COMPARISON OF SAMPLING METHODS

FOR

CARBONACEOUS AEROSOLS IN AMBIENT AIR

FINAL REPORT

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Prepared by

Susanne V. Hering
Dept. of Chemical Engineering
University of California
Los Angeles, CA 90024

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Abstract

Measurement methods for fine particle carbon (<2.5 μm) were compared under field sampling conditions. For nine consecutive days in August 1986, samplers were operated side-by-side in the Los Angeles Basin. Sampling methods included filtration, impaction and adsorption corrected filtration. Analytical methods were compared separately. For ambient sampling of organic carbon, the mean results over the study period from the individual laboratories varied by more than a factor of two. However, in the analytical comparison for organic carbon, the individual laboratory means were within 13% of the grand mean. For elemental carbon, differences among laboratories for both the analytical comparison and the ambient sampling were as much as a factor of three.

Most of the observed differences in ambient measurements of organic carbon are attributed to differences in sampling methodology. The highest reported concentrations were obtained by quartz filter sampling, with method mean values 3% to 21% higher than the grand mean. The lowest values were from the impactors, excluding the quartz after-filters, which gave method mean values 45% to 54% lower than the grand mean. Comparison of results from the different sampling systems and analysis of back-up filter data indicate organic carbon adsorption artifacts on quartz fiber filters can be significant. For the two impactor systems, the after-filters contained a large proportion of organic carbon (38% and 47%), but very little elemental carbon (5% and 12%). For systems employing tandem filters, the carbon found on the back-up filters was 14% to 53% of the aerosol carbon.

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I. Summary and Conclusions

Study Objectives

Ambient air sampling methods for organic and non-volatile (or black) carbon were compared under field conditions in a nine-day field study conducted in Glendora, CA during August, 1986. Eight different research groups participated in the comparison. The principal collection methods were filtration, impaction and denuded filter systems. Some systems employed back-up filters to correct for gaseous adsorption onto filter surfaces, while others designed collectors to correct for volatilization losses during sampling. Each group operated their own samplers, and were responsible for their own sample analyses.

The objectives of the study were: (1) to quantify differences among sampling methods for organic and total carbon aerosol concentrations; and (2) to evaluate the relative importance of volatilization and adsorption artifacts for organic aerosol sampling. These issues were addressed through a multifaceted study. The three major components were: (1) an interlaboratoy comparison of analytical methods for ambient samples; (2) side-by-side ambient sampling for nine consecutive days; and (3) special experiments designed to assess the magnitude of specific types of artifacts. The separate evaluation of analytical methods [component (1)] was necessitated because each participant group was responsible for their own sample analyses.

This report presents results from the side-by-side ambient sampling (component 2), and applicable results from the analytical methods comparison (component 1). These two components allow us to establish systematic differences among sampling methods, apart from differences from analytical methods. The importance of volatilization and adsorption artifacts is discussed in terms of the side-by-side results and back-up filter data.

The sampling systems compared here include: quartz filters operated by Environmental Monitoring and Services Inc. (EMSI, Camarillo, CA), the Air and Industrial Hygiene Laboratory (AIHL, Berkeley, CA), the Environmental Protection Agency (EPA, Research Triangle Park, NC) and General Motors (GM, Warren, MI). Adsorption corrected quartz filter systems were operated by the Oregon Graduate Center (OGC, Beaverton, OR), AeroVironment (AV, Monrovia, CA) and AIHL. OGC also operated an *in situ* particulate carbon analyzer. Two impactors were included in the study, a single-stage micro-orifice impactor from the University of Minnesota (UM, Minneapolis, MN) and a cascade impactor operated by GM. The University of California, Davis (UCD, Davis, CA) used a Teflon filter system for total carbon.

Conclusions

For ambient sampling of organic carbon, the mean results over the study period from the individual laboratories varied by more than a factor of two. However, in the analytical comparison for organic carbon, the individual laboratory means were within 13% of the grand mean. For elemental carbon, differences among laboratories for both the analytical comparison and the ambient sampling were as much as a factor of three. Results for total

carbon are much the same as for organic carbon since the organic fraction was dominant, averaging 80% of the total for this study.

Among most of the laboratories, the differences in reported concentrations for ambient organic and total carbon are attributed to sampling method. The only exception is EMSI, which showed lower than average results for both the analytical comparison and ambient sampling. For the other laboratories, the highest ambient sampling results are obtained from quartz filter sampling. Using the grand mean of five of the more consistent sampling methods as a basis of comparison, we find the average reported ambient organic carbon values from the from the AIHL, EPA and GM quartz filters are higher than the average by 3% - 21%. The adsorption corrected quartz filter system from the OGC gave values 22% lower than the grand 5-sampler mean. The lowest organic carbon was reported by the two impactors, with values 45% to 54% lower than the mean (excluding after-filters). Total carbon values from the UCD Teflon filter are comparable to those from the impactors, and lower than those from the quartz filter sampling systems. The mean organic carbon from the AV denuded filter was higher than that from the other quartz filters, but lower than that from the parallel, undenuded filter operated by AV. For elemental carbon, the observed differences in measured values are mostly accounted for by differences in analytical methods.

The data point strongly to a positive, gaseous adsorption artifact for collection of organic aerosols on quartz fiber filters. The aerosol carbon loadings measured using quartz filters are higher than those from the Teflon filter, and higher than those from the impactors (excluding the after-filter). The impactor after-filters contain a large proportion of organic carbon, but very little elemental carbon. For systems employing tandem filters, the carbon found on the back-up filters was 14% to 53% of the aerosol carbon. Higher back-up filter carbon values correspond to shorter term sampling and lower face velocities. In the AV sampling system, the placement of a quartz filter parallel plate denuder upstream of the sample collection reduced the average amount of carbon on the back-up filter from 2.8 to 0.6 μg/m3.

There are inconsistencies among samplers which remain unexplained. Whereas both OGC and AV correct for an adsorption artifact, the AV data are significantly higher for organic and total carbon. In fact, the AV data are higher than the EPA and GM dichotomous sampler quartz filter data, for which no adsorption corrections were made. The difference between OGC and AV is not in the magnitude of the adsorption correction, but in the amount collected on the front (undenuded) filter. The magnitude of the gaseous adsorption correction for the quartz filter data is not sufficient to account for the lower values reported by the UCD Teflon filter and the impactors (excluding the after-filters). Correcting quartz filter data for an adsorption reduces, but does not eliminate, the dependence of reported carbon loadings on filter face velocity and sample duration.

II. Overview of the Carbonaceous Species Measurement Methods Comparison Study

Sampling Artifacts for Aerosol Carbon

Carbonaceous compounds are one of the major components of ambient aerosols, yet there is much debate as to how accurately sample these volatile and/or reactive species. Since virtually all aerosol carbon measurement methods rely on sample collection prior to analysis, the reported ambient concentrations of these species can be no more accurate that the method used for sample collection. Sampling artifacts for specific compounds such as the polycyclic aromatic hydrocarbons have been studied for several decades. Only more recently have artifacts for total particulate carbon been addressed.

For sampling onto quartz filters, several investigators (Appel et al., 1983, McDow and Huntzicker, 1986) have shown that the apparent carbon aerosol concentrations are dependent on face velocity and sample duration. Discrepancies are also found in side-by-side sampling with impactors and quartz filters. McDow and Huntzicker contend that the major artifact is gaseous adsorption onto the quartz filter media. On the other hand Appel et al. have argued that volatilization is important. For specific compounds, such as some of the polycyclic aromatic hydrocarbons, chemical reaction on the collection surface can be important (Peters and Seifert, 1980, Miguel et al. 1986, Pitts et al. 1978, 1980)

Study Objectives

The objectives of the Carbonaceous Species Methods Comparison Study were (1) to quantify differences among various measurement techniques and (2) to better understand the reasons for those differences. Specifically we wished to separate differences due to analysis methods from those due to sampling. Secondly, for sampling, we wished to evaluate the relative importance of volatilization and gaseous adsorption artifacts for organic aerosol sampling. Chemical reaction artifacts were only addressed for specific compounds, but not for total carbonaceous aerosol determinations.

In this study, comparison was made among methods for determining the total organic and non-volatile (or light absorbing) carbon in a polluted urban environment. Aerosol collection methods in the field study included filtration, impaction, electrostatic precipitation, and denuded filter systems. Analytical methods included temperature programed thermal analysis, combustion and forward alpha scattering. Some methods used light adsorption to assay black carbon while others relied on thermal techniques to assay non-volatile carbons.

Components of the Aerosol Carbon Methods Comparison

The aerosol carbon methods comparison consisted of three components: (1) a comparison of analytical methods for total and organic carbon, (2) side-by-side ambient

sampling to evaluate systematic differences among methods under field conditions, and (3) special experiments for evaluating sampling artifacts. By comparing results from the side-by-side ambient sampling (component 2) with those from the analytical methods evaluation (component 1), it is possible to assess whether differences among methods are due to analytical technique or due to sampling methodology. The sampling artifact studies (component 3) were conducted in the field simultaneously with the side-by-side ambient sampling. They were designed to assess the relative magnitude of adsorption, volatilization or chemical reaction artifacts under field conditions. Each of these three components of the study are described below.

(1) Analytical Methods Comparison

Aliquots from 22 different aerosol carbon samples were distributed among 10 different laboratories. Three additional laboratories not involved in the field portion of the study received aliquots from 16 of the samples. Aliquots for each group were distributed at the end of the field study. Each laboratory was responsible for sample transport and storage prior to analysis. Results were reported in terms of mass of carbon per unit area of filter for both organic and elemental (i.e. non-volatile or light absorbing) carbon.

The samples used for the analytical comparison included twelve ambient air samples, three vehicle exhaust samples, two wood smoke samples, one smog chamber sample, one soot sample and one blank. All were collected on quartz fiber filters. The ambient air samples were emphasized because they are most important for interpreting the side-by-side sampling results. The ambient air samples were triplicate sets of four PM10 samples collected during consecutive twelve-hour periods of the field study. The smog chamber sample represented a purely organic aerosol, while the soot sample was mostly elemental carbon. The vehicle samples were one each from catalyst, non-catalyst and diesel vehicles. The other two samples were bulk materials from NBS road dust standards. The analytical comparison was conducted by Environmental Monitoring and Services Inc. (EMSI, Camarillo, CA), and a complete report is given by Countess (1987).

(2) Side-by-Side Ambient Sampling

The field comparison of aerosol carbon measurements specifically addressed the fine, sub2.5μm particle fraction. Samplers were operated continuously for nine consecutive days at Citrus College in Glendora, CA. The samplers were shaded to minimize effects from radiative heating. Investigators operated their own samplers, and were asked to use standard procedures in sample handling, storage and analysis. Results were reported for ambient concentrations of organic and elemental carbon.

To help distinguish between sampling and analysis differences, on one of the sampling periods investigators submitted an aliquot of their sample to a central laboratory for analysis. This permitted analysis of the same sample by two different laboratories. Other quality assurance included collection of dynamic blanks, and sampler flow audits.

(3) Sampling Artifact Studies

Some of the field sampling incorporated experiments designed to assess the relative magnitude of adsorption and volatilization artifacts. A dilution experiment for estimating volatilization and adsorption compared results from ordinary sampling and back-up filters with sampling of partially filtered air. The experiment was performed for both filter and impactor sampling. A volatilization experiment examined the effects of sampler temperature by comparing results from shaded and unshaded samplers. A study of chemical reaction artifacts included speciated analyses of filter samples collected downstream of various denuders designed to remove oxidants or nitric acid. Some investigators addressed artifacts by speciated analyses of front and back-up filters. These experiments ran in parallel to the side-by-side ambient sampling. The artifact experiments are described in the Carbon Study Measurement Protocol (Appendix E), and results are reported by the individual investigators.

Summary of Field Study Measurements

The Carbonaceous Species Methods Comparison Study contained many measurements in addition to aerosol carbon. In particular, the field study included a comparison of measurement methods for formaldehyde, hydrogen peroxide, nitric acid and gaseous hydrocarbons. There were several measurements of inorganic aerosols species. Routine air quality and meteorological measurements included ozone, carbon monoxide, nitrogen oxides, temperature, relative humidity, wind direction and wind speed. A complete list of measurements is given in Appendix A (Table A1). Sampling schedules and the corresponding period numbers are listed in Table A2, and siting of the samplers is given in Figure A1.

III. Comparison of Sampling Methods for Fine Carbonaceous Aerosols

Introduction

Eight different research groups participated in the comparison of sampling methods for organic and non-volatile (or black) carbon. The principal collection methods were filtration, impaction and denuded filter systems. Some systems employed back-up filters to correct for gaseous adsorption onto filter surfaces, while others designed collectors to correct for volatilization losses during sampling.

The objectives of the study were: (1) to quantify differences among sampling methods for organic and total carbon aerosol concentrations; and (2) to evaluate the relative importance of volatilization and adsorption artifacts for organic aerosol sampling. These issues were addressed through a multifaceted study. The three major components were: (1) a comparison of analytical methods for ambient samples; (2) side-by-side ambient sampling for nine consecutive days; and (3) special experiments designed to assess the magnitude of specific types of artifacts.

This chapter presents results from the side-by-side ambient sampling (component 2), and applicable results from the analytical methods comparison (component 1). These two components allow us to establish systematic differences among sampling methods, apart from differences from analytical methods. The importance of volatilization and adsorption artifacts is discussed in terms of the side-by-side results and back-up filter data. The special experiments which directly addressed specific artifacts are not presented.

Measurement Protocol

Side-by-side Sampling: Ambient sampling was conducted for nine consecutive days from August 12 to August 20, 1986. The study site was at Citrus College in Glendora, California, located in the northeastern portion of the Los Angeles Basin. Each research group operated their own samplers, and were responsible for their own sample storage and analysis. Sampling instruments were placed along a 3 m wide, 42 m long, 1 m high wooden platform oriented perpendicular to the prevailing winds. Sampler inlets were 1.5 m above the platform (2.5 m above ground level). Investigators were asked to shade their samplers to reduce radiative heating. All pump exhausts were filtered or vented away from the sampling area. Quality assurance activities included replicate analysis of some samples by a central laboratory, and flow audits.

Two sampling schedules were used. One schedule consisted of five samples per day, with four 4-hour daytime samples beginning at 0800 PDT, and one 8-hour nighttime sample from midnight to 0800. The second schedule provided for the collection of two 12-hour samples beginning at 0800 and 2000 PDT. Investigators were asked to choose the schedule which best suited the requirements of their sampler, and to maintain the same schedule and sampler configuration throughout the study.

