

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Air Quality Monitoring Project-Indian Clean Air Programme (ICAP)

*Draft Final Report
on*

“SOURCE PROFILING FOR VEHICULAR EMISSIONS”
as a part of Ambient Air Quality Monitoring and Emission Source Apportionment Studies

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Executive Summary

The vehicle emission profile generated, for Indian vehicles, by PM characterization together with the ambient particulate matter speciation data could be a realistic input to the Chemical Mass Balance (CMB) receptor model for source apportionment study for identification of sources of air pollution.

Increasing number of vehicles plying on the road and its impact on ambient air quality and human health is a matter of concern. Chemical speciation of vehicle exhaust particulate matter (source profiles) is required for assessment of contribution from vehicle sources using receptor model. The available international database "SPECIATE-4.0" is the U.S. Environmental Protection Agency's (EPA) repository of total organic compound (TOC) and particulate matter (PM) speciation profiles of air pollution sources(Vehicular as well as non-vehicular sources).The vehicle categories available under Speciate for CMB application mostly fall under LCVand HCV category. In view of this and looking at the Indian scenario where traffic composition include 2Wheeler (2Stroke and 4Stroke), 3Wheeler (Diesel, Gasoline, LPG and CNG) alongwith LCV and HCV. As no data is available on Vehicle profiles for vehicles plying in Indian cities, the need was felt to develop the Vehicle profiles and estimate contribution of mobile sources (especially vehicles) in urban environment. This project was therefore aimed at development of Vehicle Source profiles for Indian vehicles to use in receptor model for Source Apportionment Study.

To carry out detailed chemical characterization of Particulate Matter two mass emission tests were carried out on each vehicle -one with Teflon for mass, ions and element analysis and another on Quartz for carbon fractions and molecular markers analysis, as per the applicable test procedure, in the given vehicle test matrix for collection of particulate matter on respective filter papers.

A comprehensive data base on source profiles generated on Indian vehicles including-

- Total 192 mass emission tests on 96 vehicles (2 tests on each vehicle).
- Vehicle selected/ tested w.r.t. fuel type category and vintage as below-
 - Gasoline, Diesel, LPG (OE/Retrofit) and CNG (OE/Retrofit)
 - 2S-2W, 4S-2W, 2S-3W, 4S-3W, Cars, LCV, HCV
 - 1991-96, 1996-2000, 2000-2005+ vintage
- The mass emission results of 96 vehicles are made available as a supplement to emission factors generated for Indian vehicles
- Detailed chemical speciation of vehicle exhaust particulate matter for ions, elements, carbon fractions, molecular markers
- Total of 96 no Individual profile and 44 nos of Composite profiles prepared for different category and fuel

The list of constituents under each above said group were identified by CPCB as defined in project “Source Apportionment Study of PM 10 collected in Ambient Air of selected cities”, which includes chemical species expected from motor vehicles exhaust.

Constituents of chemical characterization of the PM for source profiling of vehicle emissions

Group	Constituents	
Elements	Na, Mg, Al, Si, P, S, Cl, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ca, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb	
Ions	F ⁻ , Cl ⁻ , Br ⁻ , NO ₂ ⁻ , NO ₃ ⁻ , SO ₄ ²⁻ , K ⁺ , NH ₄ ⁺ , Na ⁺ , Ca ⁺⁺ , Mg ⁺⁺	
Carbon	Elemental Carbon, Organic Carbon and Total Carbon	
Molecular markers	Alkanes	n- Henriacontane n-Tritriacontane n- Pentatriacontane
	Hopanes	22, 29, 30 – Trisnorneohopane 17α(H), 21β(H)-29 Norhopane 17α(H), 21β(H) Norhopane
	Alkanoic acid	Hexadecanamide Octadecanamide
	PAHs	Benzo[b]fluoranthene Benzo[k]fluoranthene Benzo[e]pyrene Indeno[1,2,3-cd]fluoranthene Indeno[1,2,3-cd]pyrene Phenylbenzopyrene Picene Coronene
	Others	Stigmasterol Levoglucosan

Observations:

Diesel and gasoline composite:

Composite profiles for all gasoline and diesel vehicles including different categories and vintages were generated as it was decided to use composite profiles, which are representative of vehicle fleet including all categories and vintages in gasoline and diesel vehicles.

Distribution of exhaust particulate matter in composite profiles for all gasoline and all diesel vehicles in different chemical groups like organic carbon, elemental carbon, ions, elements and other is presented in Figures below. In both, all gasoline and all diesel composite, organic carbon was found to dominate with 54% and 50% respectively. Elemental carbon fraction was found to be higher in all diesel composite (22%) than in all gasoline composite (7%), which is a major distinguishing factor between gasoline and diesel composite. Ions percentage was found to be higher in gasoline composite (19%) as compared to diesel composite (4%). Higher fraction of ions in gasoline exhaust can be attributed to the higher sulphate, chloride, calcium and sodium ions in exhaust due to use of lube oil. Elements, mainly wear metal (Fe, Pb & Cu) are found to be higher in percent in gasoline exhaust than diesel exhaust. Although, the absolute quantity of these metals was found to be similar from both the vehicle exhaust, percentage contribution in gasoline vehicles is higher due to less overall mass of PM in gasoline exhaust.

Organic molecular markers were found to be higher in percentage in gasoline exhaust composite (~4%) than in diesel exhaust composite (~1.3%). 17 alpha (H), 21 beta (H)-Hopane was found to be marginally higher (2.1%) in gasoline than in diesel exhaust (1.6%). Hopanes are present in lubricating oil used by gasoline and diesel powered engines and hence, are emitted in particle phase from both the engine types.

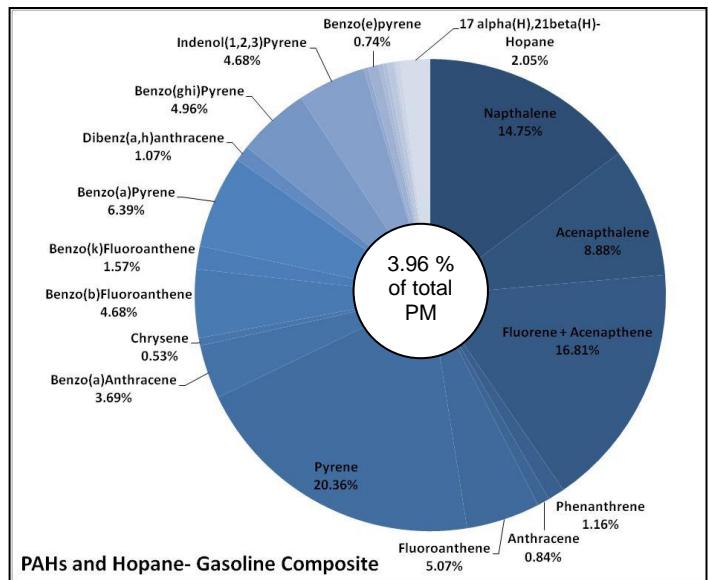
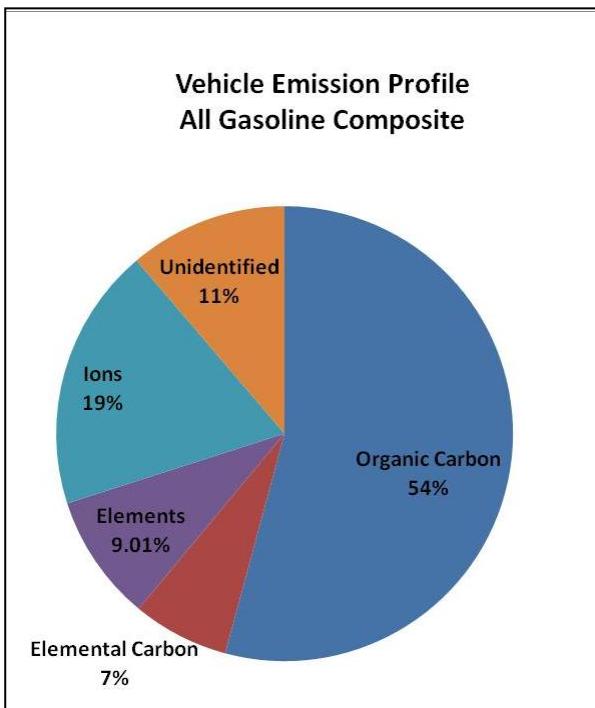
Overall mass concentration of all the 16 PAHs is higher in diesel than gasoline exhaust due to higher PM mass in Diesel vehicles. Qualitative interpretation (2, 3, 4 ,5 rings PAH) reveals that mass concentration of 2,3 and 4 ring lighter PAH compounds e.g. Fluorene +Acenaphthene, (3-ring) Fluoranthene and (4-ring) Pyrene is higher in Diesel Vehicles as compared to Gasoline vehicles. Whereas, mass Concentration of 5-ring heavier PAH compounds e.g. Benzo(a)Pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3 cd)pyrene and Benzo(ghi)perylene is higher in diesel vehicles as compared to gasoline vehicles. Overall mass of 2,3 and 4 ring lighter PAH compounds is high as compared to 5-ring heavier PAH compounds in Diesel as well as Gasoline vehicles.

Co-linearity in data

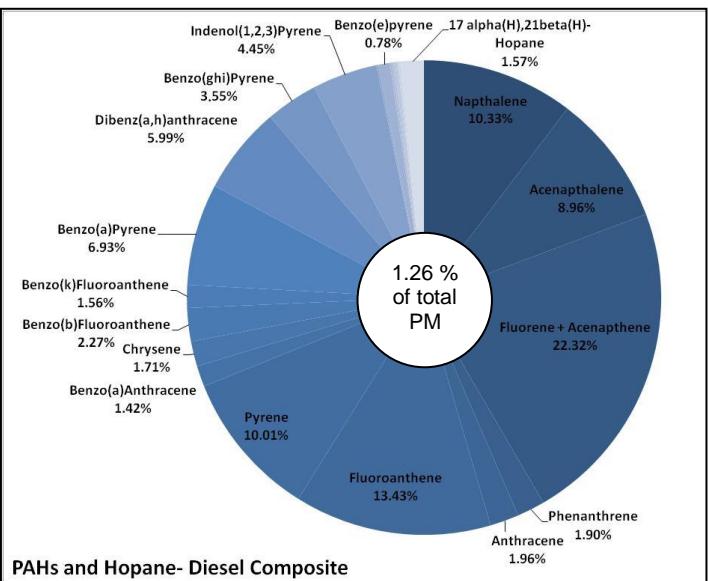
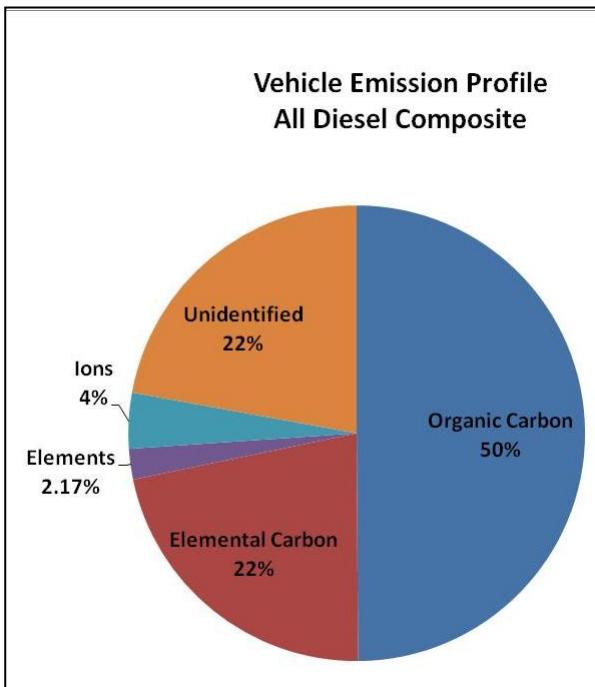
Colinerarity checks are performed to assess the gasoline and diesel composite profiles for their distinctness.

OC % found to be close in gasoline (54%) and diesel (50%). However, diesel and gasoline exhaust EC content was 22% and 7% respectively. Diesel exhaust particles are known to have contained much higher fraction of elemental carbon than gasoline

exhaust particles and based on this elemental to organic carbon ratio in gasoline and diesel exhaust, contribution from both engine types can be differentiated. For certain elements % share was found to be very less and similar. PAHs and ions data was not found to be collinear and shows higher % in gasoline exhaust.



Distribution of all gasoline composite vehicle exhaust PM in different chemical groups



Distribution of all diesel composite vehicle exhaust PM in different chemical groups

Category wise chart for distribution of species

Chemical speciation data of vehicle exhaust PM is analysed and grouped under different categories based on engine technology and fuel types. Category wise distribution of chemical species in various groups like carbon fractions, ions, elements and PAHs is given in **Table** below.

Organic carbon was found to vary from 48 to 57 % amongst the composite of different category gasoline vehicles. Similarly, elemental carbon was varied from 3% to 13%. OC and EC in composite of all gasoline vehicles was 52% and 6.6% respectively. Category wise composites for diesel vehicles show variation in organic carbon from 46 % to 52% and variation in EC from 16% to 25%. All diesel vehicles composite shows OC and EC % as 49% and 22% respectively. OC % in CNG vehicles composite varied from 29% to 58% and EC % variation was from 6% to 22%. In case of LPG category wise composite OC % variation was 26% to 49% and EC % variation was from 7% to 14%. All CNG vehicle composite OC and EC % are found to be 43% and 16% respectively, whereas all LPG composite OC and EC % are 38%and 11% respectively.

Amongst the ions sulphate, nitrate, chloride and ammonium ions were found to have major share. Gasoline vehicle exhaust was found to have higher % of ions then diesel exhaust, which may be due to lower overall PM mass in gasoline exhaust.

Elements % were found to be very less in exhaust PM of all vehicle types. Elements from lube oil (Ba, Ca, S, Mg, Zn, P & Mo) and engine wear metals (Fe, Cu & Pb) were found to be comparatively in higher proportion. In terms of % mass gasoline exhaust is found to contain higher % of these metals as compared to diesel exhaust.

PAHs % distribution shows higher fraction of Pyrene, Fluorine+ Acenaphthene and Acenaphthalene in all vehicle categories. Total PAHs were observed to higher in gasoline vehicle composite (3.96%) than in diesel vehicle composite (1.26%).

Percentage distribution of major chemical species (carbon fraction, ions, elements) in different categories of vehicles

Vehicle Category	Carbon Fraction (%)		Ions (%)			Elements (%)											
	OC	EC	Chloride (Cl)	Nitrate (NO3)	Sulphate(SO4)	Ammonium (NH4)	Barium (Ba)	Calcium (Ca)	Copper (Cu)	Iron (Fe)	Magnesium (Mg)	Molybdenum (Mo)	Sodium (Na)	Phosphorus (P)	Lead (Pb)	Sulphur (S)	Zinc (Zn)
2-stroke, 2-wheeler (Gasoline)	57.34	3.10	4.37	0.86	4.24	0.56	0.813	3.163	0.006	0.056	0.000	0.008	1.295	0.000	0.037	0.035	0.292
4-stroke, 2-wheeler (Gasoline)	48.63	5.08	5.07	0.39	5.94	0.00	3.263	1.792	0.036	0.082	0.000	0.000	0.398	0.031	0.319	0.000	1.229
3-Wheeler(Gasoline)	54.24	4.70	2.62	0.76	4.80	0.01	2.057	0.739	0.003	0.114	0.000	0.011	0.000	0.005	0.010	0.072	1.201
Passenger Car(Gasoline)	47.98	13.42	2.44	1.40	3.20	0.50	0.000	2.373	0.018	0.347	0.081	0.004	0.461	0.066	0.082	0.414	0.000
3-Wheeler(Diesel)	48.73	16.20	0.95	0.04	0.56	0.00	0.539	0.148	0.006	0.003	0.000	0.000	0.389	0.008	0.010	0.021	0.120
Passenger Car(Diesel)	50.26	18.59	0.10	0.17	0.74	0.01	0.573	0.507	0.014	0.026	0.000	0.000	0.000	0.016	0.021	0.324	0.303
LCV(Diesel)	46.16	26.86	0.12	0.23	0.98	0.08	0.782	0.210	0.008	0.008	0.000	0.001	0.000	0.000	0.014	0.415	0.532
HCV(Diesel)	51.93	24.62	0.20	0.28	1.06	0.00	0.782	0.210	0.008	0.008	0.000	0.001	0.000	0.000	0.014	0.415	0.532
3 Wheeler (CNG)	58.38	6.46	3.27	0.08	2.34	0.00	0.000	2.147	0.000	0.242	0.000	0.003	2.941	0.015	0.152	0.000	0.000
4 Wheeler (CNG)	28.71	18.56	3.42	2.02	3.77	0.96	0.490	1.083	0.035	0.301	0.607	0.000	0.228	0.069	0.035	0.282	0.156
HCV (CNG)	41.97	22.01	2.19	0.00	0.67	1.21	0.000	0.000	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 Wheeler (LPG)	49.04	7.17	2.74	0.06	1.68	0.00	0.245	1.383	0.029	0.072	0.000	0.000	0.937	0.002	0.201	0.000	0.026
4 Wheeler (LPG)	26.41	14.36	2.84	1.18	4.97	1.14	0.134	2.736	0.009	1.246	0.737	0.003	2.396	0.060	0.035	0.325	0.000
All Gasoline Composite	52.05	6.58	3.63	0.85	4.54	0.27	1.53	2.02	0.02	0.15	0.02	0.01	0.54	0.03	0.11	0.13	0.68
All Diesel Composite	49.27	21.57	0.34	0.18	0.83	0.02	0.58	0.27	0.01	0.02	0.00	0.00	0.10	0.01	0.01	0.23	0.25
CNG Composite	43.02	15.68	2.96	0.70	2.26	0.72	0.16	1.08	0.03	0.18	0.20	0.00	1.06	0.03	0.06	0.09	0.05
LPG Composite	37.72	10.77	2.79	0.62	3.32	0.57	0.19	2.06	0.02	0.66	0.37	0.00	1.67	0.03	0.12	0.16	0.01

Percentage distribution of PAHs in different categories of vehicles

Vehicle Category	PAHs (%)										Total PAHs
	Acenaphthalene	Fluorene + Acenaphthene	Fluoranthene	Pyrene	Benzo(a) Anthracene		Chrysene	Benzo(b) Fluoranthene	Dibenz(a,h) anthracene	Benzo(ghi) Pyrene	
2-stroke, 2-wheeler (Gasoline)	0.683	0.652	0.101	0.066	0.002	0.001	0.165	0.000	0.000	0.000	1.900
4-stroke, 2-wheeler (Gasoline)	0.382	1.637	0.532	1.933	0.045	0.041	0.111	0.125	0.427	0.751	8.572
3-Wheeler(Gasoline)	0.331	0.252	0.147	0.878	0.056	0.011	0.024	0.046	0.349	0.017	2.910
Passenger Car(Gasoline)	0.078	0.251	0.062	0.503	0.510	0.034	0.478	0.006	0.048	0.009	2.414
3-Wheeler(Diesel)	0.080	0.122	0.028	0.079	0.004	0.006	0.011	0.012	0.010	0.006	0.511
Passenger Car(Diesel)	0.024	0.036	0.007	0.037	0.000	0.001	0.005	0.005	0.001	0.001	0.130
LCV(Diesel)	0.020	0.056	0.013	0.056	0.004	0.000	0.002	0.006	0.002	0.001	0.181
HCV(Diesel)	0.345	0.951	0.654	0.352	0.066	0.083	0.100	0.290	0.171	0.225	4.235
3 Wheeler (CNG)	0.333	2.340	0.396	1.124	0.029	0.040	0.052	0.128	0.000	0.000	6.642
4 Wheeler (CNG)	0.092	0.324	0.060	0.109	0.002	0.001	0.001	0.000	0.000	0.000	0.666
HCV (CNG)	0.016	0.072	0.132	0.154	0.012	0.008	0.014	0.033	0.002	0.011	0.533
3 Wheeler (LPG)	0.225	1.343	0.199	0.835	0.027	0.015	0.001	0.018	0.001	0.001	3.605
4 Wheeler (LPG)	0.163	0.270	0.057	0.334	0.003	0.006	0.007	0.012	0.026	0.035	1.253
All Gasoline Composite	0.37	0.70	0.21	0.84	0.15	0.02	0.19	0.27	0.04	0.21	3.96
All Diesel Composite	0.12	0.29	0.18	0.13	0.02	0.02	0.03	0.08	0.05	0.06	1.26
CNG Composite	0.15	0.91	0.20	0.46	0.01	0.02	0.02	0.05	0.00	0.00	2.61
LPG Composite	0.19	0.81	0.13	0.58	0.01	0.01	0.00	0.01	0.01	0.02	2.43

Salient Observations:

Following are the observations based on the emission profiles obtained for different vehicle category and vintages -

- Carbonaceous material accounted for a majority of the PM mass. Of the total carbon, OC represented on average between 54 & 50% of the mass in gasoline and diesel vehicle exhaust PM.
- Higher fraction of EC was observed in Diesel Vehicles (22%) than in Gasoline vehicle exhaust (7%).
- Mass of (2-ring) Fluorene +Acenaphthene, (3-ring) Fluoranthene and (4-ring) Pyrene are found to be highest amongst all the 16 PAHs analyzed in diesel composite. Whereas, mass of (4-ring) Pyrene, (2-ring) Fluorene +Acenaphthene and (2-ring) Acenaphthalene were highest in gasoline composite. However, % share of PAHs in PM is higher in case of gasoline exhaust (3.96%) than diesel exhaust (1.26%), which may be due to lower PM mass in case of gasoline exhaust.
- Ions fraction in gasoline vehicles were found to be higher than Diesel vehicles. Gasoline exhaust composite was found to contain high percentage of sulphate (~4.5%), chloride (~3.5%) calcium (~3%) ions and sodium (~2%). In diesel exhaust composite ions percentage was found to be below 1% for all the ions.
- Calcium, barium, sodium, magnesium, zinc and iron were found to be higher as compared to other metals in gasoline and diesel exhaust. The Zn, P, Mg, and Ca are attributed to compounds in the lubricant while the Fe is an indication of engine wear.
- Unidentified percentage varied from 3 to 30 % in all the vehicle categories.

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1. Introduction

A diverse range of sources like, domestic, industry and vehicles contribute to the airborne particulate matter observed in the urban atmosphere. Impact of growing number of vehicles with a compounded annual growth rate of 15% on air quality is evident. This growth is expected to be maintained upto 2015. Particulate matter is one of the major source of air pollution.

One of the important methods for resolving the pollutant source contribution is through chemical mass balance (CMB) receptor modeling. CMB requires chemically speciated source profiles with known uncertainty to ensure accurate source contribution estimates. Mobile source PM profiles are available from various sources and are generally in the form of weight fraction by chemical species. The weight fraction format is commonly used, since it is required for input into the CMB receptor model.

While source apportionment methods can be applied to assess the impact of source emissions on ambient levels, scientific data on PM emissions are limited and often not representative of reality. The database on vehicle emission source profiles, developed by US EPA (SPECIATE), which is available to use with CMB model is developed based on different vehicle technology and fuel quality. Chemical nature of the particulate matter from the vehicle exhaust gases is dependent on technology and fuel quality. Also, the data on 2-wheelers and 3-wheelers exhaust profiles is not available. It is, therefore, important to have particulate characterization data, in Indian context, to use receptor model for source apportionment study.

The vehicle emission profile generated, for Indian vehicles, by PM characterization together with the ambient particulate matter speciation data could be a realistic input to the source apportionment study for identification of sources of air pollution.

2. Literature Review:

2.1 EPA profiles gasoline composite, diesel composite

SPECIATE is the U.S. Environmental Protection Agency's (EPA) repository of total organic compound (TOC) and particulate matter (PM) speciation profiles of air pollution sources [Ref. 1].

The total speciated percentage of a given PM profile is listed under the field of Total in the new SPECIATE database. It is calculated as the sum of all speciated compounds (e.g., EC, OC, sulfates, nitrates, metals), excluding elemental sulfur and speciated organics in PM (e.g., PAHs).

EC and OC measurements reported in DRI PM profiles were measured by the TOR procedure. EPA and Schauer profiles used the TOT procedure for EC and OC analyses. This difference measurement procedure is important, since previous studies have observed that the discrepancy in EC resulting from TOR and TOT procedures could be up to 40% due to differences in the operational definitions of EC and OC.

2.1.1 Gasoline-engine exhaust PM profiles

There are 62 gasoline PM profiles in the new SPECIATE database. **Table 1** is a comparison of selected gasoline PM profiles of four major constituents and EC-to-OC ratios. In general, the EC-to-OC ratio is expected to be less than one for gasoline exhaust PM. This table also contains an overall arithmetic average profile, which is based on 61 original profiles. The recommended gasoline PM profiles (**Table 1**) were speciated for approximately 57%-94% of the PM mass [Ref. 2].

Profile # 3158 is a composite exhaust PM profile based on fifty light duty gasoline vehicles developed by CARB. Two motor vehicles exhaust PM emissions studies were used in the update of the gasoline-powered vehicles exhaust PM speciation profile. Both studies were conducted for motor vehicles PM emissions:

- 1) "Characterization of Particulate Emissions from Gasoline-Fueled Vehicles", California Air Resources Board (CARB) contract 94-319, 1998; and
- 2) "Measurement of Primary Particulate Matter Emissions from Light-Duty Motor Vehicles", Coordinating Research Council (CRC) contract E-24-2, 1998.

The CARB study tested vehicles over the Unified Cycle (UC) to obtain mass emissions rates for particulate, total hydrocarbons, non-methane hydrocarbons, carbon monoxide and nitrogen oxides. The CRC study tested vehicles over the Federal Test Procedure (FTP) to obtain the same suite of pollutants as the ARB study. All vehicles were tested using that fuel in their tanks at the time vehicles were received. Although each fuel grade varied by vehicle, all fuels types were California Phase 2 reformulated gasoline (RFG). Teflon membrane filters were utilized for chemical analysis of metals and other trace elements like sulfate, nitrate, chloride, and ammonium ions. Quartz fiber filters were used for elemental and organic carbon analyses. Even though these studies were tested over different driving cycles, the PM chemical compositions were very similar. Therefore, all tests were pooled to generate a statewide gasoline-powered vehicles exhaust PM speciation profile.

Although both studies for PM emission rates were designed to be representative of the California vehicle fleet, the subset of PM samples collected for more detailed speciation analyses were biased toward high PM emitters. Due to detection limit and measurement uncertainties of low PM emission vehicles, heavier loaded samples from high PM emitters were selected for chemical

analyses. Therefore, simply averaging all of these sample results would have biased the speciation profile toward the compositions of the higher PM emitting vehicles, which have very high organic carbon fractions yet are only a small portion of the vehicle population in California.

2.1.2 CARB Profile Methodology

A methodology was therefore developed to reconstruct speciated data, which reflects the vehicle population distributions of California in order to generate an unbiased statewide gasoline-powered vehicles exhaust PM speciation profile. A statistical cluster analysis was conducted to bin all PM emission rate measurements from both studies as weights to be used in the compilation the speciation profile.

Based on variance, 11 bins were identified as appropriate for use in weighting the speciated analyses to better reflect California's vehicle fleet mix. The speciated profiles were each placed in one of the 11 bins as appropriate based on the PM emission rate of the vehicle from which the sample was taken. Once binned, the profiles were weighted by number of vehicles in each bin. The final profile (**Table 1**) represents the statewide gasoline vehicles exhaust PM speciation profile, which has taken vehicle population distributions into account.

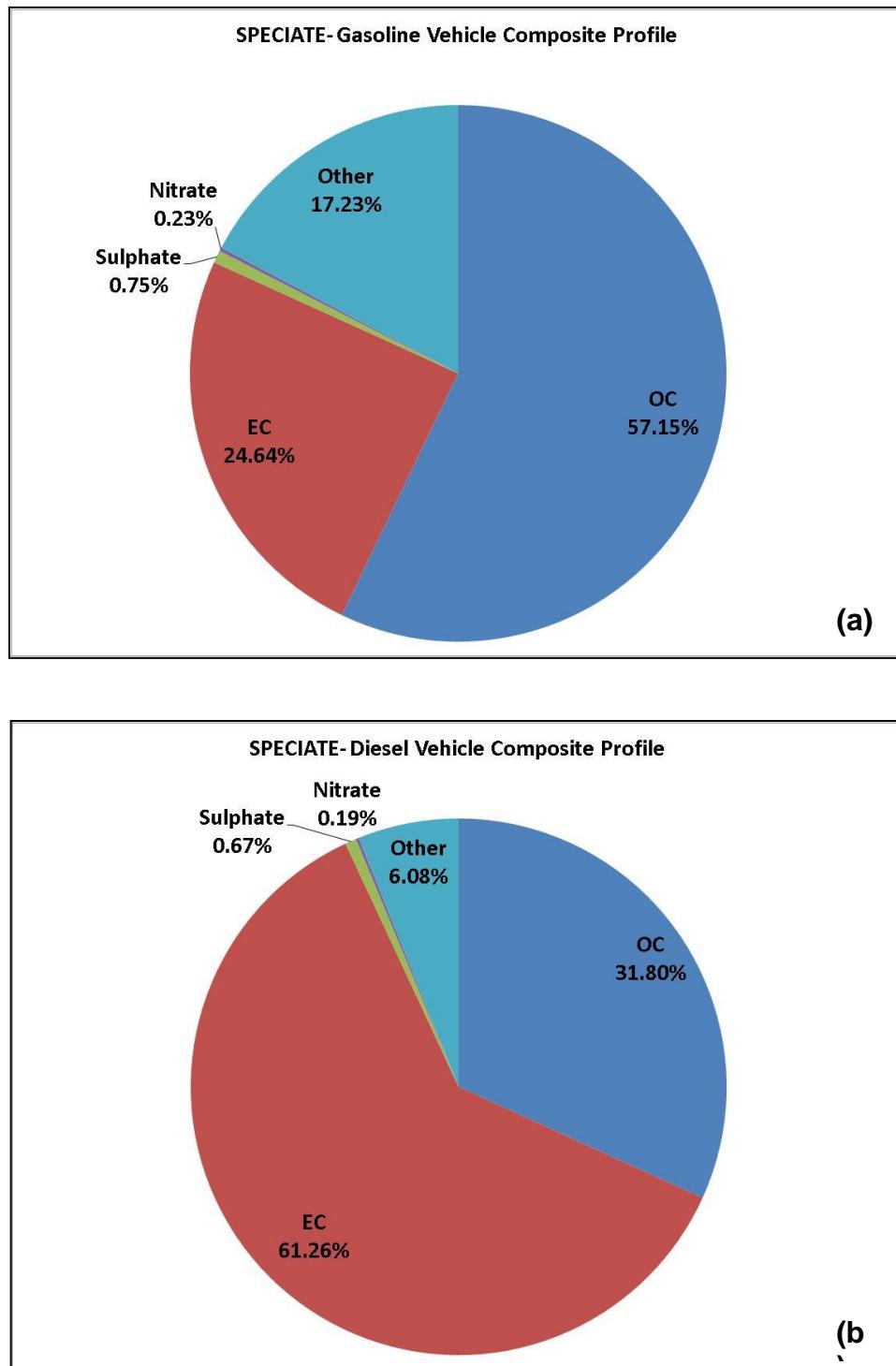
The final gasoline-powered vehicles exhaust PM speciation profile has more organic carbon (OC) than element carbon (EC). This is due to the fact that older vehicles emit much more OC than EC and their higher emission rates tend to dominate vehicles exhaust PM emissions. Newer vehicles (1991 and newer), on the contrary, have more EC than OC in their emission profiles. Both studies procured a number of smoking vehicles constituting about 2% of their vehicle sampling population. **Fig. 1 (a)** represents the distribution of PM mass from Speciate composite gasoline exhaust.

2.1.3 Diesel-engine exhaust PM profiles

In total, there are 42 diesel exhaust PM profiles from DRI and one from Schauer et al [Ref. 3]. A typical profile contains 40 elements (from sodium to uranium) by X-ray fluorescence, ions (chloride, nitrate, sulfate, ammonium, water-soluble sodium, and water-soluble potassium) by ion chromatography (IC), automated colorimetry (AC) or atomic absorption spectrophotometry (AAS), and carbon fractions (organic carbon and elemental carbon) by the thermal/optical reflectance (TOR) method. Additional measurements such as phosphate, carbonate, sulfate, and ammonia are available in some of the profiles. Eight carbon fractions (OC1–OC4, EC1–EC3, OP) are commonly included in the more recent profiles. These diesel exhaust PM profiles were normalized on the bases of gravimetric mass, sum of species, and reconstructed mass.

There are 43 diesel PM profiles in the new SPECIATE database. Six composite diesel PM profiles are excluded from the process for duplication reason. One profile developed from an ambient sample taken near diesel-dominated tunnel is also excluded. In addition, a set of nineteen original diesel PM profiles are not recommended for composite for the following reasons: the samples were taken in other country (e.g., Mexico) and/or the EC-to-OC ratios are not within the reasonable range (e.g., much smaller than 1)

Table 2 is a comparison of selected diesel PM profiles of four major constituents and EC-to-OC ratios. This table also contains an overall arithmetic average profile, which is based on 17 original profiles. The recommended diesel PM profiles (**Table 2**) were speciated for approximately 54%-136% of the PM mass [Ref. 4]. **Fig. 1 (b)** represents the distribution of PM mass from Speciate composite diesel exhaust.



**Fig. 1: Distribution of PM in composite profile from Speciate database for
(a) Gasoline and (b) Diesel vehicle exhaust**

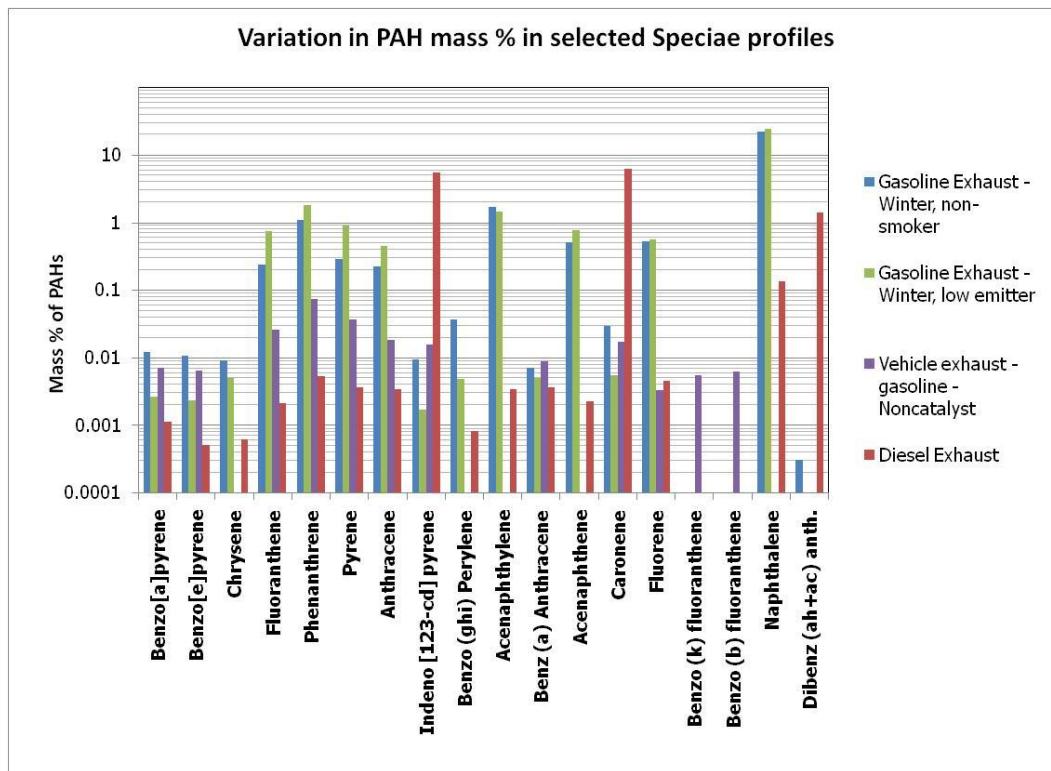


Fig. 2: Variation in contribution of PAHs in vehicle exhaust PM for gasoline and diesel vehicle categories from Speciate database

Table 1: Gasoline exhaust PM profiles from Speciate Database (EPA)

Profile No.	EC		OC		SO4		NO3		Total % Speciated	EC-OC Ratio	Original or Composite	Notes
	Mass %	STDev										
3517	13.50	8.02	30.08	12.30	2.29	1.32	3.89	2.87	56.62	0.45	Original	1990
3857	17.40	10.10	35.55	8.67	1.26	0.41	0.88	0.56	80.55	0.49	Original	1995
3866	42.47	14.23	45.92	14.26	0.36	1.48	0.16	0.15	90.24	0.92	Original	1997
3867	44.09	7.93	47.27	9.72	0.79	2.29	0.20	0.22	92.30	0.93	Original	1997
3868	39.10	21.32	50.66	17.40	0.23	0.19	0.08	0.03	89.71	0.77	Original	1997
3869	41.85	14.87	43.29	13.78	1.12	0.99	0.16	0.13	89.85	0.97	Original	1997
3870	46.80	16.39	38.44	15.77	1.36	1.36	0.20	0.20	90.62	1.22	Original	1997
3871	38.56	15.03	46.52	13.59	0.97	0.79	0.14	0.09	89.33	0.83	Original	1997
3872	25.11	14.56	56.72	10.96	0.94	0.66	0.14	0.17	86.61	0.44	Original	1997
3873	38.35	11.92	38.82	27.35	1.94	1.66	0.33	0.53	87.10	0.99	Original	1997
3874	20.82	15.49	61.91	12.22	0.67	0.50	0.10	0.10	86.14	0.34	Original	1997
3875	6.12	3.04	77.18	3.36	0.24	0.11	0.28	0.25	84.50	0.08	Original	1997
3876	6.25	3.09	77.04	2.75	0.24	0.11	0.29	0.26	84.53	0.08	Original	1997
3877	6.00	2.99	77.31	2.63	0.23	0.10	0.27	0.23	84.48	0.08	Original	1997
3881	45.76	5.39	37.34	7.01	1.68	0.77	0.20	0.15	89.56	1.23	Original	1997
3882	22.31	9.24	56.57	9.09	1.44	0.34	0.19	0.21	85.63	0.39	Original	1997
3883	42.74	12.11	37.27	12.98	2.07	1.13	0.28	0.25	88.79	1.15	Original	1997
3884	37.46	8.45	43.35	9.16	1.73	0.56	0.20	0.16	87.96	0.86	Original	1997
3885	40.48	2.98	43.89	2.98	2.47	0.17	0.42	0.13	89.86	0.92	Original	1997
3886	11.78	6.55	66.77	6.55	1.16	0.45	0.25	0.32	84.36	0.18	Original	1997
3887	29.14	7.67	52.15	6.14	1.09	0.52	0.40	0.42	86.94	0.56	Original	1997
3888	27.82	5.11	53.86	4.85	1.75	0.34	0.35	0.25	87.31	0.52	Original	1997
3889	37.94	21.87	49.24	17.88	0.33	0.10	0.09	0.03	89.46	0.77	Original	1997
3890	23.09	11.06	60.06	10.31	0.56	0.48	0.11	0.08	86.42	0.38	Original	1997

Contd....

Profile No.	EC		OC		SO4		NO3		Total % Speciated	EC- OC Ratio	Original or Composite	Notes
	Mass %	STDev										
3891	30.92	20.69	51.66	19.89	0.79	0.68	0.16	0.09	87.60	0.60	Original	1997
3892	34.03	20.34	51.92	16.90	0.45	0.21	0.10	0.04	88.65	0.66	Original	1997
3893	62.35	3.12	29.39	1.30	0.43	0.02	0.12	0.01	93.71	2.12	Original	1997
3894	34.09	1.94	50.16	2.36	0.30	0.04	0.07	0.04	87.65	0.68	Original	1997
3895	54.66	3.55	29.11	2.13	0.44	0.11	0.24	0.11	90.65	1.88	Original	1997
3896	56.65	2.91	33.34	1.53	0.41	0.03	0.12	0.02	92.43	1.70	Original	1997
3897	41.88	13.58	43.32	12.58	1.10	0.91	0.15	0.12	89.86	0.97	Original	1997
3898	24.04	9.06	57.14	8.70	1.06	0.60	0.15	0.16	86.44	0.42	Original	1997
3899	34.71	16.06	46.31	16.23	1.52	1.13	0.23	0.20	88.19	0.75	Original	1997
3900	35.91	12.84	47.54	11.90	1.18	0.80	0.16	0.11	88.69	0.76	Original	1997
3901	17.88	13.76	67.10	11.68	0.46	0.26	0.19	0.14	86.40	0.27	Original	1997
3902	11.14	13.60	73.00	11.52	0.20	0.07	0.29	0.15	85.22	0.15	Original	1997
3903	17.29	19.90	66.91	17.66	0.29	0.15	0.36	0.34	86.22	0.26	Original	1997
3904	14.92	16.23	69.56	13.93	0.35	0.22	0.24	0.18	85.87	0.21	Original	1997
3905	9.93	0.53	73.85	3.23	0.31	0.06	0.25	0.15	85.11	0.13	Original	1997
3906	3.29	0.95	79.62	3.47	0.19	0.10	0.25	0.18	83.94	0.04	Original	1997
3907	5.81	0.43	77.11	3.37	0.24	0.18	0.43	0.45	84.42	0.08	Original	1997
3908	5.55	0.34	77.60	3.39	0.23	0.07	0.28	0.23	84.34	0.07	Original	1997
3944	29.32	6.10	51.40	10.06	0.99	0.43	0.00	0.33	86.71	0.57	Original	1996
3945	11.58	5.44	66.48	7.21	0.84	0.66	0.00	0.63	83.75	0.17	Original	1996
3946	9.72	4.16	68.41	7.44	0.80	0.77	0.00	0.72	83.50	0.14	Original	1996
3947	23.55	2.77	54.86	6.42	1.33	0.56	0.00	0.52	86.39	0.43	Original	1996
3948	24.24	11.27	59.30	10.13	0.50	0.40	0.00	0.11	86.94	0.41	Original	1996
3949	14.56	10.52	66.32	8.96	0.58	0.34	0.00	0.31	84.94	0.22	Original	1996
3950	15.65	12.97	66.20	11.76	0.37	1.08	0.00	0.29	84.90	0.24	Original	1996

Contd....

Profile No.	EC		OC		SO4		NO3		Total % Speciated	EC- OC Ratio	Original or Composite	Notes
	Mass %	STDev										
3951	23.54	10.76	60.16	9.22	0.37	0.52	0.00	0.22	86.66	0.39	Original	1996
3952	18.45	13.31	66.37	11.83	0.25	0.14	0.13	0.06	86.20	0.28	Original	1996
3953	11.84	5.03	70.76	6.85	0.28	0.16	0.00	0.15	84.61	0.17	Original	1996
3954	6.21	3.94	77.18	5.14	0.16	0.15	0.02	0.13	84.23	0.08	Original	1996
3955	10.59	9.82	73.43	9.53	0.20	0.10	0.00	0.08	85.03	0.14	Original	1996
3956	8.58	5.47	75.60	5.05	0.09	0.06	0.03	0.05	84.73	0.11	Original	1996
3957	10.04	11.76	74.28	9.76	0.08	0.04	0.03	0.04	84.89	0.14	Original	1996
3958	25.30	9.60	61.39	8.22	0.17	0.03	0.02	0.02	87.42	0.41	Original	1996
3959	31.98	8.70	55.46	7.31	0.23	0.03	0.02	0.03	88.49	0.58	Original	1996
4558	10.30	2.10	43.70	2.90	1.09	0.30	0.47	0.45	60.01	0.24	Original	1998
4559	1.40	0.40	83.90	3.90	0.05	0.01	0.07	0.02	85.72	0.02	Original	1998
3158	16.44	15.65	59.37	15.20	0.50	0.65	0.06	0.23	81.42	0.28	CARB Composite	Composite of 50 gasoline exhaust profiles.
Overall Average	24.64	14.94	57.15	14.60	0.75	0.60	0.23	0.50	85.91	0.53	Composite	Composite of 61 original

Table 2: Diesel exhaust PM profiles from Speciate Database (EPA)

Profile No.	EC		OC		SO4		NO3		Total % Speciated	EC-OC Ratio	Original or Composite	Notes
	Mass %	STDev										
3219	78.83	23.3	18.54	7.9	1.37	0.79	0.1	0.04	100	4.25	Original	1987-1988
3220	72.5	21.22	25.75	13.6	1.1	0.7	0.11	0.05	100	2.82	Original	1998
3221	74.04	21.04	23.33	8.48	1.3	0.9	0.17	0.12	100	3.17	Original	1998
3878	75	10.27	18.93	7.89	0.42	0.45	0.17	0.14	95.43	3.96	Original	1998
3879	80.75	7.71	13.95	5.58	0.46	0.5	0.19	0.17	96.35	5.79	Original	1998
3880	70.24	12.09	23.04	9.55	0.3	0.4	0.15	0.12	94.67	3.05	Original	1998
3909	60.94	10.97	30.26	9.65	1.4	0.8	0.36	0.18	93.71	2.01	Original	1998
3910	62.27	18.73	30.38	15.63	0.42	0.14	0.42	0.16	93.83	2.05	Original	1998
3911	59.98	17.57	32.28	14.83	0.4	0.1	0.37	0.12	93.47	1.86	Original	1998
3912	61.46	16.13	30.73	13.66	0.7	0.2	0.39	0.13	93.73	2	Original	1998
3913	73.51	10.14	19.81	7.74	0.46	0.48	0.2	0.14	94.46	3.71	Original	1998
3914	77.12	9.67	17.56	7.58	0.3	0.3	0.11	0.08	95.36	4.39	Original	1998
3960	48.04	17.78	41.59	15.63	0.4	0.1	0.16	0.11	91.11	1.16	Original	1998
3961	36.89	7.04	51.71	5.91	0.29	0.08	0	0.07	89.38	0.71	Original	1998
3962	34.05	13.44	54.07	10.72	0.31	0.19	0	0.04	88.92	0.63	Original	1998
3963	45.06	10.78	89.04	5.49	0.4	0	0.03	0.05	135.82	0.51	Original	1998
4675	30.8	2.6	19.7	1.6	1	0.2	0.23	0.38	53.54	1.56	Original	1998
Overall Average	61.26	16.49	31.8	18.72	0.67	0.41	0.19	0.13	94.69	2.57	Composite	Composite of 17 original

In another study [Ref. 5] conducted by Center for Environmental Research and Technology, College of Engineering, University of California (July 2002), chassis dynamometer emissions tests were performed on light-heavy-duty diesel pickup trucks. Vehicles were tested over the light-duty Federal Test Procedure (FTP) to compare emissions for different fuel/after-treatment configurations including: ARCO ECD and ECD-1 with an Engelhard DPX filter (DPX), ECD only, and in-use California reformulated diesel (CARB) fuel only.

The chemical composition of the PM was analyzed for samples taken during tests with CARB fuel, ECD fuel, and ECD-1 fuel with a DPX. The analysis of the PM mass indicated that a majority of the mass was carbonaceous, with organic carbon representing between 76 and 80% of the carbonaceous material. Inorganic species represented only 1 to 3 mg/mi or less than 1% of the total mass for the ARCO ECD and CARB fuels. The only species with PM contributions above 0.1 mg/mi include S, SO₄²⁻, Zn, NO₃⁻, NH₄⁺, P, Mg, Si, Ca, Cl and Fe. A summary of the mass emission results for EC and OC, ions, and trace elements is provided in **Table 3** below.

Table 3: Summary of Mass emission test results (mg/mile)

	ARCO ECD			CARB			ECD-1 + DPX		
Total C	211.8	+/-	1.1	255.1	+/-	5.0	27.2	+/-	1.6
Organic C	168.8	+/-	27.9	194.7	+/-	37.3	21.7	+/-	1.0
Elemental C	43.0	+/-	26.8	60.4	+/-	42.3	5.4	+/-	0.4
SO ₄ ²⁻	0.58	+/-	0.18	0.26	+/-	0.00	0.09	+/-	0.01
S	0.49	+/-	0.07	0.27	+/-	0.04	0.03	+/-	0.01
Zn	0.36	+/-	0.06	0.21	+/-	0.04	0.01	+/-	0.00
NO ₃ ⁻	0.21	+/-	0.07	0.21	+/-	0.04	0.06	+/-	0.05
NH ₄ ⁺	0.26	+/-	0.09	0.10	+/-	0.01	0.04	+/-	0.02
P	0.21	+/-	0.03	0.12	+/-	0.02	0.01	+/-	0.00
Mg	0.14	+/-	0.01	0.17	+/-	0.01	0.00	+/-	0.02
Si	0.18	+/-	0.00	0.06	+/-	0.02	0.05	+/-	0.01
Ca	0.16	+/-	0.03	0.08	+/-	0.01	0.01	+/-	0.01
Cl	0.12	+/-	0.02	0.04	+/-	0.01	0.01	+/-	0.01
Fe	0.11	+/-	0.02	-0.11	+/-	0.01	-0.10	+/-	0.01

2.2 PAHs in vehicle exhaust:

PAH profiles, or the relative abundance of the different species in particulate emissions from different combustion sources, have been suggested as reliable source signatures where inorganic marker elements are not available. For example, PAH profiles have been used to identify vehicular emissions following the use of unleaded gasoline in many countries and the loss of lead as a vehicular source marker.

In a study, amounts of PAHs and oxy-PAHs in the samples collected from the air, from the dust on a guardrail, and from the soils of a roadway in a regular roadway tunnel were measured to assess the amounts of environmental pollution caused by automobile exhausts in the tunnel [Ref. 6]. Pyrene was found in the highest concentration (43 ± 7.2 ng/m³), followed by fluoranthene (26 ± 4.3 ng/m³) at the center of the tunnel. The linear relationship between the concentrations of particulates (SPM) and BaP was obtained, suggesting that they were formed under the same conditions. The total amount of oxy-PAHs (176 µg/g) found in the tunnel air was 5.3 times more than that of those (33 µg/g) found in a standard particulate sample from a rural area and 8.4 times more than that of those (21 µg/m³) in a standard particulate matter sample from a city area. These results suggest that most of the particulate matter found in the air samples from the tunnel were from automobile exhaust.

From the study conducted in Mumbai [Ref.7], it is reported that the Fluoranthene and Pyrene are emitted from both petrol and diesel vehicles in addition of Indeno(123-cd)pyrene from petrol vehicles and chrysene, benzo(b)fluoranthene and benzo(k)fluoranthene from diesel powered vehicles.

In order to characterise emissions of Polycyclic Aromatic Hydrocarbons (PAHs), substances that create health hazards and are, as yet, unregulated, standardised tests were performed on four light-duty diesel vehicles running in a chassis dynamometer at a vehicular emission laboratory, using the FTP-75 test cycle procedure [Ref. 8]. The pollutants were analysed in both solid and gaseous phases using high-performance liquid chromatography. Total PAH values ranged from 1.133 to 5.801 mg km⁻¹. Naphthalene, phenanthrene, fluoranthene, pyrene and chrysene were detected in all tests. Similarly, in another study [Ref. 9] presence of Naphthalene, Acenaphthene, Fluoranthene in Diesel exhaust and Benzo(k) Fluoranthene, Indenopyrene, Pyrene, Benzo(a) Pyrene in Gasoline exhaust is reported.

It was also observed that compared to gasoline engines, emissions from diesel engines were less toxic, although they might produce more PAHs. Of the same vehicular and oil type, automobiles of longer mileages produced more toxic PAHs [Ref. 10]. PAHs distributions in the vehicular exhausts were related to the oil

type. Large difference was found in the abundance of 3-, 5- and 6-ring PAHs between exhausts from gasoline and diesel oil engines.

Diesel oil engines produced relative lighter PAHs such as naphthalene, acenaphthalene, fluoranthene, while gasoline engines emitted heavier kinds such as benzo(k)fluoranthene and indeno pyrene. The automobile produced more PAHs with the increase of mileage especially fluoranthene, pyrene, BaP benzo(a)pyrene, 4-ring PAHs such as fluoranthene, pyrene, benzo(a)anthracene and chrysene were the most predominant kinds followed by 6-ring PAHs [Ref. 11].

A study to characterize particulate matter emissions from 195 in-use gasoline and diesel passenger vehicles was conducted during the summer of 1996 and the winter of 1997 in the Denver, Colorado region [Ref. 12]. Vehicles were tested as received on chassis dynamometers using the Federal Test Procedure (FTP). Approximately 88% of the PM-10 collected was carbonaceous material, of which the average organic fraction was 0.7 for gasoline vehicles and 0.4 for diesel vehicles. This suggests that the organic carbon (OC) to elemental carbon (EC) split may be useful in separating light-duty gasoline from diesel PM emissions. Elements identified by X-ray fluorescence averaged between 3 and 9% of the PM-10 mass. Polynuclear aromatic hydrocarbon (PAH) profiles developed may help distinguish between gasoline and diesel vehicles in source apportionment studies. Total PAH emissions, however, were not a good candidate as a tracer of gasoline PM emissions. Hopane and sterane emissions were very similar across the fleet and may be useful tracers for mobile source PM emissions.

Other than PAHs, Hopanes and steranes are the widely accepted markers of fossil fuel residue. The distribution patterns of hopanes at Changdao, China were studied [Ref. 13] in summer and were found to be similar to that in engine exhaust, suggesting that traffic emission was the main source of hopanes.

Rogge et al. [Ref. 14] have shown that motor vehicle exhaust dominates the hopanes and steranes emissions in Southern California and that these compounds act as useful tracers for the particulate matter emitted from motor vehicles.

Cass [Ref. 15] found that hopanes and steranes are emitted in the particle phase from both vehicle types. This was explained by the fact that hopanes and steranes are present in the lubricating oil used by both gasoline-powered and diesel-powered motor vehicles, and are also found in diesel fuel.

3. Objective of the Project

The objective of the study includes -

1. Collection of representative samples of particulate matter from vehicle exhaust on filter paper using mass emission test on the vehicles identified based on technology, vintage and fuel type
2. Chemical characterization of particulate matter (PM10) collected for Elements, Carbon (Elemental/ Organic), ions and molecular markers

4. Scope of the project

4.1 To carry out source profiling of vehicular emission for Indian Vehicles

4.2 Two mass emission tests (one with Teflon and other with Quartz) would be carried out on each vehicle in the matrix following Indian Driving Cycle for 2/3 wheelers, Modified IDC for passenger cars and LCVs and Overall Bus Driving Cycle for HCVs on Chassis dynamometer.

4.3 Gravimetric analysis and chemical characterization of particulate matter (PM10) collected on filter paper for Elements, Carbon (Elemental/ Organic), ions and molecular markers.

5. Project Execution Methodology

Source profiling of vehicle emissions involved emission test on vehicles for PM collection and Chemical characterization for marker constituents from vehicle exhaust of the collected PM (Fig. 3). The project has following major components;

1. Vehicle sourcing
2. Emission testing.
3. Chemical speciation

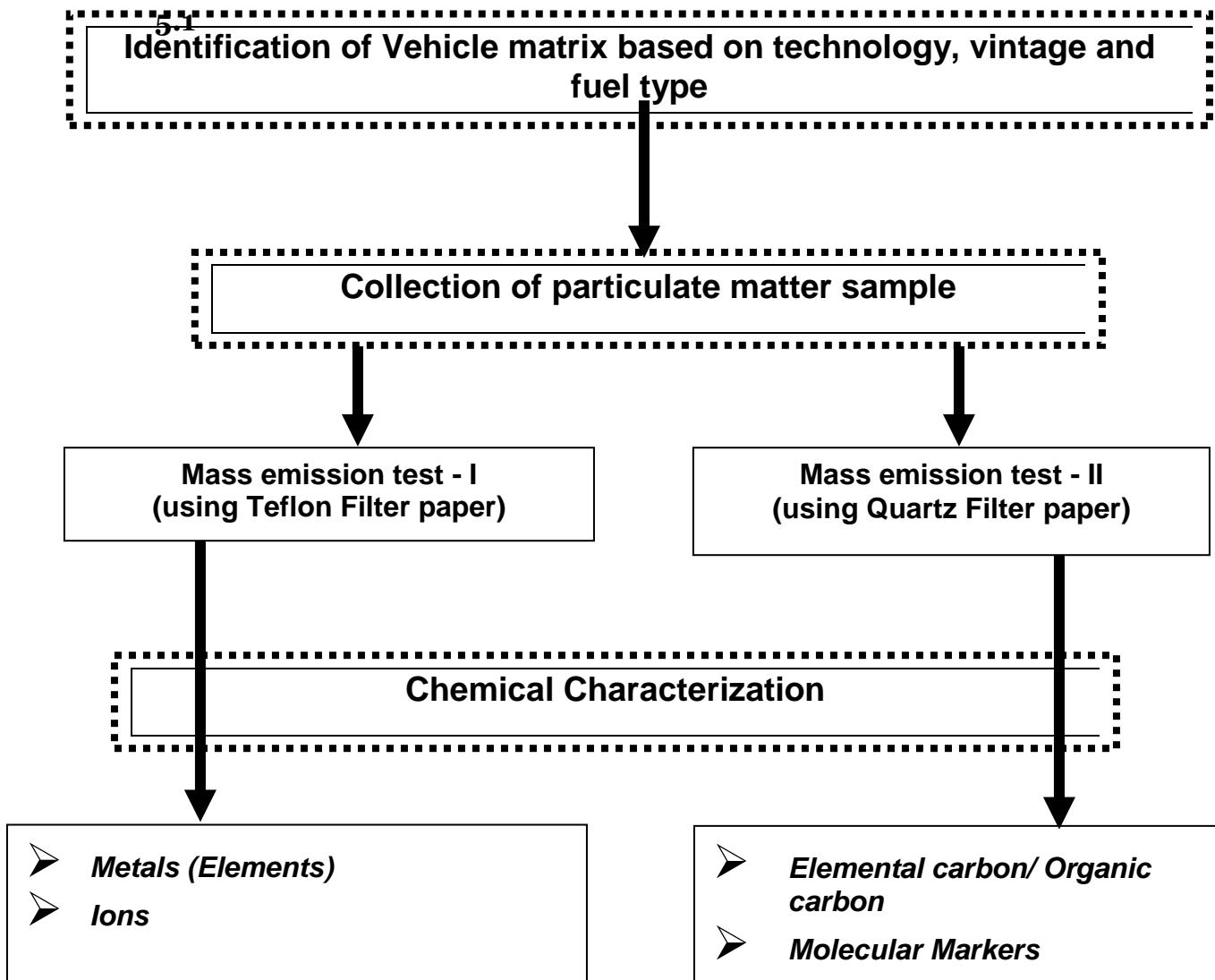


Fig. 3: Methodology for source profiling of vehicular emission

5.1 Vehicle sourcing

Test matrix is formatted in consideration with oil industry as given in Annexure I. After deliberation in technical committee meeting it was decided to have more Post 2000 vintage vehicles instead of pre 1996 vehicles. The vehicle models selected for testing are given in Annexure II.

Vehicles models are selected based on following criteria;

- i. Test Matrix as per Annexure I,
- ii. Vehicle Categorization as per engine capacity,
- iii. Market Share as per the Data given by Society of Indian Automotive Manufacturer,
- iv. Avoid Vehicles already tested under Emission Factor Determination project and cover Vehicles/Categories not addressed in Emission Factor Determination project.

A lot of effort was put in to source the vehicle models as per the desired matrix. However some of the vehicle models could not be located at all known sources such as ARAI employees, acquaintances, transport operators, dealerships, etc. Some of the vehicles (including old and newer vintages) were in bad condition and were not suitable for testing on dynamometer. Notably some of the problems faced with old vehicles were non-existent braking, torn silencer, non-operational clutch, vehicle stalling, unsteady engine running, etc. In cases where desired model was not available or unsuitable for testing due to its condition, some other alternative models were tested.

Also in some of the cases, the vehicle owners were not ready to lend their new vehicles for testing at ARAI. In such cases the vehicles available at ARAI for TA/COP testing were utilized. Maintenance was not carried out on such vehicles as they were prototype / new vehicles. In case of CNG/LPG vehicles also due to their limited availability in Pune, vehicles available at ARAI for Type Approval were utilized. In a very few cases maintenance was not carried out as the CNG/LPG vehicles available at ARAI were pre-tuned for certification tests.

Also some of the old vehicles developed problems when they were brought in for testing at ARAI. Hence few test results had to be rejected to avoid the unreliability of test results due to the condition of vehicle. The vehicle owner in such cases had to be paid with compensation although the data was not used for the purpose of the project. In such cases all the tests were repeated subsequently on some other vehicle model.

The In-use vehicles were generally sourced locally from individuals, organizations, transport operators, PMC/PCMC, MSRTC, RTO Pune, ARAI employees, Rickshaw unions and possible acquaintances. Initially by survey, the information on the in use vehicle availability for the selected vehicle models was obtained. Based on the information collected and the condition of the vehicle for the testing, vehicles were subjected to tests on dynamometer at ARAI. The

necessary vehicle documentations like registration information were also collected from the vehicle owner.

5.2 Emission Testing

The vehicles as selected above were sent for the maintenance at authorized service station by ARAI personnel. During maintenance, the major component change was not carried out but minimum checks and adjustments like spark plug cleaning, oil change, air filter cleaning, fuel pump cleaning, ignition-timing adjustment, PUC check was carried out as per the owners manual. After the maintenance, vehicles were brought to ARAI for emission testing. Initially, the vehicle was subjected to exhaust leak check and rectified if there is any exhaust leak. The fuel in the vehicle tank was drained off and the commercial fuel was topped up after necessary flushing. Then the vehicle was subjected to exhaust mass emission test on the chassis dynamometer. The standard vehicle exhaust mass emission tests was performed on Chassis dynamometer. The test procedure used for different vintages were as per the prevalent emission test procedure applicable for that category and vintage of the vehicle. The test cycle applicable for each category of vehicle is given in Table – 4.

Table 4:- Test Cycles

Vehicle Category	Test Cycle
Two / Three wheeler vehicles	Indian Driving Cycle (IDC) (See Annexure – II)
Pre 2000 model year four wheeled vehicle with gross vehicle weight (GVW) less than or equal to 3500 kg	Indian Driving Cycle
Post 2000 model year four wheeled vehicle with GVW less than or equal to 3500 kg	Modified Indian Driving Cycle (See Annexure II)
For vehicles with GVW above 3500 kg	Overall Bus Driving Cycle (OBDC) (See Annexure – II)

During the mass emission test, the exhaust mass emissions of CO, THC, NOx and CO₂ were measured for all the vehicles tested. Additionally gravimetric PM was measured. The exhaust mass emissions are expressed in g/km. The first emission test was carried with Teflon filter while repeated emission test was carried with Quartz filter. Both these particulate filters from the exhaust mass emission test on all vehicles were subjected to chemical characterization of particulate matter. The particulate matter on the filter paper was characterized into Elements, Ions, Elemental and Organic carbon and molecular markers.

Tests were carried out with commercially available gasoline, diesel and CNG/LPG fuel.

The coast down equation for the dynamometer tests was used as per the available data with ARAI. For vehicles above 3.5 t GVW, empirical equations/extrapolated equations were used.

