0.06 | 0.20 | -0.30 | -0.19 | -0.04 |
| 4,5-Methylenephenanthrene | -0.13 | 0.22 | -0.01 | 0.33 | -0.04 |
| 1-Methylanthracene | -0.13 | 0.27 | -0.12 | -0.07 | 0.05 |
| 1-Methylphenanthrene | -0.09 | 0.23 | -0.27 | -0.12 | -0.05 |
| 9-Methylanthracene | -0.17 | 0.21 | 0.09 | -0.01 | 0.06 |
| 9,10-Dimethylanthracene | -0.14 | 0.28 | -0.06 | -0.09 | 0.11 |
| Fluoranthene | 0.14 | -0.13 | -0.22 | 0.21 | 0.28 |
| Pyrene | 0.09 | -0.13 | -0.31 | 0.10 | 0.08 |
| 3,6-Dimethylphenanthrene | -0.14 | 0.21 | 0.02 | -0.34 | 0.10 |
| Benzo[a]fluorene | -0.14 | -0.01 | -0.28 | 0.25 | -0.09 |
| Retene | -0.07 | 0.17 | 0.06 | 0.49 | 0.10 |
| Benzo[b]fluorene | -0.20 | 0.01 | -0.15 | 0.20 | -0.10 |
| Cyclopenta(c,d)pyrene | -0.22 | -0.13 | -0.01 | -0.04 | -0.07 |
| Benz[a]anthracene | -0.21 | -0.15 | -0.01 | -0.05 | -0.07 |
| Chryene+Triphenylene | -0.07 | -0.13 | -0.34 | 0.03 | -0.11 |
| Napthacene | -0.20 | -0.17 | 0.04 | -0.13 | -0.04 |
| 4-Methylchrysene | -0.23 | 0.03 | 0.03 | 0.08 | 0.00 |
| Benzo[b]fluoranthene | -0.21 | -0.15 | -0.03 | 0.01 | 0.02 |
| Benzo[k]fluoranthene | -0.21 | -0.15 | -0.01 | 0.02 | 0.00 |
| Dimethylbenz[a]anthracene | -0.20 | 0.03 | 0.11 | 0.00 | -0.02 |
| Benzo[e]pyrene | -0.22 | -0.14 | -0.01 | -0.01 | 0.04 |
| Benzo[a]pyrene | -0.21 | -0.16 | 0.03 | -0.04 | -0.01 |
| Perylene | -0.20 | -0.18 | 0.02 | -0.08 | -0.03 |
| Indone[1,2,3-cd]pyrene | -0.21 | -0.15 | 0.00 | 0.01 | 0.04 |
| Dibenz[a,h+a,c]anthracene | -0.20 | -0.09 | 0.00 | 0.23 | -0.03 |
| Benzo[g,h,i]perylene | -0.22 | -0.13 | 0.01 | -0.04 | 0.04 |
| Anthranthene | -0.21 | -0.15 | 0.02 | -0.05 | 0.00 |
| Corenene | -0.22 | -0.08 | 0.01 | -0.05 | 0.05 |

**Variance**

| | Eigenvalues | Cum. % of Total Variance |
|---|---|---|
| 1 | 17.76 | 48.00 |
| 2 | 7.68 | 68.74 |
| 3 | 5.76 | 84.32 |
| 4 | 1.76 | 89.08 |
| 5 | 1.29 | 92.58 |
| 6 | 0.69 | 94.45 |
| 7 | 0.61 | 96.10 |
| 8 | 0.35 | 97.04 |
| 9 | 0.23 | 97.66 |
| 10 | 0.18 | 98.14 |
| 11 | 0.15 | 98.56 |
| 12 | 0.14 | 98.95 |
| 13 | 0.10 | 99.23 |
| 14 | 0.07 | 99.40 |
| 15 | 0.05 | 99.53 |
| 16 | 0.04 | 99.64 |
| 17 | 0.04 | 99.74 |
| 18 | 0.02 | 99.81 |
| 19 | 0.02 | 99.85 |
| 20 | 0.02 | 99.90 |
| 21 | 0.01 | 99.93 |
| 22 | 0.01 | 99.96 |
| 23 | 0.01 | 99.97 |
| 24 | 0.00 | 99.98 |
| 25 | 0.00 | 99.99 |
| 26 | 0.00 | 99.99 |
| 27 | 0.00 | 99.99 |
| 28 | 0.00 | 100.00 |
| 29 | 0.00 | 100.00 |
| 30 | 0.00 | 100.00 |
| 31 | 0.00 | 100.00 |
| 32 | 0.00 | 100.00 |
| 33 | 0.00 | 100.00 |
| 34 | 0.00 | 100.00 |
| 35 | 0.00 | 100.00 |
| 36 | 0.00 | 100.00 |
| 37 | 0.00 | 100.00 |

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