Aerosol Size Fraction: This study specifically addresses the fine fraction of the ambient aerosol. Because there is a significant amount of organic carbon in the coarse particle size range, it was necessary to specify an aerosol size fraction to be used for the sampling methods comparison. The fine aerosol fraction was chosen because most of the photochemically generated organic aerosols are in the fine aerosols. Also, much of the coarse organic matter is comprised of relatively non-volatile biogenic material which is not likely to be subject to sampling artifact. Thus, inclusion of the more stable coarse aerosol in the sampling could have reduced our ability to detect artifacts and differences among methods. Investigators were asked to provide a pre-cut for their samplers between 1 μm to 3.5 μm, with a preference for a 2.5 μm cut. Some investigators also operated PM10 samplers, but those data are not reported here.

Analytical Methods Comparison: Since each research group was responsible for its own sample analysis, a separate comparison was necessary to establish the comparability among groups for the organic and elemental carbon analyses. The analytical comparison was coordinated by Environmental Monitoring and Systems Inc. (Camarillo, CA), and a complete report is given by Countess (1987). Relevant to this work is the comparison of ambient samples. Four PM10 HiVol samples were collected on prefired Pallflex (Putman, CT) QAO quartz fiber filters during the seventh and eighth days of the study (August 18-19). The filters were cut into smaller pieces and, on August 21, were distributed among the participating groups. Each group received three aliquots from each of the four HiVol samples, for a total of twelve ambient samples. Each group was responsible for the transport of the samples from the field and sample storage prior to analysis.

Measurement Methods

The majority of the fine particle samplers were operated on the 12-hour sampling schedule, and thus we have concentrated on the comparison among these data. The only short-term data considered here are those for collection on non-quartz collection media, or systems with back-up filters to correct for vapor adsorption. For further discussion of short-term sampling data, we refer the reader to interlaboratory comparisons reported by Cadle and Mulawa (1987), Appel *et al.* (1987) and Turpin and Huntzicker (1987). Descriptions of the sampling systems follow.

Systems Collecting 12-hour Samples:

Air and Industrial Hygiene Laboratory (AIHL): A prefired Pallflex QAO quartz filter was operated downstream of an AIHL design Teflon coated cyclone with a 2.2 μm cutpoint (Appel *et al.*, 1987). Filter face velocity was 37 cm/s. A sorbent bed of Al_2O_3 followed the quartz filter (Appel *et al.*, 1987). This system was operated in parallel with a similar system employing an upstream denuder of Al_2O_3. Similar results were obtained with both systems as reported by Appel *et al.* (1987). Analysis for total carbon was by combustion and coulometry. Elemental carbon was determined by laser transmission and reflectance, with organic carbon given by difference (Rosen *et al.*, 1978).

AeroVironment (AV): The AV sampler had two parallel sampling legs; both operated downstream of a common 2.5 μm cutpoint Sensidyne (Largo,FL) cyclone coated with Apiezon M vacuum grease (Fitz, 1987). The primary leg consisted of a parallel plate denuder lined with quartz filters, followed by two quartz filters in series. Organic carbon concentrations

are given by the first quartz filter behind the denuder. The second leg operated off the same cyclone, and consisted of an empty denuder followed by two quartz filters in series. This leg was used for comparison. Pallflex QAST filters were employed throughout. Face velocities were 20 cm/s. Samples were analyzed by Environmental Research and Technology (ERT) using thermal analysis.

Environmental Monitoring Services Inc. (EMSI): A 37 mm prefired quartz QAO filter was operated at 24 L/min, downstream of a 2.5 μm cutpoint cyclone using a modified Andersen (Atlanta, GA) 245 sampler (Howes, 1987). Analysis was by pyrolysis at two temperatures, followed by oxidation and CO_2 detection. The reported results were based on an adipic acid calibration of the analytical system. However , subsequent investigations showed that calibrations with potassium acid phthalate yielded carbon values which are approximately 20% higher than for the adipic acid standard. (Discrepancies were attributed to differences in pyrolysis characteristics of the compounds in the EMSI system.)

Environmental Protection Agency (EPA): A prefired Pallflex QAOT quartz filter was operated downstream of a Teflon cylcone with a 2 μm cutpoint, and with a filter face velocity of 25 cm/s. Analysis was by combustion at two temperatures.

General Motors (GM) Dichot: A Sierra manual dichotomous sampler was operated with Pallflex QAO quartz filters, with a corresponding face velocity of 38 cm/s (Cadle and Mulawa, 1987). The fine fraction cutpoint was at 2.5 μm. Samples were analyzed by pyrolysis followed by oxidation , with NDIR detection for CO_2.

GM Impactor: GM also operated a 7-stage cascade impactor manufactured by In-Tox (Albuquerque, NM), with cutpoints at 0.15, 0.27, 0.50, 0.94, 1.88, 3.6 and 7.45 μm (Cadle and Mulawa, 1987). Impactor collection substrates were uncoated glass. The impactor was followed by a quartz after-filter, operated at a face velocity of 22 cm/s. The final four stages (<1.88 μm) were taken to be fine particle carbon. Samples were analyzed by the same pyrolysis/oxidation procedure used for the dichotomous filter samples, except that the analysis temperature was lower in order to prevent melting of the glass substrates.

Oregon Graduate Center (OGC): The OGC "Two-Port" sampler operated with an impactor precut of 2.5 μm. One of the two parallel legs consists of two Pallflex QAOT quartz filters in series; the other leg used a Teflon filter followed by quartz. The organic carbon on the quartz filter behind the Teflon filter is subtracted from the front quartz filter to give an adsorption corrected organic carbon value. Filter face velocities were 43 cm/s. Analyses were performed using a thermal-optical method (Huntzicker et al., 1980).

University of Minnesota (UM): A single stage micro-orifice impactor, with a 0.10 μm cutpoint, was operated downstream of a 2.2 μm cutpoint AIHL design cyclone (McMurry and Zhang , 1987). Aerosol was collected on aluminum foil, and analyzed by ERT using a thermal technique. The impactor was followed by a Pallflex QAO filter. The impactor sampling rate was 30 L/min, and the after filter face velocity was 62 cm/sec.

Short-Term Sampling Systems:

University of California, Davis (UCD): A Teflon filter downstream of a 2.5 μm cutpoint AIHL design cyclone was analyzed for carbon using forward alpha scattering (FAST, Cahill *et al.*, 1984). This is a nuclear technique which does not distinguish between organic and non-volatile carbon. In this study individual filter blanks were not run before sample

collection. This sampler collected 5 samples per day, and the data have been averaged for comparison with the 12-hour sample collection.

AIHL: Two filter samplers were operated in parallel, one at a face velocity of 9.6 cm/s, and one at 47 cm/s (corresponding to HiVol filtration rates). Each sampler consisted of two filters in series, a front particle filter plus a back-up to correct for gaseous adsorption. The low face velocity filter was preceded by a stainless steel Sierra 280-2 (Carmel Valley, CA) cyclone with a 2.8 μm cutpoint; the high volume filter followed a glass cyclone with a nominal 3.5 μm cutpoint. Both used prefired Pallflex QAO quartz filters, and operated on the five-per-day sampling schedule.

OGC *In Situ* Analyzer: Using an automated system, samples were collected for 1-3 hr, and analyzed *in situ* prior to the next sample collection. Aerosol was collected on a quartz QAOT filter downstream of a 2.5 μm cutpoint impactor. A second QAOT filter sampling below a Teflon prefilter was used to correct for adsorbed organic vapors. The face velocity for both quartz filters was 80 cm/s.

Comparison of Organic Carbon Measurements

Figure 1 shows scatter plots of the results for ambient fine aerosol organic carbon (blank corrected) as reported by eight different samplers, each operated using a 12-hour sample collection. The abscissa of each plot is the "5-sampler mean", calculated as the average from the AIHL undenuded quartz filter, the GM dichotomous sampler, the EMSI quartz filter, the AV denuded quartz filter, and the GM cascade impactor excluding after-filter. These samplers were chosen because complete data sets were available, and thus a consistent mean could be calculated for each study period. Also, the mean of these samplers was close to the eight sampler mean for periods with complete data sets. We emphasize that the mean is not to be considered the "truth", but is used simply to provide a consistent manner of presenting the data.

Some significant systematic differences among methods are apparent. Consistently higher organic carbon concentrations are reported by the AIHL undenuded quartz filter and the AV denuded quartz filter. For every sampling period, both of these methods reported values greater than the 5-sampler mean. Lower reported carbon values are given by the adsorption corrected quartz filter operated by OGC. The lowest organic carbon values are from the two impactors, the UM single stage impactor and the GM cascade impactor, if the after-filter is excluded. Values for the impactors plus after-filters are significantly closer to the mean. Note that the final cutpoints for the impactors, 0.10 μm for UM and 0.15 μm for GM, should be sufficiently small to collect the majority of the submicrometer aerosol mass. Thus one would not expect such a large proportion of the organic aerosol on the after-filter.

Table 1 summarizes results from the side-by-side sampling, along with results from the analytical comparison. Results are presented in terms of ratio of means. For each measurement technique, the method mean for all measurements is divided by a grand mean. For the ambient sampling, the grand mean is taken to be the average of the 5-sampler means for all sampling periods. The method mean is the average of that method over the same sampling periods. In cases where data are missing from some sampling periods, the ratio of means is calculated excluding those periods from the grand mean. For the comparison of analytical methods, the method mean is the average from the twelve

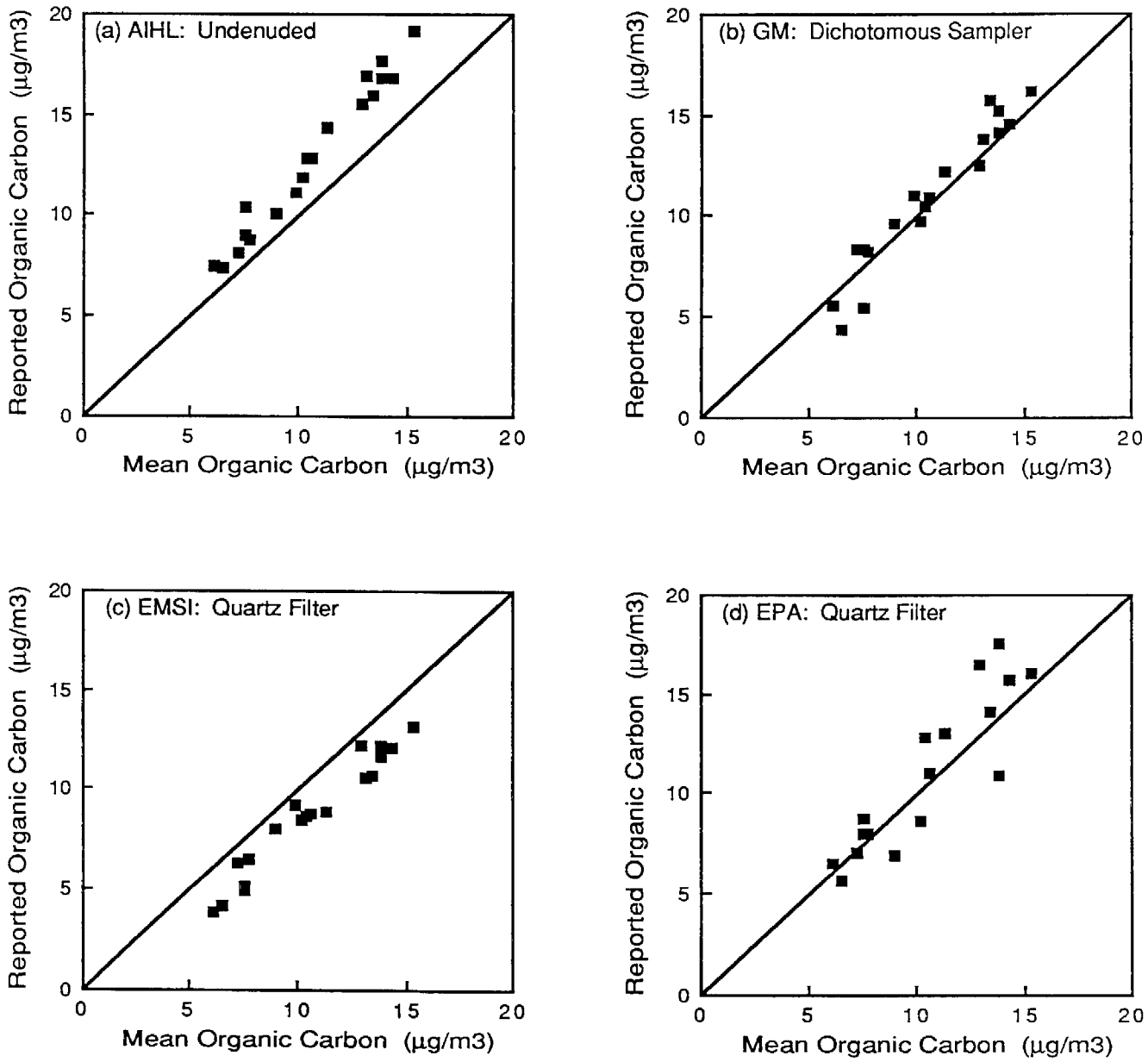


Figure 1. Ambient fine particle organic carbon concentrations as reported for 12-hour sampling periods by eight different methods. The abscissa is the average of data reported by the AIHL, EMSI and AV filters, the GM dichotomous sampler and GM impactor (see text). The diagonal on each graph is the line of equal results. For the GM cascade impactor only stages for particles less than 1.88 µm are included.