Summary of Mass Emission Results

Sr. No	VEH ID	Type of Vehicle	Vintage Category	Engine cc	Cat. Con.	CO	HC	NOx	CO2	PM
1	1	2-Stroke,2W Gasoline	1991-96	<80cc	without Cat. Con.	5.26	2.67	0.10	24.27	0.027
2	2	2-Stroke,2W Gasoline	1991-96	>80cc	without Cat. Con.	5.53	3.51	0.02	23.94	0.07
3	3	2-Stroke,2W Gasoline	1991-96	>80cc	without Cat. Con.	3.87	4.73	0.01	25.43	0.024
4	4	2-Stroke,2W Gasoline	1996-2000	<80cc	without Cat. Con.	4.27	3.20	0.03	22.93	0.068
5	5	2-Stroke,2W Gasoline	1996-2000	>80cc	without Cat. Con.	3.06	2.99	0.01	25.28	0.024
6	6	2-Stroke,2W Gasoline	1996-2000	>80cc	without Cat. Con.	8.94	6.52	0.04	34.10	0.221
7	7	2-Stroke,2W Gasoline	Post 2000	<80cc	without Cat. Con.	6.58	3.87	0.03	25.95	0.052
8	8	2-Stroke,2W Gasoline	Post 2000	>80cc	with Cat. Con.	2.63	2.53	0.01	34.13	0.017
9	9	2-Stroke,2W Gasoline	Post 2000	>80cc	with Cat. Con.	2.54	2.04	0.01	24.68	0.052
10	10	4-Stroke,2W (Gasoline)	1991-96	<100cc	without Cat. Con.	4.88	0.97	0.23	22.67	0.005
11	11	4-Stroke,2W (Gasoline)	1991-96	<100cc	without Cat. Con.	1.64	0.89	0.29	25.10	0.006
12	12	4-Stroke,2W (Gasoline)	1991-96	>200cc	without Cat. Con.	10.05	2.17	0.87	36.21	0.018
13	13	4-Stroke,2W (Gasoline)	1996-2000	<100cc	without Cat. Con.	3.73	0.90	0.19	21.62	0.005
14	14	4-Stroke,2W (Gasoline)	1996-2000	<100cc	without Cat. Con.	2.21	0.68	0.35	25.54	0.005
15	15	4-Stroke,2W (Gasoline)	1996-2000	>200cc	without Cat. Con.	3.66	1.21	0.42	38.57	0.03
16	16	4-Stroke,2W (Gasoline)	Post 2000	>100cc	with Cat. Con.	1.35	0.81	0.30	30.40	0.013
17	17	4-Stroke,2W (Gasoline)	Post 2000	100-200cc	without Cat. Con.	1.42	0.41	0.41	33.88	0.007
18	18	4-Stroke,2W (Gasoline)	Post 2000	>200CC	with Hot Tube	0.85	0.47	0.25	50.54	0.006

Sr. No	VEH ID	Type of Vehicle	Vintage Category	Engine cc	Cat. Con.	CO	HC	NOx	CO2	PM
19	19	3 Wheeler (Gasoline)	1991-96	<200cc	without Cat. Con.	5.39	6.16	0.31	57.89	0.158
20	20	3 Wheeler (Gasoline)	1991-96	<200cc	without Cat. Con.	13.78	6.40	0.12	40.45	0.15
21	21	3 Wheeler (Gasoline)	1991-96	<200cc	without Cat. Con.	8.50	8.31	0.11	59.05	0.146
22	22	3 Wheeler (Gasoline)	1996-2000	<200cc	without Cat. Con.	2.17	5.20	0.26	54.34	0.077
23	23	3 Wheeler (Gasoline)	1996-2000	<200cc	without Cat. Con.	3.52	4.32	0.08	46.04	0.02
24	24	3 Wheeler (Gasoline)	1996-2000	<200cc	without Cat. Con.	5.19	1.53	0.72	71.96	0.02
25	25	3 Wheeler (Gasoline)	Post 2000	<200cc	with Cat. Con.	1.32	4.04	0.19	52.77	0.08
26	26	3 Wheeler (Gasoline)	Post 2000	<200cc	with Cat. Con.	1.15	1.61	0.08	63.61	0.044
27	27	3 Wheeler (Gasoline)	Post 2000	<200cc	without Cat. Con.	4.40	1.00	0.57	59.15	0.011
28	28	3 Wheeler (Diesel)	1991-96	<500cc	without Cat. Con.	12.74	2.67	1.19	74.14	2.229
29	29	3 Wheeler (Diesel)	1991-96	<500cc	without Cat. Con.	10.38	1.10	0.94	65.41	0.71
30	30	3 Wheeler (Diesel)	1991-96	<500cc	without Cat. Con.	13.16	1.64	1.04	94.32	0.856
31	31	3 Wheeler (Diesel)	1996-2000	<500cc	without Cat. Con.	10.98	1.13	0.78	109.27	0.851
32	32	3 Wheeler (Diesel)	1996-2000	<500cc	without Cat. Con.	2.74	0.48	0.65	129.82	0.487
33	33	3 Wheeler (Diesel)	1996-2000	<500cc	without Cat. Con.	6.22	1.26	0.53	115.27	0.436
34	34	3 Wheeler (Diesel)	Post 2000	<500cc	without Cat. Con.	0.29	0.03	0.51	91.22	0.047
35	35	3 Wheeler (Diesel)	Post 2000	<500cc	without Cat. Con.	0.63	0.12	0.68	86.19	0.049
36	36	3 Wheeler (Diesel)	Post 2000	<500cc	without Cat. Con.	0.34	0.06	0.44	89.44	0.068

Sr. No	VEH ID	Type of Vehicle	Vintage Category	Engine cc	Cat. Con.	CO	HC	NOx	CO2	PM
37	37	Passenger Car (Gasoline)	1991-96	<1000cc	without Cat. Con.	7.18	0.96	1.04	107.77	0.007
38	38	Passenger Car (Gasoline)	1991-96	<1000cc	without Cat. Con.	7.14	1.04	0.98	113.97	0.005
39	39	Passenger Car (Gasoline)	1996-2000	1000-1400cc	without Cat. Con.	3.46	0.74	0.75	115.23	0.004
40	40	Passenger Car (Gasoline)	1996-2000	<1000cc	without Cat. Con.	3.79	0.72	0.91	115.29	0.00
41	41	Passenger Car (Gasoline)	1996-2000	1000-1400cc	without Cat. Con.	5.54	0.61	0.59	131.99	0.003
42	42	Passenger Car (Gasoline)	1996-2000	>1400CC	without Cat. Con.	4.84	0.67	0.70	129.92	0.007
43	43	Passenger Car (Gasoline)	Post 2000	<1000cc	with Cat. Con.	1.45	0.26	0.17	126.74	0.001
44	44	Passenger Car (Gasoline)	Post 2000	1000-1400CC	with Cat. Con.	0.74	0.11	0.01	158.19	0.001
45	45	Passenger Car (Gasoline)	Post 2000	>1400CC	with Cat. Con.	0.61	0.06	0.02	160.21	0.001
46	47	Passenger Car (Diesel)	1991-96	<1600CC	without Cat. Con.	1.95	1.78	0.69	174.09	0.3
47	46	Passenger Car (Diesel)	1996-2000	<1600 CC	without Cat. Con.	0.76	0.17	0.71	139.66	0.102
48	48	Passenger Car (Diesel)	1996-2000	<1600CC	without Cat. Con.	0.83	0.18	0.51	134.60	0.186
49	49	Passenger Car (Diesel)	1996-2000	<1600CC	without Cat. Con.	0.88	0.41	0.52	159.93	0.11
50	50	Passenger Car (Diesel)	1996-2000	<1600CC	without Cat. Con.	0.82	0.16	0.57	130.05	0.075
51	51	Passenger Car (Diesel)	1996-2000	1600-2400CC	without Cat. Con.	0.97	0.51	0.61	148.28	0.30
52	52	Passenger Car (Diesel)	Post 2000	<1600CC	without Cat. Con.	0.37	0.05	0.45	117.63	0.06
53	53	Passenger Car (Diesel)	Post 2000	<1600CC	with Cat. Con.	0.53	0.08	0.34	157.76	0.10
54	54	Passenger Car (Diesel)	Post 2000	<1600CC	with Cat. Con.	0.08	0.03	0.43	152.26	0.06

Sr. No	VEH ID	Type of Vehicle	Vintage Category	Engine cc	Cat. Con.	CO	HC	NOx	CO2	PM
55	57	LCV (Diesel)	1991-96	>3000CC	without Cat. Con.	8.53	1.25	7.13	353.79	1.06
56	55	LCV (Diesel)	1996-2000	<3000CC	without Cat. Con.	1.33	1.44	0.71	226.12	0.20
57	56	LCV (Diesel)	1996-2000	<3000CC	without Cat. Con.	1.28	1.13	0.82	231.53	0.15
58	58	LCV (Diesel)	1996-2000	<3000CC	without Cat. Con.	1.26	1.30	1.70	237.97	0.25
59	59	LCV (Diesel)	1996-2000	<3000CC	without Cat. Con.	1.27	1.09	0.62	236.12	0.65
60	60	LCV (Diesel)	1996-2000	>3000CC	without Cat. Con.	5.30	1.73	3.51	354.15	1.34
61	61	LCV (Diesel)	Post 2000	<3000CC	with Cat. Con.	0.27	0.06	0.53	327.84	0.08
62	62	LCV (Diesel)	Post 2000	<3000CC	with Cat. Con.	0.08	0.04	0.86	290.83	0.1
63	63	LCV (Diesel)	Post 2000	>3000CC	without Cat. Con.	1.04	0.26	2.35	338.13	0.233
64	64	HCV (Diesel)	1991-96	>6000cc	without Cat. Con.	16.52	2.19	8.67	682.91	2.15
65	66	HCV (Diesel)	1991-1996	>6000cc	without Cat. Con.	8.73	1.83	9.42	785.55	1.57
66	67	HCV (Diesel)	1996-2000	>6000cc	without Cat. Con.	9.69	0.88	9.37	615.04	0.9
67	68	HCV (Diesel)	1996-2000	>6000cc	without Cat. Con.	4.67	0.68	6.99	689.00	0.89
68	69	HCV (Diesel)	1996-2000	>6000cc	without Cat. Con.	6.43	1.05	12.85	803.61	0.88
69	65	HCV (Diesel)	Post 2000	>6000cc	without Cat. Con.	4.14	0.29	8.64	920.79	0.42
70	70	HCV (Diesel)	Post 2000	>6000cc	without Cat. Con.	4.15	0.12	6.02	818.85	0.49
71	71	HCV (Diesel)	Post 2000	>6000cc	without Cat. Con.	2.99	0.16	7.50	704.01	0.43
72	72	HCV (Diesel)	Post 2000	>6000cc	without Cat. Con.	7.00	0.23	7.67	794.44	1.74

Sr. No	VEH ID	Type of Vehicle	Vintage Category	Engine cc	Cat. Con.	CO	HC	NOx	CO2	PM
73	73	3W-CNG OE	Post 2005	<200cc	without Cat. Con.	0.38	1.31	0.47	55.88	0.002
74	74	3W-CNG OE	Post 2005	<200cc	with Cat. Con.	0.28	0.28	0.21	54.22	0.004
75	75	3W-CNG RETROFIT	1996-2000	<200cc	without Cat. Con.	0.87	9.38	0.19	48.71	0.535
76	76	3W-CNG RETROFIT	2000-2005	<200cc	with Cat. Con.	0.45	3.12	0.21	48.03	0.023
77	77	3W-CNG RETROFIT	Post 2005	<200cc	with Cat. Con.	0.15	6.78	0.08	41.85	0.01
78	78	3W-LPG OE	Post 2005	<200cc	with Cat. Con.	0.14	1.76	0.46	60.28	0.003
79	79	3W-LPG OE	Post 2005	<200cc	with Cat. Con.	0.33	1.25	0.64	75.76	0.014
80	80	3W-LPG RETROFIT	1996-2000	<200cc	without Cat. Con.	7.21	5.08	0.05	44.87	0.375
81	81	3W-LPG RETROFIT	2000-2005	<200cc	with Cat. Con.	0.83	1.51	0.17	78.55	0.002
82	82	3W-LPG RETROFIT	Post 2005	<200cc	with Cat. Con.	1.55	3.55	0.08	45.13	0.267
83	83	4W-CNG OE	Post 2005	<1000cc	with Cat. Con.	0.22	0.35	0.27	102.97	0.005
84	84	4W-CNG OE	Post 2005	>1400cc	with Cat. Con.	0.47	0.31	0.37	182.90	0.015
85	85	4W-CNG RETROFIT	1991-1996	1000-1400cc	without Cat. Con.	2.52	0.78	1.04	100.19	0.018
86	86	4W-CNG RETROFIT	2000-2005	1000-1400CC	with Cat. Con.	0.61	0.44	0.04	126.85	0.001
87	87	4W-CNG RETROFIT	Post 2005	>1400cc	with Cat. Con.	0.72	0.43	0.03	173.78	0.003

Sr. No	VEH ID	Type of Vehicle	Vintage Category	Engine cc	Cat. Con.	CO	HC	NOx	CO2	PM
88	88	4W-LPG OE	2000-2005	<1000cc	with Cat. Con.	2.87	0.82	0.69	164.45	0.008
89	89	4W-LPG OE	Post 2005	1000-1400cc	with Cat. Con.	0.80	0.14	0.10	126.19	0.001
90	90	4W-LPG RETROFIT	1996-2000	<1000cc	without Cat. Con.	6.68	1.65	0.48	93.57	0.001
91	91	4W-LPG RETROFIT	2000-2005	>1400cc	with Cat. Con.	1.37	0.22	0.06	146.63	0.009
92	92	4W-LPG RETROFIT	Post 2005	>1400cc	with Cat. Con.	0.32	0.04	0.04	151.34	0.001
93	93	HCV CNG (OE)	2000-2005	<6000cc	with Cat. Con.	4.18	2.74	6.03	279.40	0.083
94	94	HCV CNG (OE)	Post 2005	<6000cc	with Cat. Con.	3.37	2.42	5.70	621.81	0.058
95	95	HCV CNG (Retrofitted)	2000-2005	>6000cc	with Cat. Con.	3.66	4.70	4.10	570.90	0.031
96	96	HCV CNG (Retrofitted)	Post 2005	<6000cc	with Cat. Con.	3.41	3.11	3.98	422.94	0.032

5.3 Chemical Speciation:

One of the important methods for resolving the mobile source contribution is through chemical mass balance (CMB) receptor modeling. CMB requires chemically speciated source profiles with known uncertainty to ensure accurate source contribution estimates.

The vehicle emission profile generated, for Indian vehicles, by PM characterization together with the ambient particulate matter speciation data could be a realistic input to the source apportionment study for identification of sources of air pollution. Also, chemical nature of the particulate matter from the vehicle exhaust gases is dependent on technology and fuel quality. It is, therefore, important to have particulate characterization data, in Indian context, to use receptor model for Source Apportionment Study.

Two mass emission tests (one with Teflon and other on Quartz), as per the applicable test procedure, were carried out on each vehicle in the given matrix for collection of particulate matter on respective filter papers for detailed chemical characterization.

5.3.1 *Species selected and analysis methodology:*

Chemical speciation analysis can be broken into the three most common categories: Elements, Ions and Carbons. This would be helpful in identifying the distribution of major groups present in the Particulate Matter collected during Mass Emission test of Vehicle Exhaust. The list of constituents (**Table 5**) under each above said group are selected as defined in project “Source Apportionment Study of PM 10 collected in Ambient Air of selected cities”, which includes chemical species expected from motor vehicles exhaust.

Table 5: Constituents of chemical characterization of the PM for source profiling of vehicle emissions

Group	Constituents	
Elements	Na, Mg, Al, Si, P, S, Cl, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ca, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb	
Ions	F ⁻ , Cl ⁻ , Br ⁻ , NO ₂ ⁻ , NO ₃ ⁻ , SO ₄ ⁻² , K ⁺ , NH ₄ ⁺ , Na ⁺ , Ca ⁺⁺ , Mg ⁺⁺	
Carbon	Elemental Carbon, Organic Carbon and Total Carbon	
Molecular markers	Alkanes	n- Hentriacontane n-Tritriacontane n- Pentatriacontane
	Hopanes	22, 29, 30 – Trisnorneohopane 17α(H), 21β(H)-29 Norhopane 17α(H),21β(H) Norhopane
	Alkanoic acid	Hexadecanamide Octadecanamide
	PAHs	Benzo[b]fluoranthene Benzo[k]fluoranthene Benzo[e]pyrene Indeno[1,2,3-cd]fluoranthene Indeno[1,2,3-cd]pyrene Phenylendepyrene Picene Coronene
	Others	Stigmasterol Levoglucosan

Typical sample preparation and analytical technique/methodology applicable for each of speciation categories is described below:

5.3.1.1 Elemental/Organic Carbon

PM samples collected on pre-baked quartz samples were analysed using DRI Model 2001 Thermal/Optical Carbon Analyzer for organic and elemental carbon fractions. The operation is based on the preferential oxidation of organic carbon (OC) compounds and elemental carbon (EC) at different temperatures. Following methodology was used for analyses. Detailed method of analysis is presented at **Annexure IV-A**.

- 1) Liberating carbon compounds under different temperature and oxidation environments from a small sample punch taken from a quartz-fiber filter;
- 2) Converting these compounds to carbon dioxide (CO₂) by passing the volatilized compounds through an oxidizer (heated manganese dioxide, MnO₂);
- 3) Reducing CO₂ to methane (CH₄) by passing the flow through a methanator (hydrogen-enriched nickel catalyst); and
- 4) Quantifying CH₄ equivalents with a *flame ionization detector* (FID).

The principal function of the optical (laser reflectance) component of the analyzer is to correct for pyrolysis charring of OC compounds into EC. Without this correction, the OC fraction of the sample might be underestimated and the EC fraction might include some pyrolyzed OC. The correction for pyrolysis is made by continuously monitoring the filter reflectance and/or transmittance (via a helium-neon laser and a photo detector) throughout an analysis cycle. The reflectance and transmittance, largely dominated by the presence of light absorbing EC, decrease as pyrolysis takes place and increase as light-absorbing carbon is liberated during the latter part of the analysis. By monitoring the reflectance, the portion of the EC peak corresponding to pyrolyzed OC can be accurately assigned to the OC fraction. The correction for the charring conversion of OC to EC is essential for a less-biased measurement of carbon fractions.

Seven temperature fractions, as well as the TOR and TOT charring correction, are individually quantified and reported when the IMPROVE temperature protocol is applied. Values routinely reported include total OC, total EC, total carbon (TC, sum of total OC and total EC), and pyrolyzed carbon, monitored by both reflectance (OPR) and transmittance (OPT). Based on thermal optical reflectance (TOR) protocol for quantification, thermally-derived sub-fractions of organic carbon (OC1, OC2, OC3 and OC4) and elemental carbon (EC1, EC2 and EC3) were analyzed. Carbon content in the exhaust PM is fractionated based on the temperature range in which the carbon is evolved. Temperature ranges for the fractions are given below-

OC1: Carbon evolved from the filter punch in a He-only atmosphere from ambient (~25 °C) to 140 °C.

OC2: Carbon evolved from the filter punch in a He-only atmosphere from 140 to 280 °C.

OC3: Carbon evolved from the filter punch in a He-only atmosphere from 280 to 480 °C.

OC4: Carbon evolved from the filter punch in a He-only atmosphere from 480 to 580 °C.

EC1: Carbon evolved from the filter punch in a 98% He/2% O₂ atmosphere at 580 °C.

EC2: Carbon evolved from the filter punch in a 98% He/2% O₂ atmosphere from 580 to 740 °C.

EC3: Carbon evolved from the filter punch in a 98% He/2% O₂ atmosphere from 740 to 840 °C.

OP: The carbon evolved from the time that the carrier gas flow is changed from He to 98% He/2% O₂ at 580 °C to the time that the laser-measured filter reflectance (OPR) reaches its initial value. A negative sign is assigned if the laser split occurs before the introduction of O₂.

Organic Carbon: Carbon evolved from the filter punch in a He-only atmosphere at 140, 280, 480 and 580 °C plus pyrolyzed organic carbon. This is the same as Volatile Organic Carbon (VOC) plus high-temperature OC.

Elemental Carbon: Carbon evolved from the filter punch in a 98% He/2% O₂ atmosphere at 580, 740, and 840 °C minus any pyrolyzed OC.

High Temperature OC: Carbon evolved from the filter punch in a He-only atmosphere at 280, 480, and 580 °C plus pyrolyzed organic carbon. This is OC minus the first OC peak (OC1).

High Temperature EC: Carbon evolved from the filter punch in a 98% He/2% O₂ atmosphere at 740 and 840 °C minus any pyrolyzed organic carbon present in these two peaks. This is EC minus the first EC peak (EC1).

Pyrolysis: The conversion of OC compounds to EC due to thermal decomposition; this may be envisioned as "charring" during the organic portion of the analysis.

5.3.1.2 Organic Molecular Markers

PM samples were extracted using Soxhlet extraction method with Acetone and Methylene Dichloride as organic solvents in 1:1 proportion. GC-MS technique was used for qualitative analysis of organic species and quantification was done by using High resolution Gas Chromatograph (HR-GC) with Flame Ionization Detector (FID) and High performance liquid chromatography (HPLC) with UV detector. Analysis of Alkanes, Hopanes and Alkanoic Acids were carried out on HRGC-FID whereas, HPLC-UV detector was used for analysis of PAHs compounds. Apart from list mentioned as constituents for chemical characterization of PM for source profiling of vehicle emissions for PAHs, other 13 PAHs were also analysed. The list of other PAHs which are included in chemical characterization of PM for source profiling of vehicle emissions are as follows:-

- Napthalene
- Fluorene and Acenaphthene
- Acenaphthalene
- Phenanthrene
- Anthracene
- Fluoroanthene
- Pyrene
- Benzo(a)Anthracene
- Chrysene
- Benzo(a)Pyrene
- Dibenz(a,h)anthracene
- Benzo(g,h,i)Pyrene

16 PAHs Mix NIST traceable Calibration Standards were used for analysis on HPLC with UV-detector. Detailed methodology of analysis using GC-MS & HRGC and HPLC are presented at ***Annexure- IV-B and IV-C*** respectively.

5.3.1.3 Elements

For quantification of elements present in PM collected on Teflon Filter during Mass Emission Test, Energy Dispersive X-ray fluorescence (ED-XRF) technique was used (Compendium Method IO-3.3). An X-ray source removes electrons from the inner shells of atoms by exciting the atoms to energy states above the stable configuration. As electrons move to refill the ground state energy levels, the atomic system maintains its fundamental energy balance by emission of electromagnetic radiation. The emitted radiation is an x-ray whose energy is characteristic of the excited element. The samples are quantitatively analyzed by counting the number of observed x-rays over a set period, as compared with the number of fluoresced x-rays from similarly analyzed standards.

X-ray Fluorescence Spectrometer, Make- SPECTRO, Germany, Model-XEPOS with HOPG, Mo, Al₂O₃ targets and Si drift detector was used for analysis. Other specifications of the equipment are as follows-

- Tube voltage: 0-50 kV with resolution of 12 bit.
- Tube current: 0-2 mA with resolution of 12 bit.
- Power Output: 50W max.
- Energy resolution: < 170 eV.

Single element thin-film calibration standards from Micromatter for 34 elements were used for calibration of equipment. The instrument is calibrated by acquiring spectra for all the single element thin film standards. Mg, Ca, Si, P, S, Zn are specifically targeted for their origin source of 2T/4T Lubricating Oil Formulations, whereas Fe, Cu and Pb are selected as they emerge out in exhaust as Engine Wear metals. Analysis method followed is presented at ***Annexure-IV-D***, in detail.

5.3.1.4 Ions

Anions and Cations were analyzed using Ion Chromatograph with conductivity detector. Sample preparation for PM is done using Ultrasonication technique in de-ionized (18 M.Ohm resistivity) water. The aqueous extract filtered through 0.2 micron membrane filters of PM was analysed for anions such as Fluoride, Chloride, Bromide, Nitrite, Nitrate, Phosphate and Sulphate and cations such as Sodium, Ammonium, Potassium, Calcium and Magnesium Sulphate, Nitrate, Chloride and Ammonium Ions were mainly focused due to their likely presence in fuel and oils during combustion process. Analysis method followed for ions is presented at **Annexure-IV-E**, in detail.

An outline of laboratory performance observed as QA/ QC procedures for above mentioned analyses are presented in **Table 6**.

Table 6: An outline of laboratory performance observed

Sr. No.	Parameter	Standard Ref. Method	Test procedure/ SOP	Analytical Technique/ Method	Calibration Standard Details	Performance Test Standard	Perform. Test Frequency	Calibration Periodicity	Primary Standard
1	Elements	Method IO –3.3 for XRF CARB	TP- Elements- AML	Energy Dispersive - X-Ray Fluorescence (ED-XRF)	Micromatter Thin Film Standards	Replicate Thin Film Standard	1/10th sample	Once/2-months When Performance test Not Met	Micromatter Thin Film Standards
2	Ions	CARB/ MLD NO.064	TP-155- AML	Ion Chromatograph with Conductivity Detector	NIST Traceable MERCK make Certipur Standards	Solution Standard	1/10th sample	At Beginning of Each Run	Certified NIST traceable standards
3	EC/OC	CARB/ MLD NO.065	TP-156- AML	Thermal Optical Reflectance/Transmission Carbon Analyzer	Methane, Gas and Certified	CO2 ACS KHP	Replicate Methane Gas Run	Once/2-months or When Performance test not met	ACS Certified chemicals
4	Molecular Markers	CPCB provided SOP for SA Studies.	TP--MM- AML	Gas Chromatograph - Mass Spectrometer(GC-MS)	Available Sigma Aldrich and Fluka Make authentic standards	Solution Standard		Intermediate checks with authentic standard before analysis of set of samples.	ACS Certified chemicals
5	Poly-Aromatic Hydrocarbons (PAH)	As per NIST SRM 1647d	TP-148- AML	High Performance Liquid Chromatography (HPLC) with UV Detector	NIST SRM-1647d 16 component PAH-Mix. Acceptance criterion of +/- 5 % of the NIST Standards	Solution Standard		Intermediate checks with NIST standard before analysis of set of samples.	Certified NIST traceable standards

NOTE:- Audit frequency was kept once per 2 months for all the above mentioned parameters in Table..

5.3.2 Calculations of uncertainty in measurement

Uncertainties in measurements were calculated for all the species and reported as percentage of PM mass. Methodology for calculation of uncertainty for ions, PAHs is shown below

With reference to equation (1) in RTI document equation for uncertainties in units of mass per filter is given as.

$$Mi, j \sigma = \max (\sigma^2 Ai + \sigma^2 V_k \cdot M^2, \sigma Bi) \quad (1)$$

Where

$Mi, j \sigma$ = Std.dev of mass for analyte i for event j (micrograms per filter)

$Ai \sigma$ = analytical uncertainty for analyte i (micrograms per filter)

$V_k \sigma$ = relative std. dev. attributable to field sampling (dimensionless)
(assumed as 5%)

M = analytical mass (micrograms per filter)

$Bi \sigma$ = default minimum uncertainty (micrograms per filter)

Calculation for $Ai \sigma$

Analytical uncertainty is calculated by equation

$$Ai \sigma = Bi \sigma + M \cdot REL \sigma \quad (2)$$

Where

$REL \sigma$ = relative uncertainty multiplier=0.05

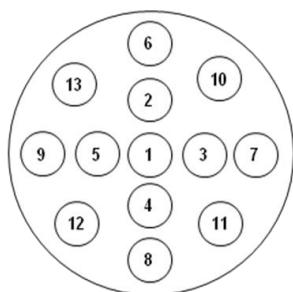
Uncertainty Calculations for Ion chromatograph analysis were done by considering the Type A factor i.e. Repeatability of NIST-Certified Mix-Standard Solution of Anion as well as Cation. Similarly, for Type B type uncertainties following factors were considered -

- Rounding Error due to resolution of Analytical Balance while measuring Weight
- Uncertainty of Analytical Balance given in Calibration Report while measuring Weight
- Accuracy of Analytical Balance while measuring Weight
- Uncertainty of 50 ml Volumetric Flask given in Calibration Report
- Rounding Error due to resolution of 1ml pipette
- Uncertainty of 1ml pipette given in Calibration Report while measuring volume
- Accuracy of 1ml pipette while measuring volume of Stock Standard solutions

Similarly, in specific case of Vehicle Exhaust samples, background values of both the types of filters (i.e. 47 mm diam. Size Teflon Filter which were used for 2 Wheelers and 3 Wheelers tests and 70 mm diam. Teflon Filter for 4 Wheelers and HCV Mass Emission Test) are used in calculation of uncertainty.

Uncertainty calculation for carbon fractions analysis

Carbon fractions were analysed by analyzing a punch (approx. 5.12 cm²) taken from center of a 47 or 70 mm PM-loaded quartz filter paper which is about 5% area of total filter paper. Major source of uncertainty is non-uniform distribution of particulate matter on to the filter paper. Taking this into account, 13 punches were taken (as shown below) from a single paper at different radial location to capture radial variation in the PM loading.



These punches were analysed separately thus covering a total of about 65% of PM loaded filter paper. Difference in the carbon contents obtained was used as a source of uncertainty in calculation. Other sources which were considered include rounding-off error due to resolution of carbon analyser and uncertainty of the standards used for calibration. Non-uniformity in the PM loading is dependent on the actual PM loading and increases with decrease in PM loading. Therefore, this exercise was carried out for different PM loadings categorized into, low, medium and high loading. For organic carbon the uncertainty with higher and lower PM loading was found to be 5% and 8.3 % respectively. Similarly, for elemental carbon, the uncertainty with higher and lower PM loading was found to be 3.7% and 8.1%. Uncertainty values were observed to be higher for low PM loadings as expected.

Elements analyses were carried out using ED XRF. Uncertainty for a particular element was taken as one half the method detection limit for that element.

6. Results and discussion:

6.1 Chemical Group wise distribution

6.1.1 Carbon Fractions:

Carbon content in the exhaust PM is fractionated based on the temperature range in which the carbon is evolved. Distribution of various carbon fractions of organic carbon (OC1, OC2, OC3 & OC4) and elemental carbon (EC1, EC2 & EC3) as percent mass of Total carbon is presented in **Fig. 4** below.

As can be seen from the figure, in gasoline composite, OC1 & OC2 fractions are dominating with a share of around 70% in total carbon. EC1 & EC2 are found to be in same proportion with negligible EC3 share. Pyrolytic correction was also found to be very low. This suggests that the carbon fractions from gasoline vehicles is dominated by organic carbon with major portion of it evolved below 280°C

Diesel composite was found to be dominated by OC4 (~40%) and EC2 (~25%) with very high pyrolytic correction. This suggests major portion of elemental carbon (EC1) is pyrolysed carbon, which is added to OC4. Therefore, very high OC4 share was observed. Overall share of elemental carbon was found to be higher as compared to gasoline exhaust. CNG and LPG exhaust composite show similar trend as shown by gasoline vehicle exhaust for organic carbon fractions i.e. higher OC1 and OC2 percentage. However, share of EC1, EC2 & EC3 were found to be higher in CNG and LPG vehicle exhaust than in Gasoline exhaust.

6.1.2 Ions and Elements

Percent distribution of various ions in vehicle exhaust PM for different fuel types is presented in **Fig. 1 & 2**. For the purposes of determining total PM mass, the ionic sulfate results from the ion chromatography analysis were used, since this technique provides a higher total mass than the elemental measurements. It is possible that some double counting of Na, K, and Cl occurred in the calculation of total PM, but those errors are assumed to be negligible.

Gasoline exhaust composite was found to contain high percentage of sulphate (~4.5%), chloride (~3.5%) calcium (~3%) ions and sodium (~2%). In diesel exhaust composite ions percentage was found to be below 1% for all the ions. Similarly, calcium, barium, sodium, Magnesium, zinc and iron were found to be higher as compared to other metals in gasoline and diesel exhaust. However, % share in PM is higher in case of gasoline exhaust, which may be due to lower PM mass in case of gasoline exhaust. Presence of these ions/ elements can be attributed to the sulfur content in fuel, engine wear metals and other elements in oil additives. Some contribution of the PM S could be attributed to lubricants. The Zn, P, Mg, and Ca are attributed to compounds in the lubricant while the Fe is an indication of engine wear.

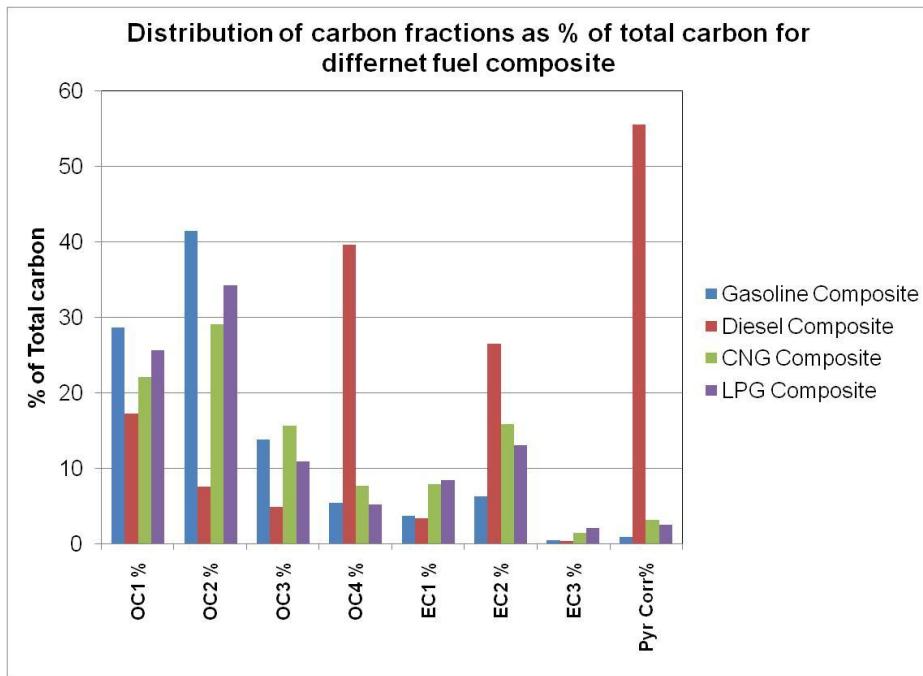
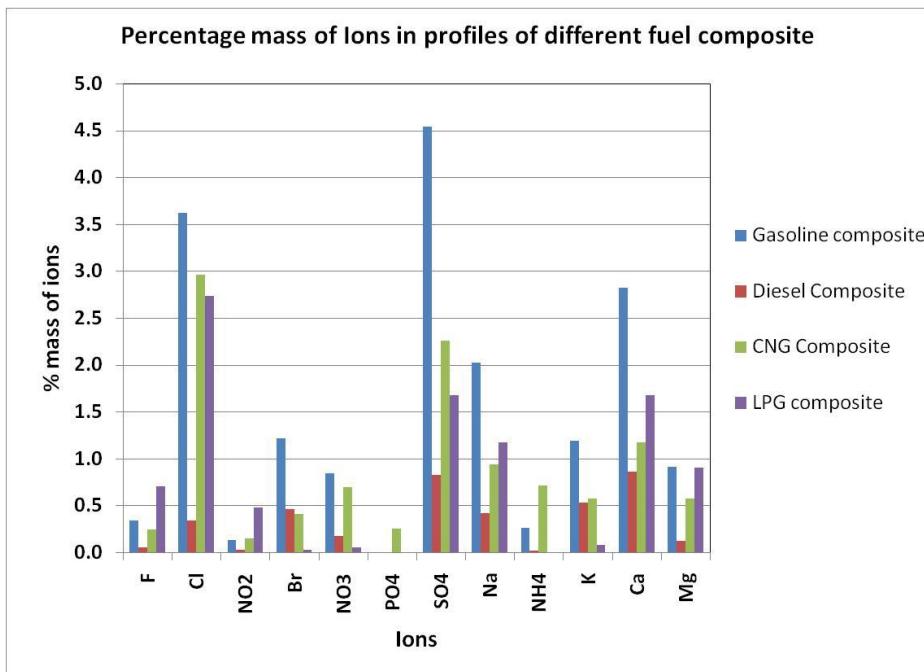
6.1.3 PAHs

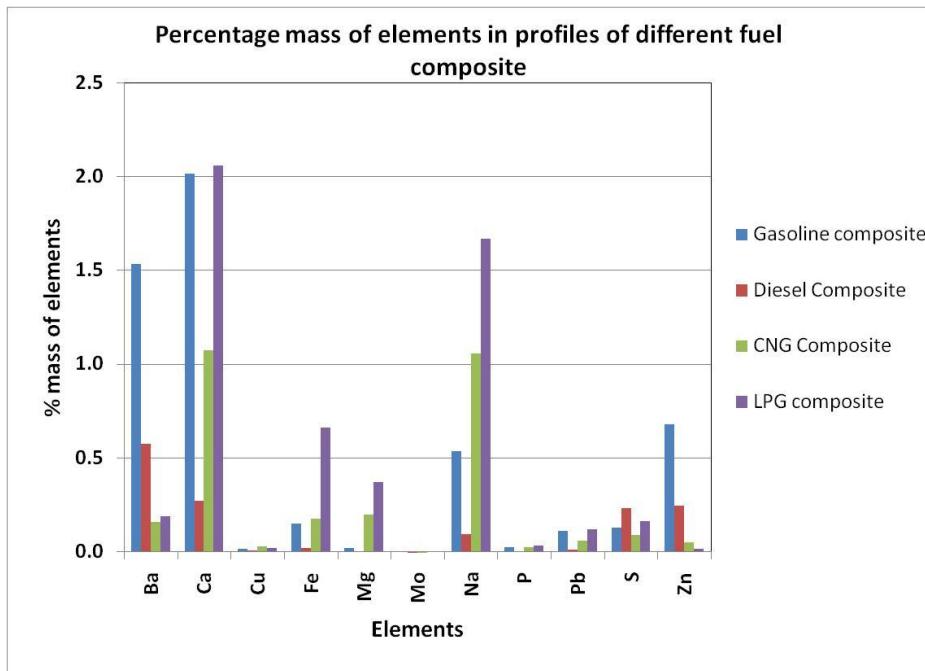
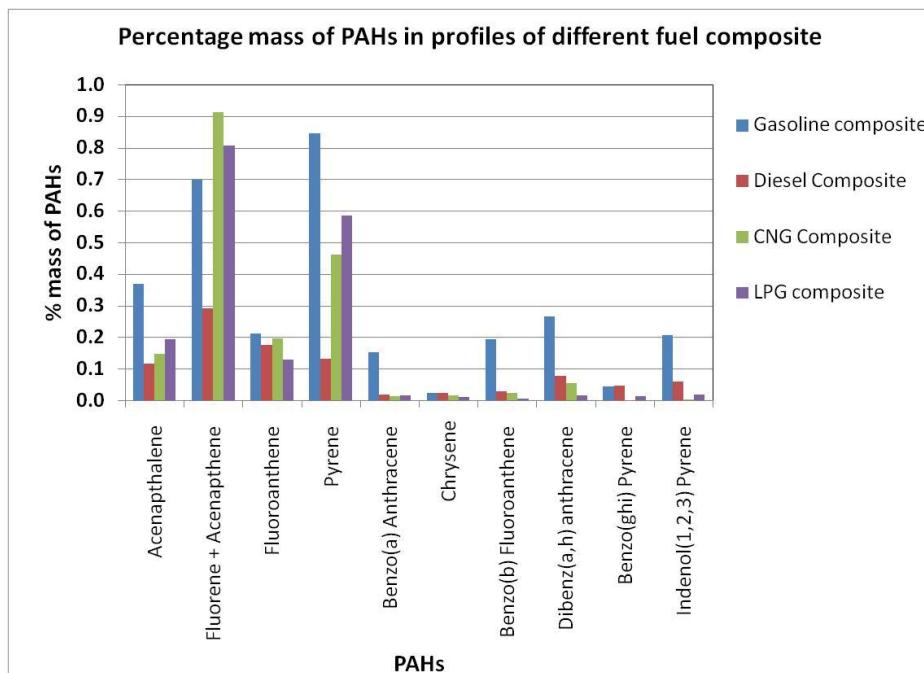
Mass of (2-ring) Fluorene +Acenaphthene, (3-ring) Fluoranthene and (4-ring) Pyrene are found to be highest amongst all the 16 PAHs analyzed in diesel

composite. Whereas, mass of (4-ring) Pyrene, (2-ring) Fluorene +Acenaphthene and (2-ring) Acenaphthalene were highest in gasoline composite (**Fig. 4**). Several factors could be responsible for the high PAH emission rates, which include differences in fuel oil composition (e.g. aromaticity) and fuel oil properties (e.g., fuel density) and the content of chlorinated compounds. It is reported that PAH formation is enhanced in the presence of chlorine-catalyzed chemical reactions and chloride ions were found to be in higher proportions in gasoline and diesel exhaust PM in this study.

The mass of these organic species was divided by PM mass to calculate their mass fraction. To calculate the mass % identified, the mass of each PM-associated organic species was excluded from the sum of all speciated compounds to avoid double-counting with OC (i.e., PAHs are included in the OC fraction). The OC included in these PM speciation data have a much higher mass than the sum of the speciated organic compounds since not all species are identified and quantified. Therefore, the OC mass is used in the calculation of total PM mass when the profile is developed in order to achieve better mass closure.

Overall mass percentage of ions, elements, PAHs in gasoline are higher than the diesel vehicles due to overall less PM mass in gasoline exhaust.

**Fig. 4: Distribution of various carbon fractions in different fuel composites.****Fig. 5: Distribution of various ions in different fuel composites.**

**Fig. 6: Distribution of various elements in different fuel composites****Fig. 7: Distribution of various PAHs in different fuel composites**

6.2 Category wise chart for distribution of species

Chemical speciation data of vehicle exhaust PM is analysed and grouped under different categories based on engine technology and fuel types. Category wise distribution of chemical species in various groups like carbon fractions, ions, elements and PAHs is given in **Table 7 & 8**.

Organic carbon was found to vary from 48 to 57 % amongst the composite of different category gasoline vehicles. Similarly, elemental carbon was varied from 3% to 13%. OC and EC in composite of all gasoline vehicles was 52% and 6.6% respectively. Category wise composites for diesel vehicles show variation in organic carbon from 46 % to 52% and variation in EC from 16% to 25%. All diesel vehicles composite shows OC and EC % as 49% and 22% respectively. OC % in CNG vehicles composite varied from 29% to 58% and EC % variation was from 6% to 22%. In case of LPG category wise composite OC % variation was 26% to 49% and EC % variation was from 7% to 14%. All CNG vehicle composite OC and EC % are found to be 43% and 16% respectively, whereas all LPG composite OC and EC % are 38%and 11% respectively.

Amongst the ions sulphate, nitrate, chloride and ammonium ions were found to have major share. Gasoline vehicle exhaust was found to have higher % of ions than diesel exhaust, which may be due to lower overall PM mass in gasoline exhaust.

Elements % were found to be very less in exhaust PM of all vehicle types. Elements from lube oil (Ba, Ca, S, Mg, Zn, P & Mo) and engine wear metals (Fe, Cu & Pb) were found to be comparatively in higher proportion. In terms of % mass gasoline exhaust is found to contain higher % of these metals as compared to diesel exhaust.

PAHs % distribution shows higher fraction of Pyrene, Fluorine+ Acenaphthene and Acenaphthalene in all vehicle categories. Total PAHs were observed to be higher in gasoline vehicle composite (3.96%) than in diesel vehicle composite (1.26%).

PM mass distribution in terms of chemical groups like organic & elemental carbon, ions, elements and further speciation of organic carbon into molecular markers like PAHs for different vehicle category composites is presented in **Fig.7 to Fig.13**.

Table 7: Percentage distribution of major chemical species (carbon fraction, ions, elements) in different categories of vehicles

Vehicle Category	Carbon Fraction (%)		Ions (%)				Elements (%)										
	OC	EC	Chloride (Cl)	Nitrate (NO ₃)	Sulphate(SO ₄)	Ammonium (NH ₄)	Barium (Ba)	Calcium (Ca)	Copper (Cu)	Iron (Fe)	Magnesium (Mg)	Molybdenum (Mo)	Sodium (Na)	Phosphorus (P)	Lead (Pb)	Sulphur (S)	Zinc (Zn)
2-stroke, 2-wheeler (Gasoline)	57.34	3.10	4.37	0.86	4.24	0.56	0.813	3.163	0.006	0.056	0.000	0.008	1.295	0.000	0.037	0.035	0.292
4-stroke, 2-wheeler (Gasoline)	48.63	5.08	5.07	0.39	5.94	0.00	3.263	1.792	0.036	0.082	0.000	0.000	0.398	0.031	0.319	0.000	1.229
3-Wheeler(Gasoline)	54.24	4.70	2.62	0.76	4.80	0.01	2.057	0.739	0.003	0.114	0.000	0.011	0.000	0.005	0.010	0.072	1.201
Passenger Car(Gasoline)	47.98	13.42	2.44	1.40	3.20	0.50	0.000	2.373	0.018	0.347	0.081	0.004	0.461	0.066	0.082	0.414	0.000
3-Wheeler(Diesel)	48.73	16.20	0.95	0.04	0.56	0.00	0.539	0.148	0.006	0.003	0.000	0.000	0.389	0.008	0.010	0.021	0.120
Passenger Car(Diesel)	50.26	18.59	0.10	0.17	0.74	0.01	0.573	0.507	0.014	0.026	0.000	0.000	0.000	0.016	0.021	0.324	0.303
LCV(Diesel)	46.16	26.86	0.12	0.23	0.98	0.08	0.782	0.210	0.008	0.008	0.000	0.001	0.000	0.000	0.014	0.415	0.532
HCV(Diesel)	51.93	24.62	0.20	0.28	1.06	0.00	0.782	0.210	0.008	0.008	0.000	0.001	0.000	0.000	0.014	0.415	0.532
3 Wheeler (CNG)	58.38	6.46	3.27	0.08	2.34	0.00	0.000	2.147	0.000	0.242	0.000	0.003	2.941	0.015	0.152	0.000	0.000
4 Wheeler (CNG)	28.71	18.56	3.42	2.02	3.77	0.96	0.490	1.083	0.035	0.301	0.607	0.000	0.228	0.069	0.035	0.282	0.156
HCV (CNG)	41.97	22.01	2.19	0.00	0.67	1.21	0.000	0.000	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 Wheeler (LPG)	49.04	7.17	2.74	0.06	1.68	0.00	0.245	1.383	0.029	0.072	0.000	0.000	0.937	0.002	0.201	0.000	0.026
4 Wheeler (LPG)	26.41	14.36	2.84	1.18	4.97	1.14	0.134	2.736	0.009	1.246	0.737	0.003	2.396	0.060	0.035	0.325	0.000
All Gasoline Composite	52.05	6.58	3.63	0.85	4.54	0.27	1.53	2.02	0.02	0.15	0.02	0.01	0.54	0.03	0.11	0.13	0.68
All Diesel Composite	49.27	21.57	0.34	0.18	0.83	0.02	0.58	0.27	0.01	0.02	0.00	0.00	0.10	0.01	0.01	0.23	0.25
CNG Composite	43.02	15.68	2.96	0.70	2.26	0.72	0.16	1.08	0.03	0.18	0.20	0.00	1.06	0.03	0.06	0.09	0.05
LPG Composite	37.72	10.77	2.79	0.62	3.32	0.57	0.19	2.06	0.02	0.66	0.37	0.00	1.67	0.03	0.12	0.16	0.01

Table 8: Percentage distribution of PAHs in different categories of vehicles

Vehicle Category	PAHs (%)										
	Acenaphthalene	Fluorene + Acenaphthene	Fluoranthene	Pyrene	Benzo(a) Anthracene	Chrysene	Benzo(b) Fluoranthene	Dibenz(a,h) anthracene	Benzo(ghi) Pyrene	Indenol(1,2,3) Pyrene	Total PAHs
2-stroke, 2-wheeler (Gasoline)	0.683	0.652	0.101	0.066	0.002	0.001	0.165	0.000	0.000	0.000	1.900
4-stroke, 2-wheeler (Gasoline)	0.382	1.637	0.532	1.933	0.045	0.041	0.111	0.125	0.427	0.751	8.572
3-Wheeler(Gasoline)	0.331	0.252	0.147	0.878	0.056	0.011	0.024	0.046	0.349	0.017	2.910
Passenger Car(Gasoline)	0.078	0.251	0.062	0.503	0.510	0.034	0.478	0.006	0.048	0.009	2.414
3-Wheeler(Diesel)	0.080	0.122	0.028	0.079	0.004	0.006	0.011	0.012	0.010	0.006	0.511
Passenger Car(Diesel)	0.024	0.036	0.007	0.037	0.000	0.001	0.005	0.005	0.001	0.001	0.130
LCV(Diesel)	0.020	0.056	0.013	0.056	0.004	0.000	0.002	0.006	0.002	0.001	0.181
HCV(Diesel)	0.345	0.951	0.654	0.352	0.066	0.083	0.100	0.290	0.171	0.225	4.235
3 Wheeler (CNG)	0.333	2.340	0.396	1.124	0.029	0.040	0.052	0.128	0.000	0.000	6.642
4 Wheeler (CNG)	0.092	0.324	0.060	0.109	0.002	0.001	0.001	0.000	0.000	0.000	0.666
HCV (CNG)	0.016	0.072	0.132	0.154	0.012	0.008	0.014	0.033	0.002	0.011	0.533
3 Wheeler (LPG)	0.225	1.343	0.199	0.835	0.027	0.015	0.001	0.018	0.001	0.001	3.605
4 Wheeler (LPG)	0.163	0.270	0.057	0.334	0.003	0.006	0.007	0.012	0.026	0.035	1.253
All Gasoline Composite	0.37	0.70	0.21	0.84	0.15	0.02	0.19	0.27	0.04	0.21	3.96
All Diesel Composite	0.12	0.29	0.18	0.13	0.02	0.02	0.03	0.08	0.05	0.06	1.26
CNG Composite	0.15	0.91	0.20	0.46	0.01	0.02	0.02	0.05	0.00	0.00	2.61
LPG Composite	0.19	0.81	0.13	0.58	0.01	0.01	0.00	0.01	0.01	0.02	2.43

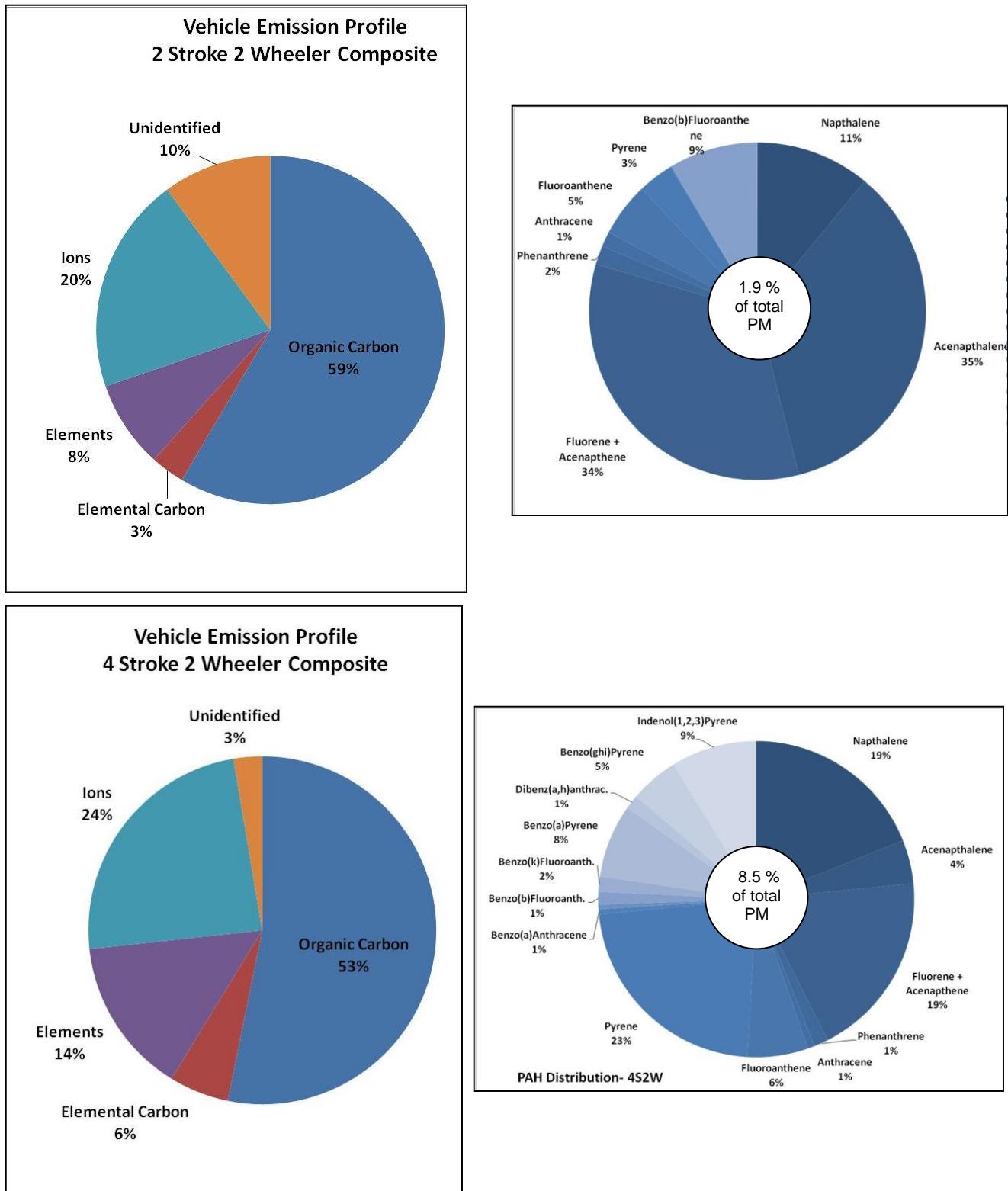


Fig. 7: Distribution of PM mass form 2-wheeler exhaust

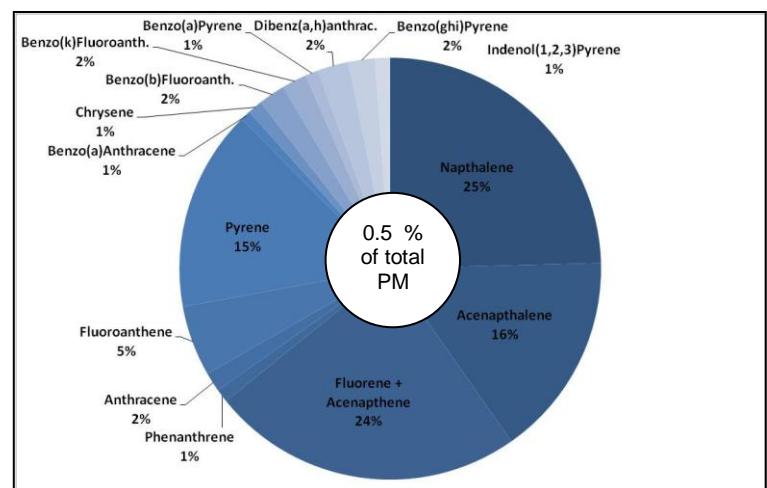
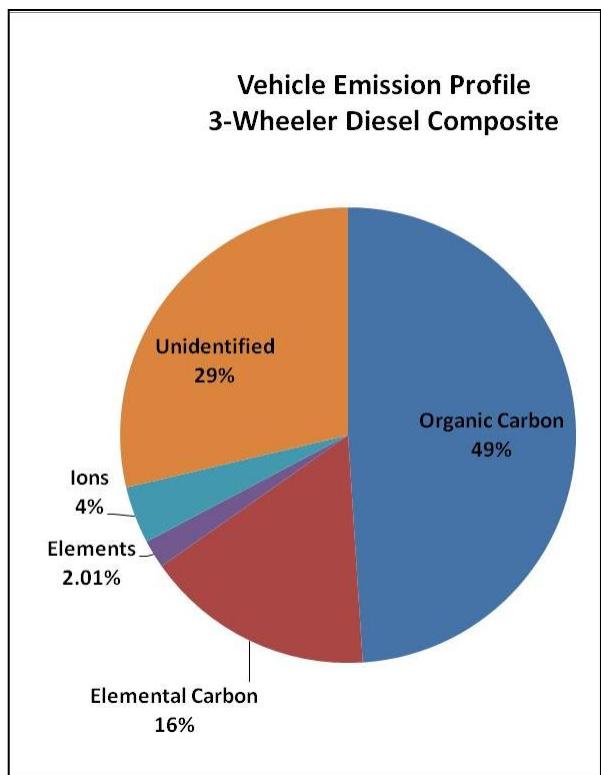
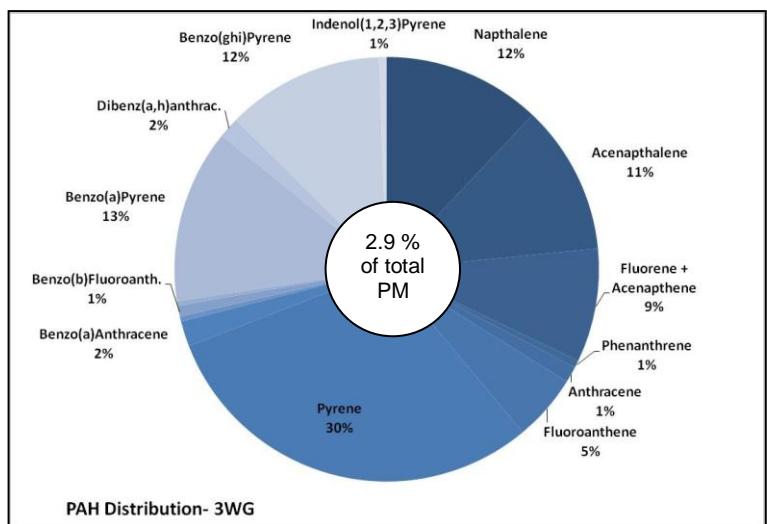
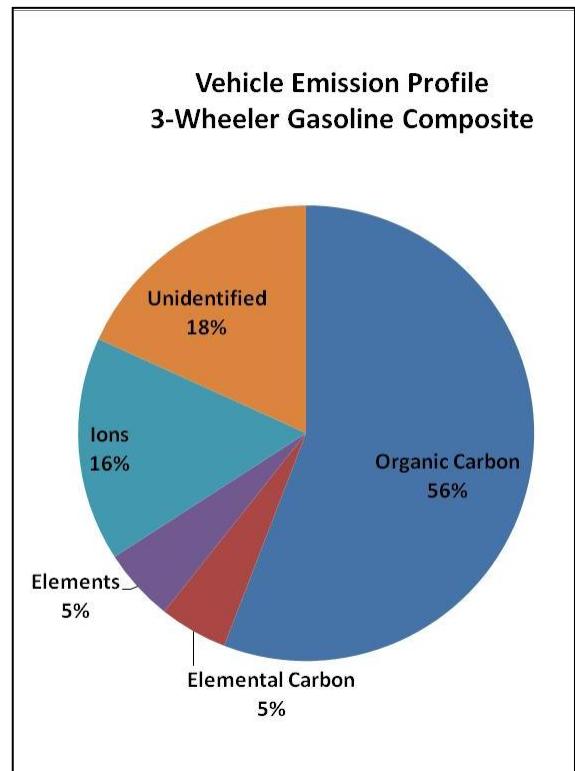


Fig. 8: Distribution of PM mass form 3-wheeler exhaust

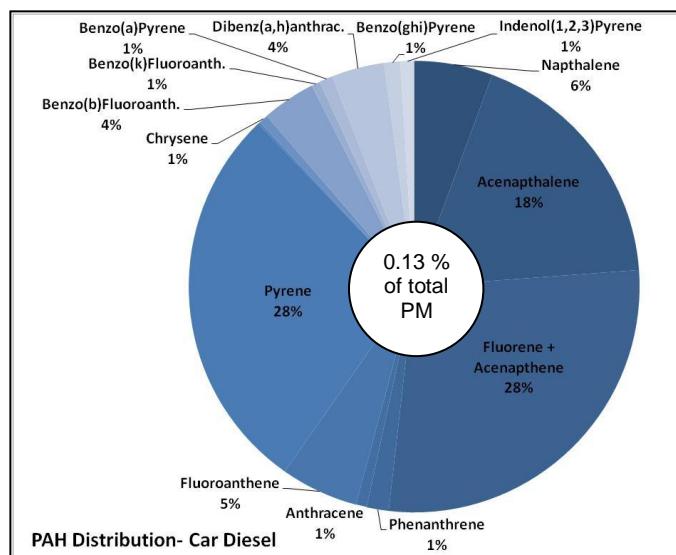
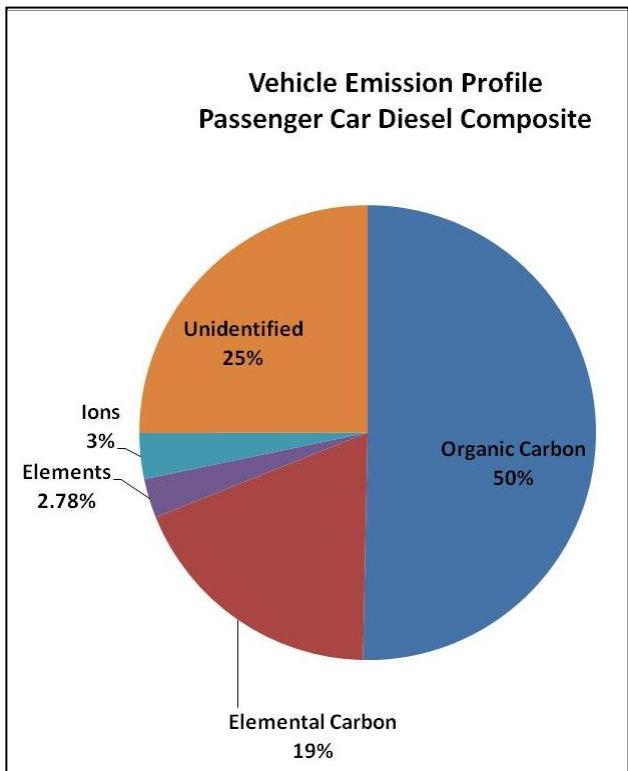
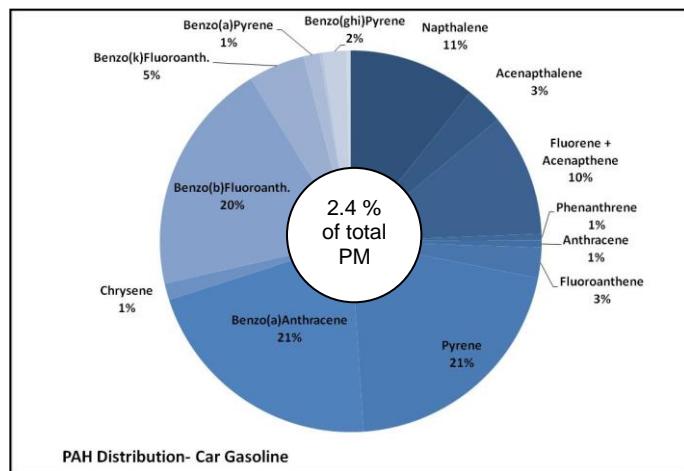
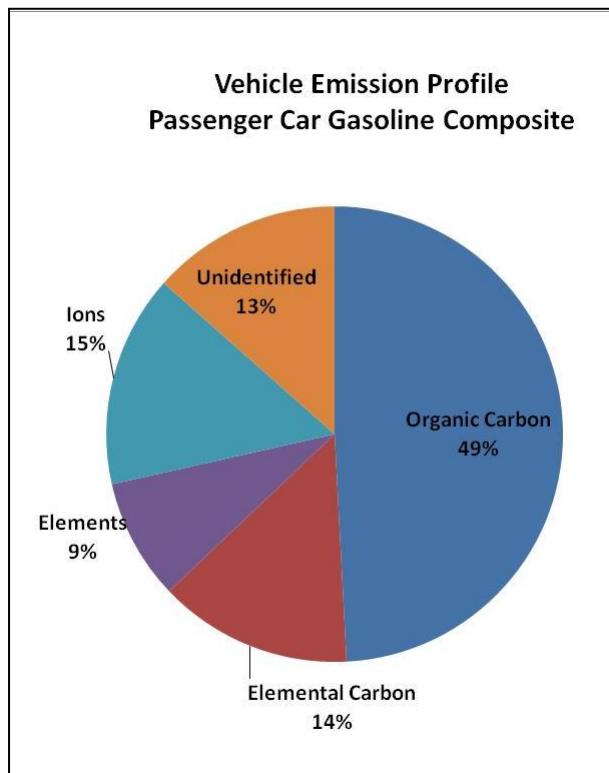
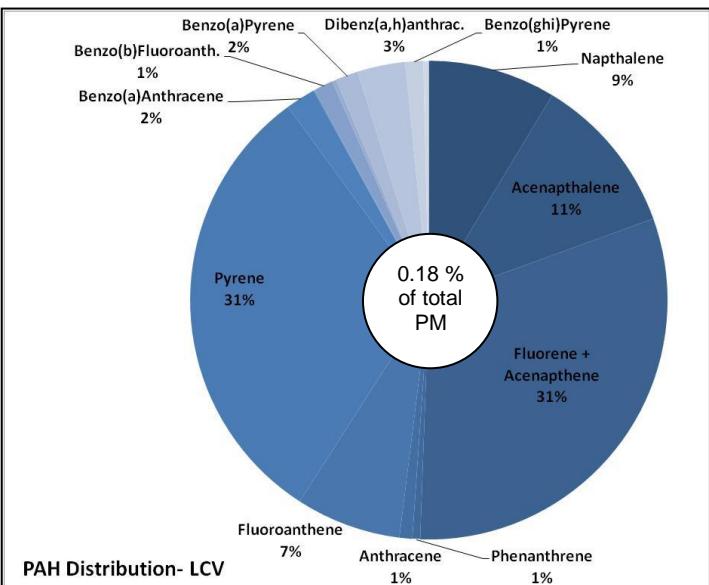
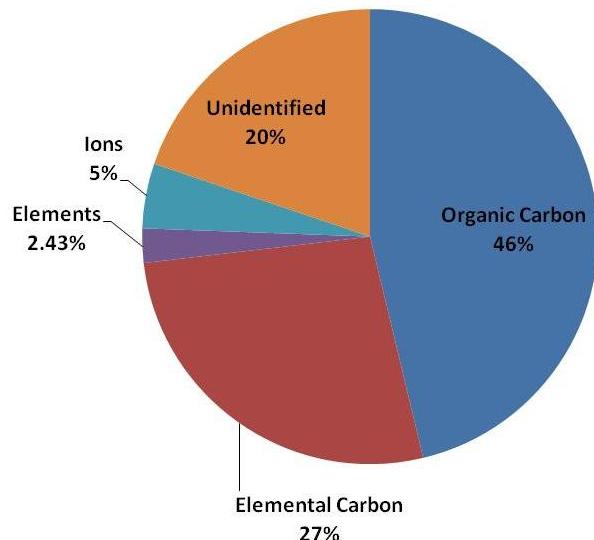