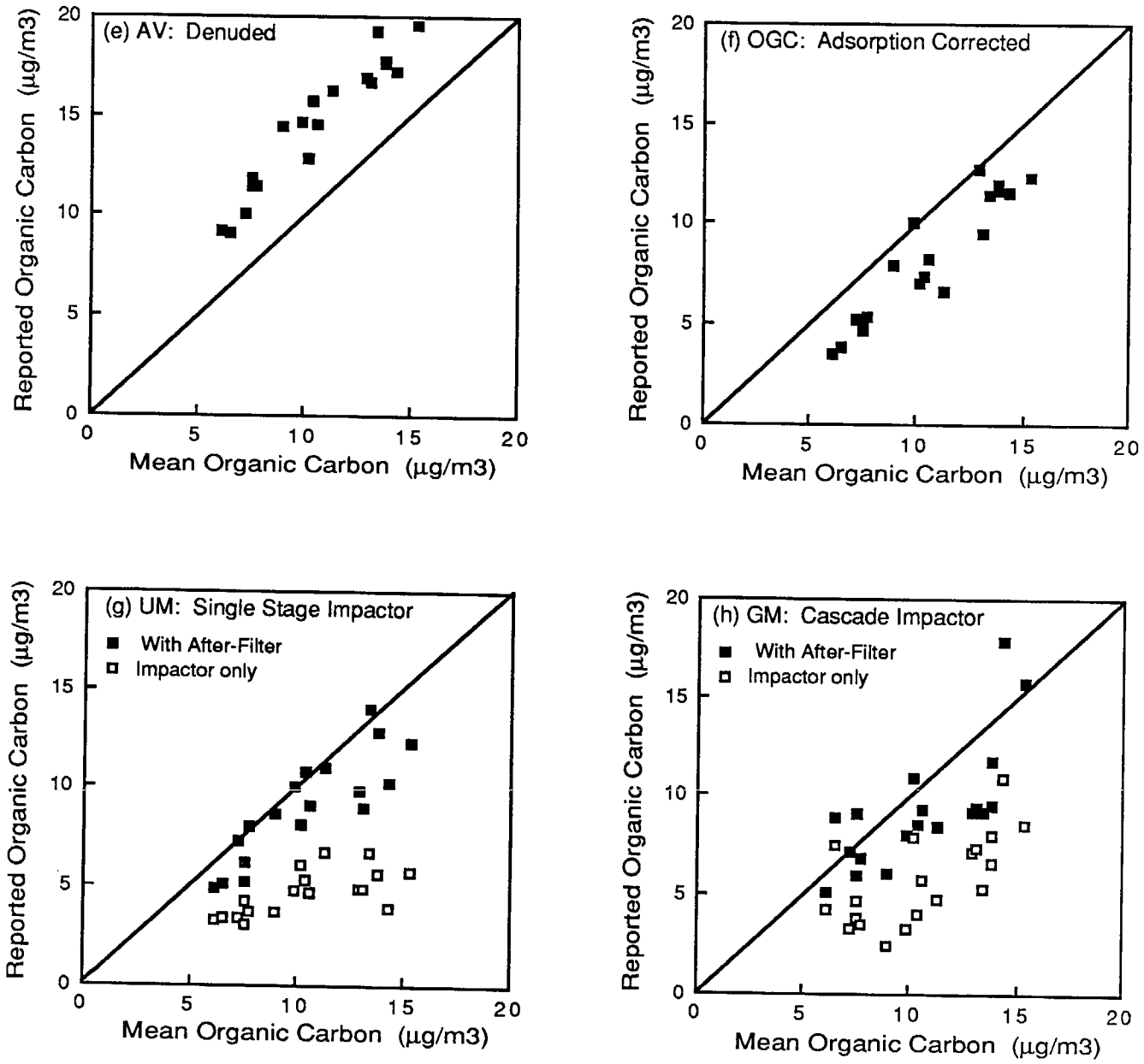


Figure 1 (con't). Ambient fine particle organic carbon concentrations as reported for 12-hour sampling periods by eight different methods. The abscissa is the average of data reported by the AIHL, EMSI and AV filters, the GM dichotomous sampler and GM impactor (see text). The diagonal on each graph is the line of equal results. For the GM cascade impactor only stages for particles less than 1.88 µm are included.

Table 1. Ratio of Measurement Method Means to the Grand Mean for Analytical and Ambient Sampling Methods.

		Method Mean / Grand Mean					
		Organic Carbon		Elemental Carbon		Total Carbon	
Group	Sampler	Analytical Method	Ambient Sampling	Analytical Method	Ambient Sampling	Analytical Method	Ambient Sampling
AIHL	Cyclone - Quartz Filter	1.01	1.21	1.22	1.18	1.05	1.21
EPA	Cyclone - Quartz Filter	1.09	1.06	0.55	0.48	0.99	0.92
EMSI	Cyclone - Quartz Filter	0.87	0.83	0.69	0.77	0.84	0.81
GM	Dichotomous Sampler with Quartz Filters	1.02	1.03	1.18	1.21	1.05	1.07
AV	Quartz Filter Denuder - Quartz Filters (with cyclone precut)	1.00	1.38	0.95	0.43	0.99	1.14
O G C	Adsorption Corrected Quartz Filter (with impactor precut)	1.00	0.78	1.42	1.16	1.08	0.88
O G C	In Situ Analyzer	1.00	-.-	1.42	-.-	1.08	0.94
UM	Cyclone - Single Stage Impactor (0.1-2.2 μm)	1.00	0.46	0.95	0.78	0.99	0.54
	Including quartz after-filter	"	0.87	"	0.89	"	0.87
GM	Cascade Impactor (0.15 -1.88 μm)	1.02	0.55	1.18	1.41	1.05	0.76
	Including quartz after-filter	"	0.88	"	1.48	"	1.03
UCD	Cyclone - Teflon Filter	-.-	-.-	-.-	-.-	-.-	0.64
Grand Means:	Analytical Round Robin (μg/cm2)	25.4		5.9		31.2	
	Side-by-side Sampling (μg/m3)		10.5		3.5		14.0

Notes: Analytical methods are compared for analysis of ambient samples only, and are not blank subtracted.
Ambient samples are for aerosols <2.5 μm.

ambient samples distributed to each laboratory for the analytical comparison, while the grand mean is the average of all samples analyzed by the six laboratories involved in the side-by-side sample analysis. In contrast to Countess (1987), the analytical comparison results presented here were not blank subtracted.

From Table 1 it is readily apparent that the differences among methods for organic carbon are much greater for ambient side-by-side sampling than for the analytical methods comparison. Thus, for most measurements, the systematic differences in reported ambient concentrations are attributable to sampling method. One exception is the EMSI measurement, which is somewhat lower than the mean for both the analytical and ambient sampling comparisons. For the other measurements, the highest ambient organic carbon concentrations are given by the AV and AIHL samplers, intermediate values are obtained from the EPA and GM filter samplers, lower values from the OGC adsorption corrected filter, and the lowest values from the two impactors (excluding after-filters). The sum of the after-filter and impactor data is still somewhat lower than the non-adsorption corrected quartz filter data.

Comparison of Elemental Carbon Measurements

Figure 2 shows non-volatile and light-absorbing carbon results, referred to here as elemental carbon. As in Figure 1, the data are plotted against the 5-sampler mean of AIHL, AV, EMSI, the GM Dichot, and GM impactor. As with the organic carbon measurements, there are significant differences among methods. However, in contrast to the organic data, much of the difference is attributable to the analysis methods. This is apparent from the elemental carbon ratio of means for the analytical comparison and ambient sampling listed in Table 1. In most cases, the differences among measurement methods parallel the differences among analytical methods. One exception is the AV elemental carbon, which is 43% of the mean for the ambient samples, but for which the analysis is only 5% below the mean. For OGC, the ambient elemental carbon values are much closer to the mean than in the analytical methods comparison.

Total Carbon Teflon Filters

The UCD Teflon filter samples were analyzed by a forward alpha scattering technique, which yields data for total carbon only, without distinction between the organic and elemental fractions. This was the only filter system which did not use quartz filters, and thus provides an interesting comparison. Since the UCD sampler operated on the five sample per day schedule, its data have been averaged to provide a comparison with the 12-hour samples from the other groups. The results are presented in Figure 3 (a) in the form of a scatter plot with respect to the 5-sampler mean for total carbon. Total carbon results for the other samplers follow the same trends as the organic carbon data in Figure 1.

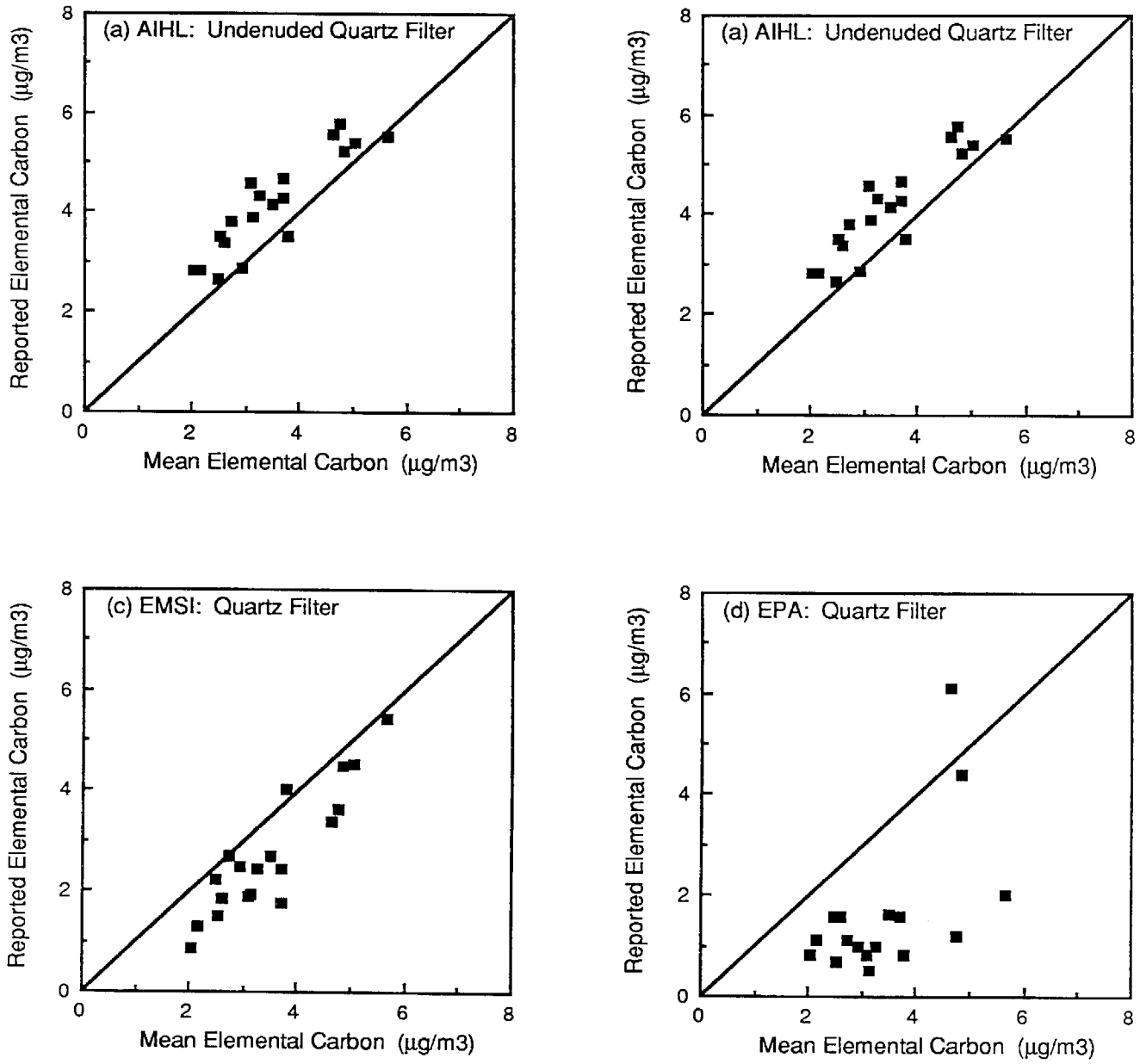


Figure 2. Ambient fine particle elemental (non-volatile or black) carbon concentrations for the same methods and sampling periods as Figure 1. Data from each sampler are plotted against the average from the AIHL, EMSI, AV and two GM samplers; the diagonals indicate the line of equal results.

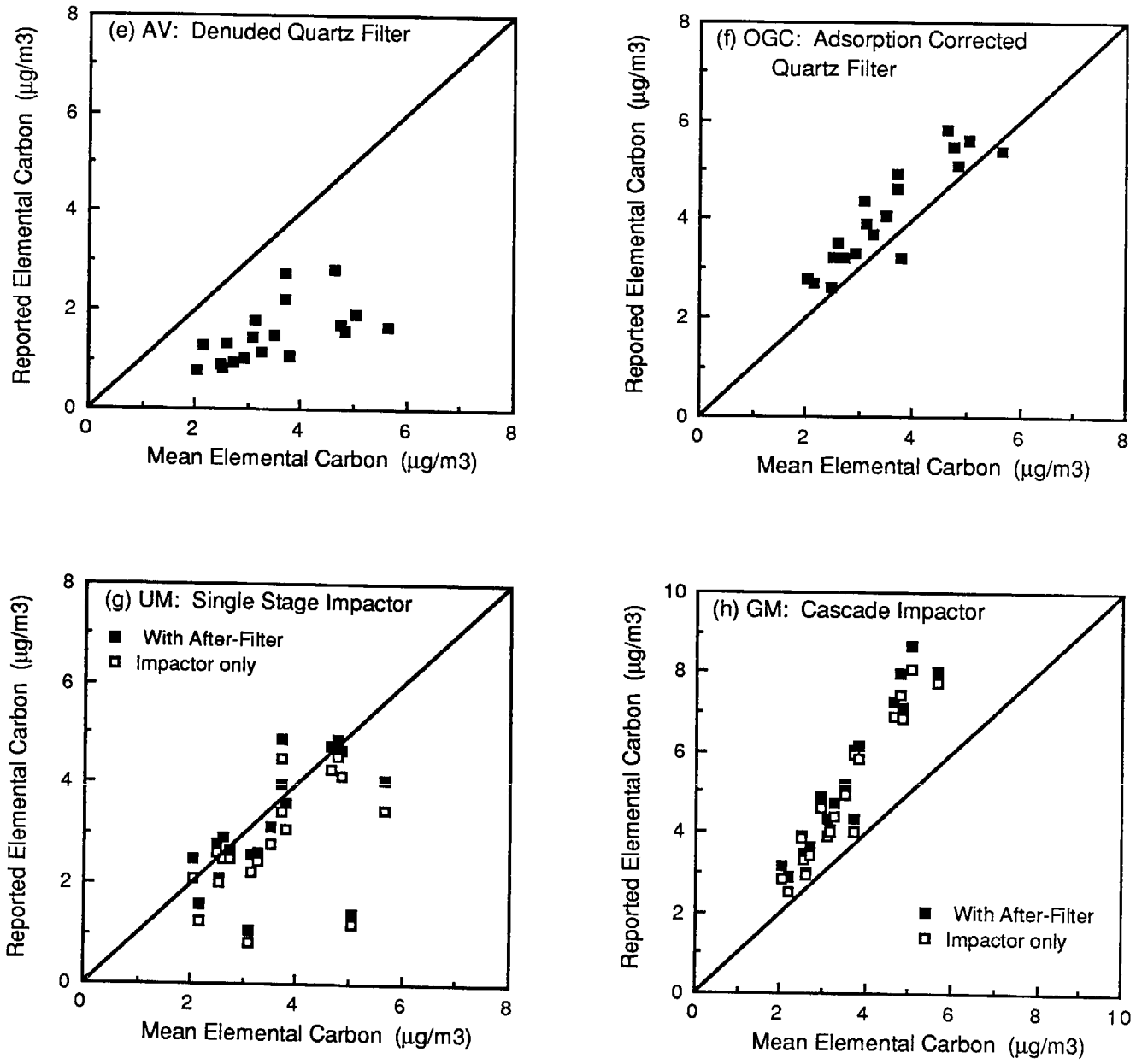


Figure 2 (con't.). Ambient fine particle elemental (non-volatile or black) carbon concentrations for the same methods and sampling periods as Figure 1. Data from each sampler are plotted against the average from the AIHL, EMSI, AV and two GM samplers; the diagonals indicate the line of equal results.

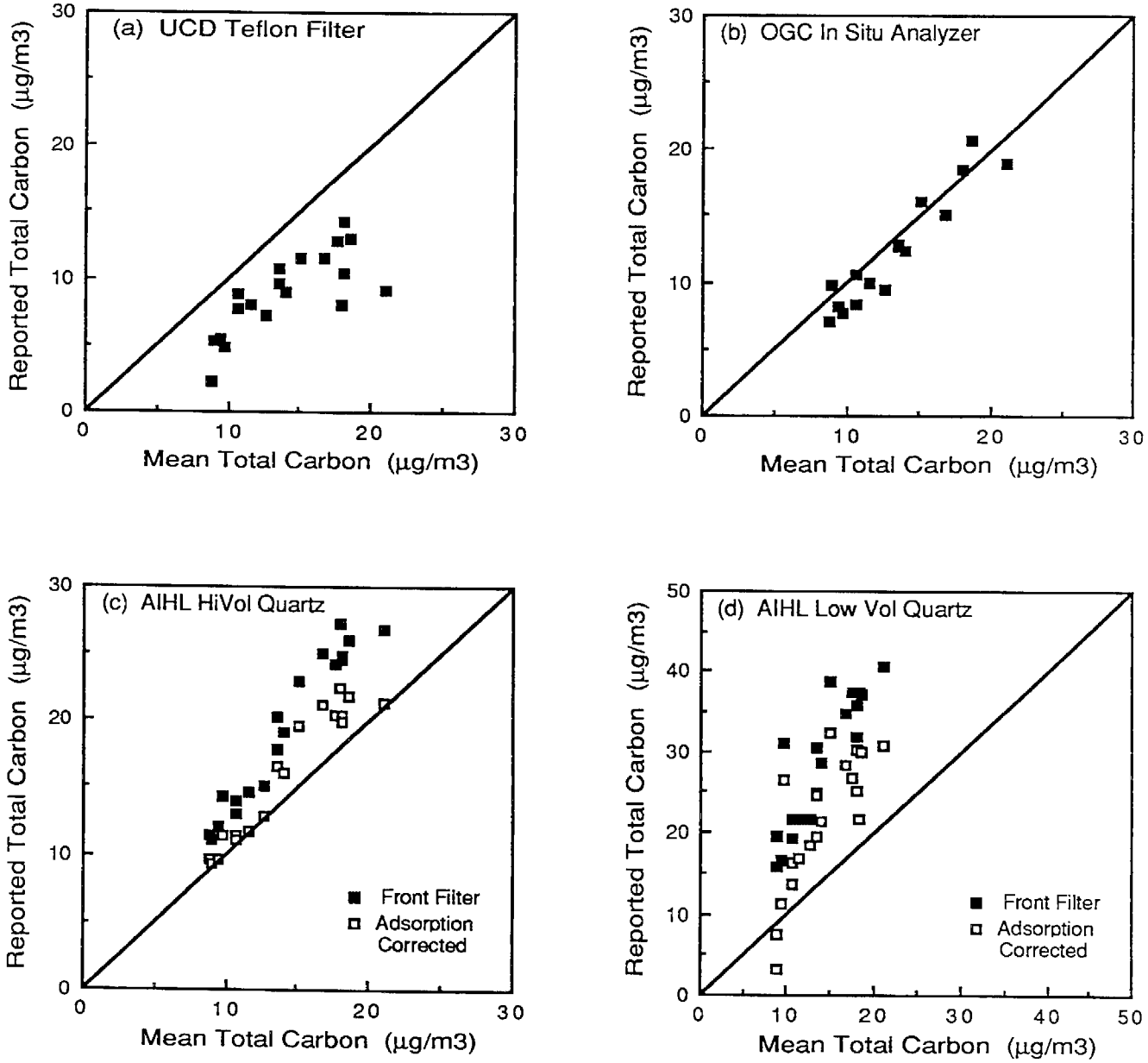


Figure 3. Fine particle total carbon concentrations from short term sampling reported by (a) the UCD Teflon filter, (b) the OGC *In situ* Analyzer, (c) the AIHL HiVol quartz minus back-up filter, the AIHL Low Vol quartz filter minus its back-up. The data have been averaged over the twelve hour sampling periods, and are plotted against the 5-sampler mean from the AIHL, EMSI, AV and GM samplers of Figures 1 and 2.

Despite the scatter in the data, it is apparent that the UCD total carbon values lie below the mean. The ratio of means for ambient sampling for total carbon (Table 1) shows that the Teflon filter results are 64% of the mean. This is comparable to the impactors excluding the quartz after-filters, which are 54% (UM) and 76% (GM) of the mean. All of the data using quartz filters give higher results.

Total Carbon from the *In Situ* Analyzer and Short-term Quartz Filter Samplers

Figure 3(b) shows data from the OGC *in situ* analyzer, which uses 1 - 3 hour collection on quartz filters with an adsorption correction using the backup filter behind a Teflon prefilter. (Because of experimental difficulties, only total carbon values were reported for most of the study.) The data have been averaged over twelve-hour periods for comparison against the 5-sampler total carbon mean. Values are higher than for the UCD Teflon filter, but close to the values from the OGC 12-hour quartz filter sampling system.

Data from the AIHL 4- and 8-hour quartz filter samplers are shown in Figures 3 (c) and 3(d). To maximize face velocity effects, these were operated for short time periods at face velocities differing by a factor of five (9.6 and 47 cm/s respectively). Shown are both the uncorrected carbon (front particle filter) values and the adsorption corrected (front minus backup filter) data. By far the highest reported total carbon values are for the low face velocity collection. At 9.6 cm/s the ratio of means to the 5-sampler mean are respectively 2.0 and 1.5 for the uncorrected and adsorption corrected values. Corresponding values for the 47 cm/s (HiVol) face velocity sampling are 1.37 and 1.14. The adsorption corrected values for the 4- and 6-hour collection at 47 cm/s are close to those from the uncorrected 12-hour, 37 cm/s collection by the same group.

Quartz Back-up Filter Data

Several of the samplers in the project used quartz back-up filters, either to test, or to correct for, gaseous adsorption artifacts. The questions of interest in examining this data are the magnitude of carbon on the back-up filter relative to the prefilter, and its variability. The back-up filter variability addresses the question of whether carbon loading on the back-up filters can be described by a saturation of adsorption sites.

The systems examined are listed in Table 2. Five systems consisted of two quartz filters in series. AIHL ran two short-term samplers, one at a low face velocity (9.6 cm/s), and one at a high face velocity (47 cm/s). OGC operated tandem quartz filters at 20 and 40 cm/s face velocities. The undenuded side of the AV quartz denuder system also consisted of tandem quartz filters. Two systems from OGC consisted of a quartz filter behind a Teflon prefilter. The back-up filter from the denuded side of the AV system is the second of the two tandem quartz filters running downstream of the quartz denuder. Table 2 also includes the after-filters from the impactors.

With the exception of the denuded system, the carbon detected on a quartz back-up filter is a significant proportion of the total. As shown in Table 2, for the 12-hour sampling periods, the amount on these back-up filters was between 14% and 32% of the grand mean for

Table 2. Average Total Carbon on Quartz Back-up Filters for all Sampling Periods

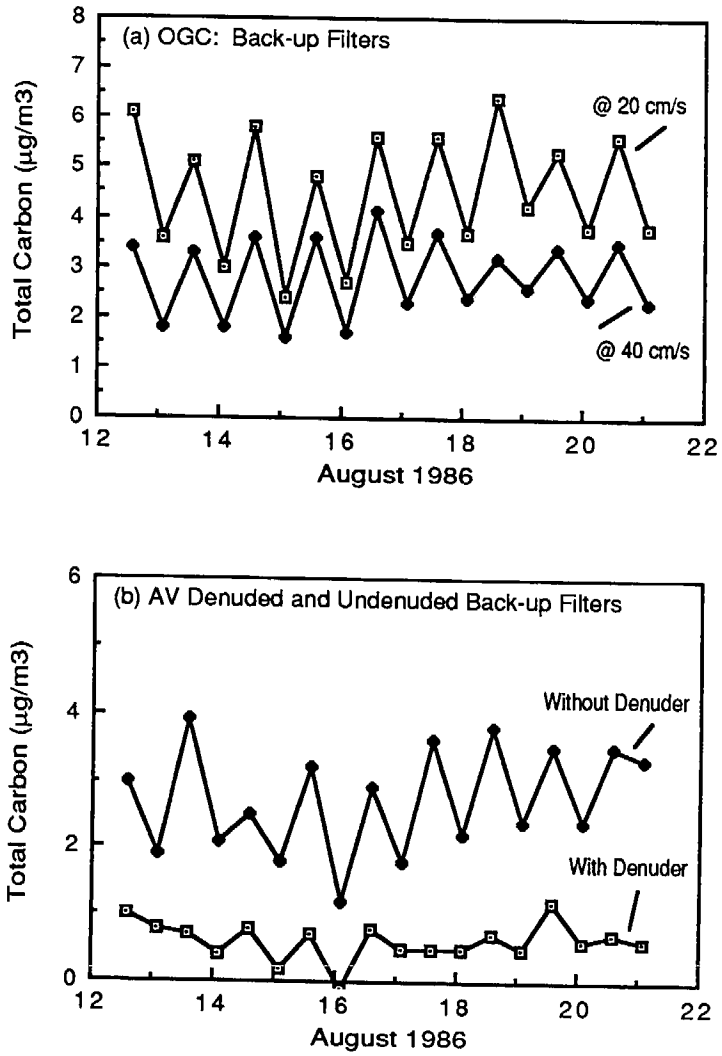
	Mean Total Carbon on Back-up Filters		
	(μg/m3)	% of Mean TC†	(μg/cm2)
Back-up filters behind quartz filters			
AIHL 4- & 8-hr sampling @ 9.6cm/s	7.5 ± 3.4	53 %	1.0
AIHL 4- & 8-hr sampling @ 47cm/s	3.2 ± 1.2	23 %	2.2
OGC 12-hr sampling @ 20cm/s	2.9 ± 1.1	21 %	2.5
OGC 12-hr sampling @ 40cm/s	1.9 ± 0.4	14 %	3.3
Back-up Filters behind Teflon Prefilter			
OGC 12-hr sampling @ 20cm/s	4.5 ± 1.2	32 %	3.9
OGC 12-hr sampling @ 40cm/s	2.8 ± 0.8	20 %	4.9
Quartz Denuder System			
AV Behind denuder and quartz filter (20 cm/s)	0.6 ± 0.3	4 %	0.5
AV Behind quartz filter (20 cm/s)	2.7 ± 0.8	19 %	2.4
Impactor After-Filters			
UM Behind Single Stage Impactor (62 cm/s)	4.8 ± 2.1	34 %	12.2
GM Behind Cascade Impactor (22 cm/s)	3.8 ± 1.7	27 %	3.6

† Percent of the 5-sampler mean total carbon for all sampling periods = 14.0 μg/m3

total carbon. (The grand mean is taken as the 5-sampler mean averaged over all 12-hour sampling periods.) Lower face velocities and shorter sampling periods give higher carbon loadings per cubic meter of air sampled. As reported previously by McDow and Huntzicker (1986), the OGC back-up filters behind Teflon prefilters are about 50% higher than the back-up filters operated at the same face velocity behind quartz prefilters. The highest value (53%) is for 4- and 8-hour sampling at low face velocity, as expected. By contrast, the quartz back-up filter for the denuded leg of the AV sampler is only 4% of the total carbon mean.

There was considerable period-to-period variation in the back-up filter carbon, as shown by the time series plots of Figure 4. Data are shown for OGC back-up filters at 20 cm/s and 40 cm/s, for the denuded and undenuded legs of the AV sampler, and for the impactor after-filters. Each exhibits a diurnal variation, with higher values recorded during the daytime when organic carbon concentrations were higher. Back-up filter loadings correlate with the 5-sampler mean organic carbon, yielding correlation coefficients of 0.85 and 0.92 respectively for the 20 cm/s and 40 cm/s OGC filters and 0.69 for AV's undenuded back-up filter.

The final column of Table 2 gives the back-up filter carbon per unit area of the filter, averaged over the entire study period. For tandem quartz filters, the average values range from 1.0 μg/cm2 to 4.9 μg/cm2. From the AIHL and OGC data, it is apparent that lower face velocities yield less back-up filter carbon per unit filter area. These data, and the period to period variations shown in Figure 4, indicate that the back-up filters are not saturated with respect to the adsorption of gaseous carbon species.



Figures 4(a) and 4(b) Time series plots of the total carbon on quartz back-up filters. (a) Quartz filters with face velocities of 20 cm/s and 40 cm/s following a Teflon prefilter (OGC). (b) The second of two quartz filters in series operated with and without a quartz filter denuder upstream (AV).

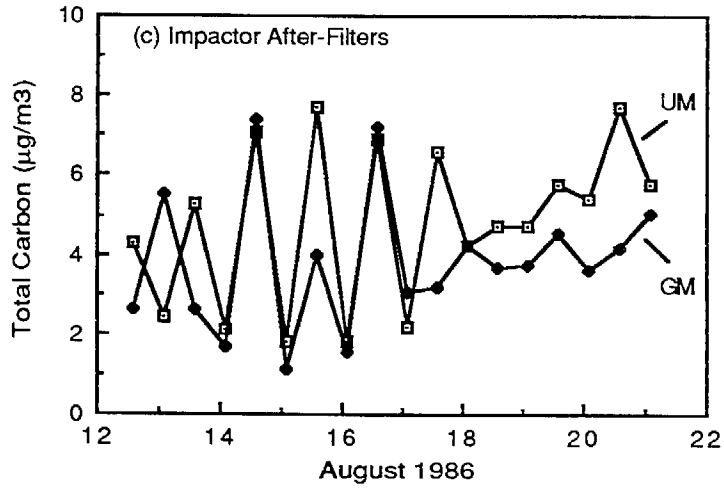


Figure 4(c) Time series plots of the total carbon on quartz after-filters following the UM single stage impactor and GM cascade impactor. Final cutpoints of the impactors are 0.10 µm (UM) and 0.15 µm (GM)

Impactor After-Filter Data

For both the GM and UM impactors, the proportion of the measured organic carbon detected on the after-filters was large; 38% for GM and 47% for UM. However, only a small proportion of the elemental carbon was found on the after-filter. On the average, GM found 5% of the elemental carbon on the after-filter; UM found 12%. For individual samples, the mass of organic and elemental carbon on the after-filter can be seen by comparing the open and solid symbols in the impactor data presented in Figures 1 and 2.

The large organic carbon and low elemental carbon values on the impactor after-filters have been attributed to a positive gaseous adsorption artifact for the quartz filters (Cadle and Mulawa, 1987 and McMurry and Zhang, 1987). Because very little elemental carbon is found on the after-filter, it is not likely that the organic material on the after-filter is due to direct aerosol deposition. Particle bounce errors in the impactor would be expected to affect the elemental carbon data at least as much as the organic data. Volatilization losses would be greater for the after-filter than for the impactor stages because the after-filter is at a lower pressure than any of the impaction stages.