Fig. 9: Distribution of PM mass form Car exhaust

**Vehicle Emission Profile
LCV Diesel Composite**



**Vehicle Emission Profile
HCV Diesel Composite**

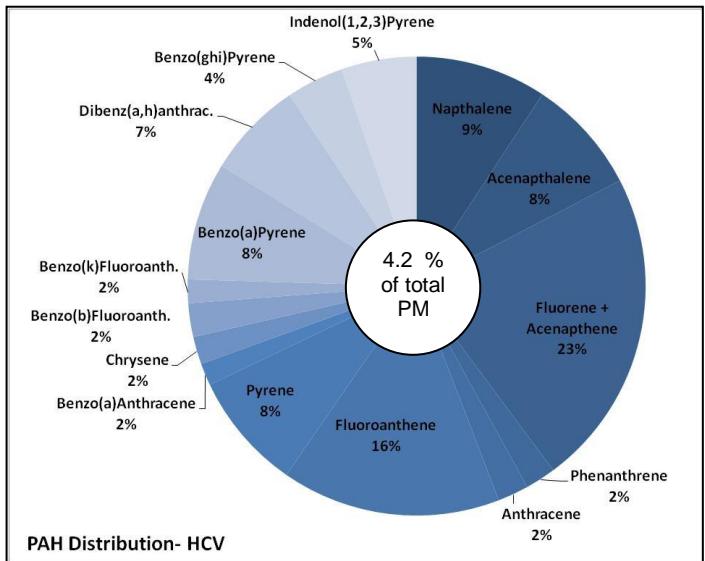
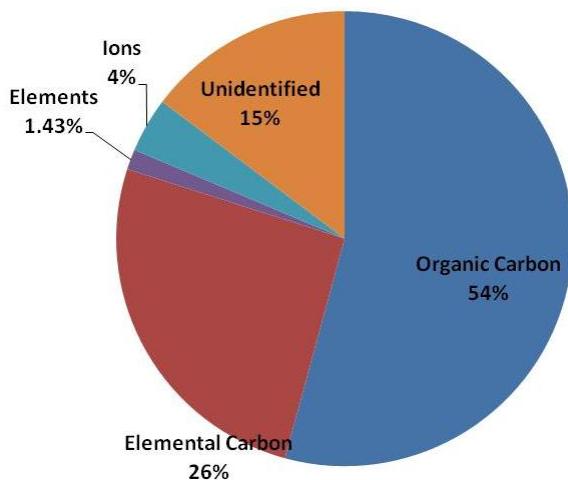
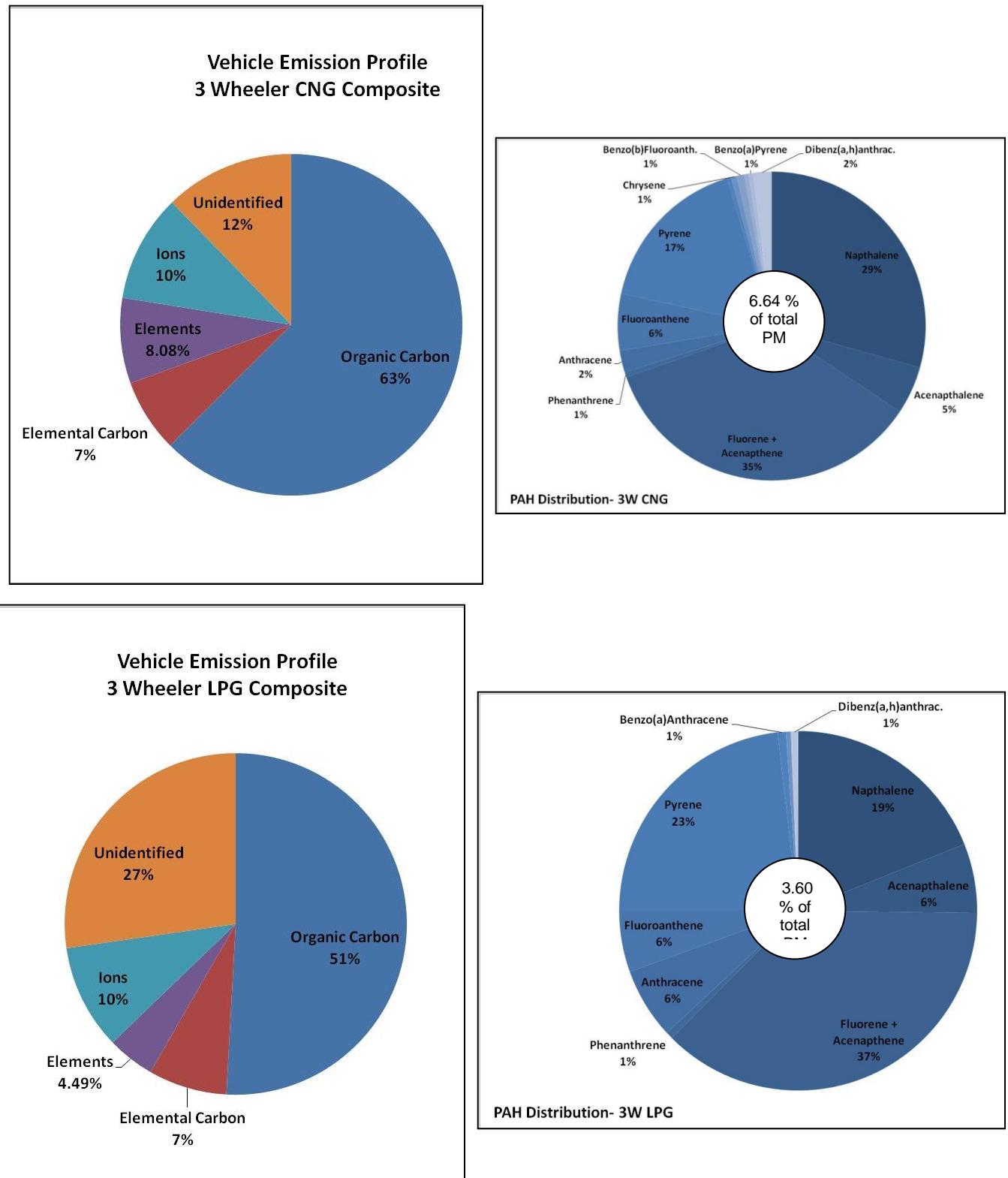
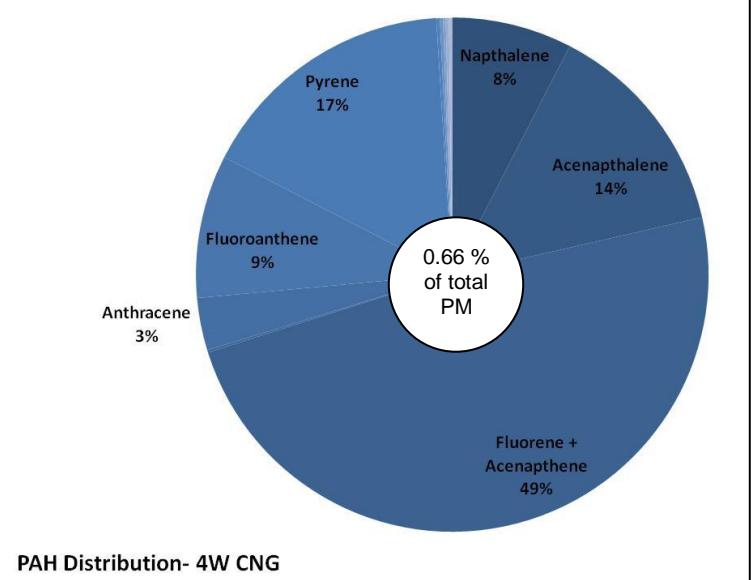
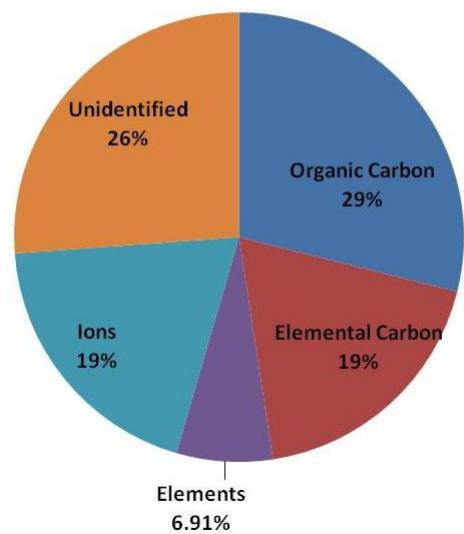


Fig. 10: Distribution of PM mass from LCV and HCV exhaust

**Fig. 11: Distribution of PM mass form 3-Wheeler CNG and LPG exhaust**

**Vehicle Emission Profile
4 Wheeler CNG Composite**



**Vehicle Emission Profile
4 Wheeler LPG Composite**

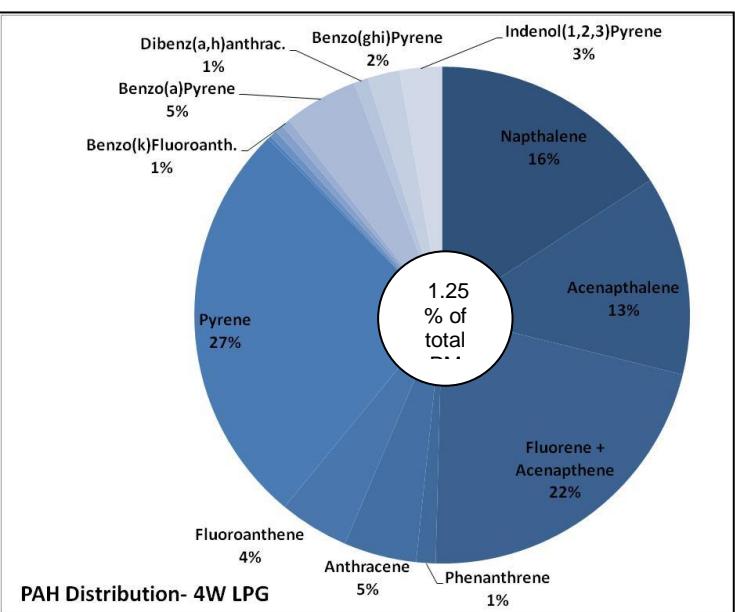
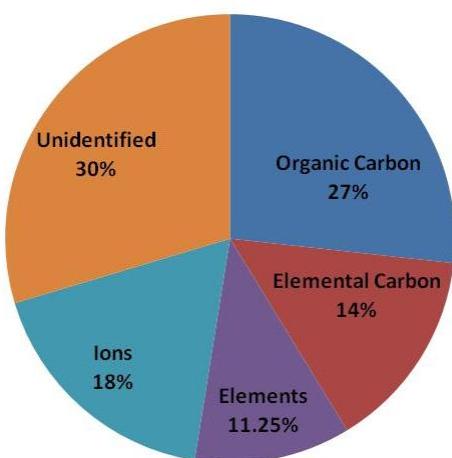


Fig. 12: Distribution of PM mass form 4-Wheeler CNG and LPG exhaust

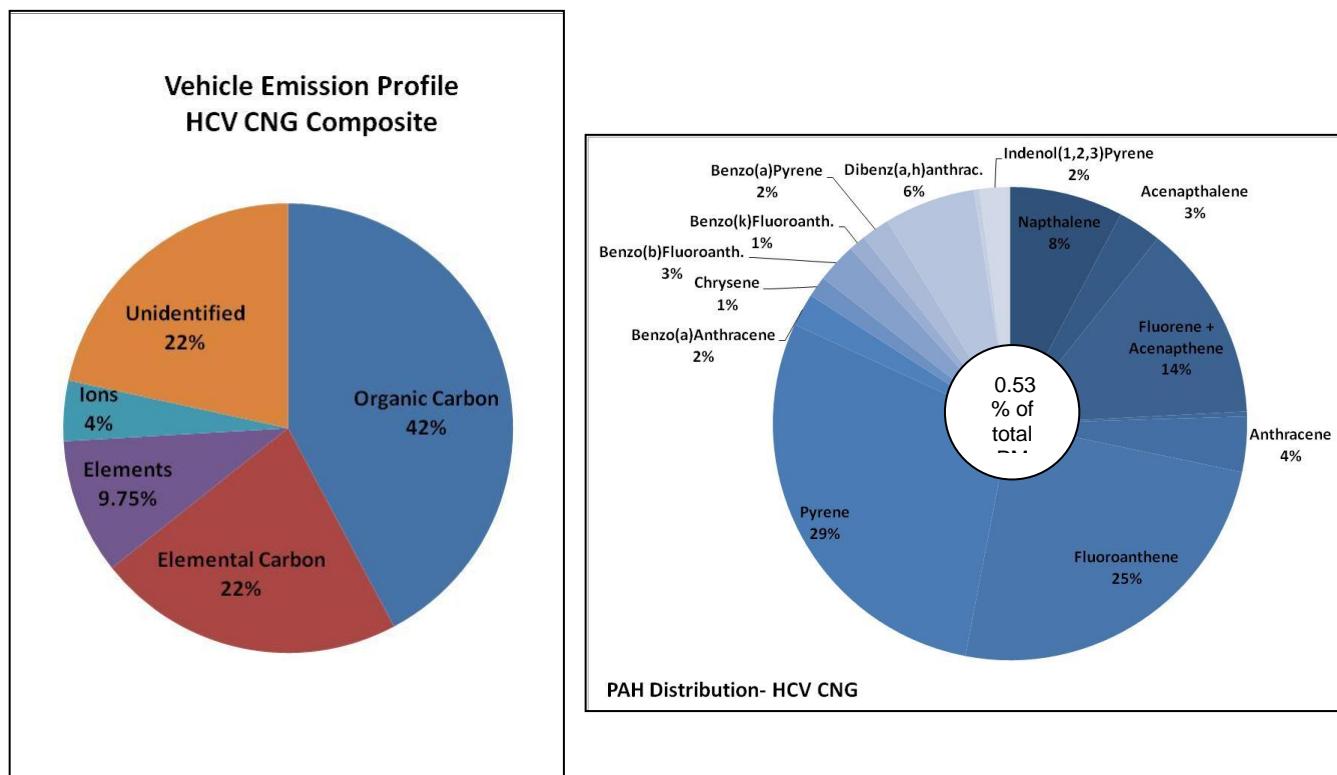


Fig. 13: Distribution of PM mass form HCV CNG exhaust

6.3 Diesel and gasoline composite:

Distribution of exhaust particulate matter in composite profiles for all gasoline and all diesel vehicles in different chemical groups like organic carbon, elemental carbon, ions, elements and other is presented in **Fig. 14 & 15**. In both, all gasoline and all diesel composite, organic carbon was found to dominate with 54% and 50% respectively. Elemental carbon fraction was found to be higher in all diesel composite (22%) than in all gasoline composite (7%), which is a major distinguishing factor between gasoline and diesel composite. Ions percentage was found to be higher in gasoline composite (19%) as compared to diesel composite (4%). Higher fraction of ions in gasoline exhaust can be attributed to the higher sulphate, chloride, calcium and sodium ions in exhaust due to use of lube oil. Elements, mainly wear metal (Fe, Pb & Cu) are found to be higher in percent in gasoline exhaust than diesel exhaust. Although, the absolute quantity of these metals was found to be similar from both the vehicle exhaust, percentage contribution in gasoline vehicles is higher due to less overall mass of PM in gasoline exhaust.

Organic molecular markers were found to be higher in percentage in gasoline exhaust composite (~4%) than in diesel exhaust composite (~1.3%). 17 alpha (H), 21 beta (H)-Hopane was found to be marginally higher (2.1%) in gasoline than in diesel exhaust (1.6%). Hopanes are present in lubricating oil used by gasoline and diesel powered engines and hence, are emitted in particle phase from both the engine types.

Overall mass concentration of all the 16 PAHs is higher in diesel than gasoline exhaust due to higher PM mass in Diesel vehicles.

Qualitative interpretation (2, 3, 4 ,5 rings PAH) reveals that mass concentration of 2,3 and 4 ring lighter PAH compounds e.g. Fluorene +Acenaphthene, (3-ring) Fluoranthene and (4-ring) Pyrene is higher in Diesel Vehicles as compared to Gasoline vehicles. Whereas, mass Concentration of 5-ring heavier PAH compounds e.g. Benzo(a)Pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3 cd)pyrene and Benzo(ghi)perylene is higher in diesel vehicles as compared to gasoline vehicles. Overall mass of 2,3 and 4 ring lighter PAH compounds is high as compared to 5-ring heavier PAH compounds in Diesel as well as Gasoline vehicles.

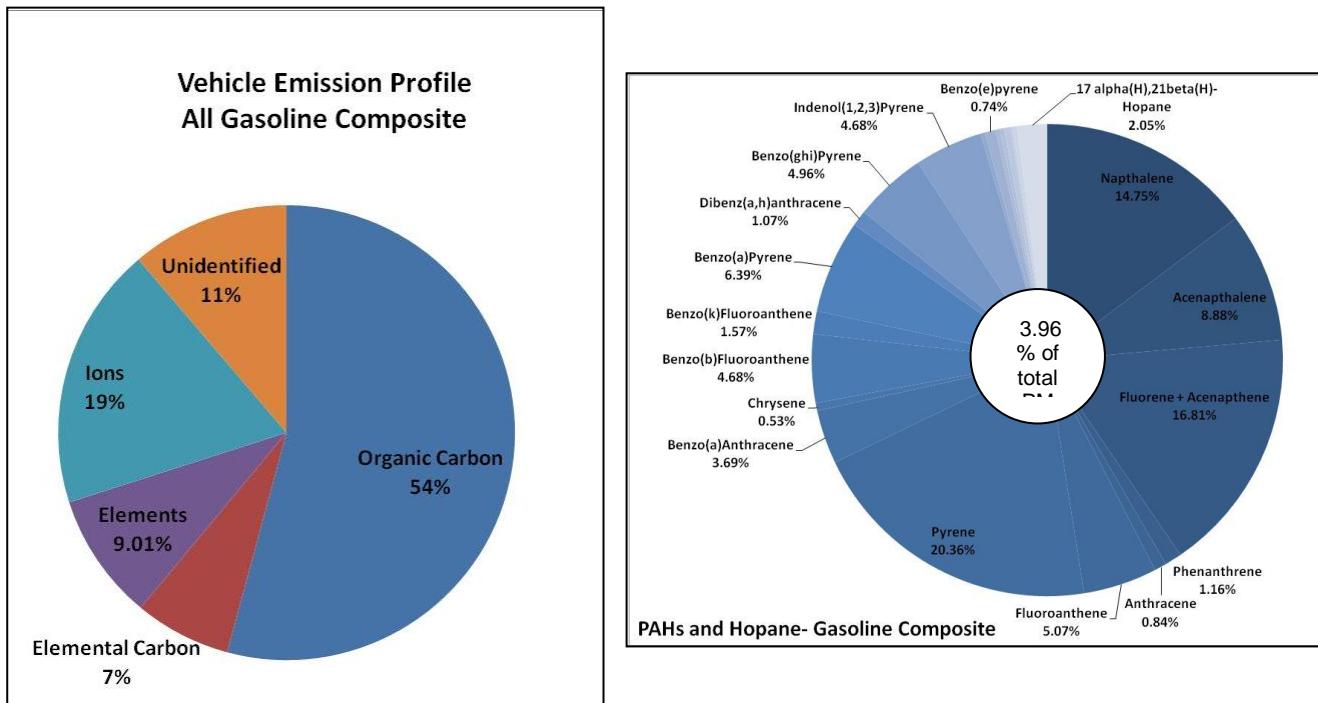


Fig. 14: Distribution of all gasoline composite vehicle exhaust PM in different chemical groups

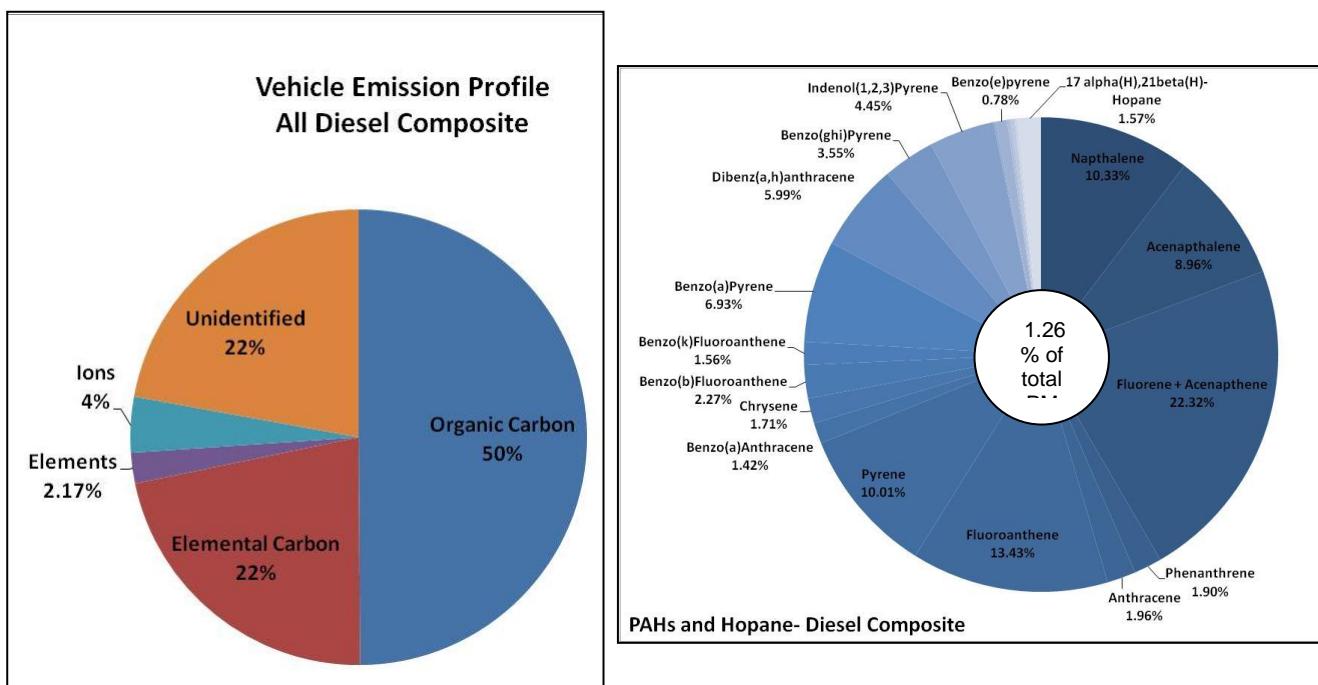


Fig. 15: Distribution of all diesel composite vehicle exhaust PM in different chemical groups

6.4 Co-linearity in speciation data:

Chemical speciation data (% mass of species in exhaust) of all gasoline composite and all diesel composite was plotted to check the co linearity as shown in **Fig. 16 a-d**.

To capture the complete set of data containing all species with % mass ranging from 0.002% to about 50%, it is plotted on logarithmic scale. Separate co linearity plots for ions, PAHs and elements are plotted. OC % found to be close in gasoline (54%) and diesel (50%). However, diesel and gasoline exhaust EC content was 22% and 7% respectively. Diesel exhaust particles are known to have contained much higher fraction of elemental carbon than gasoline exhaust particles and based on this elemental to organic carbon ratio in gasoline and diesel exhaust, contribution from both engine types can be differentiated. For certain elements % share was found to be very less and similar. PAHs and ions data was not found to be collinear and shows higher % in gasoline exhaust.

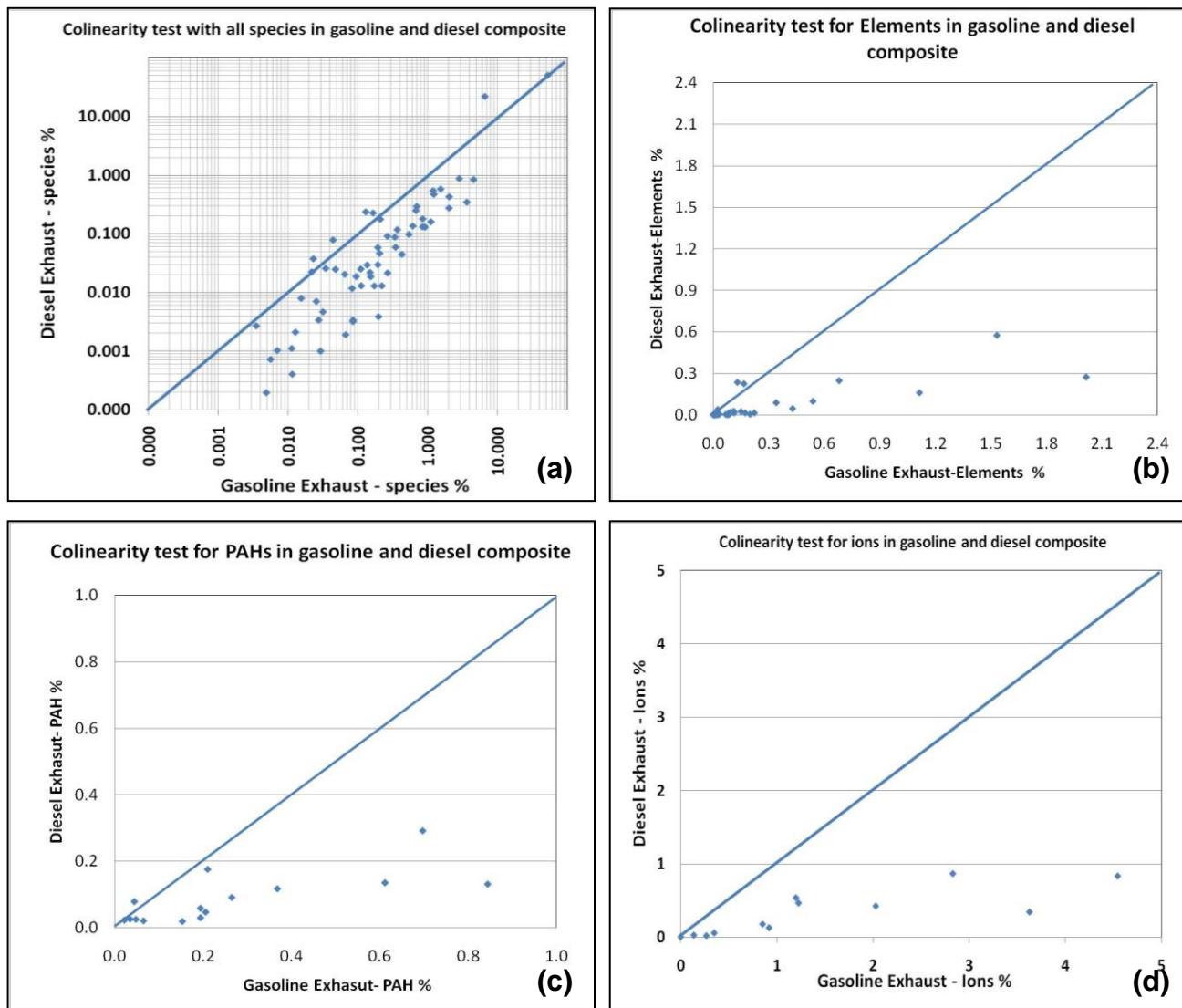


Fig. 16: Co linearity plots between gasoline and diesel exhaust for (a)all species together, (b) elements, (c) PAHs, and (d) Ions

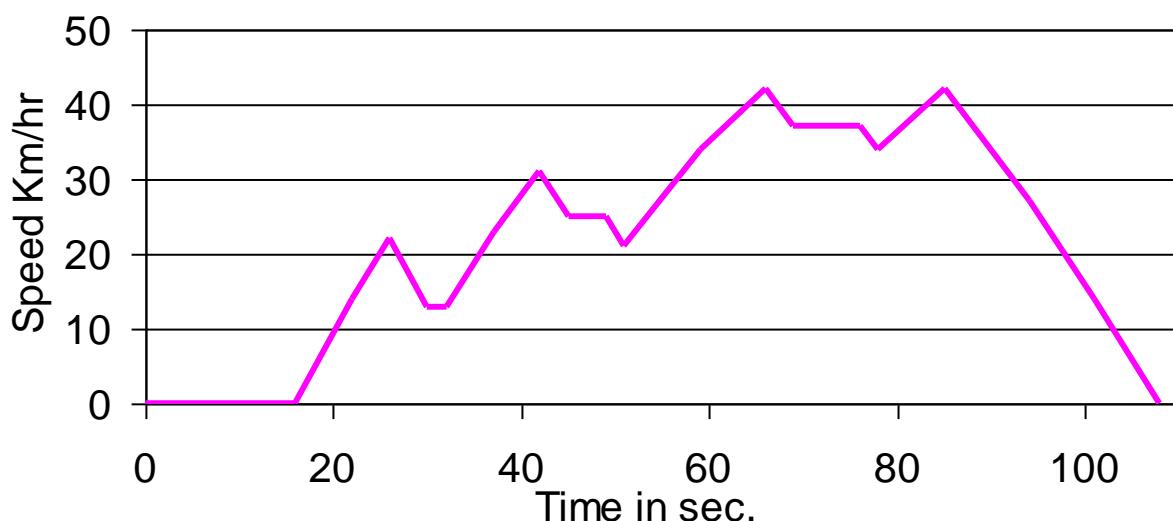
7. Annexure-I Test Matrix

The following table depicts the test matrix used for the project.

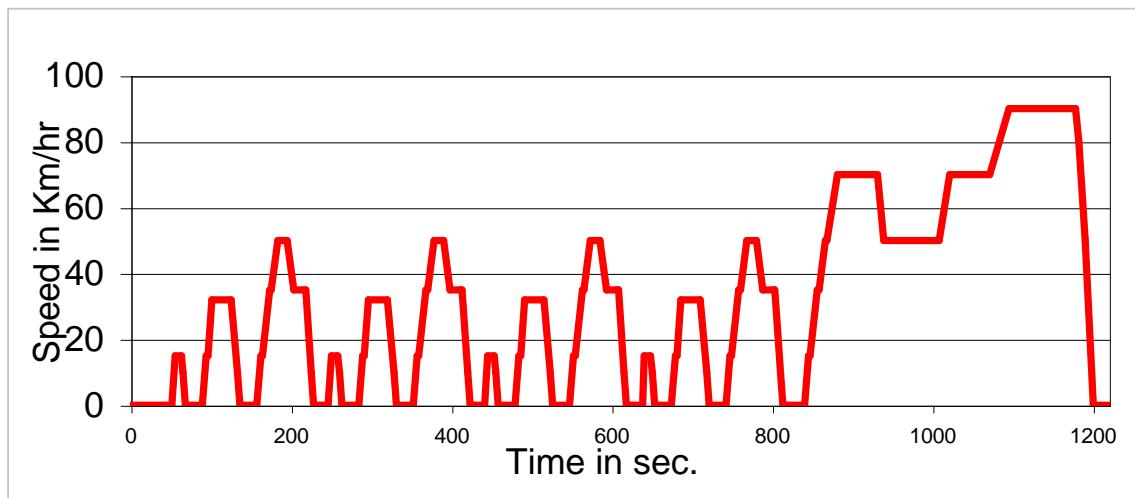
Vehicle Category	1991-1996	1996-2000	Post 2000
2 Wheeler 2 stroke	3	3	3
2 Wheeler 4 stroke	3	3	3
3 Wheeler Gasoline	3	3	3
3 Wheeler Diesel	3	3	3
Passenger Car Gasoline	3	3	3
Passenger Car Diesel	3	3	3
LCV	3	3	3
HCV	3	3	3
Vehicle Category	1996-2000	2000-2005	2005+
3W-CNG (OE)	-	1	1
3W-CNG (Retrofit)	1	1	1
3W-LPG (OE)	-	1	1
3W-LPG (Retrofit)	1	1	1
4W-CNG (OE)	-	1	1
4W-CNG (Retrofit)	1	1	1
4W-LPG (OE)	-	1	1
4W-LPG (Retrofit)	1	1	1
HCV CNG (OE)	-	1	1
HCV CNG (Retrofit)	1	1	1

8. Annexure II Driving Cycles

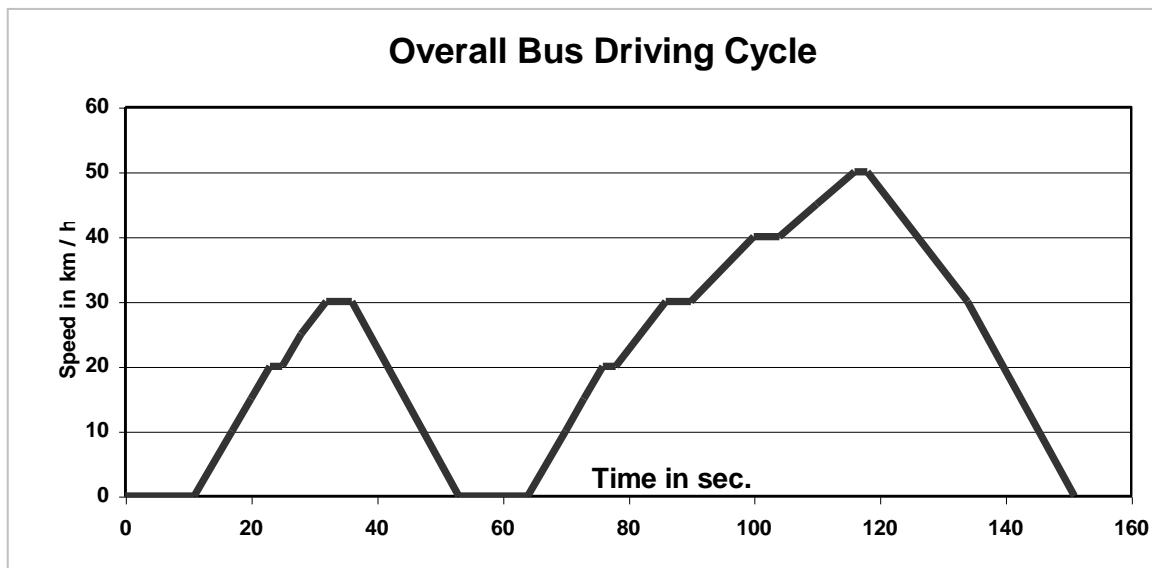
8.1 Indian Driving Cycle (2-/3-wheeler, passenger cars and MUV)



8.2 Modified Indian Driving Cycles for passenger cars and MUV (Post 2000)



8.3 Overall Bus Driving Cycle for LCV and HCV



9. Annexure III: Test Procedure, Equipment Details and Calibration Details used for Mass Emission Testing

9.1 Test Equipment:

The main equipments used for Mass emission testing are chassis dynamometer, CVS System, Analyzers which are supported by additional equipment such as dilution tunnel (for PM measurement), weighing balance, cooling blower, etc. Main equipment used for PM characterization analysis are ion chromatograph, carbon analyzer, ED-XRF and GC-MS

9.1.1 Specifications of Test Equipment:

The following section gives a brief technical specifications of the important equipment used for emission testing under emission factor determination project.

i. Chassis Dynamometer

	BEP make 2 & 3-wheeler	BEP make 4-wheeler	FCL make HCV
Type	AC Machine	AC Machine	DC Machine
Maximum power	50 kW absorption / motoring	149 kW absorption / motoring	155 kW absorption / motoring
Maximum Speed	200 km/h	200 km/h	100 km/h
Maximum tractive effort	2233 N	5844 N	14000 N
Vehicle inertia range	100-450 kg for 2-Wheeler, 400- 1500 kg for 3-Wheeler	120-5443 kg Universal dyno for 2W, 3W & 4W	Up to 32000 Kg.
Roller diameter	610 mm	1220 mm	2500 mm.
Width over rollers	1900 mm	2742 mm	2800 mm.
Space between the rollers	Single roller	Single roller	800 mm

ii. Constant Volume Sampler system

Parameter	Fisher Rosemount CVS with dilution tunnel	HORIBA CVS with Dilution Tunnel – 7400T	Beckman CVS with dilution tunnel
Venturi Sizes	2, 3, 4.5, 6, 9,12 m ³ /min	4.5, 6, 9 & 12 m ³ / min	200, 400, 600, 1000 SCFM
Tunnel diameter	10 inches	12 inches	18 inches
Filter Holder Assembly	70, 47 mm Ø	70, 47 mm Ø	70, 47 mm Ø
Propane Injection	CFO type	Gravimetric Method	CFO type

iii. Analyzers

Analyzer		Fisher Rosemount NGA Analyzers	Horiba 7200 H	Horiba 7400 H	
				Diesel	Gasoline/LPG/CNG
Low CO	Model	MLT-A1	A1A-721A	AIA-721A	AIA-721LE
	Range	0 – 50, 2500 ppm	0 – 50, 5000 ppm	0-50, 5000 ppm	0-10,500 ppm
CO ₂	Model	MLT-B3	AIA - 722	AIA-722	AIA-722
	Range	0 – 0.5, 5 vol%	0 – 0.5, 20 vol%	0 - 0.5, 20 vol%	0 - 0.5, 20 vol%
NOx	Model	C-A-A10	CLA – 750A	CLA-755A	CLA-750A
	Range	0 – 10, 800 ppm	0 – 10, 10000 ppm	0-10, 10000 ppm	0-10, 10000 ppm
THC	Model	F-A-A10	FIA – 720	-	FIA-720
	Range	0 – 50, 10000 ppmC	0 – 10, 20000 ppmC	-	0-10, 20000 ppmC
THC heated	Model	HFID	FIA 725-A	FIA-725A	-
	Range	0 – 20, 10000 ppmC	0 – 10, 50000 ppmC	0 – 50, 10000 ppmC	-
Methane (GC)	Model	--	GFA -720	-	GFA-720
	Range	--	0-100, 2500 ppm	-	0-5, 2500 ppm
Heated HC with Methane Cutter	Model	--	721 HA	FIA-721HA	-
	Range	--	0-10, 5000 ppmC	0-50, 5000 ppmC	-

9.2 Test Procedure:

Emission cycles are a sequence of speed and load conditions performed on an engine or chassis dynamometer. Emissions measured on vehicle (chassis) dynamometers are expressed in grams of pollutant per unit of travelled distance, expressed in g/km. In a transient cycle such as the one used for the chassis dynamometer testing, the vehicle follows a prescribed driving pattern, which includes accelerations, decelerations, changes of speed and load, etc. The final test results are obtained by analyzing exhaust gas samples collected in polyurethane bags over the duration of the cycle.

In order to determine the emission of a vehicle, the vehicle was tested in ARAI's emissions test cell under conditions which accurately simulated the driving cycle as applicable to the vehicle category under test (see 5.2).

A schematic layout of the test cell with vehicle is given in figure below.

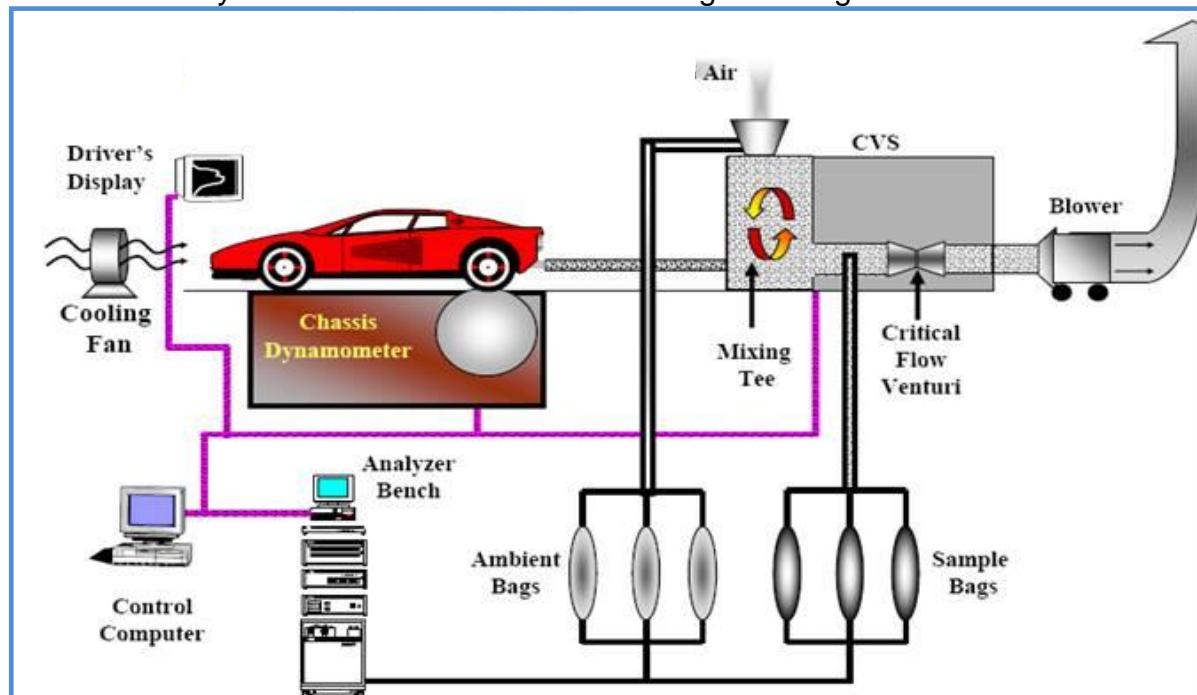


Fig. 17 Mass Emission Test Set-Up

Each test vehicle was mounted with its drive wheels on the rollers of the test bed whose rotational resistance was adjusted to simulate friction and aerodynamic drag. Inertial masses were added to simulate the weight of the test vehicle as per the category of the vehicle (see 5.2.1). A variable speed vehicle cooling blower mounted at a short distance in front of the vehicle provided the necessary cooling.

Test vehicle was subjected to exhaust leak check and rectified if there is any exhaust leak. The fuel in the vehicle tank was drained off and Test fuel was filled after necessary flushing. After preconditioning on chassis dynamometer or on road vehicle, was then soaked (i.e., cooled to bring it to ambient temperature and conditions and maintained in that state till the commencement of the test) to get

the vehicle and the engine conditions to the test cell ambient conditions. Before starting the Test, the chassis dynamometer was warmed up for 30 minutes with the vehicle mounted on the chassis dynamometer and the engine in OFF condition. After the warm up chassis dynamometer was calibrated to compensate the frictional losses and then the vehicle was ready to undergo test. The same procedure was followed for all the vehicles.

A highly skilled driver was enlisted to drive the test vehicles on the chassis dynamometer. The same driver strictly followed the test cycle by maintaining the speed and also changing the gears and the acceleration and deceleration of the vehicle as displayed on the driver's aid monitor.

After ensuring the calibration of chassis dynamometer, the test cycle, as per the applicable regulatory test procedure depending upon the vintage and category of the vehicle was started. The driver started the engine and followed test cycle. The exhaust sampling was started at the same time. The exhaust gases produced by the test vehicle were diluted with fresh air using a critical flow venturi-type CVS (constant volume sampler). For gaseous emission measurement, a constant proportion of the diluted exhaust gas was extracted for collection in one sample bag. The pollutant concentration in the sample bag at the end of the test corresponded exactly with the mean concentration in the total quantity of fresh air/exhaust mixture that was extracted. As the total volume of the fresh air/mixture could be defined, the pollutant concentrations were used as the basis for calculating the pollutant masses produced during the course of the test. For THC (total hydrocarbon) emission measurement for diesel vehicles, the diluted exhaust gas was sampled through a heated (191°C) and measured continuously by using heated FID THC analyser. The exhaust gas emission analysers were calibrated before the gas analysis. The gas analysis of each sample bag was done immediately after each test. The gases in the sampling bag was analysed for concentrations of CO (carbon monoxide), NOx (nitrogen oxides), THC (gasoline) and CO₂ (carbon dioxide), and the emissions were expressed in g/km.

Additionally, for every tests PM was measured. PM measurement was done with the help of dilution tunnel and particulate sampling system. For PM measurement, the flow capacity of the CVS and DT system was such that the temperature at the particulate sampling point was below 52 °C during the test. The particulate emissions were collected on the primary and back up filters. Before starting the test the primary and secondary particulate filters were conditioned as per the procedure given in EEC directives. They were then weighed and mounted on the filter holder assembly and then installed in the particulate sampling system. At the end of the test the filters were removed and again conditioned as per the procedure given by the EEC and weighed.

Every vehicle was undergone two emission testing, one with Teflon particulate filter and other with Quartz particulate filter.

9.3 Brief Description of Test Set-up at ARAI

9.3.1 Two and Three Wheeler Test Cell:

The set up has facility for Type Approval /COP/Development Tests on three wheelers (Gasoline/CNG/LPG/Diesel) as per BS-II and BS-III, EURO and EPA norms and as per customer requirements with customized test cycles. The 50 kW AC machine chassis dynamometer having 24-inch dia roller, With inertia simulation from 100 to 1500 kg is used for complete road load Simulation, measurement of vehicle emission, constant speed fuel Consumption and vehicle performance. The Dilute Diesel / Gasoline / CNG / LPG Exhaust Gas Analyzer, constant Volume sampler and 10 inches dia. dilution tunnel are suitable for Measurement of all 3 wheelers.



Figure 18: Schematic of 3-Wheeler Test Cell

9.3.2 Four Wheeler Test Cell:

The set up has facility for Type Approval /COP/Development Tests on four wheelers (Gasoline/CNG/LPG/Diesel) as per BS-II and BS-III, EURO and EPA norms and as per customer requirements with customized test cycles. The 150 kW AC machine chassis dynamometer having 48 inch dia single roller with inertia simulation from 120 to 5443 kg is used for complete road load simulation, measurement of vehicle emission, constant speed fuel consumption and vehicle performance. The latest generation Dilute Diesel / Gasoline / CNG / LPG Exhaust Gas Analyzer, constant volume sampler and 12 inch. dilution tunnel are suitable for measurement of all 4 wheeler passenger cars and light commercial vehicles.



Figure 19: Schematic of 4-Wheeler Test Cell

9.3.3 HCV Test Cell:

This Emission Test Cell at ECL has facility for Development test for mass emission, fuel consumption and performance evaluation of oil and lubricants on trucks and buses. During the measurement of particulate matters for HCV applications, A secondary dilution tunnel along with 18" primary dilution tunnel allows complete testing of Bus and trucks on chassis dynamometer for particulates.



Figure 20: Schematic of HCV Test Cell

9.4 Test Conditions:

During the test, the test cell temperature was maintained between 293 K and 303 K (20 and 30°C). The absolute humidity (H) of either the air in the test cell or the intake air of the engine was maintained such that: $5.5 \leq H \leq 12.2 \text{ g H}_2\text{O/kg dry air}$

For post 2000 vehicles, the soak period was maintained for at least 6 hours and upto a maximum of 30 hours at 20-30 deg. C.

9.5 Mass Emission Calculations:

The mass emission of pollutants are calculated by means of the following equation:

$$Mi = \frac{(V_{mix} * Q_i * k_H * C_i * 10^{-6})}{d}$$

Mi = Mass emission of the pollutant i in g/km

V_{mix} = Volume of the diluted exhaust gas expressed in m³/test and corrected to standard conditions 293 K and 101.33 kPa

Q_i = Density of the pollutant i in kg/m³ at normal temperature and pressure (293 K and 101.33 kPa)

k_H = Humidity correction factor used for the calculation of the mass emissions of oxides of nitrogen. There is no humidity correction for HC and CO.

C_i = Concentration of the pollutant i in the diluted exhaust gas expressed in ppm and corrected by the amount of the pollutant i contained in the dilution air.

d = distance covered in km

9.6 Calibration of Important Test Cell Equipments:

Chassis Dynamometer:

Sr. No.	Particulars	Requirement	Frequency
1	Load cell	1% Full Scale	1 month
2	Speed Calibration of dynamometer	1 kph	6 months
3	Cooling blower	5 kph	1 year

Analyzers:

Sr. No.	Particulars	Requirement	Frequency
1	Linearity	2% point	1 month
2	NOX Conversion Efficiency	>95%	Weekly

CVS:

Sr. No.	Particulars	Requirement	Frequency
1	CVS LFE Venturi Cal	<0.3%	6 months
2	Propane Injection	5%	6 monthly

10. ANNEXURE IV: Brief Description of Unregulated Emissions Measurement Procedure, Equipment used and Calibration Details

10.1 A) Title: DETERMINATION OF ELEMENTAL CARBON (EC) AND ORGANIC CARBON (OC) IN PARTICULATE MATTER (PM) SAMPLES OF AUTOMOTIVE EXHAUST BY DESERT RESEARCH INSTITUTE (DRI) THERMAL/OPTICAL CARBON ANALYZER

1.0 SCOPE

The procedure is applicable to automotive engine exhaust and ambient air.

2.0 REFERENCE DOCUMENT

- 2.1 Standard Operating Procedure (SOP) MLD 065 for the analysis of Organic and Elemental Carbon in Particulate matter (PM) samples by using DRI Model 2001 TOR/TOT Carbon Analyzer.
- 2.2 Operation manual of DRI make Thermal/Optical Carbon Analyzer.
- 2.3 NABL 141 estimation & expression of uncertainty in measurement

3.0 CALIBRATION

- 3.1 Standard: Calibration with standard traceable 5% CO₂ in He, 5% CH₄ in He and NIST traceable Standard Potassium Hydrogen Phthalate (KHP) solution. 5% CH₄ in He is also used as internal standard by instrument during each sample run.
- 3.2 Frequency: Intermediate calibration after six months or when the internal calibration gas cylinder is changed, whichever is earlier. Daily checks with Gas standard before analysis of set of samples. Acceptance criterion of +/- 5 % of the Standard.
- 3.3 Calibration Record: In a Calibration Test Report.

4.0 APPARATUS

- 4.1 Desert Research Institute (DRI) Model 2001A Thermal Optical Carbon Analyzer (AML/ INST/ 149) System with computer (ARAI/120/02/0562).

The programmable combustion oven is the heart of the carbon analyzer and includes loading, combustion, and oxidation zones in a single quartz "oven".

In addition to the DRI Model 2001 thermal/optical analyzer, the following items are needed for routine carbon analysis:

- 4.2 Stainless steel punching tool: 5/16-inch diameter, 0.5 cm² nominal area.
- 4.3 Syringes: Hamilton Gas-Tight 1000 μl syringe for calibration injections; 25 μl syringe for carbonate analysis and for analyzer calibration.
- 4.4 Flat-tip tweezers.
- 4.5 Flat glass plate.
- 4.6 Tissue paper
- 4.7 Lighter
- 4.8 Glassware



Fig.21 Carbon Analyzer

5.0 REAGENTS

- Potassium Hydrogen Phthalate (KHP)
- Sucrose
- Hydrochloric Acid (HCL)
- Nanopure ASTM type 1 deionized water (>16 Mega Ohm-cm)
- **Gases:** All gases are required of high purity grade

Sr. No.	Name of the gas	Regulated pressure (psi)	Purpose
1	Helium	15-40	As a carrier gas
2	10 % O ₂ in helium	15	As a carrier gas
3	Hydrogen	15	As a fuel for FID
4	Zero air	15	As an Oxidizer for FID
5	Zero air	~25	For pneumatic activation
6	5% methane in He	10	Internal Calibration
7	5% CO ₂ in He	10	Calibration

SUMMARY OF TEST PROCEDURE

PRINCIPLE

The operation of the DRI Model 2001 Thermal/Optical Carbon Analyzer is based on the Preferential oxidation of organic carbon (OC) compounds and elemental carbon (EC) at different temperatures. The principal function of the optical (laser reflectance and transmittance) component of the analyzer is to correct for pyrolysis charring of OC compounds into EC. Without this correction, the OC fraction of the sample might be underestimated and the EC fraction might include some pyrolyzed OC.

6.0 DETAIL PROCEDURE

6.1 **Analyzer start-up** (When the analyzer is started up for the first time, or after an extended period of non-operation):

- Check the gases for their pressures/settings.
- Start all the gases except Air to FID on front panel
- **Start PC only.**
- Put on Analyzer (Switch is on the rear side of the analyzer.)
- Set **FID temperature to 125°C** and **Line Heater temperature to 105°C**.
- Heat Both **Oxygenator to 912°C** and **Methanator to 425°C** with an increment of 100°C with hold time 30 minutes at each increment.
- It will take a period of three days for conditioning to **reach** a stable system background.
- When system stabilization is achieved then perform the leak check test. For daily routine operation, start the operation with leak check test onwards.

6.2 **Leak Check test**

- **Close** sample oven outlet toggle valve on right side of control panel.
- Wait for sample oven pressure display to reach approximately 5 units from 2.6 units.
- Then close sample oven inlet valve on the front panel.
- A “leak free” condition is indicated by a steady pressure reading, or a decline of 0.01 units or less per second
- After the leak check test is **PASS**, then **open** the sample oven outlet valve and then open the sample oven inlet.

6.3 Click the DriCarb shortcut icon from desktop to begin the carbon program

6.4 Make sure that the analyzer's multi-function **switch** (at the left of the front panel) is **at auto** mode on front panel.

6.5 **Oven Baking**

- Oven Baking is performed after Leak Check is passed
- Select “Analysis” from the “Main” submenu of the Welcome form. This will initiate the analysis protocol.
- Under “Command Table” select *cmd/BakeOven*.
- In the analysis “Setup” form, enter “Sample” for the Type.
- Enter the Sample ID number as “OB1”, Enter the Run #, Punch area and Deposit area for the filter being analyzed. Punch area and Deposit area should be “1”. Enter technician initials in the “Tech initials” field.
- Click “OK” on the analysis “Setup” screen.

- Repeat until the system is clean. Sample runs or calibrations may then begin.
- System blanks are run after the oven bake.

6.6 **System Blank**

- System blanks are run at the beginning of each day after oven baking.
- Run a system blank with the IMPROVE_A protocol.
- Select “Analysis” from the “Main” submenu of the Welcome form. This will initiate the analysis protocol.
- In the analysis “Setup” form, enter “Sample” for the Type. Select FID ID as FID_8
- Polarity should default to “Unipolar”. Fill out the information about the sample, including: Project Name as SysBlk, Batch #, and Subbatch#.
- Under “Command Table” select *cmdlImproveA*.
- Enter the Sample ID number as SysBlank_date, Enter the Run #, Punch area and Deposit area for the filter being analyzed. Punch area and Deposit area should be “1”. Enter technician initials in the “Tech initials” field.
- Select any pre-analysis flags from the drop-down menu in the “Flags” field.
- Click “OK” on the analysis “Setup” screen. Computer will prompt to load the filter punch. But when prompted to load filter punch, remove the filter from the previous day and leave the boat empty. Enter delay value as 10 sec. Click “OK”
- The boat will load to the calibration position after 10 sec. The computer will ask, “Would you like to proceed or would you like to delay analysis?” Enter a 130-second delay is in the “delay” box. Click “OK” and analysis will begin.
- Calculated carbon concentrations should not be more than 0.2 µg carbon. Values greater than this warrant additional system blanks. Samples may not be analyzed until the system blank is <0.2 µg carbon. After this carry out filter-blank analysis

6.7 **Auto-calibration**

- Auto-calibration is performed after system blank
- Select “Analysis” from the “Main” submenu of the Welcome form. This will initiate the analysis protocol.
- Under “Command Table” select *cmdlAutoCalibcheck*.
- In the analysis “Setup” form, enter “Sample” for the Type.
- Enter the Sample ID number as “AutoCalib_Date”, Enter the Run #, Punch area and Deposit area for the filter being analyzed. Punch area and Deposit area should be “1”. Enter technician initials in the “Tech initials” field.

- Click “OK” on the analysis “Setup” screen.
- After the run time is over, computer will prompt the calibration check result.
- Do not proceed to sample analysis unless calibration is established or confirmed. There should not be more than 10% difference in three peak areas of calibration.

6.8 **Sample analysis-**

- Note down the sample details.
- Examine the filter visually and note any non-uniformity or unusual deposit. Place the filter on the flat glass plate and remove a sample punch using punching tool.
- Select “Analysis” from the “Main” submenu of the Welcome form. This will initiate the analysis protocol.
- In the analysis “Setup” form, enter “Sample” for the Type. Select FID ID as FID_8
- Polarity should default to “Unipolar”. Fill out the information about the sample, including: Project Name as SysBlk, Batch #, and Subbatch#.
- Under “Command Table” select cmdImprove.
- Enter the Sample ID number, Enter the Run #, Punch area and Deposit area for the filter being analyzed. Enter technician initials in the “Tech initials” field.
- Select any pre-analysis flags from the drop-down menu in the “Flags” field.
- Click “OK” on the analysis “Setup” screen. Computer will prompt to load the filter punch. But when prompted to load filter punch, remove the filter from the previous day and leave the boat empty. Enter delay value as 10 sec. Click “OK”
- The boat will load to the calibration position after 10 sec. The computer will ask, “Would you like to proceed or would you like to delay analysis?” Enter a 130-second delay is in the “delay” box. Click “OK” and analysis will begin. Report of analysis will be generated automatically.

6.9 **Filter blank –**

- Filter blank analysis, one for every 10 samples analysed, is performed similar to sample analysis with pre-baked blank filter paper punch loaded instead of sample punch.
- Pre-baking of blank filter paper is carried out by heating the blank filter paper in furnace at 900°C for 4 hrs using porcelain dishes and preserved in dessicator.

6.10 **Calibration –**

- The instrument is calibrated every six months or the internal calibration gas cylinder is changed, whichever is earlier. 5% CO₂ in He, 5% CH₄ in

He and KHP are used for calibration. 5% CH₄ in He is also used for end of run calibration automatically injected by the instrument.

- 5% CO₂ in He is injected in the volume 100 ul, 200 ul, 500 ul, 700 ul and 1000 ul.
- 5% CH₄ in He is injected in the volume 100 ul, 200 ul, 500 ul, 700 ul and 1000 ul.
- KHP solution of 1800 ppm concentration is used for calibration. Following volumes were injected- 5 ul, 10 ul, 15 ul and 20 ul, which corresponds to 9 ug, 18 ug, 27 ug and 36 ug Carbon.
- The gas standard concentrations are corrected for temperature and pressure at laboratory conditions using ideal gas law and certified percent of gas in cylinder.
- The injection peak counts divided by calibration peak counts is calculated and slope is determined by plotting calculated carbon in ug vs. injection peak area/calibration peak area. The line is forced through zero.
- The slope value determined from three calibration standards is entered into *carbon.par* table

7.0 CALCULATIONS

The conversion of integrated peak counts to μg of carbon for each peak in the thermogram is performed by the computer at the end of the analysis program based on analysis result, punch area, deposit area, internal calibration peak area.

8.0 REPORT

Report the concentration of Organic carbon fractions (OC1, OC2, OC3 and OC4) and Elemental Carbon Fractions (EC1, EC2 and EC3) in the PM.

**10.2 B) Title: DETERMINATION OF MOLECULAR MARKERS
COMPOUNDS IN AUTOMOTIVE EXHAUST BY HR-GC with FID and
GC-MS**

1.0 SCOPE

The procedure is applicable to automotive engine exhaust and ambient air samples.

2.0 REFERENCE DOCUMENT

- 2.1 "Conceptual Guidelines And Common Methodology For Air Quality Monitoring, Emission Inventory And Source Apportionment Studies For Indian Cities" (November 06) prepared by CPCB and ASEM-GTZ
- 2.2 Model Standard Operating Procedure For Organic Speciation (Molecular Markers) (Chapter X)-prepared by CPCB and ASEM-GTZ February 07
- 2.3 MSDS of Chemicals & Reagents specified in this method.

3.0 CALIBRATION

The PAH standard of Accustandard (M-610) Polynuclear Aromatic Hydrocarbons (PAHs) Mix (in acetonitrile) of 16 constituents were used to cover all the probable PAHs present in exhaust samples. Apart from these, individual standard of Accustandard make Benzo(e)pyrene and Coronene were also used for quantification. Due to unavailability of the other homologues only one hopane constituent i.e. 17 α (H), 21 β (H) Norhopane were referred for qualitative as well as quantitative analysis which is a representative of Hopane group. Authentic standards of n-Hentriacontane n-Tritriacontane ,n- Pentatriacontane belonging to alkane series were used as a individual standards for alkanes identification.



Figure 22:

4.0 APPARATUS

- 4.1 GC/MS System: (Schimadzu make Model QP-5050) The mass spectrometer is operated in both scan and SIM mode utilizing 70-volt electron energy in the electron impact ionization mode and producing a qualified mass spectrum. A computer system, interfaced to the mass spectrometer, is used for system control as well as data acquisition, storage and data processing. Qualitative detection of organic compounds is done by using GC-MS system whereas , quantification of identified compounds is done using HR-GC with FID.
- 4.2 GC Columns: 30 m long x 0.25 mm ID, 0.25 µm film thickness capillary DB-5 MS was used in GC/MS system for analyses of PAHs, alkylated PAH, Hopanes and Other Biomarkers. DB-1701 was used for HR-GC FID analysis.
- 4.3 Apparatus for Sample Extraction and Concentration
- Glassware: All glassware are washed and rinsed manually with deionised water. It is then rinsed with three portions each of acetone and Dichloromethane. Glassware is air-dried in an oven and then stored in a contaminant free area.
 - Vacuum filtration system.
 - Soxhlet Extractor Soxhlet Extraction Assembly: 250 ml Capacity of round bottom Flask
 - Analytical balance capable of accurately weighing 0.0001 g.
 - Erlenmeyer flasks, 250 mL.