For the GM impactor after-filter, which operated at a face velocity of 22 cm/s, the mean carbon loading of 3.6 $\mu g/cm^2$ is close to the value of 3.9 $\mu g/cm^2$ observed by OGC on the quartz back-up to a Teflon prefilter, operated at 20 cm/s (Table 2). It is greater than the 2.4 $\mu g/cm^2$ and 2.5 $\mu g/cm^2$ loadings measured respectively by AV and OGC on the second of two quartz filters, also operated at 20 cm/s. The mean carbon loading on the UM impactor after-filter, which operated at a face velocity of 62 cm/s, is more than double that for the 40 cm/s quartz back-up filters.

Table 3. Comparison of Adsorption Corrected Total Carbon Values, Averaged over Study Period.

Sampler	Sample Duration	Face Velocity	Uncorrected (front filter) Mean (µg/m3)	Uncorrected (front filter) Ratio † of Means	Adsorption Corrected (subtracting back-up) Mean (µg/m3)	Adsorption Corrected (subtracting back-up) Ratio † of Means
AIHL						
Short term, low volume	4-8 hr	9.6 cm/s	28.7	1.49	21.3	1.33
Short term, high volume	4-8 hr	47 cm/s	19.2		16.0	
OGC						
1 µm cut, low velocity	12 hr	20 cm/s	14.8	1.20	10.4	1.09
1 µm cut, high velocity	12 hr	40 cm/s	12.3		9.5	
OGC						
In-situ analyzer, 2.5 µm cut	1-3 hr	80 cm/s	21.0	1.37	12.4	1.07
Integrated sample, 2.5 µm cut	12 hr	43 cm/s	15.3		11.6	
AV						
Undenuded filters	12 hr	20 cm/s	18.1	1.12	15.4	0.99
Denuded filters	12 hr	20 cm/s	16.1		15.4	

† Ratio between data pairs
AIHL and AV data represent the difference between tandem quartz filters.
OGC uses quartz behind a Teflon filter at the same face velocity to correct for adsorption.

Adsorption Corrected Quartz Filter Data

In Figure 5 adsorption corrected quartz filter data are compared with uncorrected data for parallel collection systems operated by the same group. Mean values for the entire study are given in Table 3. The mean total carbon is the average reported ambient carbon concentration for the entire study period, and the ratio of means is the ratio of means within each data pair. The AIHL data are for short term (4- and 8-hour sampling) at 9.6 and 47 cm/s face velocities. Two sets of OGC data are presented; the first corresponds to submicrometer aerosol collection at two face velocities, the second compares sub-2.5 µm aerosol collection by an *in situ* analyzer with 1 to 3 hour collection times and by a filter sampler with 12-hour collection.

Without adsorption correction, the discrepancies in the apparent total carbon are 49% for AIHL and 20% to 37% for OGC. With the adsorption correction, the discrepancy in the AIHL data is reduced to 33%, and the OGC data pairs agree within 9%. Lower filter face velocities and the shorter sampling times result in higher apparent carbon loadings; but using the back-up filter to correct for adsorption reduces the discrepancy. However, for the extreme case of short term sampling with face velocities differing by a factor of five (AIHL data), subtracting the backup filter adsorption does not correct for measurement differences. With the AV data the difference between the front filters of the denuded and undenuded legs of the sampler is 12%, whereas when the carbon on the back-up filters is subtracted the mean value for the two legs is the same.

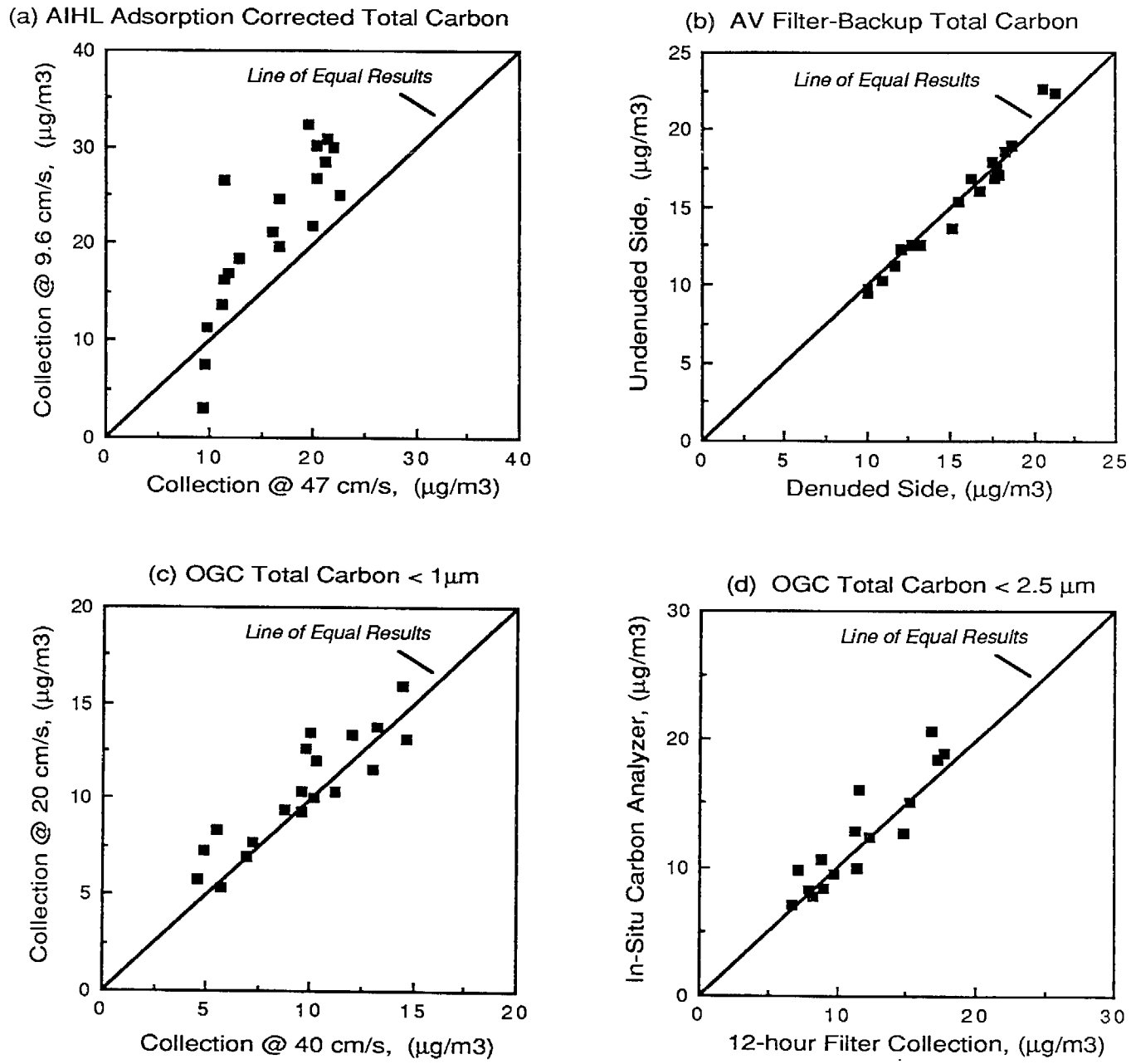


Figure 5. Adsorption corrected total carbon from pairs of quartz filter samplers operated by the same group, as given in Table 3. The diagonals represent lines of equal results.

Summary

The data presented here indicate significant differences among sampling methods for the fine fraction of the organic aerosol in the Los Angeles Basin. Total carbon values reported by quartz filter systems sampling for 12-hour periods are within the range between 81% and 121% of the grand 5-sampler mean. Collection on Teflon filters and with impactors (excluding the after-filters) yield lower concentrations, with reported values between 54% to 76% of the 5-sampler mean.

Several systems operated with quartz filters in series, and the analysis of these data indicated that gaseous adsorption is a significant artifact. The average amount of carbon on the back-up filters was 14% to 53% of the 5-sampler mean total carbon. Systematically higher values are reported for systems employing lower face velocities and shorter sampling times. With the AV system, the amount of carbon on the back-up filter was greatly reduced by using a quartz filter diffusion denuder to remove adsorbing gaseous species prior to filter collection. The quartz after-filters for the impactor systems showed large amounts of organic carbon loadings relative to the elemental carbon, which is again indicative of an organic vapor adsorption artifact.

While significant, the adsorption artifact does not completely account for differences among sampling methods. The adsorption corrected carbon values are still higher than those reported by the Teflon filter or by the impactors (excluding after-filters). Whereas both the AV and OGC systems correct for vapor adsorption, the AV data are significantly higher for total and organic carbon. For the AIHL short term samplers, using a back-up filter to correct for adsorption reduced, but did not eliminate, the discrepancy between filters operated at different face velocities. These inconsistencies remain unexplained.

IV. References

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V. Appendix

A. Measurements, Schedules and Sampler Siting

Table A1. List of Measurements
Table A2. Sampling Schedules and Period Numbers
Figure A1. Site Layout and Position Numbers

B. Listing of Ambient Fine Particle Carbon Data

Table B1. Fine Particle Carbon: 12-hour Data
Table B2. Short Term Sampling Data for Fine Carbon
Table B3. Black Carbon and Light Adsorption Data
Table B4. LBL Hourly Black Carbon Data
Table B5. OGC In Situ Analyzer Measurements

C. Interlaboratory Analysis Comparison

Table C1. Data Listing from the Interlaboratory Analytical Comparison

D. Meteorological Summaries, and Routine Air Quality Measurements

Table D1. Hourly Averages of Ozone, Carbon Monoxide and Nitrogen Oxides and Meteorological Parameters
Table D2. PM10 Mass, Sulfate and Nitrate (South Coast AQMD)
Meteorological Summaries (M. Zeldin, Southern California Edison)

E. Carbon Study Protocol

F. List of Participants

Table A1. 1986 CARBON STUDY: LIST of MEASUREMENTS
August 12-20, 1986, Citrus College, Glendora, CA

Group	(Institution/PI)	Pstn	ID	Smpl/day	Sampler Descrition	Measured Parameter
OGC	Huntzicker	21	HCC	Con't	In situ Carbon analyzer	OC, EC
		6	HSM	2	6 Port dual filter sampler	OC, EC
		6	HJH	5	2 Port dual filter sampler (Dil exp or speciation)	OC, EC
		6	HJR	2	5 stage "parallel" impactor	OC, EC
		6	HBT	1	Br/Pb Teflon filter collector	Pb, Br
UM	McMurry	7	UI1	2	MOUDI	OC, EC
		7	UF	2	Quartz Filter	OC, EC
		7	UE	2	Electrostatic Precipitator	OC, EC
		7	UI2	2	Single Stage MOUDI	OC, EC
		7	UI3	2	Single stage MOUDI (dup, 2hr, dil, gresd, QAO/ST)	OC, EC
		11	UIH	2	MegaVol MOUDI	Specieated OC
		11	UFH	2	HiVol w/1µm impactor precut - quartz	OC, EC
AV	Fitz/Fung	8	FDA	2	Quartz Filter	OC, EC
		8	FDB	2	Denuder - quartz filter	OC, EC
AIHL	Appel	9	AD1	2	Particle carbon: Cy-DD-Fltr-Al2O3 Fluid.Bed	OC, EC
		9	AF2	2	Low Vol Carbon: Cy- Fltr-Al2O3 Fluidized Bed	OC, EC
		9	AT4	5	Cy-Low Vol	OC, EC
		9	AT3	5	Cy-Hivol	OC, EC
GGC	Gordon/Brewer	11	GDIFA	2	Denuder/impactor/Q	OC, EC
		15	GH1	2	HiVol w/ 1.7 µm precut	OC, EC
		15	GH2	2	HiVol w/ 1.7 µm precut	OC, EC
UCD	Cahill	12	DI1	5	Drum impactor - mylar	Elements > Na by PIXE
		12	DI2	5	Drum impactor - mylar (duplicate)	Elements > Na by PIXE
		12	DI3	5	Drum impactor - Teflon	Mass (beta atten.), FAST
		12	DFM	5	Stacked filter unit - mass (1.1 cm2 area)	H,C,N,O by FAST, PIXE, Babs, Mass (grav.)
		12	DFO	5	Stacked filter unit - Nu/T (3.8 cm2)	PIXE, Mass (grav.), Babs (integr.plate)
		12	DFD	5	Stacked filter unit - Nu/Nu (13.8 cm2,0.03µm pore)	PIXE, Mass (grav.), Babs (integr.plate)
		12	DFC	5	2µm Cyclone - 25 mm Teflon	H,C,N,O by FAST, PIXE, Babs, Mass (grav.)
		12	DFS	5	Streaker	-

Table A1. 1986 CARBON STUDY: LIST of MEASUREMENTS
August 12-20, 1986, Citrus College, Glendora, CA

Group	(Institution/PI)	Pstn	ID	Smpl/day	Sampler Descrition	Measured Parameter
EMSI	Howes/Colovos	4	EF1	2	Dual Filters T&Q -sun	Inorganic ions, OC, EC
		4	EF2	2	Dual Filters T&Q -sun, smpl storage study	Inorganic ions, OC, EC
		4	EF3	2	Dual Filters T&Q -shade, & heated inlets	Inorganic ions, OC, EC
GM	Cadle/Mulawa	5	CF1	5	LoVol-dual Quartz fltr -20Lpm	OC, EC
		5	CF2	5	LoVol-dual Quartz fltr - 7Lpm	OC, EC
		5	CP	5	H2O2 - hydroxyphenylacetic acid impinger	H2O2
		5	CDC	2	Dichot - Quartz filter	OC, EC
		5	CDC	2	Dichot - Quartz filter, Coarse Fraction	OC, EC
		5	CI	2	Impactor	OC, EC
		5	CQ	2	HCHO-DNPH Cartridge	HCHO
		15	CH	2	PM10 HiVol - Q	OC, EC
LBL	Hansen/Novakov	3	QCA	Con't	Aethalometer - black carbon	Black Carbon
UCLA-UW	Hering	2	YFN	5	2 µm Imp-Nuclepore Fltr	Fine particle absorption - Integrating Plate
UCLA	Allen	2	YI	1	LPI for FTIR organic functional grps	FTIR for Carbon functional groups
IIT	Noll	13	ORI	2	Rotating arm impactor for coarse particles	SO4=, NO3- and mass Dp >10 µm
EMSI	Countess	15	EH1,2,3	1	PM10 HiVol - Q, in triplicate	OC, EC for Round Robin
SCAQMD	Bope	15	BH	1	PM10 HiVol - Q	PM10 Mass
UCR	Atkinson	15	RH	1	PM10 HiVols	Polycyclic Aromatic Hydrocarbons
Ford	Pierson	BBF	K	1	Dew Samples	Inorganic ions and acidity
DGA	Grosjean	3	MA	5	Teflon/KOH impreg. filter pack	Diacids C2-C6, Monoacids C1-C6
		3	MB	5	Teflon/KOH impreg. filter pack	Archive and artifact experiments
		3	MC	Pd 3	Nylon/KOH impreg filters	Oxalate, diacids, monoacids
		3	MD	5	T/CO3 filters	Aromatic acids, HCl. (T=1/dy)
		3	ME	5	T/Nylon filter pack	Aliphatic C11-C20, HNO3. (T=1/dy)