- Beakers: 100, 250 and 500 mL.
- Glass funnel
- Glass wool and glass fibre filters (9.0 cm).
- Graduated cylinder: 100 ml
- Vials: 5 mL and 15 mL, with Teflon-lined screw cap septa.
- Pipettes: Pipettes with capacities from 10 to 1000 μ L capacity and appropriate condensers.
- Macro Kuderna Danish Concentrator with ground glass joints (Supelco ,Sigma Aldrich Make) –

Note: The Soxhlet extraction assembly should be vented into a hood to prevent unnecessary exposure of the analyst to the organic vapor.

5.0 **REAGENTS**

All solvents should be of ultra pure HPLC grade or equivalent.

- 5.1 Dichloromethane (Extra Pure): For Soxhlet Extraction
- 5.2 Acetone (Extra Pure): For Soxhlet Extraction

SUMMARY OF TEST PROCEDURE

The quartz filter papers are extracted by Soxhlet Extraction and the extract is concentrated by Kuderna Danish Evaporation Apparatus. The concentrated extract is then analysed by GC-MS.

6.0 **DETAIL PROCEDURE**

6.1 Soxhlet Extraction:

- a. PM collected on Quartz filter after EC/OC analyses are to be taken for extraction process as per CPCB Protocol.
- b. Preparation of Extraction solvent is done in 1:1 proportion
- c. Wrap the filter papers together in Whatman filter paper no.42 & transfer into Soxhlet Extractor.
- d. Transfer the solvent mixture in to the round bottom flask by assembling the Soxhlet Extraction Assembly .
- e. Connect the water condenser & check the flow rate of water & start heating.
- f. Extract the filter papers for 16 hrs (Continuous Extraction).
- g. After 16 hrs stop heating & cool the assembly.

h. Collect the Extracted sample solution in conical flask & use it for further Evaporation.

6.2 Sample Pre-concentration:

- Kuderna – Danish Evaporation Apparatus (It includes 310 mm .3-ball column with 500 ml flask and 15 ml receiving vessel. Cat No. 64685-U)
 - a. Wash the apparatus with solvent mixture (Dichloromethane: acetone 1:1).
 - b. Transfer the extracted sample solution into the flask.
 - c. Add 1-2 Glass beads in the sample to avoid bumping.
 - d. Assemble the apparatus as per the procedure mentioned by Manufacturer.
 - e. Maintain the temperature of water bath at 70-80°C for 4 hours duration.
 - f. Reduce the sample up to 5ml.
 - g. Cool the Apparatus & collect the evaporated sample in Vial.
 - h. Store it at low temperature.

6.3 GC-MS Instrumental Setup

Shimadzu Make (Model QP-5050)

GC-Column

DB-5 Thickness 0.25 micro meter. Diam. 0.25mm J & W make DB-1701 length 30 ms, I.D. 0.25 mm and 0.25 micro meters

MS

Mass range: - 10-900 amu

Operating Parameters

Injection Temp: 290 0C

Interface Temp.: 300 0C

Carrier Gas: Helium

Column Inlet pressure: 27.7 Kpa

Column Flow: 0.7 ml/min

Linear Velocity: 30.4cm/sec

Split Ratio: Split less mode.

Carrier flow: 29 ml/min

Injection Volume: 2 microlitre

Oven Temp. Program

Initial Temp: 70 0C for 4 mins
10 0C /min to 200 0C for 5 mins.
5 0C /min to 300 0C for 20 mins.
Solvent Cut Time: 6 mins
Total Run Time: 62 mins.
Column used: DB-5

6.4 HR-GC Analysis

High Resolution Gas Chromatograph with Flame Ionization detector were used for analysis of Alkanes, Hopanes and other bio markers present in PM extract.

Instrumental Setup

Perkin Elmer Make High Resolution Gas Chromatography (HR-GC)

Model: - Auto system XL

GC Column (Fused Silica Capillary make) DB-1701

Length	30 m
Diameter	250 um
Film	0.25
Thick.	um

Operating Conditions: for HRGC-FID

Initial Temp= 70 oC	10 oC/min to 200
Ramp 1:	oC
	at 200 oC hold for
	5 min
Ramp 2:	5oC/min to 280 oC
	at 280 oC hold for
	20 min

Analysis:-

- Filter extracted samples are evaporated to 0.5 ml volume in Acetone :Dichloromethane solvent and then injected on GC.
- Standard: List of standard is given with available information in Table 2 Calibration standards for GC-MS analysis

7.0 CALCULATIONS

When a compound has been identified, the quantitation of that compound will be based on the integration area or integrated abundance. Quantitation will be performed using the internal standard method.

Calculate the concentration of the analyte of interest in the sample using the response factor determined

$$\text{Concentration } (\mu\text{g/g}) = \frac{\text{AS} \times \text{WIS} \times \text{D} \times \text{F}}{\text{AIS} \times \text{RRF} \times \text{WS}}$$

Where:

AS = Response for the analyte in the sample, units may be in area counts or peak height.

AIS = Response for the internal standard in the sample, units same as As.

WIS = Amount (μg) of internal standard added to the sample.

D = Dilution factor. If dilution was made on the sample prior to analysis. If no dilution was made, D = 1, dimensionless.

WS = Weight of sample extracted, g. either a dry or wet weight may be used, depending upon the specific application of the data.

F = Factor if the samples are splitted in half for analyses, so the final concentration of individual analytes should multiply volume factor.

8.0 REPORT

Reporting units are $\mu\text{g}/\text{m}^3$ or pg/m^3 .

Surrogate Recovery- Surrogate recovery is reported for each sample analysed. Data should be flagged if the percent recovery is outside of the 70-120% range. In case the concentrations found below detectable limits (BDL), respective MDL should be reported.

10.3 C) Title: DETERMINATION OF PAH COMPOUNDS IN AUTOMOTIVE EXHAUST BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

1.0 SCOPE

The procedure is applicable to automotive engine exhaust and ambient air.

2.0 REFERENCE DOCUMENT

- 2.1 NIST SRM 1647 standard document for analysis method
- 2.2 Operating Manual of Series 200 Liquid Chromatograph.
- 2.3 Applicable MSDS for proper handling storage use disposal of chemicals for Acetonitrile, Water, Acetone and Dichloromethane.

3.0 CALIBRATION

- 3.4 Standard: NIST SRM 1647d- Priority pollutant Polycyclic Aromatic Hydrocarbons. 16 component PAH-Mix in Acetonitrile
- 3.5 Frequency: Intermediate checks with NIST standard before analysis of set of samples. Acceptance criterion of +/- 5 % of the NIST Standard.
- 3.6 Calibration Record: In a Calibration Test Report format attached

4.0 APPARATUS

The designated chemist, engineer will select the appropriate testing reforming master list of instruments. The general instruments are as follows.

- 4.1 Series 200 High Performance Liquid Chromatograph (HPLC) (AML/INST/136)
- 4.2 Balance (AML/INST/117 & AML/INST/118)
- 4.3 Envirotech APM 850 machines (AML/INST/138)



Fig 23

5.0 REAGENTS

All reagents are HPLC grade unless otherwise stated.

5.1 Acetonitrile

5.2 Water

5.3 Acetone

5.4 Dichloromethane

6.0 SUMMARY OF TEST PROCEDURE

PM 10 Quartz filter are extracted for 16 hours (Continuous). The extracted solution is then concentrated by Kuderna – Danish Evaporation Apparatus. The concentrated sample is dissolved in 1 ml Acetonitrile. The sample injected in High Performance Liquid Chromatography (HPLC) and analysed by using Ultraviolet detector and supelcosil and C-18 columns. Conc. of target PAH compounds in the sample under test is determined by calibrating the HPLC using a traceable Certified Reference Material (CRM).

7.0 DETAILED PROCEDURE

7.1 Switch on the equipment as per Work Instruction No. CHL/WI/136.

7.2 Open HPLC method in respective mode.

7.3 Place the vials containing blank, working standard, control standard and test samples into the auto sampler for subsequent injection into HPLC.

7.4 The peak integrations are corrected as necessary in the data system.

7.5 Calculate and record the peak areas.

- 7.6 Calculate the conc. of target each PAH compound in the CRM and the sample under test. The HPLC equipment is said to be in a known state of calibration if result obtained on the CRM (not used for the calibration) (when treated as unknown sample) is within $\pm 5\%$ value reported by certified authority. OR its retention time.
- 7.7 Record the result of the calibration in the form of enclosed format.

8.0 CALCULATIONS

- The mass of each target PAH compound is determined by the following equation :
$${}^X\text{Mass} = A \times B$$
where, ${}^X\text{Mass}$ = Mass of target PAH compound in the CRM, ugms.
A = Area of the peak PAH compound
B = Response factor for the PAH compound.

(Conc. of PAH comp. in CRM) ugm/ml

$$\text{Response factor for } = \frac{\text{PAH Compound}}{\text{Peak Area of the CRM}}$$

9.0 REPORT

Report the concentration of target PAH compound in ugm

10.CALIBRATION TEST REPORT

Determination of PAH compounds in Automotive source samples by High Performance Liquid Chromatograph.

Acceptance Criteria: Result of standard sample should be within \pm 5% of specified value.

Reference: Operation Manual of Series 200 HPLC

Observations:

A) Description of CRM

Sr.No.	PAH Compound	Carbonyl Compound			Acceptable Deviation	Remark
		Specified Value	Result Obtained	% Deviation (\pm) from specified value		
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

Calibrated By

Verified By

10.4 D) Title : DETERMINATION OF ELEMENTS IN AUTOMOTIVE EXHAUST BY ENERGY DISPERITIVE X- RAY FLUORESCENCE (ED-XRF)

1.0 SCOPE

This procedure is applicable to analysis of particulate matter (PM) collected from ambient air and vehicle exhaust.

2.0 REFERENCE DOCUMENT

2.4 Compendium Method IO-3.3, Determination of metals in ambient particulate matter using X-Ray Fluorescence (XRF) Spectroscopy, US EPA, June 1999

2.5 XEPOS (XRF Model) Software manual XEPOS application notes No. 5.

3.0 CALIBRATION

Single element thin-film calibration standards from Micromatter for 34 elements. The instrument is calibrated by acquiring spectra for all the single element thin film standards.

4.0 APPARATUS

X-ray Fluorescence Spectrometer, Make- SPECTRO, A.I. GmbH, Germany, Model- XEPOS.



Fig. 24

Instrumental specification:

- a Tube voltage: 0-50 kV with resolution of 12 bit.
- b Tube current: 0-2 mA with resolution of 12 bit.

- c Power Output: 50W max.
 - d Detector: Si drift
 - e Energy resolution: < 170 eV.
 - f HOPG, Mo, Al₂O₃ targets.
- 5.0 **MATERIALS**
- 7.1 Helium gas with 99.95% purity.
- 7.2 Sample Holders, Polypropylene X-Ray Film

SUMMARY OF TEST PROCEDURE

Elemental Analysis of Air Particulate by Energy Dispersive X-ray Fluorescence (ED-XRF). This method applies to the analysis of vehicle exhaust particulate collected on 47mm and 90 mm diameter Teflon Filters. This method describes the quantitative determination of elements in ambient air particulate collected on Teflon membrane filters. The method assumes that the particulate is collected as a surface deposit on top of the filter media, that the particulate loading level is less than approximately 100 µg/cm², and that the filter matrix is relatively uncontaminated with elements over Z=9

An X-ray source removes electrons from the inner shells of atoms by exciting the atoms to energy states above the stable configuration. As electrons move to refill the ground state energy levels, the atomic system maintains its fundamental energy balance by emission of electromagnetic radiation. The emitted radiation is an x-ray whose energy is characteristic of the excited element. The samples are quantitatively analyzed by counting the number of observed x-rays over a set period, as compared with the number of fluoresced x-rays from similarly analyzed standards.

6.0 **DETAIL PROCEDURE**

Sample Preparation:

- The samples to be analysed are stored properly at conditioned environment.
- Prepare PM loaded filter sample using filter holder ring and polypropylene film (4u). Ensure that no wrinkles or bulges are present on the film.

Analysis:

- Turn 'ON' the instrument and PC. Warm up instrument in standby mode for 30 min. Open
- X-Labpro Routine Dialog. Give identification to the sample then choose the right method (pre-calibrated) in combo box. Click 'Start' button.
- After clicking 'Start' button, auto-sampler turret will arrange itself above X-ray window and target window.

- Helium flow will start immediately. Keep the flow rate at 40lit./hr. First it will flush sample compartment for 60 sec. After analysis is completed results are obtained in tabular format in pre-specified folder.

Calibration:

- The Micromatter thin film standard material and sample under test are analysed by XRF in the same run. The equipment is said to be in a state of acceptable valid calibration if the acceptance criteria is met.

7.0 CALCULATIONS

The concentrations of the elements in the sample are calculated by the software.

8.0 REPORT

- a) Report the result in the desired unit e.g. ng/cm² upto two decimal places.
- b) Any deviation by agreement or otherwise from the procedure.

10.5 E) Title: DETERMINATION OF Anions and Cations in Particulate matter (PM) samples of autoexhaust by Ion Chromatography

1.0 SCOPE

The procedure is applicable to characterization of PM collected from vehicle exhaust and ambient air.

2.0 REFERENCE DOCUMENT

- 2.1 Standard Operating Procedure (SOP) MLD 064 Standard Operating Procedure for the analysis of anions and cations in PM2.5 speciation samples by Ion Chromatography.
- 2.2 Operation manual of Metrohm make Ion Chromatograph.
- 2.3 Methods of Air Sampling and Analysis, 3rd Edition by James p. Lodger
- 2.4 Applicable MSDS for proper handing storage use disposal of chemicals for Sodium Carbonate (Na_2CO_3) ,Sodium Bi-Carbonate (NaHCO_3),Tartaric Acid ,Pyridine 2,6 Di-Carboxylic Acid or Dipicolinic Acid

3.0 CALIBRATION

- 3.1 Standard : (a) Anion Mix Standard (Cl^- , F^- , Br^- , NO_3^- , SO_4^{2-} , PO_4^{3-}) 10 ppm concentration (Certified Multianion Standard Solution PRIMUS) Fluka Make (b) Cation Mix Standard (Na^+ , K^+ , Mg^+ , Li^+ , Ca^+) 10 ppm concentration(Certified Multication Standard Solution PRIMUS) Fluka Make
- 3.2 Frequency: The frequency of Multi-point Calibration Curve using PRIMUS Certified Multi Ion Standard is once in a six months. Whereas, use of single point calibration using AR grade salts or Certipur Standards (NIST Traceable) before the sample analysis is practiced. Relative Standard Deviation (RSD) for each anion as well as cation should be below 3 %. In order to accept the Calibration Curve, Correlation Coefficient should always be greater than or equals to 0.990
- 3.3 Calibration Record: Soft Copy available with PC attached to IC.

4.0 APPARATUS

The designated chemist, engineer will select the appropriate testing reforming master list of instruments. The general instruments are as follows.

- 4.1 Ion Chromatograph with auto sampler (IC) (AML/INST/146)

4.2 Analytical Balance (AML/INST/117 & AML/INST/118)

4.3 Ultrasonicator and Vacuum Filtration System



Fig 25

5.0 REAGENTS

All reagents should be of AR grade or Excel-R grade.

- Sodium Carbonate (Na_2CO_3)
- Sodium Bi-Carbonate (NaHCO_3)
- Tartaric Acid
- Pyridine 2,6 Di-Carboxylic Acid or Dipicolinic Acid
- Milli-Q Grade ASTM type 1 deionized water (>16 Mega Ohm-cm)

SUMMARY OF TEST PROCEDURE

PM 10 (Teflon coated Glass Fibre) Filter Extraction

The PM10 sample collected on filter received by the laboratory are extracted in de-ionized water by sonicating for one hour, and filtered through 0.2-micron Nylon membrane filters (Pall Life Sciences) using vacuum filtration system. The final filter extract volume is then made upto 50 ml. by deionised distilled water.

Analysis on Ion Chromatograph

Ion Chromatograph consisting of system comprising of guard column, analytical column, self-regenerating suppressor and a conductivity detector analyzes the final filter extract. The peak analysis is determined by using Metro data IC Net Software Version 2.3

6.0 DETAIL PROCEDURE

- 6.1 Switch on the equipment as per Work Instruction No. CHL/WI/146
- 6.2 Open IC method in respective mode.
- 6.3 Place the vials containing blank, working standard, control standard and test samples into the auto sampler for subsequent injection into IC.
- 6.4 The peak integrations are corrected as necessary in the data system.
- 6.5 Calculate and record the peak areas.
- 6.6 Calculate the conc. of each targeted Anion and Cation compound in the reference standard and the sample under test. The IC equipment is said to be in a known state of calibration if result obtained on the reference standard (not used for the calibration) (when treated as unknown sample) is as per QA/QC guidelines mentioned in SOP MLD 064.
- 6.7 Record the result.

7.0 CALCULATIONS

The conc. of each target compound is determined by the following equation:

$$\text{Concentration of Ion in } \mu\text{g} = \frac{(C \times V_1) - B}{F}$$

Where,

C= concentration of (μg or mg of Ion / ml) in the aliquot

V_1 = Volume of aliquot (ml)

B = total μg or mg of Ion in blank

F = Fraction of total sample in the aliquot used for measurement

8.0 REPORT

Report the concentration of target ions in microgram (μg).

11. ANNEXURE V: Vehicle Source Profiling Test Result

11.1 Mass Emission Results

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
1	1	2-Stroke,2W Gasoline	1991-96	1994	TVS SCOOTY	25786	<80cc	without Cat. Con.	T	5.31	2.69	0.1	24.15	0.027
									Q	5.21	2.64	0.1	24.38	-
2	2	2-Stroke,2W Gasoline	1991-96	Dec-94	LML VESPA SMART	70410	>80cc	without Cat. Con.	T	5.51	3.53	0.01	23.33	0.070
									Q	5.55	3.49	0.02	24.55	-
3	3	2-Stroke,2W Gasoline	1991-96	1992	YAMAHA RX100	79281	>80cc	without Cat. Con.	T	3.74	4.82	0.01	25.05	0.024
									Q	3.99	4.64	0.01	25.81	-
4	4	2-Stroke,2W Gasoline	1996-2000	Jul-96	KINETIC LUNA SUPER	11190	<80cc	without Cat. Con.	T	4.25	3.24	0.03	22.86	0.068
									Q	4.29	3.16	0.03	22.99	-
5	5	2-Stroke,2W Gasoline	1996-2000	1998	LML SUPREMO	36447	>80cc	without Cat. Con.	T	3.02	2.96	0.01	25.17	0.024
									Q	3.09	3.01	0.01	25.38	-
6	6	2-Stroke,2W Gasoline	1996-2000	Jul-98	SUZUKI SAMURAI	74799	>80cc	without Cat. Con.	T	8.82	6.53	0.04	33.72	0.221
									Q	9.05	6.5	0.03	34.47	-
7	7	2-Stroke,2W Gasoline	Post 2000	2001	TVS SCOOTY ES	24449	<80cc	without Cat. Con.	T	6.46	3.91	0.03	25.45	0.052
									Q	6.7	3.83	0.03	26.45	-
8	8	2-Stroke,2W Gasoline	Post 2000	2002	BAJAJ BRAVO	19797	>80cc	with Cat. Con.	T	2.6	2.51	0.01	34.23	0.017
									Q	2.65	2.54	0.01	34.02	-
9	9	2-Stroke,2W Gasoline	Post 2000	Jul-00	TVS MAXX 100	56853	>80cc	with Cat. Con.	T	2.65	2.06	0.01	24.65	0.052
									Q	2.42	2.01	0.01	24.71	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
10	10	4-Stroke,2W (Gasoline)	1991-96	Apr-91	CD 100	23557	<100cc	without Cat. Con.	T	4.65	0.97	0.22	22.31	0.005
									Q	5.11	0.96	0.23	23.03	-
11	11	4-Stroke,2W (Gasoline)	1991-96	May-96	BAJAJ 4S CHAMPION	37757	<100cc	without Cat. Con.	T	1.76	0.92	0.28	25.74	0.006
									Q	1.51	0.86	0.29	24.45	-
12	12	4-Stroke,2W (Gasoline)	1991-96	Apr-94	BULLET	44880*	>200cc	without Cat. Con.	T	10.06	2.13	0.88	35.67	0.018
									Q	10.03	2.2	0.86	36.74	-
13	13	4-Stroke,2W (Gasoline)	1996-2000	Jun-99	KINETIC K4 100	30379	<100cc	without Cat. Con.	T	3.69	0.92	0.18	21.69	0.005
									Q	3.77	0.88	0.2	21.54	-
14	14	4-Stroke,2W (Gasoline)	1996-2000	1998	SPLENDER	63956	<100cc	without Cat. Con.	T	2.16	0.68	0.34	25.34	0.005
									Q	2.26	0.68	0.35	25.73	-
15	15	4-Stroke,2W (Gasoline)	1996-2000	Nov-98	BULLET	27244	>200cc	without Cat. Con.	T	3.94	1.22	0.44	37.8	0.03
									Q	3.37	1.2	0.4	39.33	-
16	16	4-Stroke,2W (Gasoline)	Post 2000	Sep-03	TVS SCOOTY PEP	9409	>100cc	with Cat. Con.	T	1.1	0.8	0.29	29.78	0.013
									Q	1.6	0.82	0.3	31.01	-
17	17	4-Stroke,2W (Gasoline)	Post 2000	Mar-03	PULSER 150	67543	100-200cc	without Cat. Con.	T	1.44	0.42	0.4	33.75	0.007
									Q	1.4	0.4	0.42	34.01	-
18	18	4-Stroke,2W (Gasoline)	Post 2000	2006	BULLET 350	6089	>200CC	with Hot Tube	T	0.88	0.43	0.24	50.53	0.006
									Q	0.82	0.5	0.25	50.55	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
19	19	3 Wheeler (Gasoline)	1991-96	Oct-92	BAJAJ 3W 2S A/R	40950*	<200cc	without Cat. Con.	T	5.37	6.22	0.32	57.35	0.158
									Q	5.41	6.09	0.29	58.43	-
20	20	3 Wheeler (Gasoline)	1991-96	Aug-95	BAJAJ 3W 2S A/R	31229	<200cc	without Cat. Con.	T	13.89	6.48	0.13	40.05	0.15
									Q	13.67	6.31	0.11	40.85	-
21	21	3 Wheeler (Gasoline)	1991-96	Jun-96	BAJAJ 3W 2S A/R	31500*	<200cc	without Cat. Con.	T	8.65	8.34	0.1	58.59	0.146
									Q	8.35	8.27	0.11	59.5	-
22	22	3 Wheeler (Gasoline)	1996-2000	Sep-97	BAJAJ 3W 2S A/R	28350*	<200cc	without Cat. Con.	T	2.26	5.21	0.24	53.81	0.077
									Q	2.07	5.19	0.27	54.87	-
23	23	3 Wheeler (Gasoline)	1996-2000	Jan-99	BAJAJ 3W 2S A/R	14255	<200cc	without Cat. Con.	T	3.48	4.34	0.08	46.07	0.02
									Q	3.56	4.29	0.07	46.01	-
24	24	3 Wheeler (Gasoline)	1996-2000	May-00	BAJAJ 3W 4S RE A/R	91197	<200cc	without Cat. Con.	T	5.34	1.53	0.73	72.11	0.02
									Q	5.04	1.53	0.71	71.81	-
25	25	3 Wheeler (Gasoline)	Post 2000	Apr-03	BAJAJ 3W 2S A/R	12102	<200cc	with Cat. Con.	T	1.33	4.06	0.18	52.93	0.083
									Q	1.30	4.02	0.19	52.61	-
26	26	3 Wheeler (Gasoline)	Post 2000	Sep-06	BAJAJ 3W 2S A/R	17781	<200cc	with Cat. Con.	T	1.18	1.6	0.08	63.15	0.044
									Q	1.11	1.61	0.08	64.06	-
27	27	3 Wheeler (Gasoline)	Post 2000	Apr-01	BAJAJ 3W 4S RE A/R	83779	<200cc	without Cat. Con.	T	4.32	1.02	0.56	59.07	0.011
									Q	4.48	0.97	0.57	59.22	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
28	28	3 Wheeler (Diesel)	1991-96	Jun-95	GREAVES GARUDA	19440*	<500cc	without Cat. Con.	T	12.49	2.88	1.18	71.77	2.229
									Q	12.99	2.45	1.2	76.51	-
29	29	3 Wheeler (Diesel)	1991-96	Feb-96	GREAVES GARUDA	18480*	<500cc	without Cat. Con.	T	10.06	1.11	0.94	64.67	0.71
									Q	10.7	1.08	0.93	66.14	-
30	30	3 Wheeler (Diesel)	1991-96	Nov-96	MINIDOR A/R (D+6)	18047	<500cc	without Cat. Con.	T	13.14	1.63	1.04	90.84	0.856
									Q	13.17	1.65	1.03	97.79	-
31	31	3 Wheeler (Diesel)	1996-2000	1996	MINIDOR A/R (D+6)	24298	<500cc	without Cat. Con.	T	11.1	1.12	0.76	109	0.851
									Q	10.86	1.13	0.8	109.53	-
32	32	3 Wheeler (Diesel)	1996-2000	Feb-99	MINIDOR A/R (D+6)	146	<500cc	without Cat. Con.	T	2.7	0.51	0.65	127.3	0.487
									Q	2.78	0.45	0.65	132.34	-
33	33	3 Wheeler (Diesel)	1996-2000	Jul-97	MINIDOR A/R (D+6)	46876	<500cc	without Cat. Con.	T	6.09	1.22	0.5	113.11	0.436
									Q	6.35	1.3	0.55	117.43	-
34	34	3 Wheeler (Diesel)	Post 2000	2008	GC MAX HIGH DECK	133	<500cc	without Cat. Con.	T	0.29	0.04	0.51	91.96	0.047
									Q	0.29	0.02	0.5	90.47	-
35	35	3 Wheeler (Diesel)	Post 2000	Nov-07	TEJA PASSANGER A/R	788	<500cc	without Cat. Con.	T	0.61	0.12	0.69	86.92	0.049
									Q	0.64	0.12	0.67	85.46	-
36	36	3 Wheeler (Diesel)	Post 2000	2008	BAJAJ GC MAX HIGH DECK	95	<500cc	without Cat. Con.	T	0.36	0.06	0.47	92.16	0.068
									Q	0.31	0.05	0.4	86.72	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
37	37	Passenger Car (Gasoline)	1991-96	Jun-94	MARUTI 800	85200	<1000cc	without Cat. Con.	T	7.24	0.95	1.05	107	0.007
									Q	7.11	0.97	1.02	108.54	-
38	38	Passenger Car (Gasoline)	1991-96	1994	MARUTI 800	30740	<1000cc	without Cat. Con.	T	7.04	1.05	0.95	113.71	0.005
									Q	7.23	1.03	1.01	114.23	-
39	39	Passenger Car (Gasoline)	1996-2000	Aug-97	MARUTI ZEN	51075	1000-1400cc	without Cat. Con.	T	3.41	0.75	0.74	115.44	0.004
									Q	3.5	0.72	0.75	115.02	-
40	40	Passenger Car (Gasoline)	1996-2000	1997	MARUTI 800	47520*	<1000cc	without Cat. Con.	T	3.77	0.73	0.90	115.66	0.004
									Q	3.80	0.70	0.91	114.92	-
41	41	Passenger Car (Gasoline)	1996-2000	1997	MARUTI ZEN LX	59493	1000-1400cc	without Cat. Con.	T	5.56	0.62	0.59	132.72	0.003
									Q	5.52	0.6	0.58	131.26	-
42	42	Passenger Car (Gasoline)	1996-2000	Apr-96	CIELO GLE	62156	>1400CC	without Cat. Con.	T	4.78	0.67	0.69	128.31	0.007
									Q	4.89	0.66	0.71	131.52	-
43	43	Passenger Car (Gasoline)	Post 2000	Dec-04	MARUTI ALTO	12610	<1000cc	with Cat. Con.	T	1.46	0.26	0.16	126.18	0.001
									Q	1.44	0.26	0.17	127.29	-
44	44	Passenger Car (Gasoline)	Post 2000	Apr-06	MARUTI SWIFT VXI	6268	1000-1400CC	with Cat. Con.	T	0.73	0.11	0.01	157.16	0.001
									Q	0.74	0.11	0.01	159.22	-
45	45	Passenger Car (Gasoline)	Post 2000	Jun-06	MARUTI BALENO Vxi	12732	>1400CC	with Cat. Con.	T	0.61	0.06	0.02	159.39	0.001
									Q	0.6	0.06	0.02	161.03	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
46	47	Passenger Car (Diesel)	1991-96	Jun-94	PREMIER PADMINI 137D	58562	<1600CC	without Cat. Con.	T	1.97	1.8	0.68	175.49	0.30
									Q	1.93	1.75	0.69	172.69	-
47	46	Passenger Car (Diesel)	1996-2000	Sep-99	TATA INDICA	56560	<1600 CC	without Cat. Con.	T	0.76	0.17	0.7	139.25	0.102
									Q	0.76	0.17	0.71	140.07	-
48	48	Passenger Car (Diesel)	1996-2000	Nov-99	TATA INDICA	146560	<1600CC	without Cat. Con.	T	0.82	0.18	0.51	134.55	0.19
									Q	0.84	0.18	0.5	134.65	-
49	49	Passenger Car (Diesel)	1996-2000	Jun-98	HM TREKKER	63507	<1600CC	without Cat. Con.	T	0.9	0.4	0.54	161.74	0.11
									Q	0.86	0.42	0.5	158.11	-
50	50	Passenger Car (Diesel)	1996-2000	Sep-99	TATA INDICA DLX	56904	<1600CC	without Cat. Con.	T	0.81	0.16	0.57	130.91	0.075
									Q	0.82	0.16	0.57	129.18	-
51	51	Passenger Car (Diesel)	1996-2000	Jul-96	FORD ESCORT	20602	1600-2400CC	without Cat. Con.	T	1.00	0.52	0.60	147.47	0.297
									Q	0.94	0.50	0.62	149.08	-
52	52	Passenger Car (Diesel)	Post 2000	Nov-07	TATA ACE HT	1506	<1600CC	without Cat. Con.	T	0.37	0.05	0.44	117.06	0.06
									Q	0.36	0.05	0.45	118.20	-
53	53	Passenger Car (Diesel)	Post 2000	May-05	TATA INDICA DLS-V2	21124	<1600CC	with Cat. Con.	T	0.52	0.07	0.35	157.40	0.10
									Q	0.54	0.08	0.33	158.11	-
54	54	Passenger Car (Diesel)	Post 2000	2006	ACCENT	13252	<1600CC	with Cat. Con.	T	0.08	0.03	0.42	151.53	0.059
									Q	0.07	0.03	0.43	152.98	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
55	57	LCV (Diesel)	1991-96	Dec-93	TATA 407	73467	>3000CC	without Cat. Con.	T	8.67	1.26	7.25	353.93	1.059
									Q	8.38	1.24	7.01	353.65	-
56	55	LCV (Diesel)	1996-2000	Mar-99	TATA SUMO	210642	<3000CC	without Cat. Con.	T	1.33	1.43	0.71	228.93	0.200
									Q	1.32	1.44	0.70	223.31	-
57	56	LCV (Diesel)	1996-2000	Jun-97	TATA SUMO DLX	17778	<3000CC	without Cat. Con.	T	1.26	1.13	0.80	231.12	0.150
									Q	1.29	1.13	0.83	231.93	-
58	58	LCV (Diesel)	1996-2000	Sep-96	TATA SUMO	257131	<3000CC	without Cat. Con.	T	1.28	1.32	1.68	239.99	0.25
									Q	1.24	1.28	1.71	235.95	-
59	59	LCV (Diesel)	1996-2000	1998	TRAX	177098	<3000CC	without Cat. Con.	T	1.32	1.13	0.63	238.88	0.647
									Q	1.22	1.05	0.60	233.36	-
60	60	LCV (Diesel)	1996-2000	May-97	TATA 407	297833	>3000CC	without Cat. Con.	T	5.20	1.71	3.61	355.80	1.336
									Q	5.40	1.74	3.41	352.49	-
61	61	LCV (Diesel)	Post 2000	Aug.2007	PAJERO 2800 GLX	3140	<3000CC	with Cat. Con.	T	0.27	0.06	0.52	328.63	0.075
									Q	0.27	0.06	0.54	327.04	-
62	62	LCV (Diesel)	Post 2000	Mar-07	H.M.COSMO	1056	<3000CC	with Cat. Con.	T	0.08	0.04	0.84	292.2	0.1
									Q	0.07	0.03	0.87	289.45	-
63	63	LCV (Diesel)	Post 2000	Dec-04	Tata 407	19952	>3000CC	without Cat. Con.	T	1.03	0.31	2.47	342.02	0.233
									Q	1.04	0.21	2.22	334.23	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
64	64	HCV (Diesel)	1991-96	Apr-96	Ashok Leyland Bus	70463	>6000cc	without Cat. Con.	T	16.55	2.17	8.68	683.42	2.15
									Q	16.49	2.20	8.65	682.40	-
65	66	HCV (Diesel)	1991-1996	Feb-94	TATA TRUCK	95040*	>6000cc	without Cat. Con.	T	8.66	1.84	9.33	786.23	1.57
									Q	8.79	1.82	9.50	784.86	-
66	67	HCV (Diesel)	1996-2000	Mar-97	ASHOK LEYLAND BUS	97408	>6000cc	without Cat. Con.	T	9.77	0.87	9.52	614.84	0.9
									Q	9.61	0.88	9.22	615.24	-
67	68	HCV (Diesel)	1996-2000	Feb-00	TATA BUS	330359	>6000cc	without Cat. Con.	T	4.7	0.66	6.81	688.17	0.89
									Q	4.63	0.70	7.17	689.82	-
68	69	HCV (Diesel)	1996-2000	May-99	ASHOK LEYLAND TRUCK	79350*	>6000cc	without Cat. Con.	T	6.38	1.06	12.98	802.02	0.88
									Q	6.47	1.04	12.71	805.20	-
69	65	HCV (Diesel)	Post 2000	Jun-06	TATA LPT 2515 TC	68670	>6000cc	without Cat. Con.	T	4.13	0.28	8.63	918.6	0.42
									Q	4.14	0.30	8.65	922.97	-
70	70	HCV (Diesel)	Post 2000	2006	ASHOK LEYLAND BUS	53256	>6000cc	without Cat. Con.	T	4.14	0.12	6.03	821.01	0.49
									Q	4.15	0.12	6.00	816.68	-
71	71	HCV (Diesel)	Post 2000	Feb-07	TATA BUS	78457	>6000cc	without Cat. Con.	T	3.03	0.15	7.36	707.46	0.43
									Q	2.94	0.16	7.64	700.56	-
72	72	HCV (Diesel)	Post 2000	2003	TATA LPT 1613 TC	118912	>6000cc	without Cat. Con.	T	7.05	0.21	7.81	802.99	1.74
									Q	6.95	0.24	7.52	785.88	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
73	73	3W-CNG OE	Post 2005	2008	BAJAJ 3W RE 4S CNG A/R	145	<200cc	without Cat. Con.	T	0.39	1.22	0.46	55.33	0.002
									Q	0.36	1.39	0.48	56.43	-
74	74	3W-CNG OE	Post 2005	Oct-07	BAJAJ 3W RE 2S CNG	158	<200cc	with Cat. Con.	T	0.28	0.3	0.2	54.08	0.004
									Q	0.28	0.26	0.22	54.35	-
75	75	3W-CNG RETROFIT	1996-2000	Jun-98	BAJAJ 3W RE 2S CNG	26422	<200cc	without Cat. Con.	T	0.88	9.39	0.18	48.94	0.535
									Q	0.86	9.36	0.19	48.47	-
76	76	3W-CNG RETROFIT	2000-2005	May-00	BAJAJ 3W RE 2S	66407	<200cc	with Cat. Con.	T	0.43	3.06	0.21	47.58	0.023
									Q	0.46	3.17	0.21	48.47	-
77	77	3W-CNG RETROFIT	Post 2005	Apr-00	BAJAJ 3W RE 2S CNG	3123	<200cc	with Cat. Con.	T	0.15	6.55	0.08	41.74	0.01
									Q	0.15	7.00	0.08	41.96	-
78	78	3W-LPG OE	Post 2005	2008	BAJAJ 3W RE 4S LPG	142	<200cc	with Cat. Con.	T	0.14	1.82	0.45	61.09	0.003
									Q	0.13	1.69	0.46	59.47	-
79	79	3W-LPG OE	Post 2005	2008	APE CARGO 3W LPG PASSENGER	1008	<200cc	with Cat. Con.	T	0.32	1.25	0.63	75.54	0.014
									Q	0.33	1.25	0.65	75.97	-
80	80	3W-LPG RETROFIT	1996-2000	1998	BAJAJ 3W RE 2S A/R	20564	<200cc	without Cat. Con.	T	7.07	5.04	0.05	44.36	0.375
									Q	7.34	5.11	0.05	45.38	-
81	81	3W-LPG RETROFIT	2000-2005	JUNE,2000	BAJAJ 3W RE 2S	55516	<200cc	with Cat. Con.	T	0.85	1.45	0.16	78.12	0.002
									Q	0.81	1.56	0.17	78.98	-
82	82	3W-LPG RETROFIT	Post 2005	Apr-05	BAJAJ 3W RE 2S LPG	17944	<200cc	with Cat. Con.	T	1.56	3.52	0.08	44.95	0.267
									Q	1.53	3.57	0.07	45.31	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
83	83	4W-CNG OE	Post 2005	2008	TATA ACE CNG	970	<1000cc	with Cat. Con.	T	0.22	0.38	0.26	104.43	0.005
									Q	0.21	0.31	0.27	101.51	-
84	84	4W-CNG OE	Post 2005	2008	MAHINDRA MAXX MAXI TRUCK	1270	>1400cc	with Cat. Con.	T	0.48	0.28	0.35	183.31	0.015
									Q	0.45	0.34	0.38	182.49	-
85	85	4W-CNG RETROFIT	1991-1996	Dec-94	MARUTI ESTEEM	16128	1000-1400cc	without Cat. Con.	T	2.59	0.78	1.02	98.87	0.018
									Q	2.45	0.77	1.06	101.51	-
86	86	4W-CNG RETROFIT	2000-2005	Sep-00	MARUTI WAGON R VX CNG	65828	1000-1400CC	with Cat. Con.	T	0.62	0.44	0.04	127.32	0.001
									Q	0.60	0.43	0.04	126.37	-
87	87	4W-CNG RETROFIT	Post 2005	JUNE,2005	INNOVA 2.0 G CNG	11005	>1400cc	with Cat. Con.	T	0.7	0.47	0.03	173.13	0.003
									Q	0.73	0.38	0.03	174.43	-
88	88	4W-LPG OE	2000-2005	2005	MARUTI OMNI LPG	28984	<1000cc	with Cat. Con.	T	2.89	0.8	0.68	166.42	0.008
									Q	2.84	0.84	0.70	162.47	-
89	89	4W-LPG OE	Post 2005	Apr-08	SANTRO ECO GL	1900	1000-1400cc	with Cat. Con.	T	0.79	0.14	0.1	125.92	0.001
									Q	0.81	0.13	0.09	126.46	-
90	90	4W-LPG RETROFIT	1996-2000	Sep-99	MARUTI ZEN	94590	<1000cc	without Cat. Con.	T	6.46	1.78	0.44	93.28	0.001
									Q	6.89	1.52	0.51	93.86	-
91	91	4W-LPG RETROFIT	2000-2005	Oct-00	MARUTI BALENO LPG	64009	>1400cc	with Cat. Con.	T	1.35	0.22	0.06	146.25	0.009
									Q	1.39	0.22	0.05	147.01	-
92	92	4W-LPG RETROFIT	Post 2005	May-05	MARUTI BALENO LPG	2948	>1400cc	with Cat. Con.	T	0.32	0.04	0.03	150.11	0.001
									Q	0.31	0.04	0.04	152.57	-

Sr. no	Veh ID	Type of Vehicle	Vintage Category	Vintage	Vehicle Model	odo	Engine cc	Cat. Con.	sub code	CO	HC	NOx	CO2	PM
93	93	HCV CNG (OE)	2000-2005	2008	LOADKING PRIDE 6T CNG	4251	<6000cc	with Cat. Con.	T	3.99	2.71	5.99	282.03	0.083
									Q	4.37	2.77	6.07	276.77	-
94	94	HCV CNG (OE)	Post 2005	2008	EICHER 2015 CNG BUS	8594	<6000cc	with Cat. Con.	T	3.41	2.31	5.71	623.1	0.058
									Q	3.32	2.53	5.69	620.52	-
95	95	HCV CNG (Retrofitted)	2000-2005	2008	ASHOKLEYLAND BUS	1446	>6000cc	with Cat. Con.	T	3.58	4.7	4.17	566.84	0.031
									Q	3.73	4.69	4.02	574.95	-
96	96	HCV CNG (Retrofitted)	Post 2005	2008	TATA LP909 CNG BSIII	766	<6000cc	with Cat. Con.	T	3.36	3.16	3.92	420.35	0.032
									Q	3.45	3.06	4.04	425.52	-

Note:- 1) * Indicate odo is estimated odo
 2) T- Teflon filter and Q- Quartz filter

11.2 Gasoline and diesel vehicle profiles

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2Stroke 2Wheeler-Gasoline (1991-96)								
Profile Number	V1		V2		V3		Comp-2S2W-1 (V1, V2, V3)	
Identified % of Total Mass	96.1855		73.9230		93.4528		87.8538	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	63.1841	5.1179	58.2923	4.7217	58.7629	4.7598	58.2923	4.7217
Elemental carbon	7.4627	0.6194	1.4778	0.1227	4.6392	0.3851	1.4778	0.1227
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0093	0.0000	0.0153	0.0000	0.0480	0.0000	0.0153
Acenaphthalene	0.0000	0.0075	0.0000	0.0124	0.0000	0.0390	0.0000	0.0124
Fluorene + Acenaphthene	0.0000	0.0088	0.0000	0.0145	0.0000	0.0457	0.0000	0.0145
Phenanthrene	0.0000	0.0137	0.0000	0.0226	0.0000	0.0709	0.0000	0.0226
Anthracene	0.0000	0.0098	0.0000	0.0162	0.0000	0.0507	0.0000	0.0162
Fluoroanthene	0.0000	0.0081	0.0000	0.0134	0.0000	0.0420	0.0000	0.0134
Pyrene	0.0000	0.0057	0.0000	0.0093	0.0000	0.0293	0.0000	0.0093
Benzo(a)Anthracene	0.0000	0.0063	0.0000	0.0104	0.0000	0.0327	0.0000	0.0104
Chrysene	0.0000	0.0041	0.0000	0.0067	0.0000	0.0211	0.0000	0.0067
Benzo(b)Fluoroanthene	0.0000	0.0021	0.0000	0.0035	0.0000	0.0111	0.0000	0.0035
Benzo(k)Fluoroanthene	0.0000	0.0026	0.0000	0.0042	0.0000	0.0132	0.0000	0.0042
Benzo(a)Pyrene	0.0000	0.0024	0.0000	0.0040	0.0000	0.0126	0.0000	0.0040
Dibenz(a,h)anthracene	0.0000	0.0027	0.0000	0.0044	0.0000	0.0138	0.0000	0.0044
Benzo(ghi)Pyrene	0.0000	0.0015	0.0000	0.0025	0.0000	0.0078	0.0000	0.0025
Indenol(1,2,3)Pyrene	0.0000	0.0025	0.0000	0.0042	0.0000	0.0131	0.0000	0.0042
Elements								
Ag	0.0000	0.0455	0.0000	0.0150	0.0000	0.0471	0.0000	0.0150
Al	0.0000	0.2204	0.0000	0.0727	0.0000	0.2284	0.0000	0.0727
As	0.0000	0.0032	0.0000	0.0011	0.0000	0.0033	0.0000	0.0011
Au	0.0000	0.0464	0.0000	0.0153	0.0000	0.0481	0.0000	0.0153
Ba	0.0000	0.0968	7.3205	0.0319	0.0000	0.1003	7.3205	0.0319
Br	0.0297	0.0128	0.0000	0.0042	0.0000	0.0133	0.0000	0.0042
Ca	4.0212	0.0098	0.0000	0.0032	2.7580	0.0101	0.0000	0.0032
Cd	0.0000	0.0689	0.0000	0.0227	0.0000	0.0714	0.0000	0.0227
Cl	0.1173	0.0408	0.0472	0.0135	0.3687	0.0422	0.0472	0.0135
Co	0.0000	0.0047	0.0066	0.0016	0.0000	0.0049	0.0066	0.0016
Cr	0.0000	0.0060	0.0000	0.0020	0.0000	0.0062	0.0000	0.0020
Cs	0.0000	0.1055	0.0000	0.0348	0.0000	0.1093	0.0000	0.0348
Cu	0.0000	0.0091	0.0000	0.0030	0.0000	0.0094	0.0000	0.0030
Fe	0.0000	0.0163	0.1399	0.0054	0.2735	0.0169	0.1399	0.0054
Ga	0.0000	0.0359	0.0000	0.0119	0.0000	0.0372	0.0000	0.0119
Ge	0.0000	0.0223	0.0426	0.0074	0.0000	0.0231	0.0426	0.0074

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0432	0.0000	0.0142	0.0000	0.0447	0.0000	0.0142
K	0.0000	0.0129	0.2921	0.0043	0.0000	0.0134	0.2921	0.0043
La	0.0000	0.1793	0.0000	0.0592	0.0000	0.1858	0.0000	0.0592
Mg	0.0000	4.0624	0.0000	1.3408	0.0000	4.2089	0.0000	1.3408
Mn	0.0000	0.0129	0.0583	0.0043	0.1116	0.0134	0.0583	0.0043
Mo	0.0000	0.0145	0.0000	0.0048	0.0430	0.0150	0.0000	0.0048
Na	0.0000	8.7190	0.0000	2.8777	0.0000	9.0336	0.0000	2.8777
Ni	0.0000	0.0059	0.0000	0.0019	0.0000	0.0061	0.0000	0.0019
P	0.0000	0.0181	0.0000	0.0060	0.0000	0.0187	0.0000	0.0060
Pb	0.0953	0.0144	0.0289	0.0048	0.0373	0.0150	0.0289	0.0048
Pd	0.0000	0.0606	0.0000	0.0200	0.0000	0.0628	0.0000	0.0200
Rb	0.0000	0.0052	0.0000	0.0017	0.0000	0.0054	0.0000	0.0017
Rh	0.0000	0.0586	0.0000	0.0193	0.0000	0.0607	0.0000	0.0193
S	0.0000	0.0453	0.0000	0.0149	0.0000	0.0469	0.0000	0.0149
Sb	0.2258	0.0733	0.0000	0.0242	0.3515	0.0760	0.0000	0.0242
Sc	0.0540	0.0083	0.0000	0.0028	0.0000	0.0086	0.0000	0.0028
Se	0.0000	0.0051	0.0000	0.0017	0.0000	0.0053	0.0000	0.0017
Sn	0.0000	0.0595	0.0000	0.0197	0.3326	0.0617	0.0000	0.0197
Sr	0.0000	0.0346	0.0000	0.0114	0.0000	0.0358	0.0000	0.0114
Te	0.3117	0.0794	0.0000	0.0262	0.4758	0.0822	0.0000	0.0262
Ti	1.3719	0.0126	0.3247	0.0042	1.5928	0.0131	0.3247	0.0042
V	0.2252	0.0037	0.1420	0.0012	0.3839	0.0038	0.1420	0.0012
W	0.5285	0.1374	0.0000	0.0453	0.0000	0.1423	0.0000	0.0453
Y	0.0000	0.0213	0.0000	0.0070	0.0000	0.0220	0.0000	0.0070
Zn	0.0000	0.0120	2.6263	0.0040	0.0000	0.0125	2.6263	0.0040
Ions								
F	0.4975	0.1468	0.0000	0.0402	0.0000	0.1263	0.0000	0.0402
Cl	4.6766	0.6609	1.1576	0.1986	8.6340	0.8768	1.1576	0.1986
NO2	0.0000	0.0716	0.0000	0.0236	0.0000	0.0742	0.0000	0.0236
Br	0.5597	0.4326	0.0698	0.1370	0.3479	0.4366	0.0698	0.1370
NO3	0.0000	0.1610	0.0000	0.0531	0.2964	0.1817	0.0000	0.0531
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	1.1741	0.4898	0.3629	0.1604	1.3454	0.5140	0.3629	0.1604
Na	10.1658	3.7324	0.0000	1.0636	6.3557	3.6573	0.0000	1.0636
NH4	0.0000	0.1414	0.0197	0.0476	0.0000	0.1465	0.0197	0.0476
K	0.0000	1.6360	0.6873	0.5744	4.7835	1.9348	0.6873	0.5744
Ca	1.1484	0.6567	0.5761	0.2266	0.9536	0.6685	0.5761	0.2266
Mg	0.3358	0.2463	0.2504	0.0883	0.6057	0.2682	0.2504	0.0883
Identified percent of total mass	96.1855	28.5569	73.9230	12.2253	93.4528	28.9947	73.9230	12.2253

2Stroke 2Wheeler-Gasoline (1996-2000)								
Profile Number	V4	V5		V6		Comp-2S2W-2 (V4, V5, V6)		
Identified Percentage of Total Mass	83.7307	95.8086		77.6972		85.7455		
Species	% Mass (PM10)	Uncert ainty (%)	% Mass (PM10)	Uncert ainty (%)	% Mass (PM10)	Uncert ainty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	41.6816	3.3762	70.2020	5.6864	51.0078	4.1316	54.2971	4.3981
Elemental carbon	2.5045	0.2079	1.5152	0.1258	0.7839	0.0651	1.6012	0.1329
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0167	0.1667	0.0554	0.0425	0.0074	0.0697	0.0265
Acenaphthalene	0.0000	0.0135	1.0208	0.0898	0.2893	0.0189	0.4367	0.0408
Fluorene + Acenaphthene	0.0000	0.0158	1.0270	0.0966	0.0911	0.0096	0.3727	0.0407
Phenanthrene	0.0000	0.0246	0.0000	0.0694	0.0069	0.0080	0.0023	0.0340
Anthracene	0.0000	0.0176	0.0124	0.0503	0.0029	0.0057	0.0051	0.0245
Fluoroanthene	0.0000	0.0146	0.5526	0.0690	0.0000	0.0046	0.1842	0.0294
Pyrene	0.0000	0.0102	0.0000	0.0287	0.1047	0.0085	0.0349	0.0158
Benzo(a)Anthracene	0.0000	0.0114	0.0000	0.0321	0.0000	0.0036	0.0000	0.0157
Chrysene	0.0000	0.0073	0.0000	0.0206	0.0000	0.0023	0.0000	0.0101
Benzo(b)Fluoroanthene	0.0000	0.0039	0.0000	0.0109	0.0000	0.0012	0.0000	0.0053
Benzo(k)Fluoroanthene	0.0000	0.0046	0.0000	0.0130	0.0039	0.0016	0.0013	0.0064
Benzo(a)Pyrene	0.0000	0.0044	0.0000	0.0124	0.0020	0.0015	0.0007	0.0061
Dibenz(a,h)anthracene	0.0000	0.0048	0.0000	0.0136	0.0000	0.0015	0.0000	0.0066
Benzo(ghi)Pyrene	0.0000	0.0027	0.0000	0.0076	0.0000	0.0008	0.0000	0.0037
Indenol(1,2,3)Pyrene	0.0000	0.0045	0.0000	0.0128	0.0000	0.0014	0.0000	0.0063
Elements								
Ag	0.0000	0.0164	0.0000	0.0462	0.0000	0.0051	0.0000	0.0226
Al	0.0000	0.0793	0.0000	0.2238	0.0000	0.0248	0.0000	0.1093
As	0.0000	0.0012	0.0000	0.0033	0.0000	0.0004	0.0000	0.0016
Au	0.0000	0.0167	0.0000	0.0471	0.0000	0.0052	0.0000	0.0230
Ba	0.0000	0.0348	0.0000	0.0982	0.0000	0.0109	0.0000	0.0480
Br	0.0000	0.0046	0.0701	0.0130	0.0000	0.0014	0.0234	0.0064
Ca	2.5121	0.0035	10.2973	0.0099	0.6128	0.0011	4.4741	0.0049
Cd	0.0000	0.0248	0.0000	0.0700	0.0000	0.0078	0.0000	0.0342
Cl	0.4108	0.0147	0.2470	0.0414	0.0294	0.0046	0.2291	0.0202
Co	0.0000	0.0017	0.0174	0.0048	0.0000	0.0005	0.0058	0.0023
Cr	0.0000	0.0022	0.0000	0.0061	0.0000	0.0007	0.0000	0.0030
Cs	0.0903	0.0379	0.2659	0.1071	0.0578	0.0119	0.1380	0.0523
Cu	0.0000	0.0033	0.0306	0.0092	0.0000	0.0010	0.0102	0.0045
Fe	0.0000	0.0059	0.0000	0.0165	0.0217	0.0018	0.0072	0.0081

Species	% Mass (PM10)	Uncerta inty (%)						
Ga	0.0000	0.0129	0.0000	0.0365	0.0000	0.0040	0.0000	0.0178
Ge	0.0000	0.0080	0.0000	0.0226	0.0000	0.0025	0.0000	0.0111
I	0.0000	0.0155	0.0000	0.0438	0.0000	0.0049	0.0000	0.0214
K	0.0000	0.0046	0.0000	0.0131	0.0000	0.0015	0.0000	0.0064
La	0.0000	0.0645	0.0000	0.1821	0.0000	0.0202	0.0000	0.0889
Mg	0.0000	1.4607	0.0000	4.1239	0.0000	0.4572	0.0000	2.0139
Mn	0.0240	0.0046	0.0000	0.0131	0.0117	0.0015	0.0119	0.0064
Mo	0.0000	0.0052	0.0303	0.0147	0.0000	0.0016	0.0101	0.0072
Na	11.6568	3.1351	0.0000	8.8511	0.0000	0.9813	3.8856	4.3225
Ni	0.0000	0.0021	0.0000	0.0059	0.0000	0.0007	0.0000	0.0029
P	0.0000	0.0065	0.0000	0.0183	0.0000	0.0020	0.0000	0.0090
Pb	0.0114	0.0052	0.0333	0.0147	0.0064	0.0016	0.0170	0.0072
Pd	0.0000	0.0218	0.0000	0.0615	0.0000	0.0068	0.0000	0.0300
Rb	0.0000	0.0019	0.0000	0.0053	0.0000	0.0006	0.0000	0.0026
Rh	0.0000	0.0211	0.0000	0.0595	0.0000	0.0066	0.0000	0.0290
S	0.0000	0.0163	0.0000	0.0459	0.3179	0.0051	0.1060	0.0224
Sb	0.0000	0.0264	0.0000	0.0745	0.0227	0.0083	0.0076	0.0364
Sc	0.0175	0.0030	0.0206	0.0085	0.0000	0.0009	0.0127	0.0041
Se	0.0000	0.0018	0.0000	0.0052	0.0000	0.0006	0.0000	0.0025
Sn	0.0709	0.0214	0.1237	0.0604	0.0235	0.0067	0.0727	0.0295
Sr	0.0000	0.0124	0.0000	0.0351	0.0000	0.0039	0.0000	0.0171
Te	0.0000	0.0285	0.2955	0.0806	0.0271	0.0089	0.1075	0.0393
Ti	0.4522	0.0045	1.6561	0.0128	0.0000	0.0014	0.7028	0.0062
V	0.0508	0.0013	0.0000	0.0037	0.2384	0.0004	0.0964	0.0018
W	0.1176	0.0494	0.3404	0.1395	0.0000	0.0155	0.1527	0.0681
Y	0.0194	0.0076	0.1124	0.0216	0.0000	0.0024	0.0439	0.0105
Zn	0.0000	0.0043	0.0000	0.0122	0.0000	0.0014	0.0000	0.0060
Ions								
F	0.0179	0.0447	0.3788	0.1427	0.2688	0.0273	0.2218	0.0716
Cl	2.9606	0.3025	3.7879	0.6224	6.5649	0.3818	4.4378	0.4356
NO2	0.0000	0.0257	0.0000	0.0727	0.0000	0.0081	0.0000	0.0355
Br	4.9687	0.3970	0.0126	0.4114	1.2780	0.1102	2.0864	0.3062
NO3	0.8453	0.1005	0.0000	0.1635	0.8301	0.0602	0.5584	0.1081
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	5.3685	0.4268	0.4091	0.4580	3.1221	0.2070	2.9666	0.3639
Na	0.0000	1.1588	0.6987	3.3065	3.3557	0.5315	1.3515	1.6656
NH4	0.0000	0.0508	0.0000	0.1435	0.0000	0.0159	0.0000	0.0701
K	3.1817	0.7480	0.3716	1.6794	5.6655	0.4708	3.0729	0.9661
Ca	5.6992	0.5036	1.5194	0.6844	2.4949	0.1938	3.2378	0.4606
Mg	1.0689	0.1364	0.5934	0.2628	0.4129	0.0467	0.6917	0.1486
Identified percent of total mass	83.7307	12.6726	95.8086	28.4220	77.6972	7.8755	85.7455	16.3234

2Stroke 2Wheeler-Gasoline (Post-2000)								
Profile Number	V7		V8		V9		Comp-2S2W-3 (V7,V8,V9)	
Identified Percentage of Total Mass	95.1455		89.0429		92.8663		92.3516	
Species	% Mass (PM10)	Uncert ainty (%)	% Mass (PM10)	Uncerta intiy (%)	% Mass (PM10)	Uncert ainty (%)	% Mass (PM10)	Uncerta intiy (%)
Carbon								
Organic carbon	56.2141	4.5533	64.9635	5.2620	51.7730	4.1936	57.6502	4.6697
Elemental carbon	3.0593	0.2539	3.6496	0.3029	2.8369	0.2355	3.1819	0.2641
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0831	0.0220	0.0000	0.0680	0.0000	0.0220	0.0277	0.0374
Acenaphthalene	0.8161	0.0559	0.0000	0.0552	0.0000	0.0179	0.2720	0.0430
Fluorene + Acenaphthene	0.1110	0.0225	0.0000	0.0647	0.0000	0.0209	0.0370	0.0360
Phenanthrene	0.0000	0.0263	0.0000	0.1004	0.0000	0.0325	0.0000	0.0531
Anthracene	0.0000	0.0188	0.0000	0.0718	0.0000	0.0233	0.0000	0.0380
Fluoroanthene	0.1898	0.0251	0.0000	0.0594	0.0000	0.0192	0.0633	0.0346
Pyrene	0.0000	0.0109	0.0000	0.0415	0.0000	0.0134	0.0000	0.0219
Benzo(a)Anthracene	0.0083	0.0126	0.0000	0.0463	0.0000	0.0150	0.0028	0.0246
Chrysene	0.0000	0.0078	0.0000	0.0298	0.0000	0.0097	0.0000	0.0158
Benzo(b)Fluoroanthene	0.0116	0.0047	0.0000	0.0157	0.0000	0.0051	0.0039	0.0085
Benzo(k)Fluoroanthene	0.0000	0.0049	0.0000	0.0187	0.0000	0.0061	0.0000	0.0099
Benzo(a)Pyrene	0.0000	0.0047	0.0000	0.0179	0.0000	0.0058	0.0000	0.0095
Dibenz(a,h)anthracene	0.0000	0.0051	0.0000	0.0196	0.0000	0.0063	0.0000	0.0104
Benzo(ghi)Pyrene	0.0000	0.0029	0.0000	0.0110	0.0000	0.0036	0.0000	0.0058
Indenol(1,2,3)Pyrene	0.0000	0.0048	0.0000	0.0185	0.0000	0.0060	0.0000	0.0098
Elements								
Ag	0.0000	0.0175	0.0000	0.0667	0.0000	0.0216	0.0000	0.0353
Al	0.0000	0.0847	0.0000	0.3234	0.0000	0.1047	0.0000	0.1709
As	0.0000	0.0012	0.0000	0.0047	0.0000	0.0015	0.0000	0.0025
Au	0.0000	0.0178	0.0000	0.0680	0.0000	0.0220	0.0000	0.0360
Ba	0.0000	0.0372	0.0000	0.1420	0.0000	0.0460	0.0000	0.0750
Br	0.0000	0.0049	0.0554	0.0188	0.0145	0.0061	0.0233	0.0100
Ca	1.7112	0.0038	2.9630	0.0144	3.5916	0.0047	2.7553	0.0076
Cd	0.0000	0.0265	0.0000	0.1011	0.0000	0.0328	0.0000	0.0535
Cl	0.0532	0.0157	0.0000	0.0598	0.0773	0.0194	0.0435	0.0316
Co	0.0073	0.0018	0.0194	0.0069	0.0127	0.0022	0.0131	0.0037
Cr	0.0000	0.0023	0.0000	0.0088	0.0000	0.0029	0.0000	0.0047
Cs	0.0000	0.0406	0.0000	0.1548	0.1550	0.0501	0.0517	0.0818
Cu	0.0000	0.0035	0.0000	0.0133	0.0279	0.0043	0.0093	0.0070
Fe	0.0000	0.0063	0.0000	0.0239	0.0655	0.0077	0.0218	0.0126
Ga	0.0000	0.0138	0.0000	0.0527	0.0000	0.0171	0.0000	0.0279
Ge	0.0460	0.0086	0.0000	0.0327	0.0000	0.0106	0.0153	0.0173

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0166	0.2028	0.0633	0.0000	0.0205	0.0676	0.0335
K	0.0000	0.0050	0.0000	0.0190	0.0000	0.0061	0.0000	0.0100
La	0.0000	0.0689	0.0000	0.2631	0.0000	0.0852	0.0000	0.1391
Mg	0.0000	1.5613	0.0000	5.9601	0.0000	1.9303	0.0000	3.1506
Mn	0.0545	0.0050	0.2312	0.0190	0.0000	0.0061	0.0952	0.0100
Mo	0.0000	0.0056	0.0000	0.0213	0.0000	0.0069	0.0000	0.0113
Na	0.0000	3.3509	0.0000	12.7921	0.0000	4.1431	0.0000	6.7620
Ni	0.0000	0.0023	0.0000	0.0086	0.0000	0.0028	0.0000	0.0045
P	0.0000	0.0069	0.0000	0.0265	0.0000	0.0086	0.0000	0.0140
Pb	0.0000	0.0056	0.1018	0.0212	0.0219	0.0069	0.0412	0.0112
Pd	0.0000	0.0233	0.0000	0.0889	0.0000	0.0288	0.0000	0.0470
Rb	0.0000	0.0020	0.0000	0.0077	0.0000	0.0025	0.0000	0.0040
Rh	0.0000	0.0225	0.0000	0.0859	0.0628	0.0278	0.0209	0.0454
S	0.0000	0.0174	0.0000	0.0664	0.0000	0.0215	0.0000	0.0351
Sb	0.1137	0.0282	0.0000	0.1076	0.1041	0.0348	0.0726	0.0569
Sc	0.0000	0.0032	0.0000	0.0122	0.0465	0.0040	0.0155	0.0065
Se	0.0000	0.0020	0.0000	0.0075	0.0000	0.0024	0.0000	0.0040
Sn	0.1548	0.0229	0.0000	0.0874	0.1957	0.0283	0.1168	0.0462
Sr	0.0000	0.0133	0.0000	0.0507	0.0000	0.0164	0.0000	0.0268
Te	0.1114	0.0305	0.4375	0.1164	0.0891	0.0377	0.2127	0.0615
Ti	0.3078	0.0048	2.3637	0.0185	1.2664	0.0060	1.3127	0.0098
V	0.1014	0.0014	0.4908	0.0054	0.0944	0.0018	0.2288	0.0029
W	0.0000	0.0528	0.8602	0.2015	0.0000	0.0653	0.2867	0.1065
Y	0.0000	0.0082	0.1115	0.0312	0.0251	0.0101	0.0455	0.0165
Zn	0.0000	0.0046	0.0000	0.0177	0.0000	0.0057	0.0000	0.0093
Ions								
F	0.3633	0.0651	1.2409	0.2412	0.0118	0.0585	0.5387	0.1216
Cl	3.6902	0.3500	6.0219	0.9272	1.8322	0.2943	3.8481	0.5238
NO2	0.0000	0.0275	0.0000	0.1051	0.5387	0.0612	0.1796	0.0646
Br	4.0774	0.3617	0.1277	0.6000	1.4243	0.2639	1.8765	0.4085
NO3	1.6778	0.1467	0.0000	0.2362	4.0721	0.2831	1.9166	0.2220
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	12.3346	0.7920	1.4307	0.7040	12.5792	0.8432	8.7815	0.7798
Na	0.7138	1.2743	2.6156	4.8590	0.0000	1.5314	1.1098	2.5549
NH4	0.0000	0.0543	0.0000	0.2074	5.0638	0.3243	1.6879	0.1954
K	2.9227	0.7754	0.0000	2.4002	0.3394	0.7944	1.0874	1.3233
Ca	4.4471	0.4548	0.3710	0.8976	4.8719	0.5306	3.2300	0.6277
Mg	1.7639	0.1773	0.7847	0.3761	1.6726	0.1934	1.4070	0.2489
Identified percent of total mass	95.1455	14.8375	89.0429	38.3106	92.8663	16.4707	92.3516	23.2063

4Stroke 2Wheeler-Gasoline (1991-96)								
Profile Number	V10		V11		V12		Comp-4S2W-1 (V10,V11,V12)	
Identified Percentage of Total Mass	105.4806		85.2147		79.2814		99.4083	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncert ainty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	52.0513	4.2162	47.6596	3.8604	61.1921	4.9566	53.6343	4.3444
Elemental carbon	1.7949	0.1490	10.4255	0.8653	3.7086	0.3078	6.7044	0.4407
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.2390	0.0000	0.1983	0.0000	0.0617	0.2643	0.1663
Acenaphthalene	0.0000	0.1940	0.0000	0.1609	0.0000	0.0501	0.4242	0.1350
Fluorene + Acenaphthene	0.0000	0.2271	0.0000	0.1885	0.0000	0.0587	1.1598	0.1581
Phenanthrene	0.0000	0.3526	0.0000	0.2926	0.0000	0.0911	0.0468	0.2454
Anthracene	0.0000	0.2523	0.0000	0.2094	0.0000	0.0652	0.0078	0.1756
Fluoroanthene	0.0000	0.2087	0.0000	0.1732	0.0000	0.0539	0.7956	0.1453
Pyrene	0.0000	0.1458	0.0000	0.1210	0.0000	0.0377	2.1993	0.1015
Benzo(a)Anthracene	0.0000	0.1628	0.0000	0.1351	0.0000	0.0420	0.0738	0.1133
Chrysene	0.0000	0.1048	0.0000	0.0869	0.0000	0.0271	0.015	0.0729
Benzo(b)Fluoroanthene	0.0000	0.0553	0.0000	0.0459	0.0000	0.0143	0.1803	0.0385
Benzo(k)Fluoroanthene	0.0000	0.0658	0.0000	0.0546	0.0000	0.0170	0.081	0.0458
Benzo(a)Pyrene	0.0000	0.0628	0.0000	0.0521	0.0000	0.0162	0.0183	0.0437
Dibenz(a,h)anthracene	0.0000	0.0689	0.0000	0.0571	0.0000	0.0178	0.0786	0.0479
Benzo(ghi)Pyrene	0.0000	0.0388	0.0000	0.0322	0.0000	0.0100	0.0297	0.0270
Indenol(1,2,3)Pyrene	0.0000	0.0650	0.0000	0.0539	0.0000	0.0168	0.1173	0.0452
Elements								
Ag	0.0000	0.0689	0.0000	0.0572	0.0000	0.0178	0.0000	0.0480
Al	0.0000	0.2757	5.2617	0.2288	1.2817	0.0712	0.0000	0.1919
As	0.0000	0.0138	0.0000	0.0114	0.0755	0.0036	0.0000	0.0096
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	3.3083	0.1103	0.0000	0.0915	0.0000	0.0285	2.8973	0.0768
Br	0.0000	0.0138	0.0000	0.0114	0.0000	0.0036	0.0000	0.0096
Ca	0.0000	0.1378	8.4644	0.1144	2.9194	0.0356	0.0499	0.0959
Cd	0.0000	0.0689	0.0000	0.0572	0.5625	0.0178	0.6585	0.0480
Cl	0.0000	0.0276	0.0000	0.0229	0.0000	0.0071	0.1645	0.0192
Co	0.0000	0.0414	0.0000	0.0343	0.0000	0.0107	0.0135	0.0288
Cr	0.0000	0.0689	0.0000	0.0572	0.0000	0.0178	0.0000	0.0480
Cs	0.0000	0.1103	0.0000	0.0915	0.0000	0.0285	0.1937	0.0768
Cu	0.0000	0.0138	0.0000	0.0114	0.3286	0.0036	0.0311	0.0096
Fe	0.0000	0.0689	0.2860	0.0572	0.0000	0.0178	0.0743	0.0480
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncertainty (%)						
I	3.8597	0.0965	0.0000	0.0801	0.9969	0.0249	2.5181	0.0672
K	3.0326	0.1378	0.0000	0.1144	0.0000	0.0356	1.0109	0.0959
La	0.0000	0.1378	0.0000	0.1144	0.0000	0.0356	0.0000	0.0959
Mg	0.0000	1.3785	0.0000	1.1438	0.0000	0.3560	0.0000	0.9594
Mn	0.0000	0.0689	0.0000	0.0572	0.0000	0.0178	0.1508	0.0480
Mo	0.0000	0.1378	0.0000	0.1144	0.0000	0.0356	0.0000	0.0959
Na	3.5840	13.7847	0.0000	11.4384	0.0000	3.5603	1.1947	9.5945
Ni	0.0000	0.0276	0.4301	0.0229	0.1339	0.0071	0.3351	0.0192
P	0.0469	0.0414	0.0000	0.0343	0.0000	0.0107	0.0531	0.0288
Pb	0.7168	0.0276	0.0435	0.0229	0.0712	0.0071	0.5445	0.0192
Pd	0.0000	0.0689	0.0000	0.0572	0.0000	0.0178	0.0000	0.0480
Rb	0.0000	0.0414	0.0000	0.0343	0.0000	0.0107	0.0000	0.0288
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0276	0.0000	0.0229	0.0000	0.0071	0.0000	0.0192
Sb	0.0000	0.0827	0.0000	0.0686	0.0000	0.0214	0.1359	0.0576
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.1103	0.0138	0.0000	0.0114	0.0000	0.0036	0.0368	0.0096
Sn	0.0000	0.0827	0.0000	0.0686	0.0000	0.0214	0.0000	0.0576
Sr	0.0000	0.0689	0.0000	0.0572	0.0000	0.0178	0.0000	0.0480
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	0.0000	0.0689	0.0000	0.0572	0.0000	0.0178	0.2448	0.0480
V	0.0000	0.0689	0.0000	0.0572	0.0000	0.0178	0.0881	0.0480
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0354	0.0000
Y	0.0000	0.0965	0.0000	0.0801	0.0000	0.0249	0.0000	0.0672
Zn	1.7920	0.0138	0.0000	0.0114	0.0000	0.0036	1.1966	0.0096
Ions								
F	0.0000	0.6281	0.8511	0.5638	0.1987	0.1722	0.5039	0.4547
Cl	5.2564	2.4560	3.3511	1.9873	1.1060	0.6217	4.4519	1.6883
NO2	0.0000	0.3690	0.0000	0.3062	0.0000	0.0953	0.0000	0.2569
Br	0.0000	2.0853	0.0000	1.7304	0.0000	0.5386	0.1090	1.4514
NO3	0.0000	0.8299	0.0000	0.6886	0.0000	0.2143	0.0000	0.5776
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	17.9744	3.1252	1.7149	1.9290	2.3907	0.6937	8.7534	1.9160
Na	5.4573	16.8823	1.2305	13.8437	1.8433	4.3820	2.4263	11.7027
NH4	0.0000	0.7286	0.0000	0.6046	0.0000	0.1882	0.0000	0.5071
K	0.0000	8.4316	0.0000	6.9964	0.0000	2.1777	0.0000	5.8686
Ca	4.8932	3.3330	4.8050	2.8031	2.0254	0.8991	4.1924	2.3451
Mg	1.6026	1.2632	0.6915	1.0162	0.4470	0.3279	1.5132	0.8691
Identified percent of total mass	105.4806	64.2339	85.2147	53.5722	79.2814	20.6726	99.4083	46.1596

4Stroke 2Wheeler-Gasoline (1991-1996)								
Profile Number	V13		V14		V15		Comp-4S2W-2 (V13,V14,V15)	
Identified Percentage of Total Mass	98.5222		83.0274		63.7136		96.2672	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	56.9767	4.6151	47.8947	3.8795	42.2267	3.4204	49.0327	3.9717
Elemental carbon	11.3953	0.9458	1.8421	0.1529	2.2672	0.1882	5.1682	0.4290
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.2168	0.0000	0.2453	0.0000	0.0377	4.2357	0.1666
Acenaphthalene	0.0000	0.1759	0.0000	0.1991	0.0000	0.0306	0.4461	0.1352
Fluorene + Acenaphthene	0.0000	0.2060	0.0000	0.2331	0.0000	0.0359	2.8014	0.1583
Phenanthrene	0.0000	0.3198	0.0000	0.3618	0.0000	0.0557	0.2733	0.2458
Anthracene	0.0000	0.2289	0.0000	0.2590	0.0000	0.0398	0.0978	0.1759
Fluoroanthene	0.0000	0.1893	0.0000	0.2142	0.0000	0.0330	0.5238	0.1455
Pyrene	0.0000	0.1323	0.0000	0.1497	0.0000	0.0230	0.3237	0.1016
Benzo(a)Anthracene	0.0000	0.1476	0.0000	0.1670	0.0000	0.0257	0.0246	0.1135
Chrysene	0.0000	0.0950	0.0000	0.1075	0.0000	0.0165	0.0672	0.0730
Benzo(b)Fluoroanthene	0.0000	0.0502	0.0000	0.0568	0.0000	0.0087	0.1155	0.0385
Benzo(k)Fluoroanthene	0.0000	0.0597	0.0000	0.0675	0.0000	0.0104	0.264	0.0458
Benzo(a)Pyrene	0.0000	0.0570	0.0000	0.0645	0.0000	0.0099	1.8312	0.0438
Dibenz(a,h)anthracene	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.1233	0.0480
Benzo(ghi)Pyrene	0.0000	0.0352	0.0000	0.0398	0.0000	0.0061	1.2504	0.0270
Indenol(1,2,3)Pyrene	0.0000	0.0590	0.0000	0.0667	0.0000	0.0103	2.1348	0.0453
Elements								
Ag	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.0000	0.0480
Al	0.0000	0.2500	0.0000	0.2830	0.0000	0.0435	0.0000	0.1922
As	0.0000	0.0125	0.0000	0.0141	0.0091	0.0022	0.0030	0.0096
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	0.0000	0.1000	0.0000	0.1132	0.0000	0.0174	0.0000	0.0769
Br	0.0000	0.0125	0.0000	0.0141	0.0000	0.0022	0.0000	0.0096
Ca	0.0000	0.1250	0.0000	0.1415	5.2672	0.0218	1.7557	0.0961
Cd	1.9754	0.0625	2.2353	0.0707	0.0000	0.0109	1.4036	0.0480
Cl	0.0000	0.0250	0.0000	0.0283	0.0000	0.0044	0.0000	0.0192
Co	0.0000	0.0375	0.0000	0.0424	0.0000	0.0065	0.0000	0.0288
Cr	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.0000	0.0480
Cs	0.0000	0.1000	0.0000	0.1132	0.5746	0.0174	0.1915	0.0769
Cu	0.0000	0.0125	0.1118	0.0141	0.0000	0.0022	0.0373	0.0096
Fe	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.0000	0.0480
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)						
I	3.5007	0.0875	0.0000	0.0990	0.0000	0.0152	1.1669	0.0673
K	0.0000	0.1250	0.0000	0.1415	0.0000	0.0218	0.0000	0.0961
La	0.0000	0.1250	0.0000	0.1415	0.0000	0.0218	0.0000	0.0961
Mg	0.0000	1.2502	0.0000	1.4148	0.0000	0.2177	0.0000	0.9609
Mn	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.0000	0.0480
Mo	0.0000	0.1250	0.0000	0.1415	0.0000	0.0218	0.0000	0.0961
Na	0.0000	12.5024	0.0000	14.1475	0.0000	2.1765	0.0000	9.6088
Ni	1.0052	0.0250	0.9366	0.0283	0.0200	0.0044	0.6539	0.0192
P	0.1125	0.0375	0.0000	0.0424	0.0113	0.0065	0.0413	0.0288
Pb	0.7501	0.0250	0.1698	0.0283	0.0000	0.0044	0.3066	0.0192
Pd	0.0000	0.0625	1.6977	0.0707	0.0000	0.0109	0.5659	0.0480
Rb	0.0000	0.0375	0.0000	0.0424	0.0000	0.0065	0.0000	0.0288
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0250	0.0000	0.0283	0.0000	0.0044	0.0000	0.0192
Sb	0.0000	0.0750	0.0000	0.0849	0.0000	0.0131	0.0000	0.0577
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0125	0.0000	0.0141	0.0000	0.0022	0.0000	0.0096
Sn	0.0000	0.0750	3.3954	0.0849	0.0000	0.0131	1.1318	0.0577
Sr	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.0000	0.0480
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.0000	0.0480
V	0.0000	0.0625	0.0000	0.0707	0.0000	0.0109	0.0000	0.0480
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0875	0.0000	0.0990	0.0000	0.0152	0.0000	0.0673
Zn	0.0000	0.0125	0.0000	0.0141	0.0000	0.0022	0.0000	0.0096
Ions								
F	1.5116	0.6454	0.6579	0.6775	0.0000	0.0992	0.7232	0.4740
Cl	3.9070	2.1844	4.3816	2.4698	7.0445	0.7020	5.1110	1.7854
NO2	0.0000	0.3347	2.7068	0.5148	0.0000	0.0583	0.9023	0.3026
Br	0.0000	1.8914	0.0000	2.1402	0.0000	0.3293	0.0000	1.4536
NO3	0.0000	0.7527	0.0658	0.8550	0.0000	0.1310	0.0219	0.5796
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	8.1628	2.4242	9.5000	2.7564	1.4818	0.4251	6.3815	1.8686
Na	1.8217	15.1553	0.7456	17.0837	0.0000	2.6225	0.8558	11.6205
NH4	0.0000	0.6608	0.0000	0.7478	0.0000	0.1150	0.0000	0.5079
K	0.0000	7.6473	0.0000	8.6535	0.0000	1.3313	0.0000	5.8774
Ca	5.6008	3.0813	2.1469	3.2767	4.0924	0.6934	3.9467	2.3505
Mg	1.8023	1.1632	4.5395	1.4418	0.7186	0.2228	2.3535	0.9426
Identified percent of total mass	98.5222	59.4021	83.0274	64.9055	63.7136	13.4547	96.2672	45.9208

4Stroke 2Wheeler-Gasoline (Post-2000)								
Profile Number	V16		V17		V18		Comp-4S2W-3 (V16,V17,V18)	
Identified Percentage of Total Mass	88.1793		94.6234		91.1661		91.3230	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	62.3077	5.0469	32.2581	2.6129	35.1020	2.8433	43.2226	3.5010
Elemental carbon	6.9231	0.5746	1.9355	0.1606	1.2245	0.1016	3.3610	0.2790
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0717	0.0000	0.0601	0.0000	0.0380	0.0000	0.0566
Acenaphthalene	0.0000	0.0582	0.0000	0.0488	0.0000	0.0309	0.0000	0.0460
Fluorene + Acenaphthene	0.0000	0.0681	0.0000	0.0571	0.0000	0.0362	0.0000	0.0538
Phenanthrene	0.0000	0.1058	0.0000	0.0887	0.0000	0.0561	0.0000	0.0835
Anthracene	0.0000	0.0757	0.0000	0.0635	0.0000	0.0402	0.0000	0.0598
Fluoroanthene	0.0000	0.0626	0.0000	0.0525	0.0000	0.0332	0.0000	0.0495
Pyrene	0.0000	0.0437	0.0000	0.0367	0.0000	0.0232	0.0000	0.0346
Benzo(a)Anthracene	0.0000	0.0488	0.0000	0.0410	0.0000	0.0259	0.0000	0.0386
Chrysene	0.0000	0.0314	0.0000	0.0264	0.0000	0.0167	0.0000	0.0248
Benzo(b)Fluoroanthene	0.0000	0.0166	0.0000	0.0139	0.0000	0.0088	0.0000	0.0131
Benzo(k)Fluoroanthene	0.0000	0.0197	0.0000	0.0165	0.0000	0.0105	0.0000	0.0156
Benzo(a)Pyrene	0.0000	0.0189	0.0000	0.0158	0.0000	0.0100	0.0000	0.0149
Dibenz(a,h)anthracene	0.0000	0.0207	0.0000	0.0173	0.0000	0.0110	0.0000	0.0163
Benzo(ghi)Pyrene	0.0000	0.0116	0.0000	0.0098	0.0000	0.0062	0.0000	0.0092
Indenol(1,2,3)Pyrene	0.0000	0.0195	0.0000	0.0164	0.0000	0.0103	0.0000	0.0154
Elements								
Ag	0.0000	0.0703	0.0000	0.0590	0.0000	0.0373	0.0000	0.0359
Al	0.0000	0.3408	0.0000	0.2858	0.0000	0.1808	0.0000	0.1738
As	0.0000	0.0050	0.0000	0.0042	0.0000	0.0026	0.0000	0.0025
Au	0.0000	0.0717	0.0000	0.0601	0.0000	0.0380	0.0000	0.0366
Ba	5.3836	0.1496	0.0000	0.1255	15.2937	0.0794	6.8924	0.0763
Br	0.0000	0.0199	0.0000	0.0166	0.0000	0.0105	0.0000	0.0101
Ca	0.1497	0.0151	10.5638	0.0127	0.0000	0.0080	3.5712	0.0077
Cd	0.0000	0.1066	0.0000	0.0894	0.0000	0.0565	0.0000	0.0544
Cl	0.4934	0.0630	0.0000	0.0529	0.2579	0.0334	0.2505	0.0321
Co	0.0405	0.0073	0.0460	0.0061	0.0000	0.0039	0.0288	0.0037
Cr	0.0000	0.0093	0.0000	0.0078	0.0000	0.0049	0.0000	0.0047
Cs	0.5810	0.1631	0.0000	0.1368	0.0000	0.0866	0.1937	0.0832
Cu	0.0933	0.0140	0.0000	0.0118	0.0213	0.0074	0.0382	0.0072
Fe	0.2230	0.0252	0.2947	0.0211	0.0000	0.0134	0.1726	0.0128
Ga	0.0000	0.0556	0.0000	0.0466	0.0000	0.0295	0.0000	0.0284
Ge	0.0000	0.0345	0.0000	0.0289	0.0000	0.0183	0.0000	0.0176

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.1940	0.0667	0.0000	0.0560	0.1319	0.0354	0.1086	0.0340
K	0.0000	0.0200	0.0000	0.0168	1.2100	0.0106	0.4033	0.0102
La	0.0000	0.2773	0.0000	0.2326	0.2945	0.1471	0.0982	0.1414
Mg	0.0000	6.2810	0.0000	5.2680	0.0000	3.3328	0.0000	3.2040
Mn	0.4525	0.0200	0.0000	0.0168	0.1166	0.0106	0.1897	0.0102
Mo	0.0000	0.0225	0.0000	0.0188	0.0000	0.0119	0.0000	0.0115
Na	0.0000	13.4809	0.0000	11.3066	0.0000	7.1531	0.0000	6.8768
Ni	0.0000	0.0091	0.0000	0.0076	0.0000	0.0048	0.0000	0.0046
P	0.0000	0.0279	0.0000	0.0234	0.0000	0.0148	0.0000	0.0142
Pb	0.1667	0.0223	0.0758	0.0187	0.0739	0.0118	0.1054	0.0114
Pd	0.0000	0.0937	0.0000	0.0786	0.0000	0.0497	0.0000	0.0478
Rb	0.0000	0.0081	0.0000	0.0068	0.0000	0.0043	0.0000	0.0041
Rh	0.0000	0.0906	0.0000	0.0760	0.1104	0.0481	0.0368	0.0462
S	0.0000	0.0700	0.0000	0.0587	0.0000	0.0371	0.0000	0.0357
Sb	0.4078	0.1134	0.6554	0.0951	0.5431	0.0602	0.5354	0.0578
Sc	0.0000	0.0129	0.0000	0.0108	0.0000	0.0068	0.0000	0.0066
Se	0.0000	0.0079	0.0000	0.0067	0.0000	0.0042	0.0000	0.0041
Sn	0.0000	0.0921	0.3228	0.0772	0.0000	0.0488	0.1076	0.0470
Sr	0.0000	0.0535	0.0000	0.0448	0.0000	0.0284	0.0000	0.0273
Te	0.0000	0.1227	0.6219	0.1029	0.0000	0.0651	0.2073	0.0626
Ti	0.7345	0.0195	12.1080	0.0163	0.8038	0.0103	4.5488	0.0099
V	0.2643	0.0057	2.0608	0.0048	0.2857	0.0030	0.8703	0.0029
W	0.1062	0.2124	0.0000	0.1781	0.2812	0.1127	0.1291	0.1083
Y	0.0000	0.0329	0.0000	0.0276	0.0000	0.0174	0.0000	0.0168
Zn	1.7979	0.0186	0.0000	0.0156	5.6700	0.0099	2.4893	0.0095
Ions								
F	0.0000	0.1884	1.2258	0.2197	0.5714	0.1287	0.5991	0.1044
Cl	4.1923	0.8684	2.4839	0.6763	10.2653	0.8684	5.6472	0.5788
NO2	0.0000	0.1107	1.1797	0.1523	0.0000	0.0587	0.3932	0.0565
Br	0.3269	0.6420	4.4032	0.7462	5.2959	0.5991	3.3420	0.3354
NO3	0.0000	0.2490	2.0484	0.3119	1.3980	0.2025	1.1488	0.1319
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	0.1231	0.6726	4.4581	0.7831	3.4327	0.5264	2.6713	0.3881
Na	0.0000	4.9828	3.2796	4.3432	2.7075	2.7794	1.9957	2.8178
NH4	0.0000	0.2186	0.0000	0.1833	0.0000	0.1160	0.0000	0.1118
K	0.0000	2.5295	0.0000	2.1215	0.0000	1.3422	0.0000	1.3817
Ca	2.0833	1.0308	10.4892	1.3057	3.1871	0.6517	5.2532	0.5173
Mg	1.1346	0.4118	4.1129	0.5050	2.8878	0.3340	2.7118	0.2009
Identified percent of total mass	88.1793	39.8585	94.6234	32.8522	91.1661	22.4018	91.3230	21.7968

3Wheeler-Gasoline (1991-96)								
Profile Number	V19		V20		V21		Comp -3WG-1 (V19,V20,V21)	
Identified Percentage of Total Mass	60.0581		93.6652		87.6781		80.4671	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	42.2688	3.4238	67.2905	5.4505	68.9878	5.5880	59.5157	4.8208
Elemental carbon	1.0101	0.0838	1.8714	0.1553	0.8615	0.0715	1.2477	0.1036
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0457	0.0095	0.0225	0.0087	0.0000	0.0067	0.0075	0.0075
Acenaphthalene	0.0617	0.0090	0.1890	0.0157	0.0000	0.0054	0.0630	0.0090
Fluorene + Acenaphthene	0.4257	0.0285	0.1755	0.0161	0.0867	0.0107	0.0874	0.0112
Phenanthrene	0.0030	0.0108	0.0000	0.0112	0.0000	0.0099	0.0000	0.0106
Anthracene	0.0158	0.0084	0.0000	0.0080	0.0000	0.0071	0.0000	0.0076
Fluoroanthene	0.2361	0.0183	0.4317	0.0285	0.0000	0.0058	0.1439	0.0136
Pyrene	0.2889	0.0191	0.0000	0.0046	0.0000	0.0041	0.0000	0.0044
Benzo(a)Anthracene	0.0098	0.0054	0.3230	0.0216	0.0169	0.0054	0.1133	0.0106
Chrysene	0.0027	0.0033	0.0000	0.0033	0.0000	0.0029	0.0000	0.0031
Benzo(b)Fluoroanthene	0.0046	0.0019	0.0000	0.0018	0.0000	0.0015	0.0000	0.0017
Benzo(k)Fluoroanthene	0.0123	0.0026	0.0000	0.0021	0.0014	0.0019	0.0005	0.0020
Benzo(a)Pyrene	0.0025	0.0020	0.0000	0.0020	0.0000	0.0018	0.0000	0.0019
Dibenz(a,h)anthracene	0.0152	0.0029	0.0000	0.0022	0.0000	0.0019	0.0000	0.0021
Benzo(ghi)Pyrene	0.0156	0.0020	0.0000	0.0012	0.0000	0.0011	0.0000	0.0012
Indenol(1,2,3)Pyrene	0.0118	0.0026	0.0000	0.0021	0.0058	0.0021	0.0019	0.0020
Elements								
Ag	0.0000	0.0071	0.0000	0.0074	0.0000	0.0066	0.0000	0.0070
Al	0.0000	0.0344	0.0000	0.0360	0.0000	0.0318	0.0000	0.0341
As	0.0000	0.0005	0.0000	0.0005	0.0032	0.0005	0.0011	0.0005
Au	0.0000	0.0072	0.0000	0.0076	0.0000	0.0067	0.0000	0.0072
Ba	0.0000	0.0151	5.3361	0.0158	0.0000	0.0140	1.7787	0.0150
Br	0.0000	0.0020	0.0000	0.0021	0.0000	0.0019	0.0000	0.0020
Ca	1.7119	0.0015	0.0000	0.0016	0.5110	0.0014	0.7410	0.0015
Cd	0.0000	0.0108	0.0000	0.0113	0.0000	0.0099	0.0000	0.0107
Cl	0.0186	0.0064	0.0368	0.0067	0.0249	0.0059	0.0267	0.0063
Co	0.0000	0.0007	0.0080	0.0008	0.0000	0.0007	0.0027	0.0007
Cr	0.0000	0.0009	0.0000	0.0010	0.0000	0.0009	0.0000	0.0009
Cs	0.0000	0.0165	0.0381	0.0173	0.0406	0.0152	0.0262	0.0163
Cu	0.0000	0.0014	0.0000	0.0015	0.0000	0.0013	0.0000	0.0014
Fe	0.0706	0.0025	0.0000	0.0027	0.0120	0.0024	0.0276	0.0025
Ga	0.0000	0.0056	0.0000	0.0059	0.0000	0.0052	0.0000	0.0056
Ge	0.0000	0.0035	0.0158	0.0036	0.0000	0.0032	0.0053	0.0035

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0067	0.0610	0.0071	0.0251	0.0062	0.0287	0.0067
K	0.0000	0.0020	0.0361	0.0021	0.0000	0.0019	0.0120	0.0020
La	0.0000	0.0280	0.0000	0.0293	0.0000	0.0259	0.0000	0.0277
Mg	0.0000	0.6344	0.0000	0.6644	0.0000	0.5862	0.0000	0.6283
Mn	0.0000	0.0020	0.0429	0.0021	0.0146	0.0019	0.0192	0.0020
Mo	0.0000	0.0023	0.0000	0.0024	0.0086	0.0021	0.0029	0.0022
Na	0.0000	1.3617	0.0000	1.4260	0.0000	1.2581	0.0000	1.3486
Ni	0.0000	0.0009	0.0000	0.0010	0.0000	0.0008	0.0000	0.0009
P	0.0000	0.0028	0.0000	0.0030	0.0000	0.0026	0.0000	0.0028
Pb	0.0000	0.0023	0.0164	0.0024	0.0000	0.0021	0.0055	0.0022
Pd	0.0000	0.0095	0.0000	0.0099	0.0000	0.0087	0.0000	0.0094
Rb	0.0000	0.0008	0.0000	0.0009	0.0000	0.0008	0.0000	0.0008
Rh	0.0000	0.0091	0.0000	0.0096	0.0000	0.0085	0.0000	0.0091
S	0.0000	0.0071	0.1249	0.0074	0.0000	0.0065	0.0416	0.0070
Sb	0.0000	0.0115	0.0000	0.0120	0.0000	0.0106	0.0000	0.0113
Sc	0.0107	0.0013	0.0000	0.0014	0.0000	0.0012	0.0036	0.0013
Se	0.0000	0.0008	0.0000	0.0008	0.0000	0.0007	0.0000	0.0008
Sn	0.0000	0.0093	0.0000	0.0097	0.0000	0.0086	0.0000	0.0092
Sr	0.0000	0.0054	0.0000	0.0057	0.0000	0.0050	0.0000	0.0053
Te	0.0446	0.0124	0.0356	0.0130	0.0000	0.0115	0.0267	0.0123
Ti	0.3438	0.0020	0.0000	0.0021	0.2160	0.0018	0.1866	0.0019
V	0.0234	0.0006	0.0711	0.0006	0.0478	0.0005	0.0474	0.0006
W	0.0000	0.0215	0.0000	0.0225	0.0000	0.0198	0.0000	0.0212
Y	0.0000	0.0033	0.0000	0.0035	0.0119	0.0031	0.0040	0.0033
Zn	0.0000	0.0019	2.0725	0.0020	0.0000	0.0017	0.6908	0.0019
Ions								
F	0.0000	0.0190	0.0000	0.0199	0.0000	0.0176	0.0000	0.0188
Cl	1.8298	0.1590	2.9211	0.2176	2.7925	0.2029	2.5145	0.1932
NO2	0.0000	0.0112	0.0000	0.0117	0.1133	0.0160	0.0378	0.0130
Br	1.3345	0.1306	1.4015	0.1370	1.2581	0.1219	1.3314	0.1298
NO3	0.8411	0.0677	0.6286	0.0581	1.2832	0.0883	0.9176	0.0714
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	4.1111	0.2759	4.9072	0.3196	4.3905	0.2851	4.4696	0.2936
Na	0.0000	0.5033	0.0000	0.5271	0.0000	0.4650	0.0000	0.4985
NH4	0.0000	0.0221	0.0000	0.0231	0.0000	0.0204	0.0000	0.0219
K	2.5358	0.3831	2.6229	0.3996	2.7951	0.3769	2.6513	0.3865
Ca	3.3845	0.2650	2.0796	0.2030	3.8807	0.2832	3.1149	0.2504
Mg	0.5186	0.0620	0.9052	0.0833	0.2889	0.0477	0.5709	0.0643
Identified percent of total mass	60.0581	7.6624	93.6652	9.9682	87.6781	9.6687	80.4671	9.0998

3Wheeler-Gasoline (1996-2000)								
Profile Number	V22		V23		V24		Comp -3WG-2 (V22,V23,V24)	
Identified Percentage of Total Mass	90.2757		91.1546		73.0980		84.8428	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	68.2589	5.5290	29.8450	2.4174	47.8836	3.8786	48.6625	3.9417
Elemental carbon	2.6194	0.2174	6.5891	0.5469	13.7566	1.1418	7.6551	0.6354
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.1549	0.0222	0.1964	0.0460	0.0871	0.0290	0.0945	0.0298
Acenaphthalene	0.2747	0.0255	0.7828	0.0689	0.7025	0.0556	0.4951	0.0454
Fluorene + Acenaphthene	0.5621	0.0421	0.0000	0.0343	0.6062	0.0541	0.2021	0.0340
Phenanthrene	0.0033	0.0214	0.0000	0.0533	0.0229	0.0375	0.0076	0.0373
Anthracene	0.0017	0.0152	0.0338	0.0398	0.0109	0.0266	0.0149	0.0272
Fluoroanthene	0.0160	0.0133	0.0000	0.0316	0.0000	0.0215	0.0000	0.0219
Pyrene	1.5765	0.0890	0.0000	0.0220	0.0000	0.0150	0.0000	0.0153
Benzo(a)Anthracene	0.0122	0.0104	0.0000	0.0246	0.0000	0.0168	0.0000	0.0171
Chrysene	0.0199	0.0073	0.0000	0.0158	0.0000	0.0108	0.0000	0.0110
Benzo(b)Fluoroanthene	0.0052	0.0036	0.0414	0.0104	0.0562	0.0085	0.0325	0.0074
Benzo(k)Fluoroanthene	0.0030	0.0041	0.0000	0.0099	0.0000	0.0068	0.0000	0.0069
Benzo(a)Pyrene	0.0086	0.0042	0.0000	0.0095	0.0000	0.0065	0.0000	0.0066
Dibenz(a,h)anthracene	0.0277	0.0055	0.0000	0.0104	0.0526	0.0098	0.0175	0.0081
Benzo(ghi)Pyrene	0.0073	0.0027	0.0000	0.0059	0.0000	0.0040	0.0000	0.0041
Indenol(1,2,3)Pyrene	0.0093	0.0044	0.0000	0.0098	0.0000	0.0067	0.0000	0.0068
Elements								
Ag	0.0000	0.0141	0.0000	0.0354	0.0000	0.0242	0.0000	0.0246
Al	0.0000	0.0683	0.0000	0.1717	0.0000	0.1172	0.0000	0.1191
As	0.0000	0.0010	0.0000	0.0025	0.0000	0.0017	0.0000	0.0017
Au	0.0000	0.0144	0.0000	0.0361	0.0000	0.0247	0.0000	0.0251
Ba	0.0000	0.0300	9.5407	0.0754	2.6016	0.0515	4.0475	0.0523
Br	0.0080	0.0040	0.0000	0.0100	0.0000	0.0068	0.0027	0.0069
Ca	0.4782	0.0030	0.0000	0.0076	0.3768	0.0052	0.2850	0.0053
Cd	0.0000	0.0213	0.0000	0.0537	0.0000	0.0367	0.0000	0.0372
Cl	0.1168	0.0126	0.2008	0.0318	0.2491	0.0217	0.1889	0.0220
Co	0.0000	0.0015	0.0000	0.0037	0.0174	0.0025	0.0058	0.0026
Cr	0.0000	0.0019	0.0000	0.0047	0.0000	0.0032	0.0000	0.0033
Cs	0.0733	0.0327	0.4421	0.0822	0.0000	0.0561	0.1718	0.0570
Cu	0.0000	0.0028	0.0225	0.0071	0.0000	0.0048	0.0075	0.0049
Fe	0.0538	0.0050	0.2512	0.0127	0.6060	0.0087	0.3037	0.0088
Ga	0.0000	0.0111	0.0000	0.0280	0.0517	0.0191	0.0172	0.0194
Ge	0.0310	0.0069	0.0000	0.0174	0.0000	0.0119	0.0103	0.0120

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0474	0.0134	0.1208	0.0336	0.0634	0.0230	0.0772	0.0233
K	0.0000	0.0040	0.2133	0.0101	0.0000	0.0069	0.0711	0.0070
La	0.0000	0.0555	0.0000	0.1397	0.0000	0.0954	0.0000	0.0969
Mg	0.0000	1.2581	0.0000	3.1649	0.0000	2.1601	0.0000	2.1944
Mn	0.0000	0.0040	0.0965	0.0101	0.1163	0.0069	0.0709	0.0070
Mo	0.0127	0.0045	0.0366	0.0113	0.0000	0.0077	0.0164	0.0078
Na	0.0000	2.7003	0.0000	6.7927	0.0000	4.6363	0.0000	4.7098
Ni	0.0000	0.0018	0.0000	0.0046	0.0000	0.0031	0.0000	0.0032
P	0.0000	0.0056	0.0000	0.0141	0.0000	0.0096	0.0000	0.0098
Pb	0.0257	0.0045	0.0000	0.0113	0.0230	0.0077	0.0162	0.0078
Pd	0.0000	0.0188	0.0000	0.0472	0.0000	0.0322	0.0000	0.0327
Rb	0.0000	0.0016	0.0000	0.0041	0.0000	0.0028	0.0000	0.0028
Rh	0.0620	0.0181	0.0000	0.0456	0.0000	0.0311	0.0207	0.0316
S	0.3505	0.0140	0.1755	0.0353	0.0000	0.0241	0.1754	0.0244
Sb	0.0619	0.0227	0.2150	0.0571	0.0000	0.0390	0.0923	0.0396
Sc	0.0000	0.0026	0.0000	0.0065	0.0000	0.0044	0.0000	0.0045
Se	0.0000	0.0016	0.0000	0.0040	0.0000	0.0027	0.0000	0.0028
Sn	0.0653	0.0184	0.1320	0.0464	0.0000	0.0317	0.0658	0.0322
Sr	0.0000	0.0107	0.0000	0.0269	0.0000	0.0184	0.0000	0.0187
Te	0.0000	0.0246	0.1833	0.0618	0.1442	0.0422	0.1092	0.0429
Ti	0.0984	0.0039	0.1761	0.0098	0.1248	0.0067	0.1331	0.0068
V	0.0554	0.0011	0.0000	0.0029	0.0621	0.0020	0.0391	0.0020
W	0.0000	0.0425	0.3488	0.1070	0.0000	0.0730	0.1163	0.0742
Y	0.0000	0.0066	0.0000	0.0166	0.0260	0.0113	0.0087	0.0115
Zn	0.0000	0.0037	8.7196	0.0094	0.0000	0.0064	2.9065	0.0065
Ions								
F	0.0000	0.0377	0.0194	0.0959	0.0000	0.0648	0.0065	0.0662
Cl	1.1248	0.1883	7.1705	0.6937	2.0106	0.3274	3.4353	0.4031
NO2	0.0000	0.0222	0.0000	0.0558	0.0000	0.0381	0.0000	0.0387
Br	4.0485	0.3302	1.9671	0.4140	0.0198	0.2161	2.0118	0.3201
NO3	0.2812	0.0640	2.7035	0.2620	0.4563	0.1085	1.1470	0.1448
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	7.5901	0.5186	10.2364	0.8538	0.7302	0.2658	6.1856	0.5460
Na	0.0000	0.9981	3.9276	2.7074	0.0000	1.7137	1.3092	1.8064
NH4	0.0000	0.0438	0.0000	0.1101	0.0000	0.0752	0.0000	0.0764
K	0.0000	0.5067	0.0000	1.2745	0.3267	0.8863	0.1089	0.8892
Ca	4.0537	0.3904	6.7668	0.8080	1.5233	0.3951	4.1146	0.5311
Mg	0.7589	0.1093	0.0000	0.1788	0.3902	0.1416	0.3830	0.1432
Identified percent of total mass	90.2757	13.4290	91.1546	21.6712	73.0980	16.9334	84.8428	17.3445

3Wheeler-Gasoline (Post-2000)								
Profile Number	V25		V26		V27		Comp-3WG-3 (V25,V26,V27)	
Identified Percentage of Total Mass	79.9565		63.4782		96.7007		80.3383	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	55.4412	4.4907	52.8926	4.2843	55.2632	4.4763	54.5323	4.4171
Elemental carbon	3.5294	0.2929	2.2039	0.1829	9.8246	0.8154	5.1859	0.4304
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0137	0.0000	0.0257	2.3445	0.2004	0.8828	0.0850
Acenaphthalene	0.0000	0.0111	0.0000	0.0208	0.3197	0.0824	0.2028	0.0430
Fluorene + Acenaphthene	0.0000	0.0130	0.0000	0.0244	0.5543	0.1056	0.2779	0.0524
Phenanthrene	0.0000	0.0202	0.0000	0.0379	0.1061	0.1259	0.0354	0.0613
Anthracene	0.0000	0.0145	0.0000	0.0271	0.0353	0.0881	0.0118	0.0432
Fluoroanthene	0.0000	0.0120	0.0000	0.0224	0.5868	0.1009	0.1956	0.0451
Pyrene	0.0000	0.0084	0.0000	0.0157	6.3137	0.3710	2.1046	0.1317
Benzo(a)Anthracene	0.0000	0.0093	0.0000	0.0175	0.1534	0.0634	0.0511	0.0301
Chrysene	0.0000	0.0060	0.0000	0.0113	0.0753	0.0396	0.0251	0.0190
Benzo(b)Fluoroanthene	0.0000	0.0032	0.0000	0.0059	0.0979	0.0238	0.0340	0.0110
Benzo(k)Fluoroanthene	0.0000	0.0038	0.0000	0.0071	0.0847	0.0268	0.0282	0.0125
Benzo(a)Pyrene	0.0000	0.0036	0.0000	0.0068	3.4471	0.1969	1.1490	0.0691
Dibenz(a,h)anthracene	0.0000	0.0039	0.0000	0.0074	0.3129	0.0393	0.1055	0.0170
Benzo(ghi)Pyrene	0.0000	0.0022	0.0000	0.0042	3.1226	0.1723	1.0409	0.0595
Indenol(1,2,3)Pyrene	0.0000	0.0037	0.0000	0.0070	0.1379	0.0292	0.0460	0.0133
Elements								
Ag	0.0000	0.0134	0.0000	0.0252	0.0000	0.0236	0.0000	0.0207
Al	0.0000	0.0652	0.0000	0.1220	0.0000	0.0943	0.0000	0.0938
As	0.0000	0.0009	0.0000	0.0018	0.0000	0.0047	0.0000	0.0025
Au	0.0000	0.0137	0.0000	0.0257	0.0000	0.0000	0.0000	0.0131
Ba	0.0000	0.0286	1.0351	0.0536	0.0000	0.0377	0.3450	0.0400
Br	0.0000	0.0038	0.0000	0.0071	0.0000	0.0047	0.0000	0.0052
Ca	2.0862	0.0029	0.2753	0.0054	1.2073	0.0472	1.1896	0.0185
Cd	0.0000	0.0204	0.0000	0.0382	0.0000	0.0236	0.0000	0.0274
Cl	0.0478	0.0120	0.0000	0.0226	0.0000	0.0094	0.0159	0.0147
Co	0.0000	0.0014	0.0101	0.0026	0.0283	0.0141	0.0128	0.0061
Cr	0.0000	0.0018	0.0000	0.0033	0.0000	0.0236	0.0000	0.0096
Cs	0.0000	0.0312	0.0000	0.0584	0.0000	0.0377	0.0000	0.0424
Cu	0.0000	0.0027	0.0000	0.0050	0.0000	0.0047	0.0000	0.0041
Fe	0.0339	0.0048	0.0000	0.0090	0.0000	0.0236	0.0113	0.0125
Ga	0.0000	0.0106	0.0000	0.0199	0.0000	0.0000	0.0000	0.0102
Ge	0.0000	0.0066	0.0000	0.0124	0.0000	0.0000	0.0000	0.0063

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0997	0.0128	0.0000	0.0239	0.0000	0.0330	0.0332	0.0232
K	0.0000	0.0038	0.2037	0.0072	0.0000	0.0472	0.0679	0.0194
La	0.0000	0.0530	0.0000	0.0993	0.0000	0.0472	0.0000	0.0665
Mg	0.0000	1.2008	0.0000	2.2494	0.0000	0.4716	0.0000	1.3073
Mn	0.0193	0.0038	0.1101	0.0072	0.0000	0.0236	0.0431	0.0115
Mo	0.0000	0.0043	0.0402	0.0080	0.0000	0.0472	0.0134	0.0198
Na	0.0000	2.5772	0.0000	4.8279	0.0000	4.7158	0.0000	4.0403
Ni	0.0000	0.0017	0.0135	0.0032	0.0000	0.0094	0.0045	0.0048
P	0.0000	0.0053	0.0000	0.0100	0.0424	0.0141	0.0141	0.0098
Pb	0.0274	0.0043	0.0000	0.0080	0.0000	0.0094	0.0091	0.0072
Pd	0.0000	0.0179	0.0000	0.0335	0.0000	0.0236	0.0000	0.0250
Rb	0.0000	0.0015	0.0000	0.0029	0.0000	0.0141	0.0000	0.0062
Rh	0.0000	0.0173	0.0000	0.0324	0.0000	0.0000	0.0000	0.0166
S	0.0000	0.0134	0.0000	0.0251	0.0000	0.0094	0.0000	0.0160
Sb	0.1002	0.0217	0.2070	0.0406	0.0000	0.0283	0.1024	0.0302
Sc	0.0084	0.0025	0.0578	0.0046	0.0000	0.0000	0.0221	0.0024
Se	0.0000	0.0015	0.0000	0.0028	0.0000	0.0047	0.0000	0.0030
Sn	0.1050	0.0176	0.0671	0.0330	0.0000	0.0283	0.0574	0.0263
Sr	0.0000	0.0102	0.0000	0.0191	0.0000	0.0236	0.0000	0.0177
Te	0.0567	0.0235	0.2525	0.0439	0.0000	0.0000	0.1031	0.0225
Ti	0.4179	0.0037	0.3033	0.0070	0.3773	0.0236	0.3662	0.0114
V	0.0419	0.0011	0.0000	0.0020	0.0000	0.0236	0.0140	0.0089
W	0.0892	0.0406	0.0000	0.0761	0.0000	0.0000	0.0297	0.0389
Y	0.0224	0.0063	0.0494	0.0118	0.0000	0.0330	0.0239	0.0170
Zn	0.0000	0.0036	0.0145	0.0067	0.0000	0.0047	0.0048	0.0050
Ions								
F	0.0000	0.0360	0.0000	0.0675	0.3070	0.2302	0.1023	0.1112
Cl	1.9926	0.2263	2.2121	0.3469	1.5395	0.8272	1.9147	0.4668
NO2	0.0000	0.0212	0.0000	0.0396	0.3321	0.1429	0.1107	0.0679
Br	3.0846	0.2756	0.0397	0.2260	0.5482	0.7408	1.2242	0.4141
NO3	0.5184	0.0737	0.1220	0.0953	0.0000	0.2839	0.2135	0.1510
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	7.3618	0.5009	1.4526	0.3116	2.3772	0.8791	3.7305	0.5639
Na	0.0000	0.9526	0.0000	1.7845	3.5819	5.8613	1.1940	2.8661
NH4	0.0000	0.0418	0.0000	0.0783	0.0614	0.2523	0.0205	0.1241
K	0.0000	0.4836	0.3592	0.9238	3.4085	3.0551	1.2559	1.4875
Ca	4.3615	0.3976	1.4019	0.4021	0.0000	1.0564	1.9211	0.6187
Mg	0.5110	0.0935	0.1545	0.1348	0.1096	0.4102	0.2584	0.2129
Identified percent of total mass	79.9565	12.1558	63.4782	16.8756	96.7007	26.6812	80.3383	18.7089

3-Wheeler (Diesel) (1991-1996)								
Profile Number	V28		V29		V30		Comp-3WD-1 (V28,v29,v30)	
Identified Percentage of Total Mass	58.5475		69.1439		40.4212		56.0375	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	43.3613	3.5123	52.1164	4.2214	31.7100	2.5685	42.3959	3.4341
Elemental carbon	14.6449	1.2155	13.3619	1.1090	5.5844	0.4635	11.1971	0.9294
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0062	0.0005	0.2600	0.0145	0.0017	0.0012	0.0893	0.0054
Acenaphthalene	0.0011	0.0002	0.0296	0.0025	0.0029	0.0011	0.0112	0.0013
Fluorene + Acenaphthene	0.0107	0.0007	0.0714	0.0048	0.1065	0.0065	0.0629	0.0040
Phenanthrene	0.0131	0.0010	0.0029	0.0020	0.0024	0.0018	0.0061	0.0016
Anthracene	0.0013	0.0003	0.0031	0.0015	0.0011	0.0012	0.0018	0.0010
Fluoroanthene	0.0369	0.0021	0.0268	0.0025	0.0054	0.0012	0.0230	0.0019
Pyrene	0.0324	0.0018	0.0513	0.0034	0.0680	0.0041	0.0505	0.0031
Benzo(a)Anthracene	0.0108	0.0007	0.0036	0.0011	0.0002	0.0008	0.0049	0.0008
Chrysene	0.0019	0.0002	0.0041	0.0008	0.0030	0.0006	0.0030	0.0005
Benzo(b)Fluoroanthene	0.0016	0.0001	0.0223	0.0014	0.0092	0.0007	0.0110	0.0008
Benzo(k)Fluoroanthene	0.0408	0.0021	0.0051	0.0006	0.0051	0.0006	0.0170	0.0011
Benzo(a)Pyrene	0.0008	0.0001	0.0109	0.0009	0.0047	0.0005	0.0055	0.0005
Dibenz(a,h)anthracene	0.0290	0.0015	0.0243	0.0016	0.0005	0.0003	0.0179	0.0012
Benzo(ghi)Pyrene	0.0018	0.0001	0.0173	0.0011	0.0005	0.0002	0.0065	0.0005
Indenol(1,2,3)Pyrene	0.0041	0.0003	0.0210	0.0014	0.0008	0.0003	0.0086	0.0007
Elements								
Ag	0.0000	0.0002	0.0000	0.0010	0.0000	0.0008	0.0000	0.0007
Al	0.0000	0.0006	0.0000	0.0039	0.0000	0.0034	0.0000	0.0026
As	0.0014	0.0000	0.0000	0.0002	0.0000	0.0002	0.0005	0.0001
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	0.0000	0.0002	0.0391	0.0016	0.3060	0.0014	0.1150	0.0011
Br	0.0000	0.0000	0.0000	0.0002	0.0000	0.0002	0.0000	0.0001
Ca	0.0000	0.0003	0.0000	0.0020	0.0000	0.0017	0.0000	0.0013
Cd	0.0049	0.0002	0.0000	0.0010	0.0269	0.0008	0.0106	0.0007
Cl	0.0387	0.0001	0.0696	0.0004	0.1558	0.0003	0.0880	0.0003
Co	0.0000	0.0001	0.0000	0.0006	0.0000	0.0005	0.0000	0.0004
Cr	0.0000	0.0002	0.0000	0.0010	0.0000	0.0008	0.0000	0.0007
Cs	0.0000	0.0002	0.0000	0.0016	0.0000	0.0014	0.0000	0.0011
Cu	0.0000	0.0000	0.0000	0.0002	0.0000	0.0002	0.0000	0.0001
Fe	0.0238	0.0002	0.0000	0.0010	0.0000	0.0008	0.0079	0.0007
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0002	0.0000	0.0014	0.0000	0.0012	0.0000	0.0009
K	0.0000	0.0003	0.2970	0.0020	0.4284	0.0017	0.2418	0.0013
La	0.0000	0.0003	0.0000	0.0020	0.0000	0.0017	0.0000	0.0013
Mg	0.0000	0.0031	0.0000	0.0195	0.0000	0.0170	0.0000	0.0132
Mn	0.0000	0.0002	0.0145	0.0010	0.0000	0.0008	0.0048	0.0007
Mo	0.0000	0.0003	0.0000	0.0020	0.0000	0.0017	0.0000	0.0013
Na	0.0000	0.0308	0.0000	0.1954	0.0000	0.1700	0.0000	0.1321
Ni	0.0000	0.0001	0.0000	0.0004	0.0000	0.0003	0.0000	0.0003
P	0.0001	0.0001	0.0000	0.0006	0.0000	0.0005	0.0000	0.0004
Pb	0.0000	0.0001	0.0168	0.0004	0.0051	0.0003	0.0073	0.0003
Pd	0.0000	0.0002	0.0000	0.0010	0.0000	0.0008	0.0000	0.0007
Rb	0.0000	0.0001	0.0000	0.0006	0.0000	0.0005	0.0000	0.0004
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0226	0.0001	0.0000	0.0004	0.0000	0.0003	0.0075	0.0003
Sb	0.0000	0.0002	0.0000	0.0012	0.0000	0.0010	0.0000	0.0008
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0000	0.0000	0.0002	0.0000	0.0002	0.0000	0.0001
Sn	0.0000	0.0002	0.0344	0.0012	0.0000	0.0010	0.0115	0.0008
Sr	0.0000	0.0002	0.3674	0.0010	0.0000	0.0008	0.1225	0.0007
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	0.0000	0.0002	0.2423	0.0010	0.1734	0.0008	0.1386	0.0007
V	0.0000	0.0002	0.0000	0.0010	0.0000	0.0008	0.0000	0.0007
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0002	0.0000	0.0014	0.0000	0.0012	0.0000	0.0009
Zn	0.0000	0.0000	0.2052	0.0002	0.3961	0.0002	0.2004	0.0001
Ions								
F	0.0170	0.0109	0.3090	0.0793	0.3078	0.0710	0.2113	0.0537
Cl	0.0586	0.0105	0.3366	0.0647	0.2381	0.0536	0.2111	0.0429
NO2	0.0028	0.0015	0.0000	0.0084	0.0000	0.0073	0.0009	0.0057
Br	0.0178	0.0014	0.1123	0.0090	0.1145	0.0087	0.0815	0.0064
NO3	0.0127	0.0017	0.0259	0.0083	0.0117	0.0067	0.0168	0.0056
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	0.0239	0.0039	0.2407	0.0290	0.1534	0.0224	0.1393	0.0184
Na	0.0857	0.0134	0.4905	0.0826	0.3167	0.0663	0.2976	0.0541
NH4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K	0.0109	0.0048	0.0288	0.0287	0.0455	0.0260	0.0284	0.0198
Ca	0.0239	0.0068	0.2247	0.0469	0.1907	0.0406	0.1464	0.0314
Mg	0.0040	0.0013	0.0570	0.0096	0.0448	0.0081	0.0353	0.0063
Identified percent of total mass	58.5475	4.8347	69.1439	5.9852	40.4212	3.5796	56.0375	4.7998

3Wheeler-Diesel (1996-2000)								
Profile Number	V31		V32		V33		Comp-3WD-2 (V31,V32,V33)	
Identified Percentage of Total Mass	81.3838		92.6094		81.2752		85.0894	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	59.5079	4.8201	76.1963	6.7974	53.1659	4.3064	62.9567	5.3080
Elemental carbon	17.4895	1.4516	7.6994	0.7038	20.6575	1.7146	15.2821	1.2900
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0015	0.0154	0.0040	0.1340	0.0092	0.0498	0.0049
Acenaphthalene	0.0000	0.0012	0.1022	0.0083	0.0264	0.0033	0.0429	0.0042
Fluorene + Acenaphthene	0.0000	0.0014	0.0001	0.0030	0.0585	0.0053	0.0196	0.0032
Phenanthrene	0.0000	0.0021	0.0077	0.0051	0.0043	0.0038	0.0040	0.0037
Anthracene	0.0029	0.0017	0.0022	0.0034	0.0140	0.0033	0.0064	0.0028
Fluoroanthene	0.0059	0.0016	0.0376	0.0048	0.0153	0.0029	0.0196	0.0031
Pyrene	0.0000	0.0009	0.0000	0.0019	0.2460	0.0140	0.0820	0.0056
Benzo(a)Anthracene	0.0000	0.0010	0.0000	0.0021	0.0004	0.0017	0.0001	0.0016
Chrysene	0.0015	0.0007	0.0016	0.0015	0.0059	0.0014	0.0030	0.0012
Benzo(b)Fluoroanthene	0.0000	0.0003	0.0000	0.0007	0.0238	0.0018	0.0079	0.0009
Benzo(k)Fluoroanthene	0.0003	0.0004	0.0000	0.0009	0.0171	0.0015	0.0058	0.0009
Benzo(a)Pyrene	0.0000	0.0004	0.0000	0.0008	0.0053	0.0009	0.0018	0.0007
Dibenz(a,h)anthracene	0.0056	0.0007	0.0000	0.0009	0.0127	0.0013	0.0061	0.0010
Benzo(ghi)Pyrene	0.0000	0.0002	0.0000	0.0005	0.0155	0.0012	0.0052	0.0006
Indenol(1,2,3)Pyrene	0.0000	0.0004	0.0000	0.0009	0.0125	0.0013	0.0042	0.0008
Elements								
Ag	0.0000	0.0014	0.0000	0.0031	0.0000	0.0018	0.0000	0.0021
Al	0.0000	0.0069	0.0000	0.0150	0.0000	0.0073	0.0000	0.0097
As	0.0000	0.0001	0.0000	0.0002	0.0031	0.0004	0.0010	0.0002
Au	0.0000	0.0015	0.0000	0.0031	0.0000	0.0000	0.0000	0.0015
Ba	0.0000	0.0030	0.1327	0.0066	1.2443	0.0029	0.4590	0.0042
Br	0.0000	0.0004	0.0000	0.0009	0.0000	0.0004	0.0000	0.0005
Ca	0.0000	0.0003	0.0000	0.0007	0.1683	0.0037	0.0561	0.0015
Cd	0.0000	0.0022	0.0000	0.0047	0.0000	0.0018	0.0000	0.0029
Cl	0.0426	0.0013	0.0290	0.0028	0.0446	0.0007	0.0387	0.0016
Co	0.0000	0.0001	0.0010	0.0003	0.0000	0.0011	0.0003	0.0005
Cr	0.0000	0.0002	0.0000	0.0004	0.0000	0.0018	0.0000	0.0008
Cs	0.0000	0.0033	0.0251	0.0072	0.4040	0.0029	0.1430	0.0045
Cu	0.0027	0.0003	0.0000	0.0006	0.0257	0.0004	0.0095	0.0004
Fe	0.0025	0.0005	0.0000	0.0011	0.0000	0.0018	0.0008	0.0011
Ga	0.0000	0.0011	0.0000	0.0024	0.0000	0.0000	0.0000	0.0012
Ge	0.0000	0.0007	0.0000	0.0015	0.0000	0.0000	0.0000	0.0007

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0014	0.0000	0.0029	0.4099	0.0026	0.1366	0.0023
K	0.0000	0.0004	0.0000	0.0009	0.7905	0.0037	0.2635	0.0016
La	0.0000	0.0056	0.0000	0.0122	0.0000	0.0037	0.0000	0.0072
Mg	0.0000	0.1272	0.0000	0.2759	0.0000	0.0366	0.0000	0.1465
Mn	0.0072	0.0004	0.0133	0.0009	0.0000	0.0018	0.0068	0.0010
Mo	0.0000	0.0005	0.0023	0.0010	0.0000	0.0037	0.0008	0.0017
Na	0.0000	0.2729	0.0000	0.5921	0.0000	0.3660	0.0000	0.4103
Ni	0.0073	0.0002	0.0000	0.0004	0.0000	0.0007	0.0024	0.0004
P	0.0000	0.0006	0.0000	0.0012	0.0000	0.0011	0.0000	0.0010
Pb	0.0028	0.0005	0.0000	0.0010	0.0110	0.0007	0.0046	0.0007
Pd	0.0000	0.0019	0.0000	0.0041	0.0000	0.0018	0.0000	0.0026
Rb	0.0000	0.0002	0.0000	0.0004	0.0146	0.0011	0.0049	0.0005
Rh	0.0000	0.0018	0.0000	0.0040	0.0000	0.0000	0.0000	0.0019
S	0.1042	0.0014	0.0660	0.0031	0.0000	0.0007	0.0567	0.0017
Sb	0.0116	0.0023	0.0095	0.0050	0.0000	0.0022	0.0071	0.0032
Sc	0.0000	0.0003	0.0000	0.0006	0.0000	0.0000	0.0000	0.0003
Se	0.0000	0.0002	0.0000	0.0003	0.0000	0.0004	0.0000	0.0003
Sn	0.0000	0.0019	0.0080	0.0040	0.0000	0.0022	0.0027	0.0027
Sr	0.0000	0.0011	0.0000	0.0023	0.1391	0.0018	0.0464	0.0018
Te	0.0137	0.0025	0.0166	0.0054	0.0000	0.0000	0.0101	0.0026
Ti	0.0121	0.0004	0.0189	0.0009	0.3952	0.0018	0.1421	0.0010
V	0.0082	0.0001	0.0196	0.0003	0.0000	0.0018	0.0093	0.0007
W	0.0000	0.0043	0.0000	0.0093	0.0000	0.0000	0.0000	0.0045
Y	0.0017	0.0007	0.0000	0.0014	0.0000	0.0026	0.0006	0.0016
Zn	0.0000	0.0004	0.0000	0.0008	0.0000	0.0004	0.0000	0.0005
Ions								
F	0.0117	0.0044	0.0813	0.0128	0.5954	0.1494	0.2295	0.0555
Cl	0.0802	0.0173	0.3175	0.0465	0.5889	0.1191	0.3289	0.0610
NO ₂	0.0000	0.0022	0.0000	0.0049	0.0240	0.0169	0.0080	0.0080
Br	1.0407	0.0655	1.3934	0.1053	0.0097	0.0067	0.8146	0.0592
NO ₃	0.0000	0.0050	0.0000	0.0109	0.0485	0.0156	0.0162	0.0105
PO ₄	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO ₄	0.8193	0.0551	2.7350	0.1824	0.2358	0.0434	1.2634	0.0936
Na	0.0000	0.1009	0.0000	0.2188	1.1179	0.1648	0.3726	0.1615
NH ₄	0.0000	0.0044	0.0000	0.0096	0.0000	0.0000	0.0000	0.0047
K	0.9038	0.0968	1.9183	0.2178	0.1200	0.0570	0.9807	0.1239
Ca	1.2040	0.0799	1.7595	0.1389	0.3756	0.0856	1.1130	0.1015
Mg	0.0938	0.0119	0.0000	0.0156	0.0938	0.0173	0.0626	0.0149
Identified percent of total mass	81.3838	7.1675	92.6094	9.4456	81.2752	7.2139	85.0894	7.9601