Table A1. 1986 CARBON STUDY: LIST of MEASUREMENTS
August 12-20, 1986, Citrus College, Glendora, CA

Group	(Institution/PI)	Pstn	ID	Smpl/day	Sampler Descrition	Measured Parameter
DGA	Grosjean (con't)	3	MF	5	DNPH-Acetonitrile Impinger	Aldehydes
		23	M	con't	PAN: GC-electron capture	PAN
		23	M	con't	Teco 14B/E - NOx	NO/NOx
ERT	Fung	21	F	5	DNPH Cartridges: Aldehydes	Aldehydes
UCLA	Kaplan/Sakugawa	20	TP	5	Peroxide	H2O2
UT	Dasgupta	21	XP1	Con't	Peroxide Diffusion Scrubber	H2O2
		21	XQ1	Con't	HCHO Diffusion Scrubber	HCHO
BNL	Tanner	22	WPI	Con't	Peroxide impinger	H2O2
		22	WPS	Con't	Peroxide scrubber	H2O2
NCAR	Kok	22	NP	Con't	Peroxide	H2O2
		22	NQ	Con't	Formaldehyde	HCHO
Unisearch	Mackay	25	PC2	Con't	Luminox, NO2	NO2
		26	PC1	Con't	TDLAS - HCHO, H2O2	HCHO, H2O2
AES	McTavish	26	ZC1	Con't	TDLAS - HNO3	HNO3
		8	ZF	con't	Filter Packs T/N/Citric -1hr dytm, 2hr nttm.	Inorganic ions
UCR	Winer	14	RCF	Con't	FTIR	HNO3, NH3, (HCHO)
		14	RCD	Con't	DOAS	NO2, HCHO, HONO, NO3
EPA	Knapp	10	IKC	Pd 1	Canisters(0600-0900)	Gaseous HC
		10	IKB	Pd 1	Tedlar Bag in dupl- diff.storge, 9am grab smpl	Gaseous HC
		10	ITF	2	Tandom filters for O/NV & organic acids	Organic acids
		10	IFK	2	O/NV open face filter, up & dwn facing	OC, EC
		10	IHV	2	Hivol	OC, EC
		10	IE1/IE2	2/1	Transition Flow Sampler	Inorganics
		10	IEF	2	Transition Flow Smplr w/ funnel inlet	Inorganics
		10	IP	2	Peroxide	H2O2

Table A1. 1986 CARBON STUDY: LIST of MEASUREMENTS
August 12-20, 1986, Citrus College, Glendora, CA

Group	(Institution/PI)	Pstn	ID	Smpl/day	Sampler Descrition	Measured Parameter
CGC	Rasmussen	1	JC	5	Canisters-SS	Gaseous hydrocarbons
EPA	Holdren / McClenny	1	LK1	2	Canisters-SS, toxics	Gaseous hydrocarbons
		1	LK2	2	Canisters-SS, toxics	Gaseous hydrocarbons
		1	LX1	Pd 6	EPA Tenax Tubes	Gaseous hydrocarbons
		1	LK3	Pd 7	Canisters-SS, toxics (Rasmussen design)	Gaseous hydrocarbons
ARB-HS	Shikiya	28	V	1	Tedlar Bag	VOC, Chlorinated HC
		28	V	Con't	Dasibi 1003 AAS -O3	O3
		28	V	Con't	Dasibi 2008 NO2	NO2
		28	V	Con't	Monitor Labs 8440 NOx	NO/NOx
		28	V	Con't	Dasibi 3003 CO	CO
		28	V	Con't	Bendix Reactive HC	Reactive HC gases
SCE	Ellis/Games	23	S	Con't	Dasibi 1003AH - O3	O3
		23	S	Con't	CSI 1600 Chem Lumin. NOx	NO/NOx
		23	S	Con't	Beckman 66 IR CO	CO
		23	S	Con't	Meloy 285 flame photometric SO2	SO2
		23	S	Con't	MRI 1550B neph. B scatt	B scatt
		23	S	Con't	Met: Wnd spd, Wnd dir, RH, Bar Press.	Winds, Temperature and Rel. Humidity
		23	S	2	Beckman Dichot	Mass, Elements

Abrieviations:

Q = Quartz Filter
T = Teflon Filter
Nu=Nuclepore Filter
SS=Stainless Steel
Cy= Cyclone
PM10 = Particle precut at 10 µm
BBF = Located in Baseball Field

OC = Organic Carbon
EC = Non-Volatile or Black Carbon
HC = Hydrocarbons
B abs = Light adsorption
B scatt=Light scattering

Table A2. Sampling Schedule and Period Numbers

Short Term (4-hr and 8-hr) Sampling Schedule:

Period No.	Start		Stop	
21	8/12/86	0800	8/12/86	1200
22	8/12/86	1200	8/12/86	1600
23	8/12/86	1600	8/12/86	2000
24	8/12/86	2000	8/13/86	0000
25	8/13/86	0000	8/13/86	0800
31	8/13/86	0800	8/13/86	1200
32	8/13/86	1200	8/13/86	1600
33	8/13/86	1600	8/13/86	2000
34	8/13/86	2000	8/14/86	0000
35	8/14/86	0000	8/14/86	0800
41	8/14/86	0800	8/14/86	1200
42	8/14/86	1200	8/14/86	1600
43	8/14/86	1600	8/14/86	2000
44	8/14/86	2000	8/15/86	0000
45	8/15/86	0000	8/15/86	0800
51	8/15/86	0800	8/15/86	1200
52	8/15/86	1200	8/15/86	1600
53	8/15/86	1600	8/15/86	2000
54	8/15/86	2000	8/16/86	0000
55	8/16/86	0000	8/16/86	0800
61	8/16/86	0800	8/16/86	1200
62	8/16/86	1200	8/16/86	1600
63	8/16/86	1600	8/16/86	2000
64	8/16/86	2000	8/17/86	0000
65	8/17/86	0000	8/17/86	0800
71	8/17/86	0800	8/17/86	1200
72	8/17/86	1200	8/17/86	1600
73	8/17/86	1600	8/17/86	2000
74	8/17/86	2000	8/18/86	0000
75	8/18/86	0000	8/18/86	0800
81	8/18/86	0800	8/18/86	1200
82	8/18/86	1200	8/18/86	1600
83	8/18/86	1600	8/18/86	2000
84	8/18/86	2000	8/19/86	0000
85	8/19/86	0000	8/19/86	0800
91	8/19/86	0800	8/19/86	1200
92	8/19/86	1200	8/19/86	1600
93	8/19/86	1600	8/19/86	2000
94	8/19/86	2000	8/20/86	0000
95	8/20/86	0000	8/20/86	0800
101	8/20/86	0800	8/20/86	1200
102	8/20/86	1200	8/20/86	1600
103	8/20/86	1600	8/20/86	2000
104	8/20/86	2000	8/21/86	0000
105	8/21/86	0000	8/21/86	0800

12-Hour Sampling Schedule:

Period No.	Start		Stop	
26	8/12/86	0800	8/12/86	2000
27	8/12/86	2000	8/13/86	0800
36	8/13/86	0800	8/13/86	2000
37	8/13/86	2000	8/14/86	0800
46	8/14/86	0800	8/14/86	2000
47	8/14/86	2000	8/15/86	0800
56	8/15/86	0800	8/15/86	2000
57	8/15/86	2000	8/16/86	0800
66	8/16/86	0800	8/16/86	2000
67	8/16/86	2000	8/17/86	0800
76	8/17/86	0800	8/17/86	2000
77	8/17/86	2000	8/18/86	0800
86	8/18/86	0800	8/18/86	2000
87	8/18/86	2000	8/19/86	0800
96	8/19/86	0800	8/19/86	2000
97	8/19/86	2000	8/20/86	0800
106	8/20/86	0800	8/20/86	2000
107	8/20/86	2000	8/21/86	0800

Schedules are in Pacific Daylight Time

Figure A1. Citrus College Sampling Site
Carbonaceous Species Measurement Methods Comparison Study

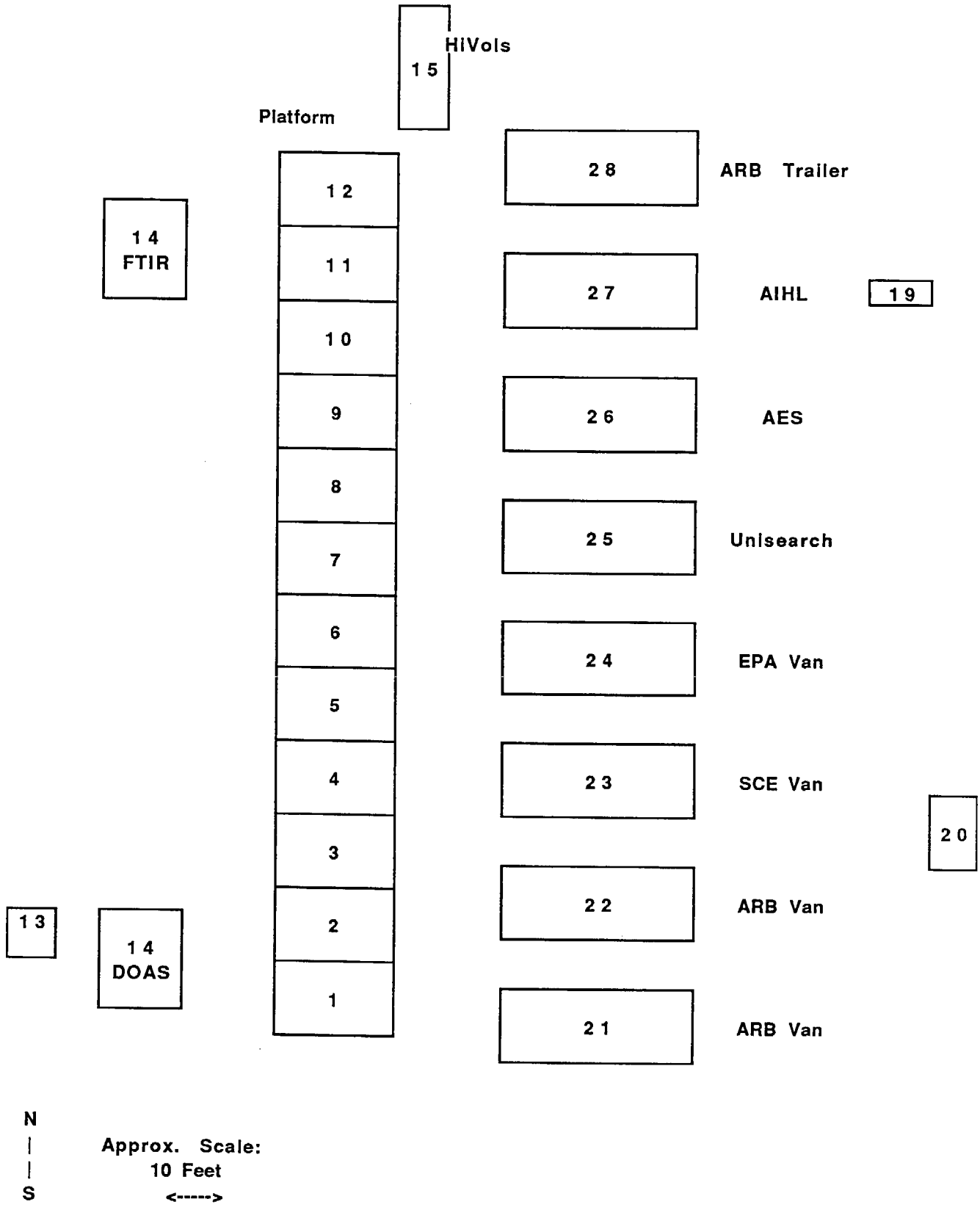


Table B1. FINE PARTICLE CARBON DATA (Dp<2.5µm): Citrus College, Glendora, CA, August 12-20, 1986
Sampler Codes given in Table A1. All concentrations are (µg/m3). * = Average of several shorter samples, m=missing data.