3-Wheeler (Diesel) (Post-2000)								
Profile Number	V34		V35		V36		Comp-3WD-3 (v34,v35,v36)	
Identified Percentage of Total Mass	69.9372		80.8556		68.9428		73.2452	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	34.5470	2.7983	37.0175	2.9984	50.9051	4.1233	40.8232	3.3067
Elemental carbon	30.7420	2.5516	24.2105	2.0095	11.4304	0.9487	22.1276	1.8366
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0965	0.0129	0.5877	0.0531	0.0285	0.0073	0.2376	0.0244
Acenaphthalene	0.0186	0.0075	0.5191	0.0452	0.0214	0.0059	0.1864	0.0195
Fluorene + Acenaphthene	0.1487	0.0152	0.4877	0.0468	0.2181	0.0167	0.2849	0.0262
Phenanthrene	0.0030	0.0120	0.0126	0.0351	0.0010	0.0088	0.0055	0.0186
Anthracene	0.0008	0.0085	0.0081	0.0251	0.0341	0.0079	0.0144	0.0138
Fluoroanthene	0.0034	0.0072	0.0920	0.0250	0.0253	0.0064	0.0403	0.0129
Pyrene	0.0083	0.0053	0.1371	0.0212	0.1684	0.0121	0.1046	0.0129
Benzo(a)Anthracene	0.0137	0.0062	0.0056	0.0162	0.0016	0.0041	0.0069	0.0088
Chrysene	0.0226	0.0047	0.0080	0.0106	0.0026	0.0027	0.0111	0.0060
Benzo(b)Fluoroanthene	0.0272	0.0032	0.0102	0.0059	0.0011	0.0014	0.0128	0.0035
Benzo(k)Fluoroanthene	0.0051	0.0025	0.0109	0.0070	0.0033	0.0018	0.0064	0.0037
Benzo(a)Pyrene	0.0116	0.0027	0.0095	0.0066	0.0023	0.0017	0.0078	0.0037
Dibenz(a,h)anthracene	0.0067	0.0027	0.0215	0.0078	0.0097	0.0022	0.0127	0.0042
Benzo(ghi)Pyrene	0.0000	0.0013	0.0590	0.0068	0.0000	0.0010	0.0197	0.0030
Indenol(1,2,3)Pyrene	0.0000	0.0022	0.0143	0.0071	0.0000	0.0016	0.0048	0.0036
Elements								
Ag	0.0000	0.0023	0.0000	0.0067	0.0000	0.0017	0.0000	0.0036
Al	0.0000	0.0093	0.0000	0.0269	0.0000	0.0068	0.0000	0.0143
As	0.0000	0.0005	0.0019	0.0013	0.0000	0.0003	0.0006	0.0007
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	0.0000	0.0037	0.0000	0.0108	3.1304	0.0027	1.0435	0.0057
Br	0.0000	0.0005	0.0000	0.0013	0.0000	0.0003	0.0000	0.0007
Ca	0.0557	0.0046	1.1049	0.0135	0.0000	0.0034	0.3868	0.0072
Cd	0.0000	0.0023	0.0000	0.0067	0.0000	0.0017	0.0000	0.0036
Cl	0.0000	0.0009	0.0154	0.0027	0.0000	0.0007	0.0051	0.0014
Co	0.0000	0.0014	0.0000	0.0040	0.0000	0.0010	0.0000	0.0022
Cr	0.0000	0.0023	0.0000	0.0067	0.0000	0.0017	0.0000	0.0036
Cs	0.0000	0.0037	0.0000	0.0108	0.0000	0.0027	0.0000	0.0057
Cu	0.0231	0.0005	0.0034	0.0013	0.0000	0.0003	0.0088	0.0007
Fe	0.0000	0.0023	0.0000	0.0067	0.0000	0.0017	0.0000	0.0036
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0032	0.7545	0.0094	0.0000	0.0024	0.2515	0.0050
K	0.0000	0.0046	0.0000	0.0135	0.0000	0.0034	0.0000	0.0072
La	0.0000	0.0046	0.0000	0.0135	0.0000	0.0034	0.0000	0.0072
Mg	0.0000	0.0464	0.0000	0.1347	0.0000	0.0340	0.0000	0.0717
Mn	0.0000	0.0023	0.0000	0.0067	0.0000	0.0017	0.0000	0.0036
Mo	0.0000	0.0046	0.0000	0.0135	0.0000	0.0034	0.0000	0.0072
Na	0.0000	0.4639	3.5032	1.3474	0.0000	0.3403	1.1677	0.7172
Ni	0.0303	0.0009	0.0315	0.0027	0.0126	0.0007	0.0248	0.0014
P	0.0153	0.0014	0.0493	0.0040	0.0091	0.0010	0.0246	0.0022
Pb	0.0241	0.0009	0.0054	0.0027	0.0286	0.0007	0.0194	0.0014
Pd	0.0000	0.0023	0.1617	0.0067	0.0408	0.0017	0.0675	0.0036
Rb	0.0000	0.0014	0.0000	0.0040	0.0000	0.0010	0.0000	0.0022
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0009	0.0000	0.0027	0.0000	0.0007	0.0000	0.0014
Sb	0.0000	0.0028	0.6036	0.0081	0.0000	0.0020	0.2012	0.0043
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0005	0.0000	0.0013	0.0000	0.0003	0.0000	0.0007
Sn	0.0000	0.0028	0.0000	0.0081	0.0000	0.0020	0.0000	0.0043
Sr	0.0000	0.0023	0.0000	0.0067	0.0000	0.0017	0.0000	0.0036
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	0.0186	0.0023	0.7815	0.0067	0.0000	0.0017	0.2667	0.0036
V	0.0000	0.0023	0.0000	0.0067	0.0000	0.0017	0.0000	0.0036
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0032	0.0000	0.0094	0.0000	0.0024	0.0000	0.0050
Zn	0.0000	0.0005	0.0000	0.0013	0.4798	0.0003	0.1599	0.0007
Ions								
F	0.1165	0.4042	0.0501	1.1596	0.0728	0.2958	0.0798	0.6199
Cl	1.5272	0.3751	4.3484	1.0852	1.0728	0.2728	2.3161	0.5777
NO2	0.3174	0.0683	0.3831	0.1714	0.1410	0.0455	0.2805	0.0951
Br	0.0065	0.0209	0.0188	0.0608	0.0111	0.0157	0.0121	0.0325
NO3	0.1186	0.0498	0.0564	0.1303	0.0427	0.0343	0.0726	0.0715
PO4	0.0000	0.0000	0.2130	0.0109	0.0000	0.0000	0.0710	0.0036
SO4	0.0052	0.1054	0.7669	0.3437	0.0228	0.0782	0.2650	0.1758
Na	1.1720	0.4205	1.7377	1.1378	0.4135	0.2861	1.1077	0.6148
NH4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K	0.0117	0.1706	0.0000	0.4938	0.0371	0.1266	0.0163	0.2636
Ca	0.6478	0.2548	2.6211	0.7773	0.4784	0.1871	1.2491	0.4064
Mg	0.1920	0.0516	0.4323	0.1436	0.0965	0.0356	0.2403	0.0770
Identified percent of total mass	69.9372	7.9537	80.8556	12.5515	68.9428	6.9630	73.2452	9.1561

Passenger Car-Gasoline (1991-96)								
Profile Number	V37		V38		V39		Comp-PCG-1 (V37,V38,V39)	
Identified Percentage of Total Mass	95.9552		60.3818		90.9049		82.4140	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	45.8741	3.7158	42.6187	3.4521	43.9271	3.5581	44.1400	3.5753
Elemental carbon	9.0909	0.7545	6.9885	0.5800	19.2308	1.5962	11.7701	0.9769
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.1270	0.0194	0.1023	0.0204	0.1293	0.0254	0.1195	0.0217
Acenaphthalene	0.0000	0.0106	0.3359	0.0294	0.1015	0.0204	0.1458	0.0201
Fluorene + Acenaphthene	0.0000	0.0124	0.2646	0.0279	0.6950	0.0531	0.3199	0.0311
Phenanthrene	0.0299	0.0207	0.0023	0.0226	0.0031	0.0280	0.0117	0.0238
Anthracene	0.0000	0.0138	0.0012	0.0162	0.0109	0.0205	0.0040	0.0168
Fluoroanthene	0.1199	0.0174	0.0125	0.0139	0.1610	0.0246	0.0978	0.0187
Pyrene	0.0000	0.0080	0.0246	0.0105	0.6263	0.0433	0.2170	0.0206
Benzo(a)Anthracene	0.0000	0.0089	0.0036	0.0106	0.0073	0.0132	0.0036	0.0109
Chrysene	0.0000	0.0057	0.0041	0.0069	0.0071	0.0086	0.0037	0.0071
Benzo(b)Fluoroanthene	0.0005	0.0030	0.0040	0.0037	0.0026	0.0045	0.0023	0.0038
Benzo(k)Fluoroanthene	0.0000	0.0036	0.0253	0.0055	0.0036	0.0054	0.0096	0.0048
Benzo(a)Pyrene	0.0000	0.0034	0.0395	0.0060	0.0064	0.0053	0.0153	0.0049
Dibenz(a,h)anthracene	0.0000	0.0038	0.0000	0.0044	0.0000	0.0054	0.0000	0.0045
Benzo(ghi)Pyrene	0.0000	0.0021	0.0000	0.0025	0.0000	0.0031	0.0000	0.0026
Indenol(1,2,3)Pyrene	0.0000	0.0035	0.0000	0.0041	0.0000	0.0051	0.0000	0.0043
Elements								
Ag	0.0000	0.0336	0.0000	0.0116	0.0000	0.0143	0.0000	0.0198
Al	0.0000	0.1629	0.0000	0.0463	0.0000	0.0572	0.0000	0.0888
As	0.0081	0.0024	0.0264	0.0023	0.0000	0.0029	0.0115	0.0025
Au	0.0000	0.0343	0.0000	0.0000	0.0000	0.0000	0.0000	0.0114
Ba	0.0000	0.0715	0.0000	0.0185	0.0000	0.0229	0.0000	0.0376
Br	0.0000	0.0095	0.0000	0.0023	0.0000	0.0029	0.0000	0.0049
Ca	4.0412	0.0072	0.0000	0.0231	0.0000	0.0286	1.3471	0.0197
Cd	0.1563	0.0510	0.3656	0.0116	0.0000	0.0143	0.1740	0.0256
Cl	0.0000	0.0301	1.1874	0.0046	3.3918	0.0057	1.5264	0.0135
Co	0.0000	0.0035	0.0000	0.0069	0.0000	0.0086	0.0000	0.0063
Cr	0.0000	0.0044	0.0000	0.0116	0.0000	0.0143	0.0000	0.0101
Cs	0.0000	0.0780	0.0000	0.0185	0.0000	0.0229	0.0000	0.0398
Cu	0.0000	0.0067	0.0000	0.0023	0.0000	0.0029	0.0000	0.0040
Fe	0.1460	0.0120	0.0000	0.0116	0.0000	0.0143	0.0487	0.0126
Ga	0.0000	0.0266	0.0000	0.0000	0.0000	0.0000	0.0000	0.0089
Ge	0.0000	0.0165	0.0000	0.0000	0.0000	0.0000	0.0000	0.0055

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0976	0.0319	0.0000	0.0162	2.4039	0.0200	0.8338	0.0227
K	0.0000	0.0096	0.0000	0.0231	0.0000	0.0286	0.0000	0.0204
La	0.0000	0.1326	0.0000	0.0231	0.0000	0.0286	0.0000	0.0614
Mg	0.0000	3.0031	0.0000	0.2314	0.7269	0.2862	0.2423	1.1735
Mn	0.0000	0.0096	0.0000	0.0116	0.0000	0.0143	0.0000	0.0118
Mo	0.0000	0.0107	0.0000	0.0231	0.0000	0.0286	0.0000	0.0208
Na	2.8732	6.4455	0.0000	2.3138	0.0000	2.8618	0.9577	3.8737
Ni	0.0271	0.0043	0.0000	0.0046	0.0000	0.0057	0.0090	0.0049
P	0.0000	0.0133	0.0891	0.0069	0.1525	0.0086	0.0805	0.0096
Pb	0.0000	0.0107	0.0694	0.0046	0.0000	0.0057	0.0231	0.0070
Pd	0.2431	0.0448	0.0000	0.0116	0.0000	0.0143	0.0810	0.0236
Rb	0.0000	0.0039	0.4165	0.0069	0.0000	0.0086	0.1388	0.0065
Rh	0.0000	0.0433	0.0000	0.0000	0.0000	0.0000	0.0000	0.0144
S	0.4767	0.0335	0.0000	0.0046	0.0000	0.0057	0.1589	0.0146
Sb	0.0000	0.0542	0.0000	0.0139	0.0000	0.0172	0.0000	0.0284
Sc	0.0952	0.0062	0.0000	0.0000	0.0000	0.0000	0.0317	0.0021
Se	0.0000	0.0038	0.0000	0.0023	0.0000	0.0029	0.0000	0.0030
Sn	0.0000	0.0440	0.0000	0.0139	0.0000	0.0172	0.0000	0.0250
Sr	0.0000	0.0256	0.0000	0.0116	0.0000	0.0143	0.0000	0.0171
Te	0.0000	0.0587	0.0000	0.0000	0.0000	0.0000	0.0000	0.0196
Ti	0.2048	0.0093	0.0000	0.0116	0.0000	0.0143	0.0683	0.0117
V	0.0000	0.0027	0.0000	0.0116	0.0000	0.0143	0.0000	0.0095
W	0.0000	0.1016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0339
Y	0.0753	0.0157	0.0000	0.0162	0.0000	0.0200	0.0251	0.0173
Zn	0.0000	0.0089	0.0000	0.0023	0.0000	0.0029	0.0000	0.0047
Ions								
F	0.0000	0.6457	0.0000	0.7556	0.0000	0.9346	0.0000	0.7786
Cl	1.8252	0.5753	2.6596	0.6996	10.5364	1.2315	5.0071	0.8355
NO2	0.0000	0.0849	0.0000	0.0994	0.0000	0.1229	0.0000	0.1024
Br	2.7720	0.1742	0.0000	0.0391	0.0648	0.0516	0.9456	0.0883
NO3	1.9371	0.1691	0.9902	0.1331	0.7996	0.1432	1.2423	0.1485
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	9.5571	0.6552	0.0000	0.1994	0.0000	0.2466	3.1857	0.3670
Na	7.0098	0.9395	2.9656	0.8350	3.5263	1.0256	4.5006	0.9334
NH4	0.5664	0.0289	0.1718	0.0088	1.8016	0.0919	0.8466	0.0432
K	1.5021	0.3510	1.0131	0.3732	2.5891	0.5289	1.7014	0.4177
Ca	6.4396	0.6854	0.0000	0.4217	0.0000	0.5216	2.1465	0.5429
Mg	0.6587	0.1012	0.0000	0.0796	0.0000	0.0985	0.2196	0.0931
Identified percent of total mass	95.9552	19.5584	60.3818	10.7974	90.9049	14.0486	82.4140	14.8469

Passenger Car-Gasoline (1996-2000)								
Profile Number	V40		V41		V42		Comp-PCG-2 (V40,V41,42)	
Identified Percentage of Total Mass	93.3929		92.2489		77.7208		87.7876	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	42.3941	3.4339	48.5352	3.9313	54.8421	7.8311	48.5904	5.0655
Elemental carbon	20.0424	1.6635	16.3086	1.3536	12.1637	1.7798	16.1716	1.5990
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.1323	0.0264	0.0242	0.0103	0.0000	0.0240	0.0522	0.0202
Acenaphthalene	0.0805	0.0201	0.1822	0.0166	0.0000	0.0195	0.0876	0.0187
Fluorene + Acenaphthene	0.4624	0.0421	0.1783	0.0177	0.0000	0.0228	0.2136	0.0275
Phenanthrene	0.0529	0.0318	0.0000	0.0134	0.0000	0.0354	0.0176	0.0269
Anthracene	0.0463	0.0232	0.0110	0.0102	0.0000	0.0254	0.0191	0.0196
Fluoroanthene	0.2155	0.0281	0.0460	0.0103	0.0000	0.0210	0.0871	0.0198
Pyrene	3.8588	0.2086	0.0000	0.0056	0.0000	0.0147	1.2863	0.0763
Benzo(a)Anthracene	0.0530	0.0161	0.0000	0.0062	0.0000	0.0164	0.0177	0.0129
Chrysene	0.0056	0.0089	0.0000	0.0040	0.0000	0.0105	0.0019	0.0078
Benzo(b)Fluoroanthene	0.2074	0.0151	0.0000	0.0021	0.0000	0.0056	0.0691	0.0076
Benzo(k)Fluoroanthene	0.1404	0.0125	0.0080	0.0029	0.0000	0.0066	0.0495	0.0073
Benzo(a)Pyrene	0.1785	0.0142	0.0000	0.0024	0.0000	0.0063	0.0595	0.0076
Dibenz(a,h)anthracene	0.0580	0.0086	0.0000	0.0026	0.0000	0.0069	0.0193	0.0061
Benzo(ghi)Pyrene	0.1993	0.0133	0.0000	0.0015	0.0000	0.0039	0.0664	0.0062
Indenol(1,2,3)Pyrene	0.0305	0.0069	0.0000	0.0025	0.0000	0.0065	0.0102	0.0053
Elements								
Ag	0.0000	0.0150	0.0000	0.0235	0.0000	0.0620	0.0000	0.0335
Al	0.0000	0.0599	0.0000	0.1138	1.1430	0.3003	0.3810	0.1580
As	0.0000	0.0030	0.0195	0.0017	0.0061	0.0044	0.0085	0.0030
Au	0.0000	0.0000	0.0000	0.0239	0.0000	0.0632	0.0000	0.0290
Ba	0.0000	0.0240	0.0000	0.0499	0.0000	0.1318	0.0000	0.0686
Br	0.0000	0.0030	0.0000	0.0066	0.0000	0.0175	0.0000	0.0090
Ca	0.0000	0.0300	6.9835	0.0051	1.0114	0.0133	2.6650	0.0161
Cd	0.0000	0.0150	0.0892	0.0356	0.0000	0.0939	0.0297	0.0481
Cl	1.3131	0.0060	0.0509	0.0210	0.0000	0.0555	0.4546	0.0275
Co	0.0000	0.0090	0.0000	0.0024	0.0000	0.0064	0.0000	0.0060
Cr	0.0000	0.0150	0.0000	0.0031	0.0000	0.0082	0.0000	0.0088
Cs	0.0000	0.0240	0.0000	0.0545	1.0727	0.1437	0.3576	0.0741
Cu	0.1444	0.0030	0.0120	0.0047	0.0021	0.0124	0.0528	0.0067
Fe	0.7847	0.0150	0.6125	0.0084	0.0000	0.0222	0.4658	0.0152
Ga	0.0000	0.0000	0.0000	0.0186	0.0000	0.0490	0.0000	0.0225
Ge	0.0000	0.0000	0.0000	0.0115	0.0000	0.0304	0.0000	0.0140

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0210	0.0000	0.0223	0.0000	0.0588	0.0000	0.0340
K	0.0000	0.0300	0.0000	0.0067	0.9705	0.0176	0.3235	0.0181
La	0.0000	0.0300	0.0000	0.0926	0.0000	0.2443	0.0000	0.1223
Mg	0.0000	0.2995	0.0000	2.0969	0.0000	5.5340	0.0000	2.6435
Mn	0.0000	0.0150	0.0371	0.0067	0.0000	0.0176	0.0124	0.0131
Mo	0.0000	0.0300	0.0323	0.0075	0.0000	0.0198	0.0108	0.0191
Na	0.0000	2.9952	0.0000	4.5005	1.2770	11.8776	0.4257	6.4578
Ni	0.0000	0.0060	0.0194	0.0030	0.0000	0.0080	0.0065	0.0057
P	0.2800	0.0090	0.0000	0.0093	0.0734	0.0246	0.1178	0.0143
Pb	0.4014	0.0060	0.2109	0.0075	0.0000	0.0197	0.2041	0.0110
Pd	0.7787	0.0150	0.0000	0.0313	0.0000	0.0825	0.2596	0.0429
Rb	0.0000	0.0090	0.0000	0.0027	0.0000	0.0071	0.0000	0.0063
Rh	0.0000	0.0000	0.0000	0.0302	0.0000	0.0798	0.0000	0.0367
S	0.0000	0.0060	0.6533	0.0234	0.0000	0.0616	0.2178	0.0303
Sb	0.0000	0.0180	0.0000	0.0379	0.0000	0.0999	0.0000	0.0519
Sc	0.0000	0.0000	0.0117	0.0043	0.0000	0.0114	0.0039	0.0052
Se	0.0000	0.0030	0.0000	0.0027	0.0000	0.0070	0.0000	0.0042
Sn	1.2220	0.0180	0.0000	0.0307	0.0000	0.0811	0.4073	0.0433
Sr	0.7787	0.0150	0.0000	0.0179	0.0560	0.0471	0.2782	0.0266
Te	0.0000	0.0000	0.0000	0.0410	0.0000	0.1081	0.0000	0.0497
Ti	3.6541	0.0150	0.0000	0.0065	0.0000	0.0172	1.2180	0.0129
V	0.0000	0.0150	0.0000	0.0019	0.0000	0.0050	0.0000	0.0073
W	0.0000	0.0000	0.0000	0.0709	0.0000	0.1871	0.0000	0.0860
Y	0.0000	0.0210	0.0354	0.0110	0.0000	0.0290	0.0118	0.0203
Zn	0.0000	0.0030	0.0000	0.0062	0.0000	0.0164	0.0000	0.0085
Ions								
F	0.0000	0.9781	0.0000	0.4509	0.0000	1.1899	0.0000	0.8730
Cl	2.3305	0.8497	3.4961	0.5138	1.1038	0.9890	2.3101	0.7842
NO2	0.0000	0.1287	0.0000	0.0593	0.0000	0.1565	0.0000	0.1148
Br	0.0000	0.0506	2.8047	0.1659	0.0000	0.0615	0.9349	0.0927
NO3	2.7648	0.2476	0.6592	0.0829	0.2632	0.1544	1.2291	0.1616
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	1.1723	0.3169	5.2279	0.3839	1.3499	0.4336	2.5834	0.3781
Na	3.2140	1.0495	0.0000	0.4094	2.3860	1.2916	1.8666	0.9168
NH4	1.8750	0.0956	0.0000	0.0000	0.0000	0.0000	0.6250	0.0319
K	4.5212	0.6451	1.5859	0.2722	0.0000	0.5078	2.0357	0.4750
Ca	0.0000	0.5459	3.4905	0.4276	0.0000	0.6641	1.1635	0.5458
Mg	0.0000	0.1031	0.9238	0.0942	0.0000	0.1254	0.3079	0.1076
Identified percent of total mass	93.3929	14.3849	92.2489	15.6006	77.7208	35.0867	87.7876	21.7268

Passenger Car-Gasoline (Post-2000)								
Profile Number	V43		V44		V45		Comp-PCG-3 (V43,V44,V45)	
Identified Percentage of Total Mass	91.7734		87.4487		91.8583		90.3601	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	42.4920	3.4419	57.0896	4.6243	54.0441	4.3776	51.2086	4.1479
Elemental carbon	9.5847	0.7955	13.8060	1.1459	13.6029	1.1290	12.3312	1.0235
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0298	0.0000	0.0348	1.8247	0.1268	0.6082	0.0638
Acenaphthalene	0.0000	0.0242	0.0000	0.0282	0.0000	0.0278	0.0000	0.0267
Fluorene + Acenaphthene	0.0000	0.0283	0.0000	0.0331	0.6550	0.0656	0.2183	0.0423
Phenanthrene	0.0000	0.0439	0.0000	0.0513	0.0281	0.0520	0.0094	0.0491
Anthracene	0.0000	0.0314	0.0000	0.0367	0.0646	0.0394	0.0215	0.0359
Fluoroanthene	0.0000	0.0260	0.0000	0.0304	0.0000	0.0299	0.0000	0.0288
Pyrene	0.0000	0.0182	0.0000	0.0212	0.0161	0.0217	0.0054	0.0204
Benzo(a)Anthracene	0.0000	0.0203	0.0000	0.0237	4.5217	0.2535	1.5072	0.0992
Chrysene	0.0000	0.0131	0.0000	0.0152	0.2905	0.0297	0.0968	0.0193
Benzo(b)Fluoroanthene	0.0000	0.0069	0.0000	0.0080	4.0855	0.2161	1.3618	0.0770
Benzo(k)Fluoroanthene	0.0000	0.0082	0.0000	0.0096	0.8631	0.0533	0.2877	0.0237
Benzo(a)Pyrene	0.0000	0.0078	0.0000	0.0091	0.0714	0.0126	0.0238	0.0099
Dibenz(a,h)anthracene	0.0000	0.0086	0.0000	0.0100	0.0000	0.0099	0.0000	0.0095
Benzo(ghi)Pyrene	0.0000	0.0048	0.0000	0.0056	0.2319	0.0173	0.0773	0.0093
Indenol(1,2,3)Pyrene	0.0000	0.0081	0.0000	0.0095	0.0490	0.0118	0.0163	0.0098
Elements								
Ag	0.0000	0.0768	0.0000	0.0897	0.0000	0.0884	0.0000	0.0850
Al	0.0000	0.3722	0.0000	0.4347	0.0000	0.4283	0.0000	0.4118
As	0.0319	0.0054	0.0228	0.0063	0.0000	0.0062	0.0182	0.0060
Au	0.0000	0.0783	0.0000	0.0915	0.0000	0.0901	0.0000	0.0866
Ba	0.0000	0.1634	0.0000	0.1909	0.0000	0.1880	0.0000	0.1808
Br	0.0000	0.0217	0.0000	0.0253	0.0000	0.0249	0.0000	0.0240
Ca	9.3193	0.0165	0.0000	0.0193	0.0000	0.0190	3.1064	0.0183
Cd	0.3666	0.1164	0.3850	0.1359	0.4197	0.1339	0.3904	0.1288
Cl	0.8680	0.0688	0.9473	0.0804	1.1903	0.0792	1.0019	0.0761
Co	0.0000	0.0080	0.0000	0.0093	0.0000	0.0092	0.0000	0.0088
Cr	0.0000	0.0102	0.0000	0.0119	0.0000	0.0117	0.0000	0.0112
Cs	0.0000	0.1782	0.0000	0.2081	0.0000	0.2050	0.0000	0.1971
Cu	0.0000	0.0153	0.0000	0.0179	0.0000	0.0176	0.0000	0.0169
Fe	1.5783	0.0275	0.0000	0.0321	0.0000	0.0317	0.5261	0.0304
Ga	0.0000	0.0607	0.3566	0.0709	0.0000	0.0699	0.1189	0.0672
Ge	0.5811	0.0377	0.0000	0.0440	0.3402	0.0433	0.3071	0.0417

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0729	0.3177	0.0851	0.6003	0.0839	0.3060	0.0806
K	0.0000	0.0218	0.0000	0.0255	0.0000	0.0251	0.0000	0.0241
La	0.0000	0.3028	0.0000	0.3537	0.0000	0.3485	0.0000	0.3350
Mg	0.0000	6.8601	0.0000	8.0120	0.0000	7.8942	0.0000	7.5887
Mn	0.4669	0.0218	0.0000	0.0255	0.0000	0.0251	0.1556	0.0241
Mo	0.0000	0.0245	0.0000	0.0286	0.0000	0.0282	0.0000	0.0271
Na	0.0000	14.7237	0.0000	17.1960	0.0000	16.9431	0.0000	16.2876
Ni	0.0532	0.0099	0.0000	0.0116	0.0000	0.0114	0.0177	0.0109
P	0.0000	0.0305	0.0000	0.0356	0.0000	0.0351	0.0000	0.0337
Pb	0.0000	0.0244	0.0000	0.0285	0.0558	0.0281	0.0186	0.0270
Pd	0.0000	0.1023	0.0000	0.1195	0.2689	0.1177	0.0896	0.1132
Rb	0.0000	0.0088	0.0000	0.0103	0.0000	0.0101	0.0000	0.0097
Rh	0.0000	0.0989	0.0000	0.1155	0.0000	0.1138	0.0000	0.1094
S	0.7580	0.0764	0.8012	0.0893	1.0334	0.0879	0.8642	0.0845
Sb	0.0000	0.1238	0.0000	0.1446	0.0000	0.1425	0.0000	0.1370
Sc	0.1410	0.0141	0.0000	0.0165	0.0000	0.0162	0.0470	0.0156
Se	0.0000	0.0087	0.0000	0.0101	0.0000	0.0100	0.0000	0.0096
Sn	0.0000	0.1005	0.0000	0.1174	0.0000	0.1157	0.0000	0.1112
Sr	0.0000	0.0584	0.0000	0.0682	0.0000	0.0672	0.0000	0.0646
Te	0.0000	0.1340	0.0000	0.1565	0.0000	0.1542	0.0000	0.1482
Ti	10.4817	0.0213	0.0000	0.0248	0.0000	0.0245	3.4939	0.0235
V	2.2301	0.0062	0.0000	0.0073	0.0174	0.0072	0.7491	0.0069
W	0.0000	0.2320	0.0000	0.2709	0.0000	0.2669	0.0000	0.2566
Y	0.1893	0.0359	0.1495	0.0419	0.1662	0.0413	0.1683	0.0397
Zn	0.0000	0.0203	0.0000	0.0237	0.0000	0.0234	0.0000	0.0225
Ions								
F	3.9457	1.6728	0.0000	1.7227	0.0000	1.6974	1.3152	1.6976
Cl	0.0000	1.1051	0.0373	1.2926	0.0000	1.2717	0.0124	1.2231
NO2	0.0319	0.1956	0.0000	0.2266	0.0000	0.2233	0.0106	0.2151
Br	0.0000	0.0763	1.5187	0.1657	0.0000	0.0878	0.5062	0.1099
NO3	3.0192	0.3149	0.9515	0.2376	1.1949	0.2470	1.7218	0.2665
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	1.0968	0.4441	6.4863	0.7815	3.9276	0.6454	3.8369	0.6237
Na	4.0479	1.5424	2.6007	1.6947	0.0000	1.5414	2.2162	1.5928
NH4	0.0479	0.0024	0.0000	0.0000	0.0000	0.0000	0.0160	0.0008
K	0.3003	0.6445	0.0000	0.7352	1.5956	0.8043	0.6320	0.7280
Ca	0.1415	0.8303	1.4526	1.0341	0.6037	0.9775	0.7326	0.9473
Mg	0.0000	0.1555	0.5261	0.2079	0.0956	0.1837	0.2072	0.1823
Identified percent of total mass	91.7734	35.6126	87.4487	42.3556	91.8583	41.2540	90.3601	39.7407

Passenger Car-Diesel (1991-96)								
Profile Number	V46		V47		V48		Comp-PCD-1 (V46,V47,V48)	
Identified Percentage of Total Mass	84.0653		77.0483		72.8493		77.9876	
Species	% Mass (PM10)	Uncertai nty (%)	% Mass (PM10)	Uncertai nty (%)	% Mass (PM10)	Uncertai nty (%)	% Mass (PM10)	Uncertai nty (%)
Carbon								
Organic carbon	49.8858	4.0408	58.3662	4.7277	50.4237	4.0843	52.8919	4.2842
Elemental carbon	19.2170	1.5950	17.2056	1.4281	15.9546	1.3242	17.4591	1.4491
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0030	0.0006	0.0006	0.0000	0.0017	0.0002	0.0018
Acenaphthalene	0.0000	0.0025	0.0000	0.0004	0.0000	0.0014	0.0000	0.0014
Fluorene + Acenaphthene	0.0000	0.0029	0.0181	0.0014	0.0000	0.0016	0.0060	0.0020
Phenanthrene	0.0000	0.0045	0.0000	0.0008	0.0000	0.0025	0.0000	0.0026
Anthracene	0.0000	0.0032	0.0000	0.0006	0.0000	0.0018	0.0000	0.0018
Fluoroanthene	0.0000	0.0027	0.0000	0.0005	0.0000	0.0015	0.0000	0.0015
Pyrene	0.0000	0.0019	0.0000	0.0003	0.0000	0.0010	0.0000	0.0011
Benzo(a)Anthracene	0.0000	0.0021	0.0000	0.0004	0.0000	0.0011	0.0000	0.0012
Chrysene	0.0000	0.0013	0.0000	0.0002	0.0000	0.0007	0.0000	0.0008
Benzo(b)Fluoroanthene	0.0000	0.0007	0.0000	0.0001	0.0000	0.0004	0.0000	0.0004
Benzo(k)Fluoroanthene	0.0000	0.0008	0.0000	0.0001	0.0000	0.0005	0.0000	0.0005
Benzo(a)Pyrene	0.0000	0.0008	0.0000	0.0001	0.0000	0.0004	0.0000	0.0005
Dibenz(a,h)anthracene	0.0000	0.0009	0.0237	0.0014	0.0000	0.0005	0.0079	0.0009
Benzo(ghi)Pyrene	0.0000	0.0005	0.0000	0.0001	0.0000	0.0003	0.0000	0.0003
Indenol(1,2,3)Pyrene	0.0000	0.0008	0.0072	0.0005	0.0000	0.0005	0.0024	0.0006
Elements								
Ag	0.0000	0.0078	0.0000	0.0014	0.0000	0.0000	0.0000	0.0031
Al	0.0000	0.0380	0.0000	0.0066	0.1683	0.0000	0.0561	0.0149
As	0.0185	0.0006	0.0012	0.0001	0.0000	0.0000	0.0066	0.0002
Au	0.0000	0.0080	0.0000	0.0014	0.0000	0.0000	0.0000	0.0031
Ba	3.6770	0.0167	0.0000	0.0029	1.4770	0.0000	1.7180	0.0065
Br	0.0000	0.0022	0.0000	0.0004	0.0000	0.0000	0.0000	0.0009
Ca	1.6967	0.0017	0.1534	0.0003	0.2377	0.0000	0.6959	0.0007
Cd	0.0000	0.0119	0.0052	0.0021	0.0000	0.0000	0.0017	0.0046
Cl	0.0000	0.0070	0.0090	0.0012	0.0000	0.0000	0.0030	0.0027
Co	0.0000	0.0008	0.0000	0.0001	0.0000	0.0000	0.0000	0.0003
Cr	0.0000	0.0010	0.0000	0.0002	0.0000	0.0000	0.0000	0.0004
Cs	0.0000	0.0182	0.0000	0.0031	0.0000	0.0000	0.0000	0.0071
Cu	0.0086	0.0016	0.0000	0.0003	0.0108	0.0000	0.0065	0.0006
Fe	0.0000	0.0028	0.0121	0.0005	0.0000	0.0000	0.0040	0.0011
Ga	0.0000	0.0062	0.0000	0.0011	0.0000	0.0000	0.0000	0.0024
Ge	0.0000	0.0038	0.0031	0.0007	0.0000	0.0000	0.0010	0.0015

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0074	0.0000	0.0013	0.0000	0.0000	0.0000	0.0029
K	3.4931	0.0022	0.0000	0.0004	1.6080	0.0000	1.7004	0.0009
La	0.0000	0.0309	0.0000	0.0053	0.0000	0.0000	0.0000	0.0121
Mg	0.0000	0.7006	0.0000	0.1210	0.0000	0.0000	0.0000	0.2738
Mn	0.0000	0.0022	0.0000	0.0004	0.0000	0.0000	0.0000	0.0009
Mo	0.0000	0.0025	0.0000	0.0004	0.0000	0.0000	0.0000	0.0010
Na	0.0000	1.5036	0.0000	0.2596	0.0000	0.0000	0.0000	0.5877
Ni	0.0000	0.0010	0.0000	0.0002	0.0000	0.0000	0.0000	0.0004
P	0.0644	0.0031	0.0000	0.0005	0.0548	0.0000	0.0397	0.0012
Pb	0.0756	0.0025	0.0000	0.0004	0.0000	0.0000	0.0252	0.0010
Pd	0.0000	0.0104	0.0000	0.0018	0.0000	0.0000	0.0000	0.0041
Rb	0.0000	0.0009	0.0000	0.0002	0.0000	0.0000	0.0000	0.0004
Rh	0.0000	0.0101	0.0000	0.0017	0.0000	0.0000	0.0000	0.0039
S	0.0000	0.0078	0.0511	0.0013	0.0000	0.0000	0.0170	0.0031
Sb	0.0000	0.0126	0.0000	0.0022	0.0000	0.0000	0.0000	0.0049
Sc	0.0000	0.0014	0.0036	0.0002	0.0000	0.0000	0.0012	0.0006
Se	0.0000	0.0009	0.0000	0.0002	0.0000	0.0000	0.0000	0.0003
Sn	0.0000	0.0103	0.0000	0.0018	0.0000	0.0000	0.0000	0.0040
Sr	0.0000	0.0060	0.0000	0.0010	0.0000	0.0000	0.0000	0.0023
Te	0.0000	0.0137	0.0000	0.0024	0.0000	0.0000	0.0000	0.0053
Ti	0.8930	0.0022	0.0000	0.0004	0.6966	0.0000	0.5299	0.0008
V	0.0000	0.0006	0.0000	0.0001	0.0000	0.0000	0.0000	0.0002
W	0.0000	0.0237	0.0000	0.0041	0.0000	0.0000	0.0000	0.0093
Y	0.0000	0.0037	0.0023	0.0006	0.0000	0.0000	0.0008	0.0014
Zn	1.8589	0.0021	0.0000	0.0004	0.8707	0.0000	0.9099	0.0008
Ions								
F	0.0000	0.0080	0.0000	0.0260	0.0000	0.0832	0.0000	0.0391
Cl	0.2104	0.0385	0.0659	0.0228	0.0820	0.0665	0.1195	0.0426
NO ₂	0.0000	0.0047	0.0006	0.0034	0.0000	0.0109	0.0002	0.0064
Br	0.1100	0.0321	0.2167	0.0124	0.0310	0.0059	0.1192	0.0168
NO ₃	0.0816	0.0147	0.0797	0.0069	0.1361	0.0160	0.0991	0.0125
PO ₄	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO ₄	0.4497	0.0509	0.2596	0.0200	0.3792	0.0411	0.3628	0.0374
Na	2.2812	0.3262	0.2046	0.0339	0.6277	0.1072	1.0379	0.1558
NH ₄	0.0000	0.0093	0.0000	0.0000	0.0306	0.0016	0.0102	0.0036
K	0.0000	0.1073	0.0109	0.0116	0.0000	0.0355	0.0036	0.0515
Ca	0.0438	0.0415	0.2977	0.0296	0.0422	0.0486	0.1279	0.0399
Mg	0.0000	0.0151	0.0502	0.0053	0.0182	0.0097	0.0228	0.0100
Identified percent of total mass	84.0653	8.8033	77.0483	6.7578	72.8493	5.8504	77.9876	7.1396

Passenger Car-Diesel (1996-2000)								
Profile Number	V49		V50		V51		Comp-PCD-2 (V49,v50,V51)	
Identified Percentage of Total Mass	78.2984		56.0508		53.7530		62.7007	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	56.5103	4.5773	35.9781	2.9142	39.0513	3.1632	43.8466	3.5516
Elemental carbon	15.8753	1.3177	14.5902	1.2110	13.0300	1.0815	14.4985	1.2034
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0141	0.0034	0.0220	0.0062	0.0000	0.0005	0.0120	0.0034
Acenaphthalene	0.0271	0.0036	0.0411	0.0062	0.0000	0.0004	0.0227	0.0034
Fluorene + Acenaphthene	0.0439	0.0048	0.2005	0.0150	0.0000	0.0005	0.0814	0.0068
Phenanthrene	0.0014	0.0041	0.0041	0.0077	0.0000	0.0008	0.0018	0.0042
Anthracene	0.0000	0.0029	0.0029	0.0055	0.0000	0.0005	0.0010	0.0030
Fluoroanthene	0.0000	0.0024	0.0209	0.0055	0.0001	0.0005	0.0070	0.0028
Pyrene	0.0002	0.0017	0.3259	0.0197	0.0031	0.0005	0.1097	0.0073
Benzo(a)Anthracene	0.0000	0.0018	0.0017	0.0036	0.0000	0.0004	0.0006	0.0019
Chrysene	0.0000	0.0012	0.0030	0.0024	0.0049	0.0005	0.0026	0.0013
Benzo(b)Fluoroanthene	0.0000	0.0006	0.0021	0.0013	0.0000	0.0001	0.0007	0.0007
Benzo(k)Fluoroanthene	0.0000	0.0007	0.0065	0.0017	0.0006	0.0002	0.0024	0.0009
Benzo(a)Pyrene	0.0000	0.0007	0.0078	0.0017	0.0035	0.0003	0.0038	0.0009
Dibenz(a,h)anthracene	0.0000	0.0008	0.0199	0.0025	0.0008	0.0002	0.0069	0.0011
Benzo(ghi)Pyrene	0.0000	0.0004	0.0075	0.0012	0.0060	0.0004	0.0045	0.0007
Indenol(1,2,3)Pyrene	0.0000	0.0007	0.0039	0.0016	0.0005	0.0002	0.0014	0.0008
Elements								
Ag	0.0000	0.0070	0.0000	0.0039	0.0000	0.0013	0.0000	0.0041
Al	0.0000	0.0339	0.0000	0.0155	0.0000	0.0064	0.0000	0.0186
As	0.0000	0.0005	0.0088	0.0008	0.0000	0.0001	0.0029	0.0005
Au	0.0000	0.0071	0.0000	0.0000	0.0000	0.0014	0.0000	0.0028
Ba	0.0000	0.0149	0.0000	0.0062	0.0000	0.0028	0.0000	0.0080
Br	0.0000	0.0020	0.0000	0.0008	0.0000	0.0004	0.0000	0.0010
Ca	0.0000	0.0015	1.4832	0.0077	0.1293	0.0003	0.5375	0.0032
Cd	0.0268	0.0106	0.0000	0.0039	0.0042	0.0020	0.0103	0.0055
Cl	0.0382	0.0063	0.1374	0.0015	0.0034	0.0012	0.0597	0.0030
Co	0.0000	0.0007	0.0000	0.0023	0.0010	0.0001	0.0003	0.0011
Cr	0.0000	0.0009	0.0000	0.0039	0.0000	0.0002	0.0000	0.0017
Cs	0.0000	0.0162	0.0000	0.0062	0.0000	0.0031	0.0000	0.0085
Cu	0.0000	0.0014	0.0496	0.0008	0.0000	0.0003	0.0165	0.0008
Fe	0.0000	0.0025	0.0000	0.0039	0.0000	0.0005	0.0000	0.0023
Ga	0.0000	0.0055	0.0000	0.0000	0.0000	0.0011	0.0000	0.0022
Ge	0.0000	0.0034	0.0000	0.0000	0.0017	0.0007	0.0006	0.0014

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0066	0.2163	0.0054	0.0034	0.0013	0.0732	0.0044
K	0.0000	0.0020	0.7416	0.0077	0.0000	0.0004	0.2472	0.0034
La	0.0000	0.0276	0.0000	0.0077	0.0000	0.0052	0.0000	0.0135
Mg	0.0000	0.6255	0.0000	0.0773	0.0000	0.1189	0.0000	0.2739
Mn	0.0000	0.0020	0.0000	0.0039	0.0017	0.0004	0.0006	0.0021
Mo	0.0000	0.0022	0.0000	0.0077	0.0000	0.0004	0.0000	0.0035
Na	0.0000	1.3424	0.0000	0.7725	0.0000	0.2551	0.0000	0.7900
Ni	0.0000	0.0009	0.0000	0.0015	0.0000	0.0002	0.0000	0.0009
P	0.0000	0.0028	0.0253	0.0023	0.0000	0.0005	0.0084	0.0019
Pb	0.0355	0.0022	0.0170	0.0015	0.0035	0.0004	0.0187	0.0014
Pd	0.0260	0.0093	0.0000	0.0039	0.0000	0.0018	0.0087	0.0050
Rb	0.0000	0.0008	0.0000	0.0023	0.0000	0.0002	0.0000	0.0011
Rh	0.0000	0.0090	0.0000	0.0000	0.0000	0.0017	0.0000	0.0036
S	0.4402	0.0070	0.0000	0.0015	0.1266	0.0013	0.1889	0.0033
Sb	0.0000	0.0113	0.0000	0.0046	0.0000	0.0021	0.0000	0.0060
Sc	0.0216	0.0013	0.0000	0.0000	0.0000	0.0002	0.0072	0.0005
Se	0.0000	0.0008	0.0000	0.0008	0.0000	0.0002	0.0000	0.0006
Sn	0.0000	0.0092	0.0000	0.0046	0.0000	0.0017	0.0000	0.0052
Sr	0.0000	0.0053	0.0000	0.0039	0.0000	0.0010	0.0000	0.0034
Te	0.0000	0.0122	0.0000	0.0000	0.0057	0.0023	0.0019	0.0048
Ti	0.0000	0.0019	0.4172	0.0039	0.0143	0.0004	0.1438	0.0021
V	0.0000	0.0006	0.0000	0.0039	0.0000	0.0001	0.0000	0.0015
W	0.0000	0.0212	0.0000	0.0000	0.0000	0.0040	0.0000	0.0084
Y	0.0000	0.0033	0.0000	0.0054	0.0000	0.0006	0.0000	0.0031
Zn	0.0000	0.0019	0.0000	0.0008	0.0000	0.0004	0.0000	0.0010
Ions								
F	0.0320	0.1361	0.1011	0.2573	0.0000	0.0256	0.0444	0.1397
Cl	0.0000	0.1008	0.4945	0.2138	0.0883	0.0236	0.1943	0.1127
NO2	0.0262	0.0190	0.0000	0.0332	0.0000	0.0034	0.0087	0.0185
Br	0.4594	0.0303	0.0000	0.0130	0.2071	0.0119	0.2222	0.0184
NO3	0.4442	0.0373	0.2486	0.0403	0.0872	0.0072	0.2600	0.0283
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	1.6235	0.1178	0.0000	0.0666	0.3993	0.0270	0.6742	0.0704
Na	0.1608	0.1302	0.6049	0.2594	0.1249	0.0295	0.2969	0.1397
NH4	0.0000	0.0000	0.0000	0.0000	0.0147	0.0007	0.0049	0.0002
K	0.9216	0.1039	0.0295	0.1091	0.0904	0.0155	0.3472	0.0762
Ca	1.5291	0.1523	0.1581	0.1487	0.2764	0.0282	0.6545	0.1097
Mg	0.0411	0.0162	0.0798	0.0306	0.0690	0.0062	0.0633	0.0177
Identified percent of total mass	78.2984	8.9626	56.0508	6.3594	53.7530	4.8459	62.7007	6.7345

<i>Passenger Car-Diesel (Post-2000)</i>								
Profile Number	V52		V53		V54		Comp-PCD-3 (V52,V53,54)	
Identified Percentage of Total Mass	89.4694		79.6773		83.8814		84.3427	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	58.4708	4.7361	57.0906	4.6243	46.5786	3.7729	54.0467	4.3778
Elemental carbon	24.1686	2.0060	17.7632	1.4743	29.5246	2.4505	23.8188	1.9770
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0079	0.0028	0.0117	0.0017	0.0095	0.0025	0.0097	0.0023
Acenaphthalene	0.0885	0.0065	0.0353	0.0027	0.0212	0.0027	0.0483	0.0040
Fluorene + Acenaphthene	0.0306	0.0039	0.0001	0.0011	0.0345	0.0036	0.0217	0.0029
Phenanthrene	0.0000	0.0036	0.0039	0.0019	0.0090	0.0034	0.0043	0.0030
Anthracene	0.0029	0.0027	0.0021	0.0013	0.0012	0.0022	0.0021	0.0021
Fluoroanthene	0.0000	0.0021	0.0235	0.0022	0.0208	0.0028	0.0147	0.0024
Pyrene	0.0003	0.0015	0.0000	0.0007	0.0000	0.0012	0.0001	0.0011
Benzo(a)Anthracene	0.0000	0.0017	0.0000	0.0008	0.0000	0.0014	0.0000	0.0013
Chrysene	0.0000	0.0011	0.0000	0.0005	0.0000	0.0009	0.0000	0.0008
Benzo(b)Fluoroanthene	0.0000	0.0006	0.0413	0.0024	0.0016	0.0005	0.0143	0.0012
Benzo(k)Fluoroanthene	0.0000	0.0007	0.0000	0.0003	0.0000	0.0005	0.0000	0.0005
Benzo(a)Pyrene	0.0000	0.0006	0.0000	0.0003	0.0000	0.0005	0.0000	0.0005
Dibenz(a,h)anthracene	0.0000	0.0007	0.0000	0.0003	0.0000	0.0006	0.0000	0.0005
Benzo(ghi)Pyrene	0.0000	0.0004	0.0000	0.0002	0.0000	0.0003	0.0000	0.0003
Indenol(1,2,3)Pyrene	0.0000	0.0007	0.0000	0.0003	0.0000	0.0005	0.0000	0.0005
Elements								
Ag	0.0000	0.0063	0.0000	0.0029	0.0000	0.0051	0.0000	0.0048
Al	0.0000	0.0305	0.0000	0.0142	0.0000	0.0248	0.0000	0.0232
As	0.0000	0.0004	0.0133	0.0002	0.0011	0.0004	0.0048	0.0003
Au	0.0000	0.0064	0.0000	0.0030	0.0000	0.0052	0.0000	0.0049
Ba	0.0000	0.0134	0.0000	0.0062	0.0000	0.0109	0.0000	0.0102
Br	0.0000	0.0018	0.0000	0.0008	0.0000	0.0014	0.0000	0.0014
Ca	0.7914	0.0014	0.0693	0.0006	0.0000	0.0011	0.2869	0.0010
Cd	0.0218	0.0095	0.0290	0.0044	0.0232	0.0078	0.0247	0.0072
Cl	0.0330	0.0056	0.0353	0.0026	0.0198	0.0046	0.0294	0.0043
Co	0.0000	0.0007	0.0000	0.0003	0.0000	0.0005	0.0000	0.0005
Cr	0.0000	0.0008	0.0000	0.0004	0.0000	0.0007	0.0000	0.0006
Cs	0.0000	0.0146	0.0000	0.0068	0.0000	0.0119	0.0000	0.0111
Cu	0.0000	0.0013	0.0185	0.0006	0.0376	0.0010	0.0187	0.0010
Fe	0.1042	0.0023	0.1148	0.0010	0.0000	0.0018	0.0730	0.0017
Ga	0.0000	0.0050	0.0000	0.0023	0.0000	0.0041	0.0000	0.0038
Ge	0.0074	0.0031	0.0000	0.0014	0.0000	0.0025	0.0025	0.0023

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0060	0.0118	0.0028	0.0000	0.0049	0.0039	0.0045
K	0.0000	0.0018	0.0000	0.0008	0.0000	0.0015	0.0000	0.0014
La	0.0000	0.0248	0.0000	0.0115	0.0000	0.0202	0.0000	0.0189
Mg	0.0000	0.5622	0.0000	0.2616	0.0000	0.4577	0.0000	0.4272
Mn	0.0000	0.0018	0.0000	0.0008	0.0264	0.0015	0.0088	0.0014
Mo	0.0000	0.0020	0.0000	0.0009	0.0000	0.0016	0.0000	0.0015
Na	0.0000	1.2067	0.0000	0.5615	0.0000	0.9824	0.0000	0.9169
Ni	0.0000	0.0008	0.0020	0.0004	0.0092	0.0007	0.0037	0.0006
P	0.0000	0.0025	0.0000	0.0012	0.0000	0.0020	0.0000	0.0019
Pb	0.0000	0.0020	0.0486	0.0009	0.0060	0.0016	0.0182	0.0015
Pd	0.0000	0.0084	0.0096	0.0039	0.0000	0.0068	0.0032	0.0064
Rb	0.0000	0.0007	0.0000	0.0003	0.0000	0.0006	0.0000	0.0005
Rh	0.0000	0.0081	0.0000	0.0038	0.0000	0.0066	0.0000	0.0062
S	0.4624	0.0063	0.9249	0.0029	0.9109	0.0051	0.7661	0.0048
Sb	0.0000	0.0102	0.0000	0.0047	0.0000	0.0083	0.0000	0.0077
Sc	0.0047	0.0012	0.0086	0.0005	0.0000	0.0009	0.0045	0.0009
Se	0.0000	0.0007	0.0000	0.0003	0.0000	0.0006	0.0000	0.0005
Sn	0.0000	0.0082	0.0000	0.0038	0.0000	0.0067	0.0000	0.0063
Sr	0.0000	0.0048	0.0000	0.0022	0.0000	0.0039	0.0000	0.0036
Te	0.0000	0.0110	0.0000	0.0051	0.0000	0.0089	0.0000	0.0083
Ti	0.0402	0.0017	0.0483	0.0008	0.0000	0.0014	0.0295	0.0013
V	0.0000	0.0005	0.0008	0.0002	0.0000	0.0004	0.0003	0.0004
W	0.0000	0.0190	0.0000	0.0088	0.0000	0.0155	0.0000	0.0144
Y	0.0063	0.0029	0.0044	0.0014	0.0114	0.0024	0.0074	0.0022
Zn	0.0000	0.0017	0.0000	0.0008	0.0000	0.0014	0.0000	0.0013
Ions								
F	0.0209	0.1219	0.0000	0.0562	0.0608	0.1015	0.0272	0.0932
Cl	0.0000	0.0906	0.0000	0.0421	0.0000	0.0737	0.0000	0.0688
NO ₂	0.0327	0.0175	0.0000	0.0074	0.0000	0.0129	0.0109	0.0126
Br	1.0401	0.0592	0.8811	0.0478	1.4713	0.0800	1.1308	0.0623
NO ₃	0.3142	0.0292	0.1066	0.0116	0.0000	0.0108	0.1403	0.0172
PO ₄	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO ₄	1.1124	0.0882	0.8142	0.0561	1.6272	0.1086	1.1846	0.0843
Na	0.5844	0.1391	0.0947	0.0558	0.0000	0.0894	0.2264	0.0948
NH ₄	0.0432	0.0022	0.0000	0.0000	0.0000	0.0000	0.0144	0.0007
K	0.3467	0.0690	0.9380	0.0715	1.5901	0.1225	0.9582	0.0877
Ca	1.2318	0.1296	0.5317	0.0582	1.7852	0.1453	1.1829	0.1110
Mg	0.5017	0.0382	0.0000	0.0059	0.1004	0.0154	0.2007	0.0198
Identified percent of total mass	89.4694	9.5260	79.6773	7.4416	83.8814	8.6111	84.3427	8.5262

LCV-Diesel (1991-96)								
Profile Number	V55		V56		V57		Comp-LCVD-1 (V55,V56,V57)	
Identified Percentage of Total Mass	83.0718		78.2418		72.9005		78.0714	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	48.1049	3.8965	39.0898	3.1663	52.2623	4.2332	46.4857	3.7653
Elemental carbon	30.7059	2.5486	34.0773	2.8284	19.3260	1.6041	28.0364	2.3270
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0166	0.0038	0.0275	0.0053	0.0039	0.0007	0.0160	0.0032
Acenaphthalene	0.0304	0.0039	0.0308	0.0047	0.0174	0.0013	0.0262	0.0033
Fluorene + Acenaphthene	0.0858	0.0072	0.1178	0.0096	0.0000	0.0005	0.0678	0.0058
Phenanthrene	0.0005	0.0044	0.0017	0.0058	0.0000	0.0007	0.0007	0.0036
Anthracene	0.0002	0.0031	0.0006	0.0041	0.0005	0.0005	0.0004	0.0026
Fluoroanthene	0.0016	0.0027	0.0359	0.0052	0.0000	0.0004	0.0125	0.0028
Pyrene	0.0012	0.0019	0.3473	0.0200	0.0000	0.0003	0.1161	0.0074
Benzo(a)Anthracene	0.0013	0.0021	0.0017	0.0027	0.0000	0.0003	0.0010	0.0017
Chrysene	0.0004	0.0013	0.0006	0.0017	0.0000	0.0002	0.0003	0.0011
Benzo(b)Fluoroanthene	0.0018	0.0008	0.0076	0.0013	0.0000	0.0001	0.0031	0.0007
Benzo(k)Fluoroanthene	0.0017	0.0009	0.0021	0.0012	0.0000	0.0001	0.0013	0.0007
Benzo(a)Pyrene	0.0063	0.0011	0.0020	0.0011	0.0025	0.0003	0.0036	0.0008
Dibenz(a,h)anthracene	0.0000	0.0009	0.0076	0.0015	0.0000	0.0001	0.0025	0.0008
Benzo(ghi)Pyrene	0.0000	0.0005	0.0000	0.0006	0.0000	0.0001	0.0000	0.0004
Indenol(1,2,3)Pyrene	0.0000	0.0008	0.0000	0.0011	0.0000	0.0001	0.0000	0.0007
Elements								
Ag	0.0000	0.0022	0.0000	0.0029	0.0000	0.0013	0.0000	0.0021
Al	0.0000	0.0090	0.0000	0.0118	0.0000	0.0061	0.0000	0.0089
As	0.0000	0.0004	0.0033	0.0006	0.0000	0.0001	0.0011	0.0004
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000	0.0004
Ba	0.0000	0.0036	0.0000	0.0047	0.0000	0.0027	0.0000	0.0037
Br	0.0071	0.0004	0.0000	0.0006	0.0000	0.0004	0.0024	0.0005
Ca	0.0000	0.0045	0.2468	0.0059	0.1073	0.0003	0.1180	0.0035
Cd	0.0000	0.0022	0.0000	0.0029	0.0063	0.0019	0.0021	0.0024
Cl	0.9754	0.0009	0.3156	0.0012	0.0155	0.0011	0.4355	0.0011
Co	0.0000	0.0013	0.0000	0.0018	0.0000	0.0001	0.0000	0.0011
Cr	0.0000	0.0022	0.0000	0.0029	0.0000	0.0002	0.0000	0.0018
Cs	0.0000	0.0036	0.4019	0.0047	0.0000	0.0029	0.1340	0.0037
Cu	0.0215	0.0004	0.0314	0.0006	0.0013	0.0003	0.0181	0.0004
Fe	0.0000	0.0022	0.0000	0.0029	0.0097	0.0004	0.0032	0.0019
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0003
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000	0.0002

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0031	0.0000	0.0041	0.0000	0.0012	0.0000	0.0028
K	0.2607	0.0045	0.0000	0.0059	0.0000	0.0004	0.0869	0.0036
La	0.0000	0.0045	0.0000	0.0059	0.0000	0.0050	0.0000	0.0051
Mg	0.0000	0.0450	0.0000	0.0588	0.0000	0.1122	0.0000	0.0720
Mn	0.0000	0.0022	0.0000	0.0029	0.0000	0.0004	0.0000	0.0018
Mo	0.0000	0.0045	0.0000	0.0059	0.0000	0.0004	0.0000	0.0036
Na	0.0000	0.4495	0.0000	0.5876	0.0000	0.2408	0.0000	0.4260
Ni	0.0000	0.0009	0.0000	0.0012	0.0010	0.0002	0.0003	0.0007
P	0.0000	0.0013	0.0017	0.0018	0.0000	0.0005	0.0006	0.0012
Pb	0.0387	0.0009	0.0458	0.0012	0.0000	0.0004	0.0282	0.0008
Pd	0.0000	0.0022	0.0705	0.0029	0.0000	0.0017	0.0235	0.0023
Rb	0.0000	0.0013	0.0000	0.0018	0.0000	0.0001	0.0000	0.0011
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0000	0.0005
S	0.0000	0.0009	0.0000	0.0012	0.2000	0.0012	0.0667	0.0011
Sb	0.0000	0.0027	0.0000	0.0035	0.0047	0.0020	0.0016	0.0027
Sc	0.0000	0.0000	0.0000	0.0000	0.0024	0.0002	0.0008	0.0001
Se	0.0000	0.0004	0.0000	0.0006	0.0000	0.0001	0.0000	0.0004
Sn	0.0000	0.0027	0.1034	0.0035	0.0000	0.0016	0.0345	0.0026
Sr	0.2607	0.0022	0.0000	0.0029	0.0000	0.0010	0.0869	0.0020
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0022	0.0000	0.0007
Ti	0.1798	0.0022	0.1645	0.0029	0.0244	0.0003	0.1229	0.0018
V	0.0000	0.0022	0.0000	0.0029	0.0000	0.0001	0.0000	0.0018
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0038	0.0000	0.0013
Y	0.0000	0.0031	0.0000	0.0041	0.0000	0.0006	0.0000	0.0026
Zn	0.0000	0.0004	0.0000	0.0006	0.0000	0.0003	0.0000	0.0005
Ions								
F	0.0000	0.1468	0.0000	0.1919	0.0000	0.0241	0.0000	0.1209
Cl	0.3116	0.1256	0.2140	0.1545	0.0833	0.0223	0.2030	0.1008
NO2	0.0000	0.0193	0.0000	0.0252	0.0024	0.0033	0.0008	0.0159
Br	0.1215	0.0137	0.2938	0.0248	0.1757	0.0102	0.1970	0.0162
NO3	0.1367	0.0231	0.1018	0.0263	0.1609	0.0108	0.1332	0.0200
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	0.3508	0.0564	0.6186	0.0818	0.2794	0.0205	0.4163	0.0529
Na	0.5491	0.1609	0.0000	0.1743	0.0000	0.0219	0.1830	0.1190
NH4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K	0.0299	0.0641	0.0224	0.0830	0.1839	0.0196	0.0787	0.0556
Ca	0.7184	0.1181	1.5105	0.1832	0.0258	0.0148	0.7516	0.1054
Mg	0.1514	0.0231	0.3454	0.0377	0.0040	0.0027	0.1669	0.0212
Identified percent of total mass	83.0718	7.8018	78.2418	7.7889	72.9005	6.3864	78.0714	7.3276

<i>LCV-Diesel (1996-2000)</i>								
Profile Number	V58		V59		V60		Comp-LCVD-2 (V58,V59,V60)	
Identified Percentage of Total Mass	88.7471		59.4898		87.0949		78.4439	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	51.8310	4.1983	39.9885	3.2391	59.7982	4.8437	50.5393	4.0937
Elemental carbon	30.0896	2.4974	15.9587	1.3246	26.2325	2.1773	24.0936	1.9998
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0142	0.0031	0.0057	0.0014	0.0058	0.0007	0.0086	0.0017
Acenaphthalene	0.0649	0.0052	0.0204	0.0019	0.0079	0.0007	0.0311	0.0026
Fluorene + Acenaphthene	0.0271	0.0036	0.0221	0.0021	0.0061	0.0007	0.0185	0.0022
Phenanthrene	0.0023	0.0036	0.0015	0.0017	0.0005	0.0006	0.0014	0.0020
Anthracene	0.0027	0.0027	0.0016	0.0012	0.0000	0.0004	0.0014	0.0014
Fluoroanthene	0.0190	0.0030	0.0002	0.0009	0.0000	0.0004	0.0064	0.0014
Pyrene	0.0000	0.0015	0.0000	0.0007	0.0000	0.0002	0.0000	0.0008
Benzo(a)Anthracene	0.0000	0.0016	0.0000	0.0007	0.0000	0.0003	0.0000	0.0009
Chrysene	0.0000	0.0010	0.0000	0.0005	0.0000	0.0002	0.0000	0.0006
Benzo(b)Fluoroanthene	0.0000	0.0006	0.0000	0.0002	0.0000	0.0001	0.0000	0.0003
Benzo(k)Fluoroanthene	0.0000	0.0007	0.0000	0.0003	0.0000	0.0001	0.0000	0.0004
Benzo(a)Pyrene	0.0000	0.0006	0.0000	0.0003	0.0000	0.0001	0.0000	0.0003
Dibenz(a,h)anthracene	0.0000	0.0007	0.0000	0.0003	0.0008	0.0002	0.0003	0.0004
Benzo(ghi)Pyrene	0.0000	0.0004	0.0000	0.0002	0.0000	0.0001	0.0000	0.0002
Indenol(1,2,3)Pyrene	0.0000	0.0006	0.0000	0.0003	0.0000	0.0001	0.0000	0.0004
Elements								
Ag	0.0000	0.0062	0.0000	0.0028	0.0000	0.0011	0.0000	0.0033
Al	0.0000	0.0298	0.0000	0.0134	0.0000	0.0051	0.0000	0.0161
As	0.0042	0.0004	0.0005	0.0002	0.0007	0.0001	0.0018	0.0002
Au	0.0000	0.0063	0.0000	0.0028	0.0000	0.0011	0.0000	0.0034
Ba	0.0000	0.0131	0.0000	0.0059	0.0000	0.0022	0.0000	0.0071
Br	0.0000	0.0017	0.0000	0.0008	0.0000	0.0003	0.0000	0.0009
Ca	0.7218	0.0013	0.4356	0.0006	0.0000	0.0002	0.3858	0.0007
Cd	0.0000	0.0093	0.0149	0.0042	0.0061	0.0016	0.0070	0.0050
Cl	0.0326	0.0055	0.0121	0.0025	0.0055	0.0009	0.0167	0.0030
Co	0.0000	0.0006	0.0019	0.0003	0.0000	0.0001	0.0006	0.0003
Cr	0.0000	0.0008	0.0000	0.0004	0.0000	0.0001	0.0000	0.0004
Cs	0.0000	0.0143	0.0000	0.0064	0.0000	0.0024	0.0000	0.0077
Cu	0.0000	0.0012	0.0000	0.0006	0.0009	0.0002	0.0003	0.0007
Fe	0.0000	0.0022	0.0200	0.0010	0.0044	0.0004	0.0081	0.0012
Ga	0.0000	0.0049	0.0000	0.0022	0.0000	0.0008	0.0000	0.0026
Ge	0.0000	0.0030	0.0000	0.0014	0.0020	0.0005	0.0007	0.0016