Group	Sampler	Period: / Date:	26 / 8/12	27	36 / 8/13	37	46 / 8/14	47	56 / 8/15	57	66 / 8/16	67	76 / 8/17	77	86 / 8/18	87	96 / 8/19	97	106 / 8/20	107	Method Mean
LOADINGS ON FRONT FILTERS AND IMPACTORS: EC																					
AIHL	AD1F	Elmt C	5.6	5.6	5.6	4.2	5.4	3.7	5.1	3.7	3.7	2.6	2.6	2.9	4.4	2.7	3.3	3.3	5.4	4.5	4.1
AIHL	AD2F	Elmt C	5.4	4.6	5.8	4.3	5.5	3.8	5.2	3.5	3.5	2.6	2.9	2.8	4.3	2.8	3.9	3.4	5.6	4.7	4.1
AIHL	AT3P *	Elmt C	6.4	5.1	6.4	4.3	6.0	3.8	6.6	3.5	3.8	2.6	2.8	2.9	4.9	3.0	3.9	3.3	6.6	4.9	4.5
AV	FDB1	Elmt C	1.9	1.5	1.7	1.2	1.7	0.9	1.6	0.8	1.1	0.9	1.0	1.3	2.2	0.8	1.8	1.3	2.8	2.7	1.5
AV	FDA1	Elmt C	1.8	1.6	1.8	1.2	1.7	0.9	1.6	1.0	1.2	1.0	1.2	0.9	2.0	1.2	1.8	1.5	2.9	2.2	1.5
EPA	ITF	Elmt C	m	0.8	1.2	1.0	2.0	1.1	4.4	0.7	0.8	1.6	1.0	1.1	1.6	0.8	0.5	1.6	6.1	m	1.6
GM	CDC-Tr.	Elmt C	5.4	3.6	5.3	3.9	7.8	2.7	6.0	3.5	4.5	2.9	3.7	2.9	4.4	2.9	4.1	3.5	4.5	4.7	4.2
CGC	HSMQQF.20	Elmt C	4.8	2.9	6.0	2.7	5.6	2.8	m	3.1	3.3	2.7	3.3	3.0	4.1	2.8	3.9	2.7	5.9	4.4	3.8
CGC	HSMQQF.40	Elmt C	5.6	3.0	5.5	3.0	4.9	2.5	3.7	m	2.3	2.3	2.9	2.8	4.4	2.3	m	2.9	5.2	3.8	3.6
CGC	HJHQQF	Elmt C	5.6	4.4	5.5	3.7	5.4	3.2	5.1	3.2	3.2	2.6	3.3	2.7	4.9	2.8	3.9	3.5	5.8	4.6	4.1
UM	UI2	Elmt C	1.2	0.8	4.5	2.5	3.5	2.5	4.2	2.0	3.1	2.6	m	1.2	4.5	2.1	2.2	2.5	4.3	3.4	2.8
GM	CI<3.6	Elmt C	8.3	4.1	7.6	4.6	8.0	3.6	7.0	3.5	5.9	3.9	4.6	2.6	5.9	2.9	4.1	3.1	7.1	4.1	5.1
GM	CI<1.9	Elmt C	8.1	3.9	7.4	4.4	7.8	3.4	6.9	3.3	5.9	3.9	4.6	2.5	5.9	2.9	4.0	3.0	6.9	4.0	4.9
LOADINGS ON FRONT FILTERS AND IMPACTORS: OC																					
AIHL	AD1F	Org C	16.5	10.5	14.9	9.1	18.2	7.5	19.6	7.6	16.3	11.6	16.9	7.5	11.9	7.8	12.8	10.1	15.1	10.2	12.5
AIHL	AD2F	Org C	16.9	9.0	15.6	10.4	19.1	7.5	16.8	7.4	16.8	11.9	17.6	8.1	14.3	8.8	12.9	10.1	15.9	11.2	12.8
AIHL	AT3P *	Org C	18.2	8.8	17.8	8.7	20.8	7.5	19.4	7.6	21.0	12.5	22.3	9.0	18.0	11.3	16.2	11.3	20.6	12.9	14.7
AIHL	AT4P *	Org C	35.0	18.5	37.5	16.8	40.8	19.5	37.2	15.9	35.8	21.7	34.7	16.5	38.9	31.0	30.5	21.8	29.2	21.6	27.9
AV	FDB1	Org C	16.7	11.4	16.9	11.9	19.6	9.2	17.8	9.1	17.2	12.8	17.7	10.1	16.3	11.4	15.7	14.4	19.2	14.6	14.6
AV	FDA1	Org C	18.2	12.5	19.2	13.5	23.4	10.4	20.6	9.9	19.7	13.4	21.0	11.6	19.3	12.4	18.4	14.6	23.0	17.1	16.6
EPA	ITF	Org C	m	8.8	16.5	8.0	16.0	6.5	10.9	5.7	15.7	8.7	17.5	7.1	13.0	8.0	12.8	7.0	14.1	m	11.0
GM	CDC-Tr.	Org C	13.8	8.4	12.5	5.5	16.2	5.6	14.1	4.3	14.5	9.7	15.2	8.4	12.2	8.2	10.5	9.6	15.7	11.0	10.9
CGC	HSMQQF.20	Org C	13.0	7.6	12.6	5.7	13.6	5.0	m	6.0	15.9	10.9	15.8	8.6	12.7	9.7	12.9	9.3	15.7	9.4	10.8
CGC	HSMQQF.40	Org C	10.7	5.7	12.4	4.5	11.4	3.9	9.7	m	12.3	8.7	14.0	6.7	9.7	5.9	m	8.4	12.4	8.8	9.1
CGC	HJHQQF	Org C	16.9	7.5	16.0	6.9	15.9	5.0	14.9	5.9	15.6	9.4	15.7	7.6	10.1	8.0	10.8	10.2	14.7	10.1	11.2
UM	UI2	Org C	5.0	3.1	4.9	4.3	5.8	3.3	5.7	3.5	3.9	6.1	m	3.4	6.7	3.7	5.4	3.7	6.8	4.9	4.7
GM	CI<3.6	Org C	8.0	4.4	7.7	5.1	8.9	5.3	8.8	8.0	11.5	8.5	6.9	3.8	5.3	3.8	4.3	2.7	5.6	3.7	6.2
GM	CI<1.9	Org C	7.4	3.9	7.2	4.7	8.5	4.3	8.0	7.5	11.0	7.9	6.6	3.3	4.8	3.5	4.1	2.5	5.4	3.3	5.8

Table B1. FINE PARTICLE CARBON DATA (Dp<2.5µm): Citrus College, Glendora, CA, August 12-20, 1986
Sampler Codes given in Table A1. All concentrations are (µg/m3). * = Average of several shorter samples, m=missing data.

Group	Sampler	Period: / Date:	26 / 8/12	27	36 / 8/13	37	46 / 8/14	47	56 / 8/15	57	66 / 8/16	67	76 / 8/17	77	86 / 8/18	87	96 / 8/19	97	106 / 8/20	107	Method Mean
LOADINGS ON FRONT FILTERS AND IMPACTORS: TC																					
AIHL	AD1F	Tot C	22.1	16.1	20.6	13.4	23.6	11.3	24.6	11.3	20.0	14.2	19.5	10.4	16.3	10.5	16.1	13.3	20.4	14.7	16.6
AIHL	AD2F	Tot C	22.3	13.6	21.4	14.7	24.7	11.3	22.0	10.9	20.3	14.5	20.5	11.0	18.6	11.6	16.7	13.5	21.5	15.8	16.9
AIHL	AT3P *	Tot C	24.6	13.9	24.3	13.1	26.8	11.4	26.0	11.1	24.8	15.1	25.0	12.0	22.9	14.2	20.1	14.5	27.2	17.7	19.2
AIHL	AT4P *	Tot C	37.5	21.8	37.5	19.3	40.8	19.5	37.2	15.9	35.8	21.7	34.7	16.5	38.9	31.0	30.5	21.8	31.8	24.8	28.7
AV	FDB1	Tot C	18.6	12.9	18.6	13.1	21.3	10.2	19.4	9.9	18.3	13.7	18.7	11.4	18.5	12.2	17.5	15.7	22.0	17.3	16.1
AV	FDA1	Tot C	20.0	14.1	21.0	14.7	25.1	11.3	22.2	10.9	20.9	14.4	22.2	12.5	21.3	13.6	20.2	16.1	25.9	19.3	18.1
EPA	ITF	Tot C	m	9.6	17.7	9.0	18.0	7.6	15.3	6.4	16.5	10.3	18.5	8.2	14.7	8.8	13.3	8.6	20.1	m	12.7
GM	CDC-Tr.	Tot C	19.2	12.0	17.8	9.4	24.0	8.3	20.2	7.9	19.0	12.5	18.9	11.3	16.6	11.1	14.6	13.1	20.3	15.7	15.1
CGC	HSMQQF.20	Tot C	17.8	10.5	18.6	8.4	19.2	7.8	m	9.2	19.2	13.6	19.0	11.6	16.8	12.5	16.8	12.0	21.5	13.8	14.6
CGC	HSMQQF.40	Tot C	16.3	8.7	17.9	7.5	16.3	6.3	13.3	m	14.6	11.0	16.9	9.5	14.0	8.2	m	11.3	17.6	12.6	12.6
CGC	HJHQQF	Tot C	22.6	11.9	21.4	10.6	21.4	8.2	20.0	9.1	18.8	12.0	18.9	10.3	15.1	10.8	14.7	13.8	20.8	14.7	15.3
UCD	DFC *	Tot C	14.2	8.9	12.8	7.7	9.1	2.2	12.9	5.3	10.5	7.3	11.6	5.5	11.6	4.9	9.6	8.0	8.1	10.7	8.9
UM	UI2	Tot C	6.2	3.9	9.4	6.7	9.2	5.8	9.8	5.5	7.0	8.7	m	4.7	11.2	5.8	7.6	6.2	11.0	8.3	7.5
GM	CI<3.6	Tot C	16.3	8.5	15.4	9.7	16.9	8.9	15.8	11.5	17.4	12.5	11.5	6.4	11.2	6.6	8.4	5.8	12.7	7.8	11.3
GM	CI<1.9	Tot C	15.5	7.8	14.6	9.0	16.3	7.7	14.9	10.8	16.8	11.8	11.2	5.8	10.7	6.3	8.1	5.5	12.3	7.3	10.7
BACK-UP FILTER DATA: EC																					
AIHL	AD1S	Elmt C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIHL	AD2S	Elmt C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIHL	AT3A *	Elmt C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIHL	AT4A *	Elmt C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AV	FDB2	Elmt C	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
AV	FDA2	Elmt C	0.0	-0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UM	UI2.af	Elmt C	0.2	0.3	0.3	0.2	0.6	0.2	0.5	0.1	0.6	0.1	0.4	0.3	0.4	0.4	0.3	0.4	0.5	0.6	0.4
GM	CI.af	Elmt C	0.6	0.4	0.6	0.3	0.2	0.2	0.3	0.1	0.3	0.1	0.3	0.3	0.1	0.3	0.0	0.1	0.4	0.3	0.3

Table B1. FINE PARTICLE CARBON DATA (Dp<2.5µm): Citrus College, Glendora, CA, August 12-20, 1986
Sampler Codes given in Table A1. All concentrations are (µg/m3). * = Average of several shorter samples, m=missing data.

Group	Sampler	Period: / Date:	26 8/12	27	36 8/13	37	46 8/14	47	56 8/15	57	66 8/16	67	76 8/17	77	86 8/18	87	96 8/19	97	106 8/20	107	Method Mean
BACK-UP FILTER DATA: OC																					
AIHL	AD1S	Org C	2.3	3.5	1.7	0.7	1.2	1.7	1.2	1.9	0.7	1.0	0.9	1.9	0.6	0.5	4.4	2.0	1.6	1.4	1.6
AIHL	AD2S	Org C	2.6	0.6	1.1	0.5	1.6	14.3	2.9	0.6	0.8	0.9	0.5	0.9	1.0	1.8	2.3	1.2	1.0	1.5	2.0
AIHL	AT3A *	Org C	4.7	2.4	3.9	2.0	5.5	1.8	4.1	1.8	4.4	2.2	3.9	2.3	3.3	2.9	3.6	2.7	4.7	1.2	3.2
AIHL	AT4A *	Org C	15.8	5.5	10.8	5.6	10.0	12.0	7.3	12.8	5.7	3.3	6.2	5.2	6.6	4.5	5.9	4.8	6.8	5.2	7.5
AV	FDB2	Org C	1.0	0.8	0.7	0.4	0.7	0.2	0.7	-0.1	0.7	0.5	0.5	0.4	0.7	0.5	1.2	0.6	0.7	0.6	0.6
AV	FDA2	Org C	3.1	1.9	3.8	2.1	2.6	1.8	3.2	1.2	2.9	1.8	3.6	2.2	3.8	2.4	3.5	2.4	3.6	3.3	2.7
UM	UI2.af	Org C	4.1	2.2	5.0	1.9	6.5	1.6	7.2	1.7	6.4	2.0	6.1	3.8	4.3	4.3	5.5	5.0	7.2	5.2	4.4
GM	CI.af	Org C	2.0	5.1	2.0	1.4	7.1	0.9	3.7	1.4	6.9	3.0	2.9	3.9	3.6	3.4	4.5	3.6	3.8	4.7	3.5
BACK-UP FILTER DATA: TC																					
AIHL	AD1S	Tot C	2.3	3.5	1.7	0.7	1.2	1.7	1.2	1.9	0.7	1.0	0.9	1.9	0.6	0.5	4.4	2.0	1.6	1.4	1.6
AIHL	AD2S	Tot C	2.6	0.6	1.1	0.5	1.6	14.3	2.9	0.6	0.8	0.9	0.5	0.9	1.0	1.8	2.3	1.2	1.0	1.5	2.0
AIHL	AT3A *	Tot C	4.7	2.4	3.9	2.0	5.5	1.8	4.1	1.8	4.4	2.2	3.9	2.3	3.3	2.9	3.6	2.7	4.7	1.2	3.2
AIHL	AT4A *	Tot C	15.8	5.5	10.8	5.6	10.0	12.0	7.3	12.8	5.7	3.3	6.2	5.2	6.6	4.5	5.9	4.8	6.8	5.2	7.5
AV	FDB2	Tot C	1.0	0.8	0.7	0.4	0.8	0.2	0.7	-0.1	0.8	0.5	0.5	0.5	0.7	0.5	1.2	0.6	0.7	0.6	0.6
AV	FDA2	Tot C	3.0	1.9	3.9	2.1	2.5	1.8	3.2	1.2	2.9	1.8	3.6	2.2	3.8	2.4	3.5	2.4	3.5	3.3	2.7
CGC	HSMTQB.20	Tot C	6.1	3.6	5.1	3.0	5.8	2.4	4.8	2.7	5.6	3.5	5.6	3.7	6.4	4.2	5.3	3.8	m	3.8	4.4
CGC	HSMTQB.40	Tot C	3.4	1.8	3.3	1.8	m	1.6	3.6	1.7	4.1	2.3	3.7	2.4	3.2	2.6	3.4	2.4	3.5	2.3	2.8
CGC	HSMQQB.20	Tot C	3.5	1.9	3.2	1.4	3.7	1.3	3.3	1.5	3.7	2.4	3.4	2.1	4.3	2.1	3.9	2.6	5.3	2.3	2.9
CGC	HSMQQB.40	Tot C	2.6	1.3	2.5	1.2	2.4	1.0	2.4	1.1	2.4	1.3	2.5	1.4	2.3	1.7	2.4	1.6	2.6	1.7	1.9
CGC	HJHQQB	Tot C	4.5	1.5	5.2	1.9	2.8	1.3	2.5	1.1	2.7	1.5	3.0	1.5	2.9	1.7	2.7	1.6	2.8	1.6	2.4
CGC	HJHTQB	Tot C	7.4	2.8	m	1.7	m	1.5	3.2	2.0	m	m	m	m	3.5	2.6	m	2.3	3.3	m	3.0
UM	UI2.af	Tot C	4.3	2.4	5.3	2.1	7.1	1.8	7.7	1.8	6.9	2.2	6.6	4.2	4.7	4.7	5.8	5.4	7.7	5.8	4.8
GM	CI.af	Tot C	2.6	5.6	2.6	1.7	7.4	1.1	4.0	1.6	7.2	3.0	3.2	4.2	3.7	3.7	4.5	3.6	4.2	5.0	3.8

Table B1. FINE PARTICLE CARBON DATA (Dp<2.5µm): Citrus College, Glendora, CA, August 12-20, 1986
Sampler Codes given in Table A1. All concentrations are (µg/m3). * = Average of several shorter samples, m=missing data.