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0058	0.0000	0.0026	0.0000	0.0010	0.0000	0.0032
K	0.0000	0.0017	0.0000	0.0008	0.0000	0.0003	0.0000	0.0009
La	0.0000	0.0243	0.0000	0.0109	0.0000	0.0042	0.0000	0.0131
Mg	0.0000	0.5499	0.0000	0.2465	0.0000	0.0942	0.0000	0.2969
Mn	0.0000	0.0017	0.0000	0.0008	0.0000	0.0003	0.0000	0.0009
Mo	0.0000	0.0020	0.0030	0.0009	0.0000	0.0003	0.0010	0.0011
Na	0.0000	1.1802	0.0000	0.5291	0.0000	0.2021	0.0000	0.6371
Ni	0.0000	0.0008	0.0017	0.0004	0.0008	0.0001	0.0008	0.0004
P	0.0000	0.0024	0.0000	0.0011	0.0000	0.0004	0.0000	0.0013
Pb	0.0000	0.0020	0.0000	0.0009	0.0000	0.0003	0.0000	0.0011
Pd	0.0000	0.0082	0.0000	0.0037	0.0000	0.0014	0.0000	0.0044
Rb	0.0000	0.0007	0.0000	0.0003	0.0000	0.0001	0.0000	0.0004
Rh	0.0000	0.0079	0.0000	0.0036	0.0000	0.0014	0.0000	0.0043
S	0.6825	0.0061	0.1116	0.0027	0.1806	0.0010	0.3249	0.0033
Sb	0.0000	0.0099	0.0000	0.0045	0.0000	0.0017	0.0000	0.0054
Sc	0.0127	0.0011	0.0079	0.0005	0.0004	0.0002	0.0070	0.0006
Se	0.0000	0.0007	0.0000	0.0003	0.0000	0.0001	0.0000	0.0004
Sn	0.0000	0.0081	0.0000	0.0036	0.0000	0.0014	0.0000	0.0044
Sr	0.0000	0.0047	0.0000	0.0021	0.0000	0.0008	0.0000	0.0025
Te	0.0000	0.0107	0.0000	0.0048	0.0000	0.0018	0.0000	0.0058
Ti	0.0000	0.0017	0.4850	0.0008	0.0000	0.0003	0.1617	0.0009
V	0.0000	0.0005	0.0492	0.0002	0.0370	0.0001	0.0287	0.0003
W	0.0000	0.0186	0.0000	0.0083	0.0000	0.0032	0.0000	0.0100
Y	0.0127	0.0029	0.0056	0.0013	0.0000	0.0005	0.0061	0.0016
Zn	0.0000	0.0016	0.0000	0.0007	0.0000	0.0003	0.0000	0.0009
Ions								
F	0.0000	0.1182	0.0000	0.0530	0.0000	0.0202	0.0000	0.0638
Cl	0.0000	0.0886	0.0034	0.0399	0.0467	0.0175	0.0167	0.0487
NO2	0.0000	0.0156	0.0057	0.0073	0.0035	0.0028	0.0031	0.0085
Br	1.1247	0.0634	0.5496	0.0307	0.1549	0.0089	0.6097	0.0343
NO3	0.3124	0.0288	0.1579	0.0138	0.1046	0.0075	0.1916	0.0167
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	0.7038	0.0668	0.8207	0.0556	0.1699	0.0139	0.5648	0.0454
Na	0.3129	0.1231	0.0000	0.0481	0.0343	0.0201	0.1157	0.0638
NH4	0.0000	0.0000	0.0000	0.0000	0.0182	0.0009	0.0061	0.0003
K	0.7641	0.0890	0.2352	0.0345	0.0688	0.0121	0.3561	0.0452
Ca	1.6797	0.1509	0.4287	0.0512	0.1765	0.0202	0.7617	0.0741
Mg	0.3319	0.0292	0.1408	0.0127	0.0272	0.0035	0.1666	0.0152
Identified percent of total mass	88.7471	9.4243	59.4898	5.7870	87.0949	7.4836	78.4439	7.5650

<i>LCV-Diesel (Post-2000)</i>								
Profile Number	V61		V62		V63		Comp-LCVD-3 (V61,V62,V63)	
Identified Percentage of Total Mass	89.9129		88.4290		73.6788		84.0069	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	49.8936	4.0414	37.7913	3.0611	36.7044	2.9731	41.4631	3.3585
Elemental carbon	31.8748	2.6456	27.8579	2.3122	25.6011	2.1249	28.4446	2.3609
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0253	0.0041	0.0172	0.0035	0.0000	0.0022	0.0142	0.0033
Acenaphthalene	0.0000	0.0023	0.0000	0.0021	0.0000	0.0018	0.0000	0.0021
Fluorene + Acenaphthene	0.0394	0.0047	0.0403	0.0045	0.0000	0.0021	0.0266	0.0038
Phenanthrene	0.0000	0.0042	0.0000	0.0038	0.0000	0.0032	0.0000	0.0037
Anthracene	0.0042	0.0032	0.0023	0.0028	0.0000	0.0023	0.0021	0.0028
Fluoroanthene	0.0000	0.0025	0.0332	0.0039	0.0000	0.0019	0.0111	0.0028
Pyrene	0.0010	0.0018	0.0005	0.0016	0.0000	0.0013	0.0005	0.0016
Benzo(a)Anthracene	0.0000	0.0019	0.0281	0.0032	0.0000	0.0015	0.0094	0.0022
Chrysene	0.0000	0.0012	0.0000	0.0011	0.0000	0.0010	0.0000	0.0011
Benzo(b)Fluoroanthene	0.0000	0.0007	0.0093	0.0011	0.0000	0.0005	0.0031	0.0007
Benzo(k)Fluoroanthene	0.0003	0.0008	0.0000	0.0007	0.0000	0.0006	0.0001	0.0007
Benzo(a)Pyrene	0.0029	0.0009	0.0071	0.0010	0.0000	0.0006	0.0033	0.0008
Dibenz(a,h)anthracene	0.0299	0.0023	0.0094	0.0012	0.0000	0.0006	0.0131	0.0014
Benzo(ghi)Pyrene	0.0191	0.0014	0.0000	0.0004	0.0000	0.0004	0.0064	0.0007
Indenol(1,2,3)Pyrene	0.0051	0.0010	0.0002	0.0007	0.0000	0.0006	0.0017	0.0008
Elements								
Ag	0.0000	0.0073	0.0000	0.0067	0.0000	0.0057	0.0000	0.0065
Al	0.0000	0.0354	0.0000	0.0323	0.0000	0.0275	0.0000	0.0317
As	0.0000	0.0005	0.0000	0.0005	0.0039	0.0004	0.0013	0.0005
Au	0.0000	0.0074	0.0000	0.0068	0.0000	0.0058	0.0000	0.0067
Ba	1.6794	0.0155	5.3624	0.0142	0.0000	0.0121	2.3473	0.0139
Br	0.0000	0.0021	0.0000	0.0019	0.0000	0.0016	0.0000	0.0018
Ca	0.0000	0.0016	0.0000	0.0014	0.3779	0.0012	0.1260	0.0014
Cd	0.0294	0.0111	0.0605	0.0101	0.0498	0.0086	0.0466	0.0099
Cl	0.1280	0.0065	0.0407	0.0060	0.0217	0.0051	0.0635	0.0059
Co	0.0085	0.0008	0.0062	0.0007	0.0026	0.0006	0.0058	0.0007
Cr	0.0000	0.0010	0.0000	0.0009	0.0000	0.0007	0.0000	0.0009
Cs	0.0000	0.0169	0.0000	0.0155	0.0000	0.0131	0.0000	0.0152
Cu	0.0106	0.0015	0.0031	0.0013	0.0073	0.0011	0.0070	0.0013
Fe	0.0000	0.0026	0.0000	0.0024	0.0345	0.0020	0.0115	0.0023
Ga	0.0000	0.0058	0.0401	0.0053	0.0000	0.0045	0.0134	0.0052
Ge	0.0000	0.0036	0.0000	0.0033	0.0083	0.0028	0.0028	0.0032

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0069	0.0000	0.0063	0.0139	0.0054	0.0046	0.0062
K	0.0000	0.0021	0.0000	0.0019	0.0000	0.0016	0.0000	0.0019
La	0.0000	0.0288	0.0000	0.0263	0.0000	0.0223	0.0000	0.0258
Mg	0.0000	0.6524	0.0000	0.5958	0.0000	0.5062	0.0000	0.5848
Mn	0.0000	0.0021	0.0056	0.0019	0.0000	0.0016	0.0019	0.0019
Mo	0.0102	0.0023	0.0000	0.0021	0.0000	0.0018	0.0034	0.0021
Na	0.0000	1.4003	0.0000	1.2787	0.0000	1.0864	0.0000	1.2552
Ni	0.0067	0.0009	0.0000	0.0009	0.0000	0.0007	0.0022	0.0008
P	0.0000	0.0029	0.0000	0.0026	0.0000	0.0022	0.0000	0.0026
Pb	0.0440	0.0023	0.0000	0.0021	0.0000	0.0018	0.0147	0.0021
Pd	0.0455	0.0097	0.0000	0.0089	0.0000	0.0075	0.0152	0.0087
Rb	0.0000	0.0008	0.0000	0.0008	0.0000	0.0006	0.0000	0.0008
Rh	0.0000	0.0094	0.0000	0.0086	0.0000	0.0073	0.0000	0.0084
S	0.4311	0.0073	1.5444	0.0066	0.5889	0.0056	0.8548	0.0065
Sb	0.0000	0.0118	0.0000	0.0108	0.0000	0.0091	0.0000	0.0106
Sc	0.0035	0.0013	0.0000	0.0012	0.0033	0.0010	0.0023	0.0012
Se	0.0000	0.0008	0.0000	0.0008	0.0000	0.0006	0.0000	0.0007
Sn	0.0000	0.0096	0.0000	0.0087	0.0000	0.0074	0.0000	0.0086
Sr	0.0000	0.0056	0.0000	0.0051	0.0000	0.0043	0.0000	0.0050
Te	0.0000	0.0127	0.0000	0.0116	0.0249	0.0099	0.0083	0.0114
Ti	0.0000	0.0020	0.0000	0.0018	0.0000	0.0016	0.0000	0.0018
V	0.0000	0.0006	0.0244	0.0005	0.0000	0.0005	0.0081	0.0005
W	0.0000	0.0221	0.0000	0.0201	0.0000	0.0171	0.0000	0.0198
Y	0.0199	0.0034	0.0247	0.0031	0.0000	0.0026	0.0149	0.0031
Zn	0.6593	0.0019	4.1321	0.0018	0.0000	0.0015	1.5972	0.0017
Ions								
F	0.0000	0.1403	0.0000	0.1281	0.0000	0.1088	0.0000	0.1257
Cl	0.0000	0.1051	0.0000	0.0960	0.4267	0.1030	0.1422	0.1013
NO2	0.0061	0.0188	0.0000	0.0168	0.0000	0.0143	0.0020	0.0166
Br	0.5582	0.0356	1.0619	0.0607	1.8015	0.0974	1.1405	0.0645
NO3	0.3981	0.0356	0.2469	0.0266	0.4526	0.0349	0.3659	0.0324
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	1.7117	0.1238	2.5259	0.1621	1.6121	0.1105	1.9499	0.1321
Na	0.0219	0.1285	1.1951	0.1765	0.2268	0.1102	0.4812	0.1384
NH4	0.0000	0.0000	0.6645	0.0339	0.0000	0.0000	0.2215	0.0113
K	1.3747	0.1293	2.3596	0.1743	2.6129	0.1790	2.1157	0.1609
Ca	0.8172	0.1194	2.7995	0.2133	2.7851	0.2019	2.1339	0.1782
Mg	0.0535	0.0175	0.5344	0.0406	0.3185	0.0276	0.3021	0.0285
Identified percent of total mass	89.9129	9.8606	88.4290	8.6204	73.6788	7.8853	84.0069	8.7888

HCV-Diesel (1991-96)								
Profile Number	V64				V66		Comp-HCVD-1 (V64,V66)	
Identified Percentage of Total Mass	88.8273				79.9931		85.6601	
Species	% Mass (PM10)	Uncertainty (%)			% Mass (PM10)	Uncertainty (%)	% Mass (PM10)	Uncertainty (%)
Carbon								
Organic carbon	60.6206	4.9103			60.1789	4.8745	55.0202	4.4566
Elemental carbon	26.4990	2.1994			17.2683	1.4333	24.7961	2.0581
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0073	0.0011			0.0530	0.0037	0.0306	0.0033
Acenaphthalene	0.0083	0.0010			0.0106	0.0013	0.0138	0.0022
Fluorene + Acenaphthene	0.0349	0.0025			0.0352	0.0027	0.0902	0.0063
Phenanthrene	0.0012	0.0011			0.0026	0.0016	0.0015	0.0027
Anthracene	0.0009	0.0008			0.0007	0.0011	0.0008	0.0019
Fluoroanthene	0.0049	0.0009			0.0150	0.0016	0.0355	0.0034
Pyrene	0.0120	0.0011			0.0679	0.0041	0.1200	0.0072
Benzo(a)Anthracene	0.0063	0.0008			0.0000	0.0007	0.0155	0.0020
Chrysene	0.0002	0.0003			0.0021	0.0005	0.0011	0.0008
Benzo(b)Fluoroanthene	0.0436	0.0024			0.0114	0.0008	0.0193	0.0014
Benzo(k)Fluoroanthene	0.0100	0.0007			0.0030	0.0004	0.0113	0.0011
Benzo(a)Pyrene	0.0008	0.0002			0.0227	0.0014	0.0082	0.0009
Dibenz(a,h)anthracene	0.0032	0.0004			0.0277	0.0017	0.0128	0.0012
Benzo(ghi)Pyrene	0.0006	0.0001			0.0105	0.0007	0.0066	0.0006
Indenol(1,2,3)Pyrene	0.0020	0.0003			0.0139	0.0010	0.0000	0.0000
Elements								
Ag	0.0000	0.0006			0.0000	0.0008	0.0000	0.0036
Al	0.0000	0.0022			0.0000	0.0030	0.0000	0.0170
As	0.0006	0.0001			0.0005	0.0002	0.0004	0.0003
Au	0.0000	0.0000			0.0000	0.0000	0.0000	0.0032
Ba	0.0000	0.0009			0.4240	0.0012	0.1413	0.0074
Br	0.0000	0.0001			0.0000	0.0002	0.0000	0.0010
Ca	0.0000	0.0011			0.0000	0.0015	0.3300	0.0015
Cd	0.0174	0.0006			0.0239	0.0008	0.0254	0.0052
Cl	0.1273	0.0002			0.1377	0.0003	0.0981	0.0030
Co	0.0000	0.0003			0.0000	0.0005	0.0015	0.0006
Cr	0.0000	0.0006			0.0000	0.0008	0.0000	0.0009
Cs	0.0000	0.0009			0.0000	0.0012	0.0000	0.0080
Cu	0.0093	0.0001			0.0017	0.0002	0.0065	0.0007
Fe	0.2149	0.0006			0.0000	0.0008	0.1349	0.0016
Ga	0.0000	0.0000			0.0000	0.0000	0.0000	0.0025
Ge	0.0000	0.0000			0.0000	0.0000	0.0000	0.0015

Species	% Mass (PM10)	Uncerta inty (%)			% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
I	0.0000	0.0008			0.0000	0.0011	0.0094	0.0036
K	0.0000	0.0011			0.0000	0.0015	0.0000	0.0018
La	0.0000	0.0011			0.0000	0.0015	0.0000	0.0133
Mg	0.0000	0.0110			0.0000	0.0151	0.0000	0.2901
Mn	0.0000	0.0006			0.0000	0.0008	0.0000	0.0013
Mo	0.0000	0.0011			0.0000	0.0015	0.0027	0.0019
Na	0.0000	0.1101			0.0000	0.1514	0.0000	0.6910
Ni	0.0078	0.0002			0.0000	0.0003	0.0026	0.0006
P	0.0149	0.0003			0.0050	0.0005	0.0066	0.0015
Pb	0.0068	0.0002			0.0009	0.0003	0.0101	0.0012
Pd	0.0000	0.0006			0.0182	0.0008	0.0061	0.0046
Rb	0.0000	0.0003			0.0000	0.0005	0.0000	0.0006
Rh	0.0000	0.0000			0.0000	0.0000	0.0000	0.0041
S	0.2024	0.0002			0.0000	0.0003	0.3263	0.0033
Sb	0.0000	0.0007			0.0000	0.0009	0.0139	0.0056
Sc	0.0000	0.0000			0.0000	0.0000	0.0019	0.0006
Se	0.0000	0.0001			0.0000	0.0002	0.0000	0.0004
Sn	0.0000	0.0007			0.0000	0.0009	0.0000	0.0046
Sr	0.0000	0.0006			0.2393	0.0008	0.0798	0.0028
Te	0.0000	0.0000			0.0000	0.0000	0.0171	0.0055
Ti	0.0000	0.0006			0.0273	0.0008	0.0091	0.0013
V	0.0000	0.0006			0.0000	0.0008	0.0000	0.0007
W	0.0000	0.0000			0.0000	0.0000	0.0000	0.0095
Y	0.0000	0.0008			0.0000	0.0011	0.0000	0.0021
Zn	0.0000	0.0001			0.0000	0.0002	0.0000	0.0009
Ions								
F	0.0000	0.0360			0.0600	0.0525	0.0200	0.0900
Cl	0.0931	0.0316			0.0862	0.0414	0.0598	0.0696
NO ₂	0.0008	0.0048			0.0000	0.0065	0.0003	0.0117
Br	0.1205	0.0080			0.1513	0.0102	0.6385	0.0371
NO ₃	0.0751	0.0078			0.0225	0.0066	0.1459	0.0172
PO ₄	0.0000	0.0000			0.0000	0.0000	0.0000	0.0000
SO ₄	0.2128	0.0202			0.3876	0.0327	1.5751	0.1034
Na	0.1173	0.0385			0.2455	0.0572	0.1210	0.0869
NH ₄	0.0000	0.0000			0.0000	0.0000	0.0000	0.0000
K	0.0000	0.0153			0.0127	0.0217	0.6822	0.0725
Ca	0.2904	0.0347			0.3534	0.0454	1.1212	0.1063
Mg	0.0600	0.0068			0.0719	0.0088	0.1188	0.0154
Identified percent of total mass	88.8273	7.4668			79.9931	6.8064	85.8899	8.2707

<i>HCV-Diesel (1996-2000)</i>								
Profile Number	V67		V68		V69		Comp-HCVD-2 (V67,V68,V69)	
Identified Percentage of Total Mass	80.0698		78.2647		76.0987		78.1444	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	57.3003	4.6413	45.4463	3.6812	40.0363	3.2429	47.5943	3.8551
Elemental carbon	19.4207	1.6119	29.1111	2.4162	32.1288	2.6667	26.8869	2.2316
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0000	0.0017	0.0000	0.0018	0.0000	0.0018	1.137	0.0018
Acenaphthalene	0.0000	0.0014	0.0000	0.0014	0.0000	0.0014	1.0197	0.0014
Fluorene + Acenaphthene	0.0000	0.0017	0.0000	0.0017	0.0000	0.0017	2.7624	0.0017
Phenanthrene	0.0000	0.0026	0.0000	0.0026	0.0000	0.0026	0.27	0.0026
Anthracene	0.0000	0.0018	0.0000	0.0018	0.0000	0.0019	0.2589	0.0019
Fluoroanthene	0.0000	0.0015	0.0000	0.0015	0.0000	0.0016	1.9269	0.0015
Pyrene	0.0000	0.0011	0.0000	0.0011	0.0000	0.0011	0.8646	0.0011
Benzo(a)Anthracene	0.0000	0.0012	0.0000	0.0012	0.0000	0.0012	0.0711	0.0012
Chrysene	0.0000	0.0008	0.0000	0.0008	0.0000	0.0008	0.2469	0.0008
Benzo(b)Fluoroanthene	0.0000	0.0004	0.0000	0.0004	0.0000	0.0004	0.2562	0.0004
Benzo(k)Fluoroanthene	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005	0.1863	0.0005
Benzo(a)Pyrene	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005	1.0488	0.0005
Dibenz(a,h)anthracene	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005	0.6102	0.0005
Benzo(ghi)Pyrene	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003	0.5073	0.0003
Indenol(1,2,3)Pyrene	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005	0.6735	0.0005
Elements								
Ag	0.0000	0.0013	0.0000	0.0013	0.0000	0.0014	0.0000	0.0013
Al	0.0000	0.0053	0.0000	0.0053	0.0000	0.0054	0.0000	0.0053
As	0.0053	0.0003	0.0068	0.0003	0.0000	0.0003	0.0040	0.0003
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	0.4771	0.0021	1.9661	0.0021	0.0000	0.0022	0.8144	0.0021
Br	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003
Ca	0.0000	0.0027	0.0000	0.0027	0.0000	0.0027	0.0000	0.0027
Cd	0.0000	0.0013	0.0420	0.0013	0.0000	0.0014	0.0140	0.0013
Cl	0.2425	0.0005	0.0134	0.0005	0.0381	0.0005	0.0980	0.0005
Co	0.0000	0.0008	0.0106	0.0008	0.0000	0.0008	0.0035	0.0008
Cr	0.0000	0.0013	0.0000	0.0013	0.0000	0.0014	0.0000	0.0013
Cs	0.0700	0.0021	0.0000	0.0021	0.0000	0.0022	0.0233	0.0021
Cu	0.0002	0.0003	0.0002	0.0003	0.0000	0.0003	0.0001	0.0003
Fe	0.0519	0.0013	0.0000	0.0013	0.0000	0.0014	0.0173	0.0013
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.1484	0.0019	0.0000	0.0019	0.0000	0.0019	0.0495	0.0019
K	0.2756	0.0027	0.0266	0.0027	0.0000	0.0027	0.1007	0.0027
La	0.0000	0.0027	0.0000	0.0027	0.0000	0.0027	0.0000	0.0027
Mg	0.0000	0.0265	0.0000	0.0266	0.0000	0.0270	0.0000	0.0267
Mn	0.0000	0.0013	0.0000	0.0013	0.0000	0.0014	0.0000	0.0013
Mo	0.0000	0.0027	0.0000	0.0027	0.0000	0.0027	0.0000	0.0027
Na	0.0000	0.2650	0.0000	0.2657	0.0000	0.2702	0.0000	0.2670
Ni	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005
P	0.0000	0.0008	0.0000	0.0008	0.0136	0.0008	0.0045	0.0008
Pb	0.0000	0.0005	0.0000	0.0005	0.0254	0.0005	0.0085	0.0005
Pd	0.0000	0.0013	0.0000	0.0013	0.0000	0.0014	0.0000	0.0013
Rb	0.0000	0.0008	0.0000	0.0008	0.0000	0.0008	0.0000	0.0008
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005	0.0000	0.0005
Sb	0.0000	0.0016	0.0000	0.0016	0.0000	0.0016	0.0000	0.0016
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003
Sn	0.0466	0.0016	0.0468	0.0016	0.0000	0.0016	0.0311	0.0016
Sr	0.0000	0.0013	0.0638	0.0013	0.0000	0.0014	0.0213	0.0013
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	0.5142	0.0013	0.0478	0.0013	0.0810	0.0014	0.2143	0.0013
V	0.0000	0.0013	0.0000	0.0013	0.0000	0.0014	0.0000	0.0013
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0019	0.0000	0.0019	0.0000	0.0019	0.0000	0.0019
Zn	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003
Ions								
F	0.0000	0.0866	0.0047	0.0870	0.0000	0.0882	0.0016	0.0873
Cl	0.2634	0.0781	0.2838	0.0792	0.4080	0.0866	0.3184	0.0813
NO2	0.0000	0.0114	0.0489	0.0139	0.0315	0.0132	0.0268	0.0128
Br	0.1147	0.0103	0.1160	0.0103	0.1189	0.0106	0.1165	0.0104
NO3	0.1275	0.0160	0.0498	0.0121	0.4481	0.0324	0.2085	0.0202
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	0.2762	0.0368	0.1031	0.0281	0.3742	0.0422	0.2512	0.0357
Na	0.1729	0.0873	0.2917	0.0934	0.7523	0.1180	0.4056	0.0996
NH4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K	0.0382	0.0389	0.0000	0.0370	0.8273	0.0794	0.2885	0.0518
Ca	0.4311	0.0700	0.4688	0.0720	0.6954	0.0843	0.5318	0.0754
Mg	0.0930	0.0138	0.1167	0.0150	0.1196	0.0153	0.1098	0.0147
Identified percent of total mass	80.0698	7.0549	78.2647	6.8990	76.0987	6.8394	89.9842	6.9311

HCV-Diesel (Post-2000)										
Profile Number	V65		V70		V71		V72		Comp-HCVD-3 (V65,V70,V71,V72)	
Identified Percentage of Total Mass	88.1600		87.8971		72.3073		85.1227		81.7757	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)						
Carbon										
Organic carbon	44.2610	3.5851	43.7824	3.5464	46.3540	3.7547	69.3741	5.6193	53.1702	4.3068
Elemental carbon	30.6211	2.5415	35.7883	2.9704	20.2931	1.6843	10.4924	0.8709	22.1913	1.8419
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)										
Naphthalene	0.0000	0.0037	0.0122	0.0041	0.0000	0.0036	0.0083	0.0015	0.0068	0.0031
Acenaphthalene	0.0000	0.0030	0.0000	0.0028	0.0000	0.0030	0.0000	0.0009	0.0000	0.0022
Fluorene + Acenaphthene	0.0000	0.0035	0.0000	0.0033	0.0000	0.0035	0.0000	0.0010	0.0000	0.0026
Phenanthrene	0.0000	0.0054	0.0036	0.0053	0.0000	0.0054	0.0000	0.0016	0.0012	0.0041
Anthracene	0.0000	0.0039	0.0503	0.0062	0.0000	0.0038	0.0019	0.0012	0.0174	0.0038
Fluoroanthene	0.0000	0.0032	0.0000	0.0030	0.0000	0.0032	0.0000	0.0009	0.0000	0.0024
Pyrene	0.0000	0.0022	0.2109	0.0128	0.0000	0.0022	0.0000	0.0007	0.0703	0.0052
Benzo(a)Anthracene	0.0000	0.0025	0.3378	0.0195	0.0000	0.0025	0.0000	0.0007	0.1126	0.0076
Chrysene	0.0000	0.0016	0.0000	0.0015	0.0000	0.0016	0.0002	0.0005	0.0001	0.0012
Benzo(b)Fluoroanthene	0.0000	0.0008	0.0775	0.0047	0.0000	0.0008	0.0001	0.0003	0.0259	0.0019
Benzo(k)Fluoroanthene	0.0000	0.0010	0.0406	0.0030	0.0000	0.0010	0.0002	0.0003	0.0136	0.0014
Benzo(a)Pyrene	0.0000	0.0010	0.0073	0.0013	0.0000	0.0010	0.0000	0.0003	0.0024	0.0008
Dibenz(a,h)anthracene	0.0000	0.0011	0.7375	0.0386	0.0000	0.0010	0.0018	0.0004	0.2464	0.0133
Benzo(ghi)Pyrene	0.0000	0.0006	0.0000	0.0006	0.0000	0.0006	0.0008	0.0002	0.0003	0.0005
Indenol(1,2,3)Pyrene	0.0000	0.0010	0.0000	0.0009	0.0000	0.0010	0.0000	0.0003	0.0000	0.0007
Elements										
Ag	0.0000	0.0095	0.0286	0.0089	0.0000	0.0028	0.0000	0.0028	0.0095	0.0048
Al	0.0000	0.0458	0.0000	0.0431	0.0000	0.0110	0.0000	0.0134	0.0000	0.0225
As	0.0000	0.0007	0.0000	0.0006	0.0203	0.0006	0.0019	0.0002	0.0074	0.0005
Au	0.0000	0.0096	0.0000	0.0091	0.0000	0.0000	0.0000	0.0028	0.0000	0.0040
Ba	0.0000	0.0201	0.0000	0.0189	0.0000	0.0044	0.7931	0.0059	0.2644	0.0097
Br	0.0000	0.0027	0.0000	0.0025	0.0000	0.0006	0.0000	0.0008	0.0000	0.0013
Ca	0.9899	0.0020	0.0000	0.0019	1.0497	0.0055	0.0000	0.0006	0.3499	0.0027
Cd	0.0349	0.0143	0.0392	0.0135	0.0000	0.0028	0.0000	0.0042	0.0131	0.0068
Cl	0.0294	0.0085	0.1223	0.0080	0.0884	0.0011	0.1237	0.0025	0.1115	0.0039
Co	0.0044	0.0010	0.0000	0.0009	0.0000	0.0017	0.0009	0.0003	0.0003	0.0010
Cr	0.0000	0.0013	0.0000	0.0012	0.0000	0.0028	0.0000	0.0004	0.0000	0.0014
Cs	0.0000	0.0219	0.0000	0.0206	0.0000	0.0044	0.0000	0.0064	0.0000	0.0105
Cu	0.0085	0.0019	0.0080	0.0018	0.0000	0.0006	0.0023	0.0006	0.0034	0.0010
Fe	0.1897	0.0034	0.0000	0.0032	0.0000	0.0028	0.0056	0.0010	0.0019	0.0023
Ga	0.0000	0.0075	0.0000	0.0070	0.0000	0.0000	0.0000	0.0022	0.0000	0.0031
Ge	0.0000	0.0046	0.0000	0.0044	0.0000	0.0000	0.0137	0.0014	0.0046	0.0019

Species	% Mass (PM10)	Uncertainty (%)								
I	0.0283	0.0090	0.0000	0.0084	0.0000	0.0039	0.0129	0.0026	0.0043	0.0050
K	0.0000	0.0027	0.0000	0.0025	0.1657	0.0055	0.0000	0.0008	0.0552	0.0029
La	0.0000	0.0373	0.0000	0.0351	0.0000	0.0055	0.0000	0.0109	0.0000	0.0172
Mg	0.0000	0.8440	0.0000	0.7947	0.0000	0.0552	0.0000	0.2470	0.0000	0.3657
Mn	0.0000	0.0027	0.0000	0.0025	0.0000	0.0028	0.0000	0.0008	0.0000	0.0020
Mo	0.0081	0.0030	0.0000	0.0028	0.0000	0.0055	0.0026	0.0009	0.0009	0.0031
Na	0.0000	1.8115	0.0000	1.7056	0.0000	0.5524	0.0000	0.5302	0.0000	0.9294
Ni	0.0000	0.0012	0.0025	0.0011	0.0000	0.0011	0.0016	0.0004	0.0014	0.0009
P	0.0000	0.0038	0.0000	0.0035	0.0000	0.0017	0.0000	0.0011	0.0000	0.0021
Pb	0.0225	0.0030	0.0000	0.0028	0.0033	0.0011	0.0000	0.0009	0.0011	0.0016
Pd	0.0000	0.0126	0.0382	0.0119	0.0000	0.0028	0.0119	0.0037	0.0167	0.0061
Rb	0.0000	0.0011	0.0000	0.0010	0.0000	0.0017	0.0000	0.0003	0.0000	0.0010
Rh	0.0000	0.0122	0.0000	0.0115	0.0000	0.0000	0.0000	0.0036	0.0000	0.0050
S	0.7764	0.0094	0.4113	0.0089	0.0000	0.0011	0.2050	0.0028	0.2054	0.0042
Sb	0.0417	0.0152	0.0000	0.0143	0.0000	0.0033	0.0000	0.0045	0.0000	0.0074
Sc	0.0058	0.0017	0.0000	0.0016	0.0000	0.0000	0.0014	0.0005	0.0005	0.0007
Se	0.0000	0.0011	0.0000	0.0010	0.0000	0.0006	0.0000	0.0003	0.0000	0.0006
Sn	0.0000	0.0124	0.0000	0.0116	0.2254	0.0033	0.0000	0.0036	0.0751	0.0062
Sr	0.0000	0.0072	0.0000	0.0068	0.2762	0.0028	0.0000	0.0021	0.0921	0.0039
Te	0.0514	0.0165	0.0000	0.0155	0.0000	0.0000	0.0103	0.0048	0.0034	0.0068
Ti	0.0000	0.0026	0.0000	0.0025	0.4530	0.0028	0.0000	0.0008	0.1510	0.0020
V	0.0000	0.0008	0.0000	0.0007	0.0000	0.0028	0.0000	0.0002	0.0000	0.0012
W	0.0000	0.0285	0.0000	0.0269	0.0000	0.0000	0.0000	0.0084	0.0000	0.0117
Y	0.0000	0.0044	0.0268	0.0042	0.0000	0.0039	0.0061	0.0013	0.0110	0.0031
Zn	0.0000	0.0025	0.0000	0.0024	0.0000	0.0006	0.3021	0.0007	0.1007	0.0012
Ions										
F	0.0000	0.1815	0.0000	0.1709	0.0645	0.1836	0.2111	0.0637	0.0919	0.1394
Cl	0.0000	0.1360	0.2924	0.1427	0.3478	0.1526	0.0282	0.0412	0.2228	0.1122
NO2	0.0000	0.0239	0.0259	0.0238	0.0000	0.0237	0.0000	0.0070	0.0086	0.0182
Br	1.6439	0.0930	0.6817	0.0435	0.0000	0.0093	0.8729	0.0472	0.5182	0.0333
NO3	0.3400	0.0372	0.2498	0.0314	0.9984	0.0705	0.2364	0.0178	0.4949	0.0399
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	4.1247	0.2574	2.3476	0.1641	0.6500	0.0804	1.0629	0.0680	1.3535	0.1042
Na	0.0000	0.1648	0.4689	0.1787	0.8312	0.2056	0.0606	0.0513	0.4536	0.1452
NH4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K	2.0338	0.1803	1.0877	0.1278	0.2849	0.0913	0.4405	0.0449	0.6044	0.0880
Ca	2.7198	0.2388	0.8935	0.1403	0.1873	0.1101	0.7736	0.0688	0.6181	0.1064
Mg	0.2244	0.0304	0.1244	0.0243	0.0141	0.0197	0.0617	0.0087	0.0667	0.0176
Identified percent of total mass	88.1600	10.4710	87.8971	10.3896	72.3073	7.1211	85.1227	7.7871	81.7757	8.4720

11.3 CNG and LPG vehicle profiles

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3Wheeler CNG(OE)						
Profile Number	V73		V74		Comp-3W-OC (V73, V74)	
Identified % of Total Mass	83.4557		103.1893		93.3225	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon						
Organic carbon	53.5294	4.3359	46.7547	3.7871	50.1421	4.0615
Elemental carbon	12.3529	1.0253	6.1132	0.5074	9.2331	0.7663
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)						
Naphthalene	0.6251	0.1410	6.5870	0.5095	3.6060	0.3253
Acenaphthalene	0.3494	0.1065	0.7653	0.1811	0.5573	0.1438
Fluorene + Acenaphthene	2.4399	0.2275	6.1075	0.4764	4.2737	0.3520
Phenanthrene	0.0318	0.1634	0.0249	0.2607	0.0283	0.2120
Anthracene	0.4069	0.1362	0.0266	0.1870	0.2168	0.1616
Fluoroanthene	0.2460	0.1081	0.8281	0.1952	0.5371	0.1516
Pyrene	2.8849	0.2131	0.6142	0.1381	1.7495	0.1756
Benzo(a)Anthracene	0.0138	0.0754	0.0951	0.1245	0.0544	0.0999
Chrysene	0.0448	0.0503	0.0917	0.0817	0.0683	0.0660
Benzo(b)Fluoroanthene	0.0240	0.0266	0.0442	0.0429	0.0341	0.0347
Benzo(k)Fluoroanthene	0.0215	0.0313	0.0855	0.0527	0.0535	0.0420
Benzo(a)Pyrene	0.0311	0.0304	0.0877	0.0506	0.0594	0.0405
Dibenz(a,h)anthracene	0.1285	0.0380	0.3555	0.0685	0.2420	0.0533
Benzo(ghi)Pyrene	0.0000	0.0178	0.0000	0.0285	0.0000	0.0232
Indenol(1,2,3)Pyrene	0.0000	0.0298	0.0000	0.0478	0.0000	0.0388
Elements						
Ag	0.0000	0.0316	0.0000	0.1725	0.0000	0.1021
Al	0.0000	0.1265	0.0000	0.8359	0.0000	0.4812
As	0.0000	0.0063	0.0000	0.0122	0.0000	0.0092
Au	0.0000	0.0000	0.0000	0.1759	0.0000	0.0879
Ba	0.0000	0.0506	0.0000	0.3670	0.0000	0.2088
Br	0.0000	0.0063	0.0000	0.0487	0.0000	0.0275
Ca	0.3795	0.0632	3.9156	0.0371	2.1475	0.0502
Cd	0.0000	0.0316	0.0000	0.2614	0.0000	0.1465
Cl	0.0000	0.0126	0.6774	0.1546	0.3387	0.0836
Co	0.0000	0.0190	0.1751	0.0180	0.0875	0.0185
Cr	0.0000	0.0316	0.0000	0.0228	0.0000	0.0272
Cs	0.0000	0.0506	0.0000	0.4002	0.0000	0.2254
Cu	0.0000	0.0063	0.0000	0.0344	0.0000	0.0204
Fe	0.3099	0.0316	0.5658	0.0618	0.4379	0.0467
Ga	0.0000	0.0000	0.0000	0.1363	0.0000	0.0682
Ge	0.0000	0.0000	0.0000	0.0846	0.0000	0.0423

Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
I	0.0000	0.0443	0.7845	0.1637	0.3922	0.1040
K	0.0000	0.0632	0.0000	0.0490	0.0000	0.0561
La	0.0000	0.0632	0.0000	0.6801	0.0000	0.3717
Mg	0.0000	0.6325	0.0000	15.4063	0.0000	8.0194
Mn	0.0000	0.0316	1.0048	0.0490	0.5024	0.0403
Mo	0.0000	0.0632	0.0000	0.0551	0.0000	0.0592
Na	0.6325	6.3248	6.5804	33.0664	3.6065	19.6956
Ni	0.0000	0.0126	0.0000	0.0222	0.0000	0.0174
P	0.0468	0.0190	0.0000	0.0685	0.0234	0.0437
Pb	0.5313	0.0126	0.0000	0.0548	0.2656	0.0337
Pd	0.0000	0.0316	0.0000	0.2298	0.0000	0.1307
Rb	0.0000	0.0190	0.0000	0.0198	0.0000	0.0194
Rh	0.0000	0.0000	0.5575	0.2221	0.2787	0.1111
S	0.0000	0.0126	0.0000	0.1716	0.0000	0.0921
Sb	0.0000	0.0379	0.0000	0.2781	0.0000	0.1580
Sc	0.0000	0.0000	0.4274	0.0316	0.2137	0.0158
Se	0.0000	0.0063	0.0000	0.0195	0.0000	0.0129
Sn	0.0000	0.0379	0.0000	0.2258	0.0000	0.1319
Sr	0.0000	0.0316	0.0000	0.1312	0.0000	0.0814
Te	0.0000	0.0000	1.1379	0.3010	0.5689	0.1505
Ti	0.0000	0.0316	0.2355	0.0478	0.1178	0.0397
V	0.0000	0.0316	0.0335	0.0140	0.0167	0.0228
W	0.0000	0.0000	0.0000	0.5210	0.0000	0.2605
Y	0.0000	0.0443	0.1763	0.0806	0.0881	0.0625
Zn	0.0000	0.0063	0.0000	0.0456	0.0000	0.0260
Ions						
F	0.4706	0.3117	1.9811	0.5616	1.2259	0.4367
Cl	1.5765	1.0850	5.7547	1.9021	3.6656	1.4935
NO ₂	0.1513	0.1769	0.0000	0.2716	0.0756	0.2242
Br	0.0000	0.9568	0.0000	1.5345	0.0000	1.2456
NO ₃	0.0000	0.3808	0.1415	0.6177	0.0708	0.4993
PO ₄	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO ₄	3.9529	1.2175	3.9811	1.8340	3.9670	1.5258
Na	0.0000	7.6207	0.0000	12.2219	0.0000	9.9213
NH ₄	0.0000	0.3343	0.0000	0.5362	0.0000	0.4352
K	0.0000	3.8686	0.0000	6.2044	0.0000	5.0365
Ca	1.1863	1.4762	3.7893	2.4621	2.4878	1.9692
Mg	1.0882	0.5973	2.6887	1.0053	1.8885	0.8013
Identified percent of total mass	83.4557	32.8085	103.1893	90.6692	93.3225	61.7389

3 Wheeler CNG (Retrofit)								
Profile Number	V75		V76		V77		Comp-3W-RC (V75, V76, V77)	
Identified Percentage of Total Mass	87.2716		64.7037		99.1683		83.7145	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	80.6169	3.5318	40.7125	3.2977	78.5520	6.3627	66.6271	4.3974
Elemental carbon	4.6123	0.2071	1.6692	0.1385	4.7511	0.3943	3.6776	0.2466
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0187	0.0019	0.5320	0.0506	0.3258	0.0586	0.2922	0.0370
Acenaphthalene	0.0684	0.0030	0.1584	0.0272	0.1019	0.0393	0.1096	0.0232
Fluorene + Acenaphthene	0.1674	0.0060	0.1992	0.0326	0.8496	0.0830	0.4054	0.0405
Phenanthrene	0.0417	0.0032	0.0467	0.0373	0.0536	0.0649	0.0473	0.0352
Anthracene	0.0046	0.0016	0.0000	0.0250	0.2511	0.0571	0.0852	0.0279
Fluoroanthene	0.2765	0.0089	0.3702	0.0394	0.1161	0.0427	0.2543	0.0303
Pyrene	0.2546	0.0079	0.0000	0.0145	1.2411	0.0887	0.4986	0.0370
Benzo(a)Anthracene	0.0007	0.0010	0.0008	0.0162	0.0073	0.0291	0.0029	0.0154
Chrysene	0.0043	0.0007	0.0000	0.0104	0.0281	0.0199	0.0108	0.0103
Benzo(b)Fluoroanthene	0.0058	0.0005	0.0760	0.0093	0.1303	0.0163	0.0707	0.0087
Benzo(k)Fluoroanthene	0.0079	0.0006	0.0000	0.0065	0.0134	0.0123	0.0071	0.0065
Benzo(a)Pyrene	0.0113	0.0007	0.0000	0.0062	0.0000	0.0111	0.0038	0.0060
Dibenz(a,h)anthracene	0.0026	0.0005	0.0415	0.0089	0.0000	0.0122	0.0147	0.0072
Benzo(ghi)Pyrene	0.0008	0.0003	0.0000	0.0038	0.0000	0.0068	0.0003	0.0036
Indenol(1,2,3)Pyrene	0.0011	0.0004	0.0000	0.0065	0.0000	0.0115	0.0004	0.0061
Elements								
Ag	0.0000	0.0004	0.0000	0.0233	0.0000	0.0122	0.0000	0.0119
Al	0.0000	0.0016	0.0000	0.1127	0.0000	0.0487	0.0000	0.0543
As	0.0019	0.0001	0.0000	0.0016	0.0000	0.0024	0.0006	0.0014
Au	0.0000	0.0000	0.0000	0.0237	0.0000	0.0000	0.0000	0.0079
Ba	0.0000	0.0007	0.0000	0.0495	0.0000	0.0195	0.0000	0.0232
Br	0.0000	0.0001	0.0000	0.0066	0.0000	0.0024	0.0000	0.0030
Ca	0.0456	0.0008	6.3950	0.0050	0.0000	0.0243	2.1469	0.0101
Cd	0.0000	0.0004	0.0000	0.0353	0.0000	0.0122	0.0000	0.0159
Cl	0.0023	0.0002	0.0000	0.0208	0.3853	0.0049	0.1292	0.0086
Co	0.0000	0.0002	0.0107	0.0024	0.0000	0.0073	0.0036	0.0033
Cr	0.0000	0.0004	0.0000	0.0031	0.0000	0.0122	0.0000	0.0052
Cs	0.0000	0.0007	0.0000	0.0540	0.0000	0.0195	0.0000	0.0247
Cu	0.0020	0.0001	0.0000	0.0046	0.0000	0.0024	0.0007	0.0024
Fe	0.0000	0.0004	0.1374	0.0083	0.0000	0.0122	0.0458	0.0070

Species	% Mass (PM10)	Uncertainty (%)						
Ga	0.0000	0.0000	0.0000	0.0184	0.0000	0.0000	0.0000	0.0061
Ge	0.0000	0.0000	0.0000	0.0114	0.0000	0.0000	0.0000	0.0038
I	0.0000	0.0006	0.0000	0.0221	0.0000	0.0170	0.0000	0.0132
K	0.0000	0.0008	0.0000	0.0066	1.8974	0.0243	0.6325	0.0106
La	0.0000	0.0008	0.0000	0.0917	0.0000	0.0243	0.0000	0.0390
Mg	0.0000	0.0082	0.0000	2.0777	0.0000	0.2433	0.0000	0.7764
Mn	0.0000	0.0004	0.0000	0.0066	0.0000	0.0122	0.0000	0.0064
Mo	0.0000	0.0008	0.0192	0.0074	0.0000	0.0243	0.0064	0.0109
Na	0.0000	0.0823	6.8268	4.4593	0.0000	2.4326	2.2756	2.3247
Ni	0.0112	0.0002	0.0000	0.0030	0.4719	0.0049	0.1610	0.0027
P	0.0203	0.0002	0.0000	0.0092	0.0000	0.0073	0.0068	0.0056
Pb	0.0000	0.0002	0.0258	0.0074	0.0876	0.0049	0.0378	0.0041
Pd	0.0396	0.0004	0.0000	0.0310	0.0000	0.0122	0.0132	0.0145
Rb	0.0000	0.0002	0.0000	0.0027	0.0000	0.0073	0.0000	0.0034
Rh	0.0000	0.0000	0.0000	0.0300	0.0000	0.0000	0.0000	0.0100
S	0.0000	0.0002	0.0000	0.0231	0.0000	0.0049	0.0000	0.0094
Sb	0.0000	0.0005	0.1765	0.0375	0.0000	0.0146	0.0588	0.0175
Sc	0.0000	0.0000	0.0000	0.0043	0.0000	0.0000	0.0000	0.0014
Se	0.0000	0.0001	0.0000	0.0026	0.0000	0.0024	0.0000	0.0017
Sn	0.0000	0.0005	0.0738	0.0305	0.0000	0.0146	0.0246	0.0152
Sr	0.0000	0.0004	0.0000	0.0177	0.0000	0.0122	0.0000	0.0101
Te	0.0000	0.0000	0.1415	0.0406	0.0000	0.0000	0.0472	0.0135
Ti	0.0000	0.0004	1.1189	0.0064	0.0000	0.0122	0.3730	0.0063
V	0.0000	0.0004	0.0809	0.0019	0.0000	0.0122	0.0270	0.0048
W	0.0000	0.0000	0.0000	0.0703	0.0000	0.0000	0.0000	0.0234
Y	0.0000	0.0006	0.0247	0.0109	0.0000	0.0170	0.0082	0.0095
Zn	0.0000	0.0001	0.0000	0.0062	0.0000	0.0024	0.0000	0.0029
Ions								
F	0.0085	0.0040	0.5344	0.0892	0.2262	0.1222	0.2564	0.0718
Cl	0.4259	0.0247	1.4885	0.2924	6.7195	0.7260	2.8780	0.3477
NO ₂	0.0000	0.0022	0.0000	0.0366	0.8500	0.1080	0.2833	0.0489
Br	0.0000	0.0124	0.0000	0.2069	0.0000	0.3680	0.0000	0.1958
NO ₃	0.1280	0.0084	0.0445	0.0846	0.0792	0.1504	0.0839	0.0811
PO ₄	0.0439	0.0012	0.0000	0.0000	0.0000	0.0000	0.0146	0.0004
SO ₄	0.1276	0.0167	0.3079	0.2359	1.7014	0.4774	0.7123	0.2433
Na	0.0000	0.0991	0.0000	1.6483	0.0000	2.9311	0.0000	1.5595
NH ₄	0.0000	0.0043	0.0000	0.0723	0.0000	0.1286	0.0000	0.0684
K	0.0000	0.0503	0.3015	0.8518	0.0000	1.4879	0.1005	0.7967
Ca	0.2478	0.0252	1.2616	0.3697	0.0000	0.5449	0.5031	0.3133
Mg	0.0714	0.0090	1.9275	0.2146	0.3281	0.2252	0.7757	0.1496
Identified percent of total mass	87.2716	4.1382	64.7037	15.2204	99.1683	17.6671	83.7145	12.3419

3 Wheeler LPG (OE)						
Profile Number	V78		V79		Comp-3W-OL (V78,V79)	
Identified Percentage of Total Mass	79.8972		63.3077		77.7878	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon						
Organic carbon	49.2647	3.9904	36.7552	2.9772	43.0099	3.4838
Elemental carbon	11.7647	0.9765	9.3510	0.7761	10.5579	0.8763
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)						
Naphthalene	0.0000	0.1371	0.0000	0.0275	1.1952	0.0823
Acenaphthalene	0.0000	0.1112	0.0000	0.0223	0.1752	0.0668
Fluorene + Acenaphthene	0.0000	0.1303	0.0000	0.0261	2.4291	0.0782
Phenanthrene	0.0000	0.2022	0.0000	0.0406	0.0282	0.1214
Anthracene	0.0000	0.1447	0.0000	0.0290	0.4317	0.0869
Fluoroanthene	0.0000	0.1197	0.0000	0.0240	0.2106	0.0719
Pyrene	0.0000	0.0836	0.0000	0.0168	1.6341	0.0502
Benzo(a)Anthracene	0.0000	0.0934	0.0000	0.0187	0.0525	0.0560
Chrysene	0.0000	0.0601	0.0000	0.0121	0.0288	0.0361
Benzo(b)Fluoroanthene	0.0000	0.0317	0.0000	0.0064	0.0000	0.0190
Benzo(k)Fluoroanthene	0.0000	0.0377	0.0000	0.0076	0.0000	0.0226
Benzo(a)Pyrene	0.0000	0.0360	0.0000	0.0072	0.0000	0.0216
Dibenz(a,h)anthracene	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
Benzo(ghi)Pyrene	0.0000	0.0222	0.0000	0.0045	0.0000	0.0134
Indenol(1,2,3)Pyrene	0.0000	0.0373	0.0000	0.0075	0.0000	0.0224
Elements						
Ag	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
Al	0.0000	0.1581	0.0000	0.0317	0.0000	0.0949
As	0.0000	0.0079	0.0000	0.0016	0.0000	0.0047
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	0.0000	0.0632	0.0000	0.0127	0.0000	0.0380
Br	0.0000	0.0079	0.0000	0.0016	0.0000	0.0047
Ca	0.0000	0.0791	0.0000	0.0159	0.0000	0.0475
Cd	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
Cl	0.0000	0.0158	0.0000	0.0032	0.0000	0.0095
Co	0.0000	0.0237	0.0000	0.0048	0.0000	0.0142
Cr	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
Cs	0.0000	0.0632	0.0000	0.0127	0.0000	0.0380
Cu	0.1036	0.0079	0.0000	0.0016	0.0518	0.0047
Fe	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
I	0.0000	0.0553	0.0000	0.0111	0.0000	0.0332
K	0.0000	0.0791	1.3638	0.0159	0.6819	0.0475
La	0.0000	0.0791	0.0000	0.0159	0.0000	0.0475
Mg	0.0000	0.7906	0.0000	0.1586	0.0000	0.4746
Mn	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
Mo	0.0000	0.0791	0.0000	0.0159	0.0000	0.0475
Na	0.0000	7.9060	3.4889	1.5859	1.7444	4.7459
Ni	0.0000	0.0158	0.1161	0.0032	0.0580	0.0095
P	0.0000	0.0237	0.0054	0.0048	0.0027	0.0142
Pb	0.7906	0.0158	0.0060	0.0032	0.3983	0.0095
Pd	0.9487	0.0395	0.0000	0.0079	0.4744	0.0237
Rb	0.0000	0.0237	0.0000	0.0048	0.0000	0.0142
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0158	0.0000	0.0032	0.0000	0.0095
Sb	0.0000	0.0474	0.0000	0.0095	0.0000	0.0285
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0079	0.0000	0.0016	0.0000	0.0047
Sn	0.0000	0.0474	0.0000	0.0095	0.0000	0.0285
Sr	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
V	0.0000	0.0395	0.0000	0.0079	0.0000	0.0237
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0553	0.0000	0.0111	0.0000	0.0332
Zn	0.0000	0.0079	0.0000	0.0016	0.0000	0.0047
Ions						
F	2.7941	0.5007	0.0000	0.0723	1.3971	0.2865
Cl	2.2132	1.3684	5.2950	0.5197	3.7541	0.9440
NO2	1.2920	0.2766	0.6574	0.0756	0.9747	0.1761
Br	0.0000	1.1960	0.0000	0.2399	0.0000	0.7180
NO3	0.0000	0.4760	0.1696	0.1040	0.0848	0.2900
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	4.1324	1.4812	0.9912	0.3053	2.5618	0.8932
Na	0.0000	9.5259	4.7001	2.1463	2.3500	5.8361
NH4	0.0000	0.4179	0.0000	0.0838	0.0000	0.2509
K	0.0000	4.8358	0.0000	0.9700	0.0000	2.9029
Ca	3.6887	1.9559	0.2827	0.3694	1.9857	1.1626
Mg	2.9044	0.8242	0.1254	0.1424	1.5149	0.4833
Identified percent of total mass	79.8972	39.1448	63.3077	11.0525	77.7878	25.0987

3 Wheeler LPG (Retrofit)								
Profile Number	V80		V81		V82		Comp-3W-RL (V80,V81,V82)	
Identified Percentage of Total Mass	69.4174		72.1783		67.3336		69.6431	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	60.8597	4.9296	41.3636	3.3505	62.9944	0.0000	55.0725	2.7600
Elemental carbon	3.6666	0.3043	6.8182	0.5659	0.8898	0.0000	3.7915	0.2901
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0689	0.0065	0.4257	0.0638	0.0177	0.0000	0.1708	0.0234
Acenaphthalene	0.0448	0.0047	0.7694	0.0733	0.0123	0.0000	0.2755	0.0260
Fluorene + Acenaphthene	0.0273	0.0043	0.5939	0.0702	0.1507	0.0000	0.2573	0.0248
Phenanthrene	0.0085	0.0049	0.0483	0.0649	0.0006	0.0000	0.0191	0.0233
Anthracene	0.0080	0.0036	0.0415	0.0468	0.0318	0.0000	0.0271	0.0168
Fluoroanthene	0.0223	0.0038	0.5058	0.0625	0.0344	0.0000	0.1875	0.0221
Pyrene	0.0716	0.0055	0.0014	0.0259	0.0337	0.0000	0.0356	0.0105
Benzo(a)Anthracene	0.0023	0.0022	0.0000	0.0289	0.0011	0.0000	0.0011	0.0103
Chrysene	0.0027	0.0015	0.0000	0.0186	0.0018	0.0000	0.0015	0.0067
Benzo(b)Fluoroanthene	0.0082	0.0011	0.0000	0.0098	0.0006	0.0000	0.0029	0.0036
Benzo(k)Fluoroanthene	0.0061	0.0011	0.0000	0.0117	0.0010	0.0000	0.0024	0.0043
Benzo(a)Pyrene	0.0064	0.0011	0.0000	0.0111	0.0009	0.0000	0.0024	0.0041
Dibenz(a,h)anthracene	0.1104	0.0065	0.0000	0.0122	0.0000	0.0000	0.0368	0.0062
Benzo(ghi)Pyrene	0.0076	0.0009	0.0000	0.0069	0.0000	0.0000	0.0025	0.0026
Indenol(1,2,3)Pyrene	0.0047	0.0011	0.0000	0.0115	0.0000	0.0000	0.0016	0.0042
Elements								
Ag	0.0357	0.0009	0.0000	0.0416	0.0000	0.0004	0.0119	0.0143
Al	0.0000	0.0035	0.0000	0.2014	0.0000	0.0016	0.0000	0.0688
As	0.0047	0.0002	0.0000	0.0029	0.0000	0.0001	0.0016	0.0011
Au	0.0000	0.0000	0.0000	0.0424	0.0000	0.0000	0.0000	0.0141
Ba	1.0153	0.0014	0.0000	0.0884	0.4556	0.0007	0.4903	0.0302
Br	0.0000	0.0002	0.0000	0.0117	0.0000	0.0001	0.0000	0.0040
Ca	0.0000	0.0018	8.2993	0.0089	0.0000	0.0008	2.7664	0.0038
Cd	0.0000	0.0009	0.0000	0.0630	0.0000	0.0004	0.0000	0.0214
Cl	0.0000	0.0004	1.7510	0.0372	0.0000	0.0002	0.5837	0.0126
Co	0.0000	0.0005	0.0000	0.0043	0.0000	0.0002	0.0000	0.0017
Cr	0.0000	0.0009	0.0000	0.0055	0.0000	0.0004	0.0000	0.0023
Cs	0.0000	0.0014	0.2182	0.0964	0.0000	0.0007	0.0727	0.0328
Cu	0.0172	0.0002	0.0000	0.0083	0.0027	0.0001	0.0067	0.0028
Fe	0.3569	0.0009	0.0728	0.0149	0.0000	0.0004	0.1432	0.0054
Ga	0.0000	0.0000	0.0000	0.0328	0.0000	0.0000	0.0000	0.0109
Ge	0.0000	0.0000	0.0000	0.0204	0.0000	0.0000	0.0000	0.0068

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0490	0.0012	0.3099	0.0394	0.0000	0.0006	0.1196	0.0137
K	0.0000	0.0018	0.0000	0.0118	0.0000	0.0008	0.0000	0.0048
La	0.0000	0.0018	0.0000	0.1638	0.0000	0.0008	0.0000	0.0555
Mg	0.0000	0.0175	0.0000	3.7115	0.0000	0.0082	0.0000	1.2458
Mn	0.0000	0.0009	0.0000	0.0118	0.0000	0.0004	0.0000	0.0044
Mo	0.0000	0.0018	0.0000	0.0133	0.0000	0.0008	0.0000	0.0053
Na	0.1751	0.1751	0.0000	7.9660	0.2126	0.0822	0.1292	2.7411
Ni	0.0079	0.0004	0.0000	0.0054	0.0089	0.0002	0.0056	0.0020
P	0.0018	0.0005	0.0000	0.0165	0.0031	0.0002	0.0016	0.0058
Pb	0.0007	0.0004	0.0000	0.0132	0.0079	0.0002	0.0029	0.0046
Pd	0.0000	0.0009	0.0000	0.0553	0.0000	0.0004	0.0000	0.0189
Rb	0.0000	0.0005	0.0000	0.0048	0.0000	0.0002	0.0000	0.0018
Rh	0.0000	0.0000	0.0000	0.0535	0.0000	0.0000	0.0000	0.0178
S	0.0000	0.0004	0.0000	0.0413	0.0000	0.0002	0.0000	0.0140
Sb	0.0000	0.0011	0.0000	0.0670	0.0000	0.0005	0.0000	0.0228
Sc	0.0000	0.0000	0.0863	0.0076	0.0000	0.0000	0.0288	0.0025
Se	0.0000	0.0002	0.0000	0.0047	0.0000	0.0001	0.0000	0.0016
Sn	0.0000	0.0011	0.2672	0.0544	0.0000	0.0005	0.0891	0.0186
Sr	0.0000	0.0009	0.0000	0.0316	0.0000	0.0004	0.0000	0.0110
Te	0.0000	0.0000	0.0000	0.0725	0.0000	0.0000	0.0000	0.0242
Ti	0.0000	0.0009	1.9730	0.0115	0.0000	0.0004	0.6577	0.0043
V	0.0000	0.0009	0.1176	0.0034	0.0000	0.0004	0.0392	0.0016
W	0.0000	0.0000	0.0000	0.1255	0.0000	0.0000	0.0000	0.0418
Y	0.0000	0.0012	0.1164	0.0194	0.0000	0.0006	0.0388	0.0071
Zn	0.0333	0.0002	0.0000	0.0110	0.1200	0.0001	0.0511	0.0038
Ions								
F	0.0423	0.0101	0.0000	0.1113	0.0184	0.0042	0.0202	0.0419
Cl	0.6952	0.0630	4.0682	0.5935	0.4294	0.0248	1.7309	0.2271
NO2	0.0026	0.0048	0.0000	0.0654	0.0000	0.0022	0.0009	0.0241
Br	0.0000	0.0265	0.0000	0.3697	0.2300	0.0187	0.0767	0.1383
NO3	0.0936	0.0152	0.0000	0.1471	0.0064	0.0051	0.0333	0.0558
PO4	0.0000	0.0000	0.0000	0.0000			0.0000	0.0000
SO4	0.7607	0.0667	1.1409	0.4510	0.4805	0.0264	0.7940	0.1813
Na	0.0000	0.2109	0.0000	2.9444	0.0000	0.0990	0.0000	1.0848
NH4	0.0000	0.0093	0.0000	0.1292	0.0000	0.0043	0.0000	0.0476
K	0.0000	0.1071	0.5386	1.5216	0.0000	0.0503	0.1795	0.5597
Ca	1.0341	0.0915	2.0718	0.6513	1.0214	0.0464	1.3758	0.2631
Mg	0.1653	0.0233	0.5795	0.2388	0.1660	0.0116	0.3036	0.0912
Identified percent of total mass	69.4174	6.1332	72.1783	24.8542	67.3336	0.3974	69.6431	10.4616

4 Wheeler CNG (OE)						
Profile Number	V83		V84		Comp-3W-OC (V83,V84)	
Identified Percentage of Total Mass	64.1108		63.3271		63.7189	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon						
Organic carbon	23.3977	1.8952	22.9599	1.8598	23.1788	1.8775
Elemental carbon	19.3822	1.6087	12.7310	1.0567	16.0566	1.3327
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)						
Naphthalene	0.0612	0.0103	0.0620	0.0107	0.0616	0.0105
Acenaphthalene	0.0590	0.0088	0.1141	0.0119	0.0865	0.0104
Fluorene + Acenaphthene	0.2551	0.0198	0.2387	0.0193	0.2469	0.0195
Phenanthrene	0.0019	0.0107	0.0012	0.0113	0.0015	0.0110
Anthracene	0.0387	0.0095	0.0285	0.0095	0.0336	0.0095
Fluoroanthene	0.0230	0.0074	0.0462	0.0090	0.0346	0.0082
Pyrene	0.1644	0.0127	0.2090	0.0152	0.1867	0.0140
Benzo(a)Anthracene	0.0039	0.0051	0.0017	0.0053	0.0028	0.0052
Chrysene	0.0020	0.0033	0.0029	0.0035	0.0024	0.0034
Benzo(b)Fluoroanthene	0.0013	0.0017	0.0023	0.0019	0.0018	0.0018
Benzo(k)Fluoroanthene	0.0021	0.0021	0.0023	0.0022	0.0022	0.0021
Benzo(a)Pyrene	0.0020	0.0020	0.0024	0.0021	0.0022	0.0021
Dibenz(a,h)anthracene	0.0000	0.0021	0.0000	0.0022	0.0000	0.0021
Benzo(ghi)Pyrene	0.0000	0.0012	0.0000	0.0012	0.0000	0.0012
Indenol(1,2,3)Pyrene	0.0000	0.0020	0.0000	0.0021	0.0000	0.0020
Elements						
Ag	0.0000	0.0055	0.0000	0.0058	0.0000	0.0056
Al	0.0000	0.0218	0.0000	0.0231	0.0000	0.0225
As	0.0000	0.0011	0.0065	0.0012	0.0032	0.0011
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	1.5283	0.0087	0.0000	0.0092	0.7642	0.0090
Br	0.0000	0.0011	0.0349	0.0012	0.0175	0.0011
Ca	0.0000	0.0109	0.0000	0.0116	0.0000	0.0112
Cd	0.0000	0.0055	0.0000	0.0058	0.0000	0.0056
Cl	3.6309	0.0022	4.5498	0.0023	4.0903	0.0022
Co	0.0000	0.0033	0.0786	0.0035	0.0393	0.0034
Cr	0.0000	0.0055	0.0000	0.0058	0.0000	0.0056
Cs	0.0000	0.0087	0.0000	0.0092	0.0000	0.0090
Cu	0.0810	0.0011	0.0372	0.0012	0.0591	0.0011
Fe	0.0000	0.0055	0.0000	0.0058	0.0000	0.0056
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
I	0.0000	0.0076	0.6473	0.0081	0.3237	0.0079
K	2.1178	0.0109	0.0000	0.0116	1.0589	0.0112
La	0.0000	0.0109	0.0000	0.0116	0.0000	0.0112
Mg	0.0000	0.1092	2.4275	0.1156	1.2137	0.1124
Mn	0.0524	0.0055	0.2404	0.0058	0.1464	0.0056
Mo	0.0000	0.0109	0.0000	0.0116	0.0000	0.0112
Na	0.2183	1.0917	0.6936	1.1559	0.4559	1.1238
Ni	0.0000	0.0022	0.8074	0.0023	0.4037	0.0022
P	0.2224	0.0033	0.0417	0.0035	0.1321	0.0034
Pb	0.0590	0.0022	0.0162	0.0023	0.0376	0.0022
Pd	0.0000	0.0055	0.0000	0.0058	0.0000	0.0056
Rb	0.0437	0.0033	0.0000	0.0035	0.0218	0.0034
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0022	0.0000	0.0023	0.0000	0.0022
Sb	0.0000	0.0066	0.0000	0.0069	0.0000	0.0067
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0011	0.0000	0.0012	0.0000	0.0011
Sn	0.0000	0.0066	0.2034	0.0069	0.1017	0.0067
Sr	0.0000	0.0055	0.0000	0.0058	0.0000	0.0056
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	0.5677	0.0055	0.0000	0.0058	0.2838	0.0056
V	0.0000	0.0055	0.0000	0.0058	0.0000	0.0056
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0076	0.0000	0.0081	0.0000	0.0079
Zn	0.6223	0.0011	0.0000	0.0012	0.3111	0.0011
Ions						
F	0.0000	0.3565	0.0000	0.3775	0.0000	0.3670
Cl	3.8610	0.4618	3.4199	0.4551	3.6404	0.4584
NO2	0.1583	0.0548	0.8054	0.0903	0.4818	0.0726
Br	0.1019	0.0236	0.3369	0.0365	0.2194	0.0300
NO3	1.6486	0.1228	1.9056	0.1382	1.7771	0.1305
PO4	0.2432	0.0124	0.1104	0.0056	0.1768	0.0090
SO4	1.6396	0.1768	2.0444	0.2029	1.8420	0.1898
Na	1.9629	0.4224	1.8250	0.4345	1.8940	0.4284
NH4	0.8571	0.0437	2.7195	0.1387	1.7883	0.0912
K	1.0996	0.2074	3.3189	0.3287	2.2093	0.2681
Ca	0.0000	0.1990	0.4450	0.2330	0.2225	0.2160
Mg	0.0000	0.0376	0.2093	0.0503	0.1047	0.0439
Identified percent of total mass	64.1108	7.1066	63.3271	6.9820	63.7189	7.0443

4 Wheeler CNG (Retrofit)								
Profile Number	V85		V86		V87		Comp-3W-RC (V85,V86,V 87)	
Identified Percentage of Total Mass	71.1470		89.5971		92.2212		84.3218	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	43.5832	3.5302	27.3171	2.2127	31.8182	2.5773	34.2395	2.0800
Elemental carbon	22.8565	1.8971	22.6829	1.8827	17.6653	1.4662	21.0682	1.3115
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0595	0.0073	0.0223	0.0238	0.0358	0.0114	0.0392	0.0106
Acenaphthalene	0.0167	0.0043	0.0113	0.0190	0.2650	0.0212	0.0977	0.0111
Fluorene + Acenaphthene	0.1231	0.0103	0.7113	0.0576	0.3693	0.0279	0.4012	0.0239
Phenanthrene	0.0020	0.0064	0.0000	0.0335	0.0000	0.0142	0.0007	0.0135
Anthracene	0.0174	0.0054	0.0133	0.0247	0.0000	0.0102	0.0102	0.0101
Fluoroanthene	0.0110	0.0043	0.2398	0.0319	0.0054	0.0087	0.0854	0.0112
Pyrene	0.0968	0.0075	0.0000	0.0139	0.0000	0.0059	0.0323	0.0068
Benzo(a)Anthracene	0.0007	0.0029	0.0000	0.0155	0.0000	0.0066	0.0002	0.0062
Chrysene	0.0006	0.0019	0.0000	0.0100	0.0000	0.0042	0.0002	0.0040
Benzo(b)Fluoroanthene	0.0012	0.0010	0.0000	0.0053	0.0000	0.0022	0.0004	0.0021
Benzo(k)Fluoroanthene	0.0015	0.0012	0.0000	0.0063	0.0000	0.0026	0.0005	0.0025
Benzo(a)Pyrene	0.0016	0.0012	0.0000	0.0060	0.0000	0.0025	0.0005	0.0024
Dibenz(a,h)anthracene	0.0000	0.0012	0.0000	0.0066	0.0000	0.0028	0.0000	0.0026
Benzo(ghi)Pyrene	0.0000	0.0007	0.0000	0.0037	0.0000	0.0016	0.0000	0.0015
Indenol(1,2,3)Pyrene	0.0000	0.0012	0.0000	0.0062	0.0000	0.0026	0.0000	0.0025
Elements								
Ag	0.0000	0.0032	0.0000	0.0587	0.0000	0.0248	0.0000	0.0217
Al	0.0000	0.0129	0.0000	0.2842	0.0000	0.1204	0.0000	0.1044
As	0.0000	0.0006	0.0000	0.0041	0.0000	0.0018	0.0000	0.0016
Au	0.0000	0.0000	0.0000	0.0598	0.0000	0.0253	0.0000	0.0213
Ba	0.6461	0.0052	0.0000	0.1248	0.0000	0.0528	0.2154	0.0457
Br	0.0000	0.0006	0.0414	0.0166	0.0000	0.0070	0.0138	0.0061
Ca	0.0000	0.0065	4.8188	0.0126	1.6789	0.0053	2.1659	0.0061
Cd	0.0000	0.0032	0.3021	0.0889	0.1736	0.0376	0.1586	0.0324
Cl	0.0000	0.0013	0.0000	0.0525	0.2887	0.0223	0.0962	0.0190
Co	0.0000	0.0019	0.0344	0.0061	0.0000	0.0026	0.0115	0.0027
Cr	0.0000	0.0032	0.0000	0.0078	0.0000	0.0033	0.0000	0.0036
Cs	0.0000	0.0052	0.0000	0.1360	0.0000	0.0576	0.0000	0.0497
Cu	0.0174	0.0006	0.0000	0.0117	0.0170	0.0050	0.0115	0.0043
Fe	0.0000	0.0032	0.7059	0.0210	1.0975	0.0089	0.6011	0.0083
Ga	0.0000	0.0000	0.0000	0.0463	0.0000	0.0196	0.0000	0.0165
Ge	0.0000	0.0000	0.0641	0.0288	0.0000	0.0122	0.0214	0.0102

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0045	0.0000	0.0557	0.0000	0.0236	0.0000	0.0209
K	0.1292	0.0065	0.0000	0.0167	0.0000	0.0071	0.0431	0.0075
La	0.0000	0.0065	0.0000	0.2312	0.0000	0.0979	0.0000	0.0839
Mg	0.0000	0.0646	0.0000	5.2371	0.0000	2.2182	0.0000	1.8800
Mn	0.0000	0.0032	0.0000	0.0167	0.3098	0.0071	0.1033	0.0067
Mo	0.0000	0.0065	0.0000	0.0187	0.0000	0.0079	0.0000	0.0083
Na	0.0000	0.6461	0.0000	11.2403	0.0000	4.7609	0.0000	4.1618
Ni	0.0000	0.0013	0.0000	0.0076	0.0473	0.0032	0.0158	0.0030
P	0.0162	0.0019	0.0000	0.0233	0.0000	0.0099	0.0054	0.0088
Pb	0.0504	0.0013	0.0000	0.0186	0.0493	0.0079	0.0332	0.0069
Pd	0.0000	0.0032	0.0000	0.0781	0.0000	0.0331	0.0000	0.0286
Rb	0.0000	0.0019	0.0000	0.0067	0.0000	0.0028	0.0000	0.0029
Rh	0.0000	0.0000	0.0000	0.0755	0.0000	0.0320	0.0000	0.0269
S	0.0000	0.0013	0.0000	0.0583	1.6913	0.0247	0.5638	0.0211
Sb	0.0000	0.0039	0.0000	0.0945	0.0000	0.0400	0.0000	0.0346
Sc	0.0000	0.0000	0.0465	0.0108	0.0303	0.0046	0.0256	0.0038
Se	0.0000	0.0006	0.0000	0.0066	0.0000	0.0028	0.0000	0.0025
Sn	0.0000	0.0039	0.0000	0.0768	0.0000	0.0325	0.0000	0.0283
Sr	0.0000	0.0032	0.0000	0.0446	0.0000	0.0189	0.0000	0.0167
Te	0.0000	0.0000	0.0000	0.1023	0.0000	0.0433	0.0000	0.0364
Ti	0.2972	0.0032	0.0000	0.0162	0.0000	0.0069	0.0991	0.0066
V	0.0000	0.0032	0.0000	0.0048	0.0000	0.0020	0.0000	0.0025
W	0.0000	0.0000	0.0000	0.1771	0.0000	0.0750	0.0000	0.0630
Y	0.0000	0.0045	0.2136	0.0274	0.0341	0.0116	0.0825	0.0109
Zn	0.0000	0.0006	0.0000	0.0155	0.0000	0.0066	0.0000	0.0057
Ions								
F	0.0000	0.2110	0.0000	1.1261	0.0207	0.4780	0.0069	0.4538
Cl	0.1417	0.1652	2.5732	0.9727	6.9008	0.7058	3.2052	0.4609
NO2	0.3336	0.0446	0.0000	0.1481	0.0000	0.0627	0.1112	0.0639
Br	0.0375	0.0128	4.5415	0.2889	2.2541	0.1392	2.2777	0.1102
NO3	0.8250	0.0650	0.9756	0.1731	5.0052	0.3069	2.2686	0.1363
PO4	0.0800	0.0041	3.9634	0.2021	0.0000	0.0000	1.3478	0.0515
SO4	0.4471	0.0782	8.6789	0.7362	7.9735	0.5305	5.6998	0.3362
Na	1.3537	0.2597	4.7732	1.2622	5.1467	0.6924	3.7579	0.5535
NH4	0.0000	0.0000	0.0000	0.0000	0.4081	0.0208	0.1360	0.0052
K	0.0000	0.0900	0.0000	0.4805	2.0702	0.3077	0.6901	0.2196
Ca	0.0000	0.1178	5.4129	0.9007	6.1460	0.5768	3.8529	0.3988
Mg	0.0000	0.0222	1.4537	0.1919	0.7190	0.0865	0.7242	0.0752
Identified percent of total mass	71.1470	7.3745	89.5971	29.4624	92.2212	15.9623	84.3218	13.1998

4Wheeler LPG (OE)						
Profile Number	V88		V89		Comp-4W-OL (V88,V89)	
Identified Percentage of Total Mass	54.9581		88.2330		71.5955	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon						
Organic carbon	19.9334	1.6146	29.6471	2.4014	24.7902	2.0080
Elemental carbon	15.3142	1.2711	22.9412	1.9041	19.1277	1.5876
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)						
Naphthalene	0.2222	0.0152	0.1282	0.0338	0.1752	0.0245
Acenaphthalene	0.0000	0.0031	0.0721	0.0259	0.0360	0.0145
Fluorene + Acenaphthene	0.0000	0.0037	0.4241	0.0474	0.2120	0.0256
Phenanthrene	0.0000	0.0057	0.0173	0.0413	0.0086	0.0235
Anthracene	0.0316	0.0057	0.1080	0.0344	0.0698	0.0200
Fluoroanthene	0.0000	0.0034	0.1777	0.0329	0.0889	0.0181
Pyrene	0.4640	0.0260	0.7469	0.0546	0.6055	0.0403
Benzo(a)Anthracene	0.0000	0.0026	0.0077	0.0191	0.0038	0.0108
Chrysene	0.0000	0.0017	0.0141	0.0127	0.0071	0.0072
Benzo(b)Fluoroanthene	0.0000	0.0009	0.0044	0.0066	0.0022	0.0037
Benzo(k)Fluoroanthene	0.0000	0.0011	0.0064	0.0079	0.0032	0.0045
Benzo(a)Pyrene	0.0000	0.0010	0.0082	0.0076	0.0041	0.0043
Dibenz(a,h)anthracene	0.0000	0.0011	0.0000	0.0079	0.0000	0.0045
Benzo(ghi)Pyrene	0.0000	0.0006	0.0000	0.0044	0.0000	0.0025
Indenol(1,2,3)Pyrene	0.0000	0.0011	0.0000	0.0075	0.0000	0.0043
Elements						
Ag	0.0000	0.0100	0.0000	0.0208	0.0000	0.0154
Al	0.0000	0.0485	6.4865	0.0832	3.2432	0.0658
As	0.0000	0.0007	0.0474	0.0042	0.0237	0.0024
Au	0.0000	0.0102	0.0000	0.0000	0.0000	0.0051
Ba	0.0000	0.0213	0.0000	0.0333	0.0000	0.0273
Br	0.0000	0.0028	0.0000	0.0042	0.0000	0.0035
Ca	0.6671	0.0022	6.7359	0.0416	3.7015	0.0219
Cd	0.0706	0.0152	0.0000	0.0208	0.0353	0.0180
Cl	0.0211	0.0090	0.4665	0.0083	0.2438	0.0086
Co	0.0000	0.0010	0.0000	0.0125	0.0000	0.0068
Cr	0.0000	0.0013	0.0000	0.0208	0.0000	0.0111
Cs	0.0000	0.0232	0.0000	0.0333	0.0000	0.0282
Cu	0.0043	0.0020	0.0000	0.0042	0.0022	0.0031
Fe	0.9008	0.0036	0.6071	0.0208	0.7539	0.0122
Ga	0.0000	0.0079	0.0000	0.0000	0.0000	0.0040
Ge	0.0000	0.0049	0.0000	0.0000	0.0000	0.0025

Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
I	0.0000	0.0095	0.0000	0.0291	0.0000	0.0193
K	0.0000	0.0028	0.0000	0.0416	0.0000	0.0222
La	0.0000	0.0394	0.0000	0.0416	0.0000	0.0405
Mg	2.5498	0.8936	0.0000	0.4158	1.2749	0.6547
Mn	0.0000	0.0028	0.0000	0.0208	0.0000	0.0118
Mo	0.0108	0.0032	0.0000	0.0416	0.0054	0.0224
Na	0.0000	1.9178	0.0000	4.1580	0.0000	3.0379
Ni	0.0216	0.0013	0.0000	0.0083	0.0108	0.0048
P	0.0000	0.0040	0.0753	0.0125	0.0376	0.0082
Pb	0.0118	0.0032	0.0249	0.0083	0.0184	0.0057
Pd	0.1113	0.0133	0.0000	0.0208	0.0556	0.0171
Rb	0.0000	0.0011	0.0000	0.0125	0.0000	0.0068
Rh	0.0000	0.0129	0.0000	0.0000	0.0000	0.0064
S	1.1712	0.0100	0.0000	0.0083	0.5856	0.0091
Sb	0.0364	0.0161	0.0000	0.0249	0.0182	0.0205
Sc	0.0064	0.0018	0.0000	0.0000	0.0032	0.0009
Se	0.0000	0.0011	0.0000	0.0042	0.0000	0.0026
Sn	0.0000	0.0131	0.0000	0.0249	0.0000	0.0190
Sr	0.0000	0.0076	0.6653	0.0208	0.3326	0.0142
Te	0.0000	0.0175	0.0000	0.0000	0.0000	0.0087
Ti	0.0000	0.0028	0.7484	0.0208	0.3742	0.0118
V	0.0000	0.0008	0.0000	0.0208	0.0000	0.0108
W	0.0000	0.0302	0.0000	0.0000	0.0000	0.0151
Y	0.0236	0.0047	0.0000	0.0291	0.0118	0.0169
Zn	0.0000	0.0026	0.0000	0.0042	0.0000	0.0034
Ions						
F	0.0000	0.1921	0.0000	1.3579	0.0000	0.7750
Cl	1.0674	0.1976	5.6029	1.2987	3.3352	0.7482
NO2	0.0146	0.0260	0.0000	0.1786	0.0073	0.1023
Br	0.6958	0.0453	0.0000	0.0702	0.3479	0.0577
NO3	1.0757	0.0757	3.2941	0.3160	2.1849	0.1959
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	4.5415	0.2815	5.2892	0.6250	4.9154	0.4532
Na	2.3895	0.2949	0.4324	1.2548	1.4109	0.7748
NH4	0.0583	0.0030	0.0000	0.0000	0.0291	0.0015
K	1.4582	0.1556	0.8500	0.6220	1.1541	0.3888
Ca	1.9098	0.2036	2.0567	0.8609	1.9833	0.5323
Mg	0.1752	0.0291	0.5471	0.1705	0.3611	0.0998
Identified percent of total mass	54.9581	7.6400	88.2330	16.6806	71.5955	12.1603

4 Wheeler LPG (Retrofit)								
Profile Number	V90		V91		V92		Comp-4W-RL (V90,V91,V 92)	
Identified Percentage of Total Mass	57.2457		53.9121		97.6440		69.8676	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon								
Organic carbon	34.5558	2.7990	15.7622	1.2767	33.7500	2.7338	28.0227	2.2698
Elemental carbon	9.3478	0.7759	7.2210	0.5993	12.1875	1.0116	9.5854	0.7956
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	0.0855	0.0131	0.0129	0.0040	0.5680	0.0578	0.2221	0.0250
Acenaphthalene	0.0276	0.0085	0.0185	0.0037	0.8232	0.0653	0.2898	0.0258
Fluorene + Acenaphthene	0.1526	0.0161	0.0966	0.0081	0.7359	0.0649	0.3284	0.0297
Phenanthrene	0.0203	0.0140	0.0043	0.0052	0.0443	0.0452	0.0229	0.0215
Anthracene	0.0858	0.0136	0.0151	0.0043	0.0454	0.0330	0.0488	0.0170
Fluoroanthene	0.0617	0.0108	0.0137	0.0037	0.0000	0.0254	0.0251	0.0133
Pyrene	0.0717	0.0090	0.1156	0.0079	0.0000	0.0178	0.0624	0.0116
Benzo(a)Anthracene	0.0027	0.0061	0.0019	0.0024	0.0000	0.0198	0.0015	0.0095
Chrysene	0.0122	0.0045	0.0022	0.0016	0.0000	0.0128	0.0048	0.0063
Benzo(b)Fluoroanthene	0.0341	0.0038	0.0006	0.0008	0.0000	0.0067	0.0116	0.0038
Benzo(k)Fluoroanthene	0.0308	0.0040	0.0011	0.0010	0.0000	0.0080	0.0106	0.0043
Benzo(a)Pyrene	0.3504	0.0201	0.0014	0.0010	0.0000	0.0077	0.1172	0.0096
Dibenz(a,h)anthracene	0.0656	0.0059	0.0037	0.0012	0.0000	0.0084	0.0231	0.0051
Benzo(ghi)Pyrene	0.1560	0.0094	0.0012	0.0006	0.0000	0.0047	0.0524	0.0049
Indenol(1,2,3)Pyrene	0.2062	0.0129	0.0008	0.0010	0.0000	0.0079	0.0690	0.0073
Elements								
Ag	0.0000	0.0067	0.0000	0.0026	0.0000	0.0751	0.0000	0.0281
Al	2.0310	0.0267	0.7321	0.0103	0.0000	0.3641	0.9211	0.1337
As	0.0190	0.0013	0.0117	0.0005	0.0000	0.0053	0.0102	0.0024
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0766	0.0000	0.0255
Ba	0.8017	0.0107	0.0000	0.0041	0.0000	0.1598	0.2672	0.0582
Br	0.0000	0.0013	0.0000	0.0005	0.0000	0.0212	0.0000	0.0077
Ca	2.0578	0.0134	0.0000	0.0052	3.2523	0.0162	1.7700	0.0116
Cd	0.0000	0.0067	0.0000	0.0026	0.3094	0.1138	0.1031	0.0410
Cl	0.0000	0.0027	0.4436	0.0010	0.0000	0.0673	0.1479	0.0237
Co	0.0000	0.0040	0.0000	0.0015	0.0000	0.0078	0.0000	0.0045
Cr	0.0000	0.0067	0.0000	0.0026	0.0000	0.0099	0.0000	0.0064
Cs	0.0000	0.0107	0.0000	0.0041	0.0000	0.1743	0.0000	0.0630
Cu	0.0433	0.0013	0.0028	0.0005	0.0000	0.0150	0.0154	0.0056
Fe	0.2352	0.0067	4.3185	0.0026	0.6608	0.0269	1.7382	0.0121
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0594	0.0000	0.0198
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0368	0.0000	0.0123

Species	% Mass (PM10)	Uncerta inty (%)						
I	0.0000	0.0094	0.0000	0.0036	0.0000	0.0713	0.0000	0.0281
K	2.2983	0.0134	0.0000	0.0052	0.0000	0.0213	0.7661	0.0133
La	0.0000	0.0134	0.0000	0.0052	0.0000	0.2962	0.0000	0.1049
Mg	0.0000	0.1336	0.5981	0.0516	0.0000	6.7100	0.1994	2.2984
Mn	0.0000	0.0067	0.0495	0.0026	0.0000	0.0213	0.0165	0.0102
Mo	0.0000	0.0134	0.0000	0.0052	0.0000	0.0240	0.0000	0.0142
Na	0.0000	1.3362	0.0000	0.5156	14.3756	14.4016	4.7919	5.4178
Ni	0.0000	0.0027	0.0000	0.0010	0.0000	0.0097	0.0000	0.0045
P	0.0000	0.0040	0.2497	0.0015	0.0000	0.0298	0.0832	0.0118
Pb	0.0000	0.0027	0.0526	0.0010	0.1032	0.0239	0.0519	0.0092
Pd	0.0000	0.0067	0.0000	0.0026	0.0000	0.1001	0.0000	0.0364
Rb	0.0000	0.0040	0.0000	0.0015	0.0000	0.0086	0.0000	0.0047
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0968	0.0000	0.0323
S	0.0000	0.0027	0.1939	0.0010	0.0000	0.0748	0.0646	0.0262
Sb	0.0000	0.0080	0.0000	0.0031	0.0000	0.1211	0.0000	0.0441
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0138	0.0000	0.0046
Se	0.0000	0.0013	0.0000	0.0005	0.0000	0.0085	0.0000	0.0034
Sn	0.0000	0.0080	0.0907	0.0031	0.0000	0.0983	0.0302	0.0365
Sr	0.0000	0.0067	0.4331	0.0026	0.0000	0.0571	0.1444	0.0221
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.1311	0.0000	0.0437
Ti	0.5345	0.0067	0.2475	0.0026	0.1698	0.0208	0.3173	0.0100
V	0.0000	0.0067	0.0000	0.0026	0.0000	0.0061	0.0000	0.0051
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.2269	0.0000	0.0756
Y	0.0000	0.0094	0.0000	0.0036	0.1165	0.0351	0.0388	0.0160
Zn	0.0000	0.0013	0.0000	0.0005	0.0000	0.0199	0.0000	0.0072
Ions								
F	0.4206	0.4574	0.0000	0.1684	0.0000	1.4428	0.1402	0.6895
Cl	0.6380	0.3589	6.4194	0.4517	0.0000	1.0810	2.3525	0.6305
NO2	0.0000	0.0574	0.0000	0.0221	0.0000	0.1898	0.0000	0.0898
Br	0.0000	0.0226	1.1513	0.0673	7.3031	0.4458	2.8182	0.1785
NO3	0.0662	0.0514	0.1331	0.0252	0.3125	0.1746	0.1706	0.0837
PO4	1.6021	0.0817	0.0000	0.0000			0.8010	0.0408
SO4	0.2678	0.1285	5.3933	0.3187	9.3854	0.8551	5.0155	0.4341
Na	0.0000	0.3963	1.9354	0.2504	0.0000	1.3102	0.6451	0.6523
NH4	0.0662	0.0034	3.7050	0.1889	2.9844	0.1522	2.2518	0.1148
K	0.2684	0.1997	2.7659	0.2120	0.0000	0.6157	1.0114	0.3424
Ca	0.5948	0.2733	1.5989	0.1746	7.3571	1.1753	3.1836	0.5411
Mg	0.0340	0.0477	0.1134	0.0234	3.1594	0.3116	1.1023	0.1276
Identified percent of total mass	57.2457	7.5005	53.9121	4.4797	97.6440	35.7426	69.8676	15.9212

HCV-CNG (OE)						
Profile Number	V93		V94		Comp-HCV-OC (V93,V94)	
Identified Percentage of Total Mass	77.5950		85.7816		81.6883	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncertainty (%)
Carbon						
Organic carbon	43.9430	3.5594	36.8023	2.9810	40.3727	3.2702
Elemental carbon	19.9525	1.6561	32.1105	2.6652	26.0315	2.1606
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)						
Naphthalene	0.0000	0.0221	0.1651	0.0354	0.0825	0.0288
Acenaphthalene	0.0000	0.0180	0.0631	0.0252	0.0316	0.0216
Fluorene + Acenaphthene	0.0000	0.0210	0.2876	0.0402	0.1438	0.0306
Phenanthrene	0.0000	0.0327	0.0072	0.0403	0.0036	0.0365
Anthracene	0.0000	0.0234	0.0805	0.0326	0.0402	0.0280
Fluoroanthene	0.0000	0.0193	0.5276	0.0503	0.2638	0.0348
Pyrene	0.0000	0.0135	0.6155	0.0477	0.3078	0.0306
Benzo(a)Anthracene	0.0000	0.0151	0.0478	0.0208	0.0239	0.0180
Chrysene	0.0000	0.0097	0.0305	0.0134	0.0153	0.0116
Benzo(b)Fluoroanthene	0.0000	0.0051	0.0580	0.0092	0.0290	0.0072
Benzo(k)Fluoroanthene	0.0000	0.0061	0.0248	0.0087	0.0124	0.0074
Benzo(a)Pyrene	0.0000	0.0058	0.0409	0.0092	0.0205	0.0075
Dibenz(a,h)anthracene	0.0000	0.0064	0.1326	0.0145	0.0663	0.0104
Benzo(ghi)Pyrene	0.0000	0.0036	0.0082	0.0048	0.0041	0.0042
Indenol(1,2,3)Pyrene	0.0000	0.0060	0.0440	0.0096	0.0220	0.0078
Elements						
Ag	0.0000	0.0168	0.0000	0.0205	0.0000	0.0187
Al	2.4347	0.0672	2.7124	0.0822	2.5735	0.0747
As	0.1853	0.0034	0.1767	0.0041	0.1810	0.0037
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	0.0000	0.0269	0.0000	0.0329	0.0000	0.0299
Br	0.0000	0.0034	0.0000	0.0041	0.0000	0.0037
Ca	0.0000	0.0336	0.0000	0.0411	0.0000	0.0373
Cd	0.0000	0.0168	0.0000	0.0205	0.0000	0.0187
Cl	0.0000	0.0067	0.0000	0.0082	0.0000	0.0075
Co	0.0000	0.0101	0.0000	0.0123	0.0000	0.0112
Cr	0.0000	0.0168	0.0000	0.0205	0.0000	0.0187
Cs	0.0000	0.0269	0.0000	0.0329	0.0000	0.0299
Cu	0.0000	0.0034	0.0000	0.0041	0.0000	0.0037
Fe	0.0000	0.0168	0.0000	0.0205	0.0000	0.0187
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncertainty (%)
I	0.0000	0.0235	0.0000	0.0288	0.0000	0.0261
K	3.6698	0.0336	3.0411	0.0411	3.3555	0.0373
La	0.0000	0.0336	0.0000	0.0411	0.0000	0.0373
Mg	0.0000	0.3358	0.0000	0.4110	0.0000	0.3734
Mn	0.0000	0.0168	0.0000	0.0205	0.0000	0.0187
Mo	0.0000	0.0336	0.0000	0.0411	0.0000	0.0373
Na	0.0000	3.3580	0.0000	4.1096	0.0000	3.7338
Ni	0.0000	0.0067	0.0000	0.0082	0.0000	0.0075
P	0.0000	0.0101	0.0000	0.0123	0.0000	0.0112
Pb	0.0000	0.0067	0.0000	0.0082	0.0000	0.0075
Pd	0.0000	0.0168	0.0000	0.0205	0.0000	0.0187
Rb	0.0000	0.0101	0.0000	0.0123	0.0000	0.0112
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0067	0.0000	0.0082	0.0000	0.0075
Sb	0.0000	0.0201	0.0000	0.0247	0.0000	0.0224
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0034	0.0000	0.0041	0.0000	0.0037
Sn	0.0000	0.0201	0.0000	0.0247	0.0000	0.0224
Sr	1.1639	0.0168	1.8904	0.0205	1.5272	0.0187
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	2.4382	0.0168	2.7946	0.0205	2.6164	0.0187
V	0.0000	0.0168	0.0000	0.0205	0.0000	0.0187
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0235	0.0000	0.0288	0.0000	0.0261
Zn	0.0000	0.0034	0.0000	0.0041	0.0000	0.0037
Ions						
F	0.0000	0.0582	0.0000	1.3421	0.0000	0.7001
Cl	1.9287	0.3002	1.7587	1.0936	1.8437	0.6969
NO2	0.0000	0.0342	0.0000	0.1765	0.0000	0.1054
Br	0.0000	0.1932	0.0000	0.0694	0.0000	0.1313
NO3	0.0000	0.0769	0.0000	0.1479	0.0000	0.1124
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	0.7411	0.2429	0.8382	0.3961	0.7896	0.3195
Na	0.0000	1.5386	0.0000	1.2188	0.0000	1.3787
NH4	0.9976	0.1178	1.3808	0.0704	1.1892	0.0941
K	0.1401	0.7881	0.1424	0.5799	0.1413	0.6840
Ca	0.0000	0.2861	0.0000	0.7490	0.0000	0.5175
Mg	0.0000	0.1096	0.0000	0.1414	0.0000	0.1255
Identified percent of total mass	77.5950	13.4303	85.7816	17.2084	81.6883	15.3193

HCV-CNG (Retrofit)						
Profile Number	V95		V96		Comp-HCV-RC (V95, V96)	
Identified Percentage of Total Mass	81.8639		68.8825		75.3732	
Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
Carbon						
Organic carbon	45.0252	3.6470	42.0952	3.4097	43.5602	3.5284
Elemental carbon	20.6639	1.7151	15.3228	1.2718	17.9933	1.4934
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)						
Naphthalene	0.0000	0.0783	0.0000	0.0493	0.0000	0.0638
Acenaphthalene	0.0000	0.0636	0.0000	0.0400	0.0000	0.0518
Fluorene + Acenaphthene	0.0000	0.0744	0.0000	0.0469	0.0000	0.0606
Phenanthrene	0.0000	0.1155	0.0000	0.0728	0.0000	0.0941
Anthracene	0.0000	0.0827	0.0000	0.0521	0.0000	0.0674
Fluoroanthene	0.0000	0.0684	0.0000	0.0431	0.0000	0.0557
Pyrene	0.0000	0.0478	0.0000	0.0301	0.0000	0.0389
Benzo(a)Anthracene	0.0000	0.0533	0.0000	0.0336	0.0000	0.0435
Chrysene	0.0000	0.0343	0.0000	0.0216	0.0000	0.0280
Benzo(b)Fluoroanthene	0.0000	0.0181	0.0000	0.0114	0.0000	0.0148
Benzo(k)Fluoroanthene	0.0000	0.0216	0.0000	0.0136	0.0000	0.0176
Benzo(a)Pyrene	0.0000	0.0206	0.0000	0.0130	0.0000	0.0168
Dibenz(a,h)anthracene	0.0000	0.0226	0.0000	0.0142	0.0000	0.0184
Benzo(ghi)Pyrene	0.0000	0.0127	0.0000	0.0080	0.0000	0.0104
Indenol(1,2,3)Pyrene	0.0000	0.0213	0.0000	0.0134	0.0000	0.0174
Elements						
Ag	0.0000	0.0594	0.0000	0.0374	0.0000	0.0484
Al	3.0084	0.2376	1.6878	0.1496	2.3481	0.1936
As	0.1261	0.0119	0.1217	0.0075	0.1239	0.0097
Au	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ba	0.0000	0.0950	0.0000	0.0598	0.0000	0.0774
Br	0.0000	0.0119	0.0000	0.0075	0.0000	0.0097
Ca	0.0000	0.1188	0.0000	0.0748	0.0000	0.0968
Cd	0.0000	0.0594	0.0000	0.0374	0.0000	0.0484
Cl	0.0000	0.0238	0.0000	0.0150	0.0000	0.0194
Co	0.0000	0.0356	0.0000	0.0224	0.0000	0.0290
Cr	0.0000	0.0594	0.0000	0.0374	0.0000	0.0484
Cs	0.0000	0.0950	0.0000	0.0598	0.0000	0.0774
Cu	0.1328	0.0119	0.1048	0.0075	0.1188	0.0097
Fe	0.0000	0.0594	0.0000	0.0374	0.0000	0.0484
Ga	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Species	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)	% Mass (PM10)	Uncerta inty (%)
I	0.0000	0.0832	0.0000	0.0524	0.0000	0.0678
K	2.1513	0.1188	2.0582	0.0748	2.1047	0.0968
La	0.0000	0.1188	0.0000	0.0748	0.0000	0.0968
Mg	0.0000	1.1880	0.0000	0.7480	0.0000	0.9680
Mn	0.0000	0.0594	0.0000	0.0374	0.0000	0.0484
Mo	0.0000	0.1188	0.0000	0.0748	0.0000	0.0968
Na	0.0000	11.8800	0.0000	7.4800	0.0000	9.6800
Ni	0.0000	0.0238	0.0000	0.0150	0.0000	0.0194
P	0.0000	0.0356	0.0000	0.0224	0.0000	0.0290
Pb	0.0000	0.0238	0.0000	0.0150	0.0000	0.0194
Pd	0.0000	0.0594	0.0000	0.0374	0.0000	0.0484
Rb	0.0000	0.0356	0.0000	0.0224	0.0000	0.0290
Rh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0238	0.0000	0.0150	0.0000	0.0194
Sb	0.0000	0.0713	0.0000	0.0449	0.0000	0.0581
Sc	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Se	0.0000	0.0119	0.0000	0.0075	0.0000	0.0097
Sn	0.0000	0.0713	0.0000	0.0449	0.0000	0.0581
Sr	2.4370	0.0594	1.8413	0.0374	2.1391	0.0484
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ti	2.9412	0.0594	1.6931	0.0374	2.3171	0.0484
V	0.0000	0.0594	0.0000	0.0374	0.0000	0.0484
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0000	0.0832	0.0000	0.0524	0.0000	0.0678
Zn	0.0000	0.0119	0.0000	0.0075	0.0000	0.0097
Ions						
F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cl	2.6891	0.0000	2.3810	0.0000	2.5350	0.0000
NO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Br	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NO3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PO4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO4	0.7479	0.0000	0.3439	0.0000	0.5459	0.0000
Na	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NH4	1.4706	0.0000	0.9788	0.0000	1.2247	0.0000
K	0.4706	0.0000	0.2540	0.0000	0.3623	0.0000
Ca	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mg	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Identified percent of total mass	81.8639	21.1731	68.8825	14.6366	75.3732	17.9049

11.4 Composite profiles

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Profile Number	Comp-2S2W (V1 to V9)	
Identified % of Total Mass	90.0859	
Species	% Mass(PM10)	Uncertainty (%)
Carbon		
Organic carbon	57.3424	4.6447
Elemental carbon	3.1032	0.2576
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.2140	0.0252
Acenaphthalene	0.6828	0.0309
Fluorene + Acenaphthene	0.6516	0.0310
Phenanthrene	0.0352	0.0336
Anthracene	0.0207	0.0241
Fluoroanthene	0.1011	0.0250
Pyrene	0.0664	0.0172
Benzo(a)Anthracene	0.0019	0.0156
Chrysene	0.0012	0.0100
Benzo(b)Fluoroanthene	0.1648	0.0054
Benzo(k)Fluoroanthene	0.0004	0.0063
Benzo(a)Pyrene	0.0002	0.0060
Dibenz(a,h)anthracene	0.0000	0.0066
Benzo(ghi)Pyrene	0.0000	0.0037
Indenol(1,2,3)Pyrene	0.0000	0.0062
Elements		
Ag	0.0000	0.0312
Al	0.0000	0.1514
As	0.0000	0.0022
Au	0.0000	0.0318
Ba	0.8134	0.0664
Br	0.0189	0.0088
Ca	3.1630	0.0067
Cd	0.0000	0.0473
Cl	0.1501	0.0280
Co	0.0070	0.0033
Cr	0.0000	0.0041
Cs	0.0632	0.0725
Cu	0.0065	0.0062
Fe	0.0556	0.0112
Ga	0.0000	0.0247
Ge	0.0098	0.0153
I	0.0225	0.0296
K	0.0325	0.0089
La	0.0000	0.1231

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	2.7895
Mn	0.0546	0.0089
Mo	0.0081	0.0100
Na	1.2952	5.9871
Ni	0.0000	0.0040
P	0.0000	0.0124
Pb	0.0374	0.0099
Pd	0.0000	0.0416
Rb	0.0000	0.0036
Rh	0.0070	0.0402
S	0.0353	0.0311
Sb	0.0909	0.0504
Sc	0.0154	0.0057
Se	0.0000	0.0035
Sn	0.1001	0.0409
Sr	0.0000	0.0237
Te	0.1942	0.0545
Ti	1.0373	0.0087
V	0.1919	0.0025
W	0.2052	0.0943
Y	0.0298	0.0146
Zn	0.2918	0.0083
Ions		
F	0.3088	0.0992
Cl	4.3696	0.5127
NO ₂	0.0599	0.0522
Br	1.4296	0.3501
NO ₃	0.8580	0.1540
PO ₄	0.0000	0.0000
SO ₄	4.2363	0.5106
Na	2.6561	2.3461
NH ₄	0.5648	0.1258
K	1.9946	1.2237
Ca	2.4535	0.5352
Mg	0.8320	0.1995
Identified percent of total mass	90.0859	21.1763

Profile Number	Comp-4S2W (V10 to 18)	
Identified % of Total Mass	97.5696	
Species	% Mass(PM10)	Uncertainty (%)
Carbon		
Organic carbon	48.6299	3.9390
Elemental carbon	5.0779	0.3829
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	1.6244	0.1298
Acenaphthalene	0.3817	0.1054
Fluorene + Acenaphthene	1.6373	0.1234
Phenanthrene	0.1274	0.1916
Anthracene	0.0604	0.1371
Fluoroanthene	0.5320	0.1134
Pyrene	1.9328	0.0792
Benzo(a)Anthracene	0.0449	0.0884
Chrysene	0.0414	0.0569
Benzo(b)Fluoroanthene	0.1107	0.0300
Benzo(k)Fluoroanthene	0.1342	0.0357
Benzo(a)Pyrene	0.6420	0.0341
Dibenz(a,h)anthracene	0.1251	0.0374
Benzo(ghi)Pyrene	0.4267	0.0211
Indenol(1,2,3)Pyrene	0.7507	0.0353
Elements		
Ag	0.0000	0.0440
Al	0.0000	0.1860
As	0.0010	0.0072
Au	0.0000	0.0122
Ba	3.2632	0.0766
Br	0.0000	0.0098
Ca	1.7923	0.0666
Cd	0.6873	0.0501
Cl	0.1383	0.0235
Co	0.0141	0.0204
Cr	0.0000	0.0336
Cs	0.1930	0.0789
Cu	0.0355	0.0088
Fe	0.0823	0.0363
Ga	0.0000	0.0095
Ge	0.0000	0.0059
I	1.2645	0.0562
K	0.4714	0.0674
La	0.0327	0.1112

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	1.7081
Mn	0.1135	0.0354
Mo	0.0000	0.0678
Na	0.3982	8.6934
Ni	0.3297	0.0143
P	0.0315	0.0239
Pb	0.3189	0.0166
Pd	0.1886	0.0479
Rb	0.0000	0.0206
Rh	0.0123	0.0154
S	0.0000	0.0247
Sb	0.2238	0.0577
Sc	0.0000	0.0022
Se	0.0123	0.0078
Sn	0.4131	0.0541
Sr	0.0000	0.0411
Te	0.0691	0.0209
Ti	1.5979	0.0353
V	0.3195	0.0330
W	0.0548	0.0361
Y	0.0000	0.0504
Zn	1.2286	0.0096
Ions		
F	0.6087	0.3444
Cl	5.0700	1.3508
NO ₂	0.4318	0.2053
Br	1.1503	1.0802
NO ₃	0.3902	0.4297
PO ₄	0.0000	0.0000
SO ₄	5.9354	1.3909
Na	1.7593	8.7137
NH ₄	0.0000	0.3756
K	0.0000	4.3759
Ca	4.4641	1.7376
Mg	2.1928	0.6709
Identified percent of total mass	97.5696	38.1362

Profile Number	Comp-3WG (V19 to V27)	
Identified % of Total Mass	82.3019	
Species	% Mass(PM10)	Uncertainty (%)
Carbon		
Organic carbon	54.2368	4.3932
Elemental carbon	4.6962	0.3898
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.3505	0.0419
Acenaphthalene	0.3315	0.0364
Fluorene + Acenaphthene	0.2519	0.0357
Phenanthrene	0.0164	0.0365
Anthracene	0.0353	0.0273
Fluoroanthene	0.1471	0.0286
Pyrene	0.8778	0.0594
Benzo(a)Anthracene	0.0565	0.0193
Chrysene	0.0111	0.0112
Benzo(b)Fluoroanthene	0.0241	0.0068
Benzo(k)Fluoroanthene	0.0102	0.0072
Benzo(a)Pyrene	0.3857	0.0260
Dibenz(a,h)anthracene	0.0458	0.0093
Benzo(ghi)Pyrene	0.3491	0.0217
Indenol(1,2,3)Pyrene	0.0170	0.0074
Elements		
Ag	0.0000	0.0175
Al	0.0000	0.0823
As	0.0004	0.0016
Au	0.0000	0.0151
Ba	2.0571	0.0357
Br	0.0009	0.0047
Ca	0.7385	0.0084
Cd	0.0000	0.0251
Cl	0.0772	0.0143
Co	0.0071	0.0031
Cr	0.0000	0.0046
Cs	0.0660	0.0386
Cu	0.0025	0.0035
Fe	0.1142	0.0079
Ga	0.0057	0.0117
Ge	0.0052	0.0073
I	0.0464	0.0177
K	0.0503	0.0095
La	0.0000	0.0637

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	1.3767
Mn	0.0444	0.0068
Mo	0.0109	0.0100
Na	0.0000	3.3662
Ni	0.0015	0.0030
P	0.0047	0.0075
Pb	0.0103	0.0058
Pd	0.0000	0.0224
Rb	0.0000	0.0033
Rh	0.0069	0.0191
S	0.0723	0.0158
Sb	0.0649	0.0271
Sc	0.0085	0.0027
Se	0.0000	0.0022
Sn	0.0410	0.0226
Sr	0.0000	0.0139
Te	0.0797	0.0259
Ti	0.2286	0.0067
V	0.0335	0.0038
W	0.0487	0.0448
Y	0.0122	0.0106
Zn	1.2007	0.0044
Ions		
F	0.0363	0.0654
Cl	2.6215	0.3544
NO ₂	0.0495	0.0399
Br	1.5224	0.2880
NO ₃	0.7594	0.1224
PO ₄	0.0000	0.0000
SO ₄	4.7952	0.4678
Na	0.8344	1.7237
NH ₄	0.0068	0.0741
K	1.3387	0.9211
Ca	3.0502	0.4667
Mg	0.4041	0.1401
Identified percent of total mass	82.3019	15.1948

Profile Number	Comp-3WD (V28 to V36)	
Identified % of Total Mass	71.4574	
Species	% Mass(PM10)	Uncertainty (%)
Carbon		
Organic carbon	48.7253	4.0163
Elemental carbon	16.2023	1.3520
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.1256	0.0116
Acenaphthalene	0.0801	0.0083
Fluorene + Acenaphthene	0.1224	0.0111
Phenanthrene	0.0052	0.0080
Anthracene	0.0075	0.0059
Fluoroanthene	0.0276	0.0060
Pyrene	0.0790	0.0072
Benzo(a)Anthracene	0.0040	0.0038
Chrysene	0.0057	0.0026
Benzo(b)Fluoroanthene	0.0106	0.0017
Benzo(k)Fluoroanthene	0.0098	0.0019
Benzo(a)Pyrene	0.0050	0.0016
Dibenz(a,h)anthracene	0.0122	0.0021
Benzo(ghi)Pyrene	0.0105	0.0014
Indenol(1,2,3)Pyrene	0.0059	0.0017
Elements		
Ag	0.0000	0.0021
Al	0.0000	0.0089
As	0.0007	0.0004
Au	0.0000	0.0005
Ba	0.5392	0.0037
Br	0.0000	0.0005
Ca	0.1477	0.0033
Cd	0.0035	0.0024
Cl	0.0440	0.0011
Co	0.0001	0.0010
Cr	0.0000	0.0017
Cs	0.0477	0.0038
Cu	0.0061	0.0004
Fe	0.0029	0.0018
Ga	0.0000	0.0004
Ge	0.0000	0.0002
I	0.1294	0.0027
K	0.1684	0.0034
La	0.0000	0.0052

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	0.0772
Mn	0.0039	0.0018
Mo	0.0003	0.0034
Na	0.3892	0.4199
Ni	0.0091	0.0007
P	0.0082	0.0012
Pb	0.0104	0.0008
Pd	0.0225	0.0023
Rb	0.0016	0.0010
Rh	0.0000	0.0006
S	0.0214	0.0011
Sb	0.0694	0.0028
Sc	0.0000	0.0001
Se	0.0000	0.0004
Sn	0.0047	0.0026
Sr	0.0563	0.0020
Te	0.0034	0.0009
Ti	0.1824	0.0018
V	0.0031	0.0017
W	0.0000	0.0015
Y	0.0002	0.0025
Zn	0.1201	0.0005
Ions		
F	0.1735	0.2430
Cl	0.9520	0.2272
NO ₂	0.0965	0.0363
Br	0.3028	0.0327
NO ₃	0.0352	0.0292
PO ₄	0.0237	0.0012
SO ₄	0.5559	0.0959
Na	0.5927	0.2768
NH ₄	0.0000	0.0016
K	0.3418	0.1358
Ca	0.8362	0.1797
Mg	0.1127	0.0327
Identified percent of total mass	71.4574	7.3053

Profile Number	Comp-PCG (V37 to V45)	
Identified % of Total Mass	86.8539	
Species	% Mass (PM10)	Uncertainty (%)
Carbon		
Organic carbon	47.9797	4.2629
Elemental carbon	13.4243	1.1998
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.2600	0.0353
Acenaphthalene	0.0778	0.0219
Fluorene + Acenaphthene	0.2506	0.0337
Phenanthrene	0.0129	0.0332
Anthracene	0.0149	0.0241
Fluoroanthene	0.0616	0.0224
Pyrene	0.5029	0.0391
Benzo(a)Anthracene	0.5095	0.0410
Chrysene	0.0341	0.0114
Benzo(b)Fluoroanthene	0.4778	0.0295
Benzo(k)Fluoroanthene	0.1156	0.0119
Benzo(a)Pyrene	0.0329	0.0075
Dibenz(a,h)anthracene	0.0064	0.0067
Benzo(ghi)Pyrene	0.0479	0.0060
Indenol(1,2,3)Pyrene	0.0088	0.0065
Elements		
Ag	0.0000	0.0461
Al	0.1270	0.2195
As	0.0128	0.0038
Au	0.0000	0.0424
Ba	0.0000	0.0957
Br	0.0000	0.0126
Ca	2.3728	0.0180
Cd	0.1980	0.0675
Cl	0.9943	0.0391
Co	0.0000	0.0070
Cr	0.0000	0.0100
Cs	0.1192	0.1037
Cu	0.0176	0.0092
Fe	0.3468	0.0194
Ga	0.0396	0.0328
Ge	0.1024	0.0204
I	0.3799	0.0458
K	0.1078	0.0209
La	0.0000	0.1729

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0808	3.8019
Mn	0.0560	0.0163
Mo	0.0036	0.0223
Na	0.4611	8.8730
Ni	0.0111	0.0072
P	0.0661	0.0192
Pb	0.0819	0.0150
Pd	0.1434	0.0599
Rb	0.0463	0.0075
Rh	0.0000	0.0535
S	0.4136	0.0432
Sb	0.0000	0.0724
Sc	0.0275	0.0076
Se	0.0000	0.0056
Sn	0.1358	0.0598
Sr	0.0927	0.0361
Te	0.0000	0.0725
Ti	1.5934	0.0160
V	0.2497	0.0079
W	0.0000	0.1255
Y	0.0684	0.0258
Zn	0.0000	0.0119
Ions		
F	0.4384	1.1164
Cl	2.4432	0.9476
NO ₂	0.0035	0.1441
Br	0.7956	0.0970
NO ₃	1.3977	0.1922
PO ₄	0.0000	0.0000
SO ₄	3.2020	0.4563
Na	2.8612	1.1477
NH ₄	0.4959	0.0253
K	1.4564	0.5402
Ca	1.3475	0.6787
Mg	0.2449	0.1277
Identified percent of total mass	86.8539	25.6130

Profile Number	Comp-PCD '(V46 to V54)	
Identified % of Total Mass	75.0104	
Species	% Mass (PM10)	Uncertainty (%)
Carbon		
Organic carbon	50.2617	4.0712
Elemental carbon	18.5921	1.5431
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.0073	0.0025
Acenaphthalene	0.0237	0.0029
Fluorene + Acenaphthene	0.0364	0.0039
Phenanthrene	0.0020	0.0032
Anthracene	0.0010	0.0023
Fluoroanthene	0.0072	0.0022
Pyrene	0.0366	0.0032
Benzo(a)Anthracene	0.0002	0.0015
Chrysene	0.0009	0.0010
Benzo(b)Fluoroanthene	0.0050	0.0007
Benzo(k)Fluoroanthene	0.0008	0.0006
Benzo(a)Pyrene	0.0013	0.0006
Dibenz(a,h)anthracene	0.0049	0.0009
Benzo(ghi)Pyrene	0.0015	0.0004
Indenol(1,2,3)Pyrene	0.0013	0.0006
Elements		
Ag	0.0000	0.0040
Al	0.0187	0.0189
As	0.0048	0.0003
Au	0.0000	0.0036
Ba	0.5727	0.0082
Br	0.0000	0.0011
Ca	0.5068	0.0016
Cd	0.0122	0.0058
Cl	0.0307	0.0033
Co	0.0001	0.0006
Cr	0.0000	0.0009
Cs	0.0000	0.0089
Cu	0.0139	0.0008
Fe	0.0257	0.0017
Ga	0.0000	0.0028
Ge	0.0014	0.0017
I	0.0257	0.0040
K	0.6492	0.0019
La	0.0000	0.0148

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	0.3250
Mn	0.0031	0.0014
Mo	0.0000	0.0020
Na	0.0000	0.7649
Ni	0.0012	0.0006
P	0.0161	0.0017
Pb	0.0207	0.0013
Pd	0.0040	0.0051
Rb	0.0000	0.0007
Rh	0.0000	0.0046
S	0.3240	0.0037
Sb	0.0000	0.0062
Sc	0.0043	0.0006
Se	0.0000	0.0005
Sn	0.0000	0.0052
Sr	0.0000	0.0031
Te	0.0006	0.0062
Ti	0.2344	0.0014
V	0.0001	0.0007
W	0.0000	0.0107
Y	0.0027	0.0023
Zn	0.3033	0.0010
Ions		
F	0.0239	0.0907
Cl	0.1046	0.0747
NO ₂	0.0066	0.0125
Br	0.4907	0.0325
NO ₃	0.1665	0.0193
PO ₄	0.0000	0.0000
SO ₄	0.7406	0.0640
Na	0.5204	0.1301
NH ₄	0.0098	0.0015
K	0.4364	0.0718
Ca	0.6551	0.0869
Mg	0.0956	0.0158
Identified percent of total mass	75.0104	7.4745

Profile Number	Comp-LCVD (V55 to V63)	
Identified % of Total Mass	80.2186	
Species	% Mass (PM10)	Uncertainty (%)
Carbon		
Organic carbon	46.1627	3.7392
Elemental carbon	26.8582	2.2292
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.0157	0.0029
Acenaphthalene	0.0196	0.0027
Fluorene + Acenaphthene	0.0565	0.0048
Phenanthrene	0.0010	0.0031
Anthracene	0.0016	0.0023
Fluoroanthene	0.0129	0.0025
Pyrene	0.0560	0.0041
Benzo(a)Anthracene	0.0037	0.0016
Chrysene	0.0002	0.0009
Benzo(b)Fluoroanthene	0.0023	0.0006
Benzo(k)Fluoroanthene	0.0005	0.0006
Benzo(a)Pyrene	0.0028	0.0007
Dibenz(a,h)anthracene	0.0059	0.0009
Benzo(ghi)Pyrene	0.0022	0.0005
Indenol(1,2,3)Pyrene	0.0007	0.0006
Elements		
Ag	0.0000	0.0040
Al	0.0000	0.0189
As	0.0014	0.0004
Au	0.0000	0.0035
Ba	0.7824	0.0082
Br	0.0008	0.0011
Ca	0.2099	0.0019
Cd	0.0186	0.0058
Cl	0.1719	0.0033
Co	0.0021	0.0007
Cr	0.0000	0.0010
Cs	0.0447	0.0089
Cu	0.0085	0.0008
Fe	0.0076	0.0018
Ga	0.0045	0.0027
Ge	0.0011	0.0017
I	0.0015	0.0041
K	0.0290	0.0021
La	0.0000	0.0147

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	0.3179
Mn	0.0006	0.0016
Mo	0.0015	0.0022
Na	0.0000	0.7727
Ni	0.0011	0.0007
P	0.0002	0.0017
Pb	0.0143	0.0013
Pd	0.0129	0.0051
Rb	0.0000	0.0007
Rh	0.0000	0.0044
S	0.4155	0.0036
Sb	0.0005	0.0062
Sc	0.0034	0.0006
Se	0.0000	0.0005
Sn	0.0115	0.0052
Sr	0.0290	0.0032
Te	0.0028	0.0060
Ti	0.0949	0.0015
V	0.0123	0.0009
W	0.0000	0.0104
Y	0.0070	0.0024
Zn	0.5324	0.0010
Ions		
F	0.0000	0.1035
Cl	0.1206	0.0836
NO ₂	0.0020	0.0137
Br	0.6491	0.0384
NO ₃	0.2302	0.0230
PO ₄	0.0000	0.0000
SO ₄	0.9770	0.0768
Na	0.2600	0.1071
NH ₄	0.0759	0.0039
K	0.8502	0.0872
Ca	1.2157	0.1192
Mg	0.2119	0.0216
Identified percent of total mass	80.2186	7.9107

Profile Number	Comp-HCVD (V64 to V72)	
Identified % of Total Mass	85.8832	
Species	% Mass (PM10)	Uncertainty (%)
Carbon		
Organic carbon	51.9282	4.2062
Elemental carbon	24.6248	2.0439
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.3915	0.0027
Acenaphthalene	0.3445	0.0019
Fluorene + Acenaphthene	0.9509	0.0035
Phenanthrene	0.0909	0.0031
Anthracene	0.0924	0.0025
Fluoroanthene	0.6541	0.0024
Pyrene	0.3516	0.0045
Benzo(a)Anthracene	0.0664	0.0036
Chrysene	0.0827	0.0009
Benzo(b)Fluoroanthene	0.1005	0.0012
Benzo(k)Fluoroanthene	0.0704	0.0010
Benzo(a)Pyrene	0.3531	0.0007
Dibenz(a,h)anthracene	0.2898	0.0050
Benzo(ghi)Pyrene	0.1714	0.0005
Indenol(1,2,3)Pyrene	0.2245	0.0004
Elements		
Ag	0.0032	0.0032
Al	0.0000	0.0150
As	0.0039	0.0003
Au	0.0000	0.0024
Ba	0.4067	0.0064
Br	0.0000	0.0008
Ca	0.2266	0.0023
Cd	0.0175	0.0045
Cl	0.1025	0.0025
Co	0.0018	0.0008
Cr	0.0000	0.0012
Cs	0.0078	0.0069
Cu	0.0033	0.0006
Fe	0.0514	0.0017
Ga	0.0000	0.0019
Ge	0.0015	0.0012
I	0.0211	0.0035
K	0.0520	0.0025
La	0.0000	0.0110

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	0.2275
Mn	0.0000	0.0016
Mo	0.0012	0.0025
Na	0.0000	0.6291
Ni	0.0013	0.0007
P	0.0037	0.0015
Pb	0.0066	0.0011
Pd	0.0076	0.0040
Rb	0.0000	0.0008
Rh	0.0000	0.0030
S	0.1772	0.0027
Sb	0.0046	0.0049
Sc	0.0008	0.0004
Se	0.0000	0.0004
Sn	0.0354	0.0041
Sr	0.0644	0.0027
Te	0.0068	0.0041
Ti	0.1248	0.0015
V	0.0000	0.0011
W	0.0000	0.0071
Y	0.0037	0.0024
Zn	0.0336	0.0008
Ions		
F	0.0378	0.1055
Cl	0.2003	0.0877
NO ₂	0.0119	0.0142
Br	0.4244	0.0269
NO ₃	0.2831	0.0257
PO ₄	0.0000	0.0000
SO ₄	1.0599	0.0811
Na	0.3267	0.1105
NH ₄	0.0000	0.0000
K	0.5250	0.0707
Ca	0.7570	0.0960
Mg	0.0984	0.0159
Identified percent of total mass	85.8832	7.8913

Profile Number	All Gasoline	
Identified % of Total Mass	89.2061	
Species	% Mass (PM10)	Uncertainty (%)
Carbon		
Organic carbon	52.0472	4.3100
Elemental carbon	6.5754	0.5575
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.6122	0.0581
Acenaphthalene	0.3583	0.0481
Fluorene + Acenaphthene	0.7096	0.0565
Phenanthrene	0.0476	0.0737
Anthracene	0.0285	0.0528
Fluoroanthene	0.2090	0.0473
Pyrene	0.8527	0.0491
Benzo(a)Anthracene	0.1534	0.0411
Chrysene	0.0219	0.0224
Benzo(b)Fluoroanthene	0.1941	0.0179
Benzo(k)Fluoroanthene	0.0654	0.0153
Benzo(a)Pyrene	0.2648	0.0184
Dibenz(a,h)anthracene	0.0443	0.0150
Benzo(ghi)Pyrene	0.2060	0.0131
Indenol(1,2,3)Pyrene	0.1941	0.0138
Elements		
Ag	0.0000	0.0347
Al	0.0318	0.1598
As	0.0035	0.0037
Au	0.0000	0.0254
Ba	1.5334	0.0686
Br	0.0049	0.0090
Ca	2.0167	0.0249
Cd	0.2213	0.0475
Cl	0.3400	0.0262
Co	0.0071	0.0085
Cr	0.0000	0.0131
Cs	0.1103	0.0734
Cu	0.0155	0.0069
Fe	0.1497	0.0187
Ga	0.0113	0.0197
Ge	0.0294	0.0122
I	0.4283	0.0373
K	0.1655	0.0267
La	0.0082	0.1177

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0202	2.4191
Mn	0.0671	0.0169
Mo	0.0057	0.0275
Na	0.5386	6.7299
Ni	0.0856	0.0071
P	0.0256	0.0158
Pb	0.1121	0.0118
Pd	0.0830	0.0429
Rb	0.0116	0.0087
Rh	0.0065	0.0321
S	0.1303	0.0287
Sb	0.0949	0.0519
Sc	0.0129	0.0046
Se	0.0031	0.0048
Sn	0.1725	0.0443
Sr	0.0232	0.0287
Te	0.0857	0.0434
Ti	1.1143	0.0167
V	0.1986	0.0118
W	0.0772	0.0752
Y	0.0276	0.0253
Zn	0.6803	0.0085
Ions		
F	0.3480	0.4063
Cl	3.6261	0.7914
NO ₂	0.1362	0.1104
Br	1.2245	0.4538
NO ₃	0.8513	0.2246
PO ₄	0.0000	0.0000
SO ₄	4.5422	0.7064
Na	2.0277	3.4828
NH ₄	0.2669	0.1502
K	1.1974	1.7652
Ca	2.8288	0.8546
Mg	0.9185	0.2845
Identified percent of total mass	89.2061	25.0301

Profile Number	All Diesel	
Identified % of Total Mass	78.1424	
Species	% Mass(PM10)	Uncertainty (%)
Carbon		
Organic carbon	49.2695	4.0082
Elemental carbon	21.5693	1.7921
Molecular markers: Polynuclear Aromatic Hydrocarbons (PAH)		
Naphthalene	0.1350	0.0049
Acenaphthalene	0.1170	0.0040
Fluorene + Acenaphthene	0.2915	0.0058
Phenanthrene	0.0248	0.0044
Anthracene	0.0256	0.0032
Fluoroanthene	0.1755	0.0033
Pyrene	0.1308	0.0047
Benzo(a)Anthracene	0.0186	0.0026
Chrysene	0.0224	0.0014
Benzo(b)Fluoroanthene	0.0296	0.0011
Benzo(k)Fluoroanthene	0.0204	0.0010
Benzo(a)Pyrene	0.0905	0.0009
Dibenz(a,h)anthracene	0.0782	0.0022
Benzo(ghi)Pyrene	0.0464	0.0007
Indenol(1,2,3)Pyrene	0.0581	0.0008
Elements		
Ag	0.0008	0.0033
Al	0.0047	0.0154
As	0.0027	0.0003
Au	0.0000	0.0025
Ba	0.5752	0.0066
Br	0.0002	0.0009
Ca	0.2727	0.0023
Cd	0.0130	0.0046
Cl	0.0873	0.0026
Co	0.0010	0.0008
Cr	0.0000	0.0012
Cs	0.0250	0.0071
Cu	0.0079	0.0007
Fe	0.0219	0.0018
Ga	0.0011	0.0019
Ge	0.0010	0.0012
I	0.0444	0.0036
K	0.2246	0.0025
La	0.0000	0.0114

Species	% Mass (PM10)	Uncertainty (%)
Mg	0.0000	0.2369
Mn	0.0019	0.0016
Mo	0.0007	0.0025
Na	0.0973	0.6467
Ni	0.0032	0.0007
P	0.0070	0.0015
Pb	0.0130	0.0011
Pd	0.0117	0.0042
Rb	0.0004	0.0008
Rh	0.0000	0.0032
S	0.2345	0.0028
Sb	0.0186	0.0050
Sc	0.0021	0.0005
Se	0.0000	0.0005
Sn	0.0129	0.0043
Sr	0.0374	0.0027
Te	0.0034	0.0043
Ti	0.1591	0.0016
V	0.0039	0.0011
W	0.0000	0.0074
Y	0.0034	0.0024
Zn	0.2473	0.0008
Ions		
F	0.0588	0.1357
Cl	0.3444	0.1183
NO ₂	0.0292	0.0192
Br	0.4667	0.0326
NO ₃	0.1787	0.0243
PO ₄	0.0059	0.0003
SO ₄	0.8333	0.0795
Na	0.4249	0.1561
NH ₄	0.0214	0.0017
K	0.5383	0.0914
Ca	0.8660	0.1205
Mg	0.1296	0.0215
Identified percent of total mass	78.1424	7.6455

ADDENDUM

Inertia setting for different categories of vehicles

For the purpose of mass emission testing the following inertia setting for the dynamometer was used.

- 2-wheelers: ULW (Unladen Weight) + 75 kg
- 3-wheelers gasoline: 225 kg (3 passengers X 75)
- 3-wheeler diesel: GVW
- Passenger cars: ULW+225 kg(3 passengers X 75 kg)
- Multi Utility Vehicles: ULW+450 kg (6 passengers X 75kg)
- LCV
 - Bus: ULW + 1500 kg (equivalent to 20 passengers of 75 kg weight each)
 - Trucks: GVW (As specified by the vehicle manufacturer)
- HCV:
 - Bus – ULW + 4500 kg (Equivalent to 60 passengers of 75 kg each)
 - Trucks – GVW (To be limited to 20 ton max. for GVW > 20tons. If GVW is less than 20 tons, Inertia will be set to the maximum specified GVW)

The coast down equation for the dynamometer tests was used as per the available data with ARAI. For vehicles above 3.5 t GVW, empirical equations/ extrapolated equations were used.