Group	Sampler	Period: / Date:	26 8/12	27	36 8/13	37	46 8/14	47	56 8/15	57	66 8/16	67	76 8/17	77	86 8/18	87	96 8/19	97	106 8/20	107	Method Mean
REPORTED AMBIENT CARBON CONCENTRATIONS (INCLUDING CORRECTIONS): EC																					
AIHL	AD1F+AD1S	Elmt C	5.6	5.6	5.6	4.2	5.4	3.7	5.1	3.7	3.7	2.6	2.6	2.9	4.4	2.7	3.3	3.3	5.4	4.5	4.1
AIHL	AT3P-af*	Elmt C	6.4	5.1	6.4	4.3	6.0	3.8	6.6	3.5	3.8	2.6	2.8	2.9	4.9	3.0	3.9	3.3	6.6	4.9	4.5
AIHL	AD2F	Elmt C	5.4	4.6	5.8	4.3	5.5	3.8	5.2	3.5	3.5	2.6	2.9	2.8	4.3	2.8	3.9	3.4	5.6	4.7	4.1
AV	FDB1	Elmt C	1.9	1.5	1.7	1.2	1.7	0.9	1.6	0.8	1.1	0.9	1.0	1.3	2.2	0.8	1.8	1.3	2.8	2.7	1.5
EMSI	EF1B	Elmt C	3.8	1.9	m	2.3	4.5	2.5	4.7	2.0	4.0	2.5	2.4	1.2	2.5	1.0	2.2	1.9	4.5	2.7	2.7
EMSI	EF2B	Elmt C	4.5	1.9	3.7	2.5	5.4	2.7	4.5	1.5	4.0	2.2	2.5	1.3	1.7	0.9	1.9	1.9	3.4	2.4	2.7
EPA	ITF	Elmt C	m	0.8	1.2	1.0	2.0	1.1	4.4	0.7	0.8	1.6	1.0	1.1	1.6	0.8	0.5	1.6	6.1	m	1.6
GGC	GH1	Elmt C	7.5	4.7	10.0	4.3	7.5	3.4	6.6	3.2	5.8	3.7	5.9	3.4	6.2	3.6	6.0	4.5	8.1	m	5.6
GM	CDC-Treatec	Elmt C	5.4	3.6	5.3	3.9	7.8	2.7	6.0	3.5	4.5	2.9	3.7	2.9	4.4	2.9	4.1	3.5	4.5	4.7	4.2
CGC	HSM.20	Elmt C	4.8	2.9	6.0	2.7	5.6	2.8	m	3.1	3.3	2.7	3.3	3.0	4.1	2.8	3.9	2.7	m	4.4	3.6
CGC	HSM.40	Elmt C	5.6	3.0	5.5	3.0	m	2.5	3.7	m	2.3	2.3	2.9	2.8	4.4	2.3	m	2.9	5.2	3.8	3.5
CGC	HJH	Elmt C	5.6	4.4	5.5	3.7	5.4	3.2	5.1	3.2	3.2	2.6	3.3	2.7	4.9	2.8	3.9	3.5	5.8	4.6	4.1
UM	UI2	Elmt C	1.2	0.8	4.5	2.5	3.5	2.5	4.2	2.0	3.1	2.6	m	1.2	4.5	2.1	2.2	2.5	4.3	3.4	2.8
UM	UI2+af	Elmt C	1.4	1.1	4.9	2.6	4.1	2.7	4.7	2.1	3.6	2.8	m	1.6	4.9	2.5	2.6	2.9	4.7	4.0	3.1
GM	CI<1.9	Elmt C	8.1	3.9	7.4	4.4	7.8	3.4	6.9	3.3	5.9	3.9	4.6	2.5	5.9	2.9	4.0	3.0	6.9	4.0	4.9
GM	CI<1.9+af	Elmt C	8.7	4.3	8.0	4.7	8.0	3.6	7.1	3.5	6.1	3.9	4.9	2.9	6.0	3.2	4.0	3.0	7.3	4.3	5.2
		Prd. Mean	5.1	3.1	4.8	3.2	5.6	2.7	4.8	2.5	3.8	2.5	2.9	2.2	3.7	2.0	3.1	2.6	4.6	3.7	3.5

Table B1. FINE PARTICLE CARBON DATA (Dp<2.5μm): Citrus College, Glendora, CA, August 12-20, 1986
Sampler Codes given in Table A1. All concentrations are (μg/m3). * = Average of several shorter samples, m=missing data.

Group	Sampler	Period: / Date:	26 / 8/12	27	36 / 8/13	37	46 / 8/14	47	56 / 8/15	57	66 / 8/16	67	76 / 8/17	77	86 / 8/18	87	96 / 8/19	97	106 / 8/20	107	Method Mean
REPORTED AMBIENT CARBON CONCENTRATIONS (INCLUDING CORRECTIONS): OC																					
AIHL	AD1F+AD1S	Org C	18.9	14.0	16.6	9.8	19.4	9.2	20.8	9.5	17.0	12.5	17.8	9.3	12.5	8.3	17.2	12.0	16.6	11.7	14.1
AIHL	AT3P-af *	Org C	13.5	6.4	14.0	6.7	15.3	5.8	15.3	5.8	16.6	10.3	18.4	6.8	14.7	8.4	12.7	8.5	15.9	11.7	11.5
AIHL	AT4P-af *	Org C	19.2	13.0	26.7	11.3	30.7	7.6	29.9	3.1	30.1	18.4	28.5	11.3	32.3	26.4	24.6	16.9	22.4	16.4	20.5
AIHL	AD2F	Org C	16.9	9.0	15.6	10.4	19.1	7.5	16.8	7.4	16.8	11.9	17.6	8.1	14.3	8.8	12.9	10.1	15.9	11.2	12.8
AV	FDB1	Org C	16.7	11.4	16.9	11.9	19.6	9.2	17.8	9.1	17.2	12.8	17.7	10.1	16.3	11.4	15.7	14.4	19.2	14.6	14.6
EMSI	EF1B	Org C	11.0	4.9	m	6.3	13.8	5.6	11.5	4.5	12.4	8.5	11.8	6.0	10.8	5.5	9.4	8.0	10.6	8.7	8.8
EMSI	EF2B	Org C	10.6	5.1	12.2	5.0	13.2	3.9	12.2	4.2	12.1	8.4	11.7	6.3	8.9	6.6	8.7	8.0	10.7	9.2	8.7
EPA	ITF	Org C	m	8.8	16.5	8.0	16.0	6.5	10.9	5.7	15.7	8.7	17.5	7.1	13.0	8.0	12.8	7.0	14.1	m	11.0
GGC	GH1	Org C	12.0	6.1	12.6	6.7	15.0	5.0	13.2	5.4	12.9	7.4	13.6	6.4	11.8	7.2	10.6	8.8	15.6	m	10.0
GM	CDC-Treatec	Org C	13.8	8.4	12.5	5.5	16.2	5.6	14.1	4.3	14.5	9.7	15.2	8.4	12.2	8.2	10.5	9.6	15.7	11.0	10.9
CGC	HSM.20	Org C	6.8	3.9	7.4	2.7	7.8	2.5	m	3.3	10.2	7.4	10.1	4.9	6.3	5.5	7.5	5.5	m	5.5	5.7
CGC	HSM.40	Org C	7.3	3.9	9.1	2.7	m	2.2	6.0	m	8.2	6.4	10.3	4.2	6.4	3.2	m	6.0	8.9	6.4	6.1
CGC	HJH	Org C	9.5	4.7	12.7	5.2	12.3	3.5	11.7	3.9	11.5	7.1	12.0	5.2	6.6	5.4	7.4	7.9	11.4	7.8	8.1
UM	UI2	Org C	5.0	3.1	4.9	4.3	5.8	3.3	5.7	3.5	3.9	6.1	m	3.4	6.7	3.7	5.4	3.7	6.8	4.9	4.7
UM	UI2+af	Org C	9.0	5.3	9.8	6.2	12.3	4.9	12.9	5.1	10.3	8.2	m	7.3	11.1	8.0	10.8	8.7	14.0	10.1	9.1
GM	CI<1.9	Org C	7.4	3.9	7.2	4.7	8.5	4.3	8.0	7.5	11.0	7.9	6.6	3.3	4.8	3.5	4.1	2.5	5.4	3.3	5.8
GM	CI<1.9+af	Org C	9.4	9.0	9.2	6.0	15.7	5.2	11.7	8.9	17.9	10.9	9.5	7.2	8.4	6.8	8.6	6.1	9.2	8.0	9.3
		Prd. Mean	13.1	7.6	12.9	7.5	15.3	6.1	13.8	6.5	14.3	10.1	13.8	7.2	11.3	7.7	10.4	8.9	13.4	9.9	10.5

Table B1. FINE PARTICLE CARBON DATA (Dp<2.5µm): Citrus College, Glendora, CA, August 12-20, 1986
Sampler Codes given in Table A1. All concentrations are (µg/m3). * = Average of several shorter samples, m=missing data.

Group	Sampler	Period: / Date:	26 8/12	27	36 8/13	37	46 8/14	47	56 8/15	57	66 8/16	67	76 8/17	77	86 8/18	87	96 8/19	97	106 8/20	107	Method Mean
REPORTED AMBIENT CARBON CONCENTRATIONS (INCLUDING CORRECTIONS): TC																					
AIHL	D1F+D1S	Tot C	24.5	19.6	22.3	14.0	24.7	13.0	25.8	13.2	20.7	15.1	20.3	12.2	16.9	11.0	20.5	15.3	22.0	16.1	18.2
AIHL	T3P-af *	Tot C	19.9	11.5	20.4	11.1	21.3	9.6	21.9	9.3	20.4	12.9	21.2	9.7	19.6	11.3	16.6	11.8	22.5	16.6	16.0
AIHL	T4P-af *	Tot C	21.7	16.3	26.7	13.7	30.7	7.6	29.9	3.1	30.1	18.4	28.5	11.3	32.3	26.4	24.6	16.9	25.0	19.7	21.3
AIHL	D2F	Tot C	22.3	13.6	21.4	14.7	24.7	11.3	22.0	10.9	20.3	14.5	20.5	11.0	18.6	11.6	16.7	13.5	21.5	15.8	16.9
AV	DB1	Tot C	18.6	12.9	18.6	13.1	21.3	10.2	19.4	9.9	18.3	13.7	18.7	11.4	18.5	12.2	17.5	15.7	22.0	17.3	16.1
EMSI	EF1B	Tot C	14.8	6.8	m	8.6	18.3	8.1	16.2	6.5	16.4	11.0	14.2	7.2	13.3	6.5	11.6	9.9	15.1	11.4	11.5
EMSI	EF2B	Tot C	15.2	7.0	15.8	7.4	18.6	6.6	16.7	5.7	16.1	10.7	14.1	7.6	10.7	7.4	10.6	9.8	14.0	11.6	11.4
EPA	ITF	Tot C	m	9.6	17.7	9.0	18.0	7.6	15.3	6.4	16.5	10.3	18.5	8.2	14.7	8.8	13.3	8.6	20.1	m	12.7
GGC	GH1	Tot C	19.5	10.7	22.6	11.1	22.5	8.4	19.8	8.6	18.7	11.1	19.5	9.8	17.9	10.8	16.6	13.3	23.7	m	15.6
GM	CDC	Tot C	19.2	12.0	17.8	9.4	24.0	8.3	20.2	7.9	19.0	12.5	18.9	11.3	16.6	11.1	14.6	13.1	20.3	15.7	15.1
CGC	HSM.20	Tot C	11.6	6.9	13.4	5.4	13.3	5.3	m	6.4	13.5	10.0	13.4	7.9	10.4	8.3	11.4	8.2	m	10.0	9.7
CGC	HSM.40	Tot C	12.9	6.8	14.6	5.7	m	4.7	9.7	m	10.5	8.7	13.2	7.0	10.8	5.5	m	8.9	14.0	10.2	9.5
CGC	HJH	Tot C	15.1	9.0	18.2	8.9	17.7	6.7	16.8	7.1	14.7	9.7	15.3	7.9	11.5	8.2	11.3	11.4	17.2	12.4	12.3
CGC	HCC *	Tot C	m	9.0	m	10.6	19.0	7.1	m	9.8	m	9.5	15.0	8.2	m	7.7	12.8	9.9	18.4	12.7	11.5
UCD	DFC *	Tot C	14.2	8.9	12.8	7.7	9.1	2.2	12.9	5.3	10.5	7.3	11.6	5.5	11.6	4.9	9.6	8.0	8.1	10.7	8.9
UM	UI2	Tot C	6.2	3.9	9.4	6.7	9.2	5.8	9.8	5.5	7.0	8.7	m	4.7	11.2	5.8	7.6	6.2	11.0	8.3	7.5
UM	UI2+af	Tot C	10.5	6.4	14.7	8.8	16.4	7.6	17.5	7.2	13.9	10.9	m	8.8	15.9	10.5	13.4	11.6	18.7	14.1	12.2
GM	CI<1.9	Tot C	15.5	7.8	14.6	9.0	16.3	7.7	14.9	10.8	16.8	11.8	11.2	5.8	10.7	6.3	8.1	5.5	12.3	7.3	10.7
GM	CI<1.9+af	Tot C	18.1	13.4	17.1	10.7	23.7	8.8	18.9	12.3	24.0	14.8	14.4	10.0	14.4	10.0	12.6	9.1	16.5	12.3	14.5
		Prd. Mean	18.1	10.6	17.6	10.7	21.0	8.8	18.6	9.0	18.1	12.6	16.7	9.4	15.0	9.7	13.5	11.5	18.0	13.6	14.0

Table B2. SHORT-TERM SAMPLING FOR FINE PARTICLE CARBON: UCD & AIHL Data

AIHL T4P=LowVol particle filter
AIHL T4 A=LowVol after filter

Group	AIHL	AIHL	AIHL	AIHL	AIHL	AIHL
Sampler	T4P	T4P	T4P	T4A	T4A	T4A
Species	Org C	Elmt C	Tot C	Org C	Elmt C	Tot C
Units	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
Face Velocity	11	11	11	11	11	11
Precut (µm)	2.5	2.5	2.5	2.5	2.5	2.5
Period:						
21	36.64	7.57	44.21	23.96	0	23.96
22	45.34	<7.78	45.34	15.67	0	15.67
23	23.01	<7.57	23.01	7.7	0	7.7
24	28.65	<7.	28.65	9.22	0	9.22
25	13.4	4.96	18.36	3.69	0	3.69
31	40.27	<7.	40.27	9.79	0	9.79
32	37.14	<7.	37.14	12.91	0	12.91
33	35.21	<7.	35.21	9.69	0	9.69
34	21.09	<7.	21.09	7.5	0	7.5
35	14.67	3.67	18.34	4.58	0	4.58
41	41.84	<7.	41.84	9.89	0	9.89
42	39.2	<7.	39.2	13.57	0	13.57
43	41.21	<7.	41.21	6.63	0	6.63
44	28.74	<7.	28.74	4.74	0	4.74
45	14.9	<4.	14.9	15.57	0	15.57
51	37.36	<7.	37.36	4.37	0	4.37
52	43.14	<7.	43.14	9.32	0	9.32
53	31.09	<7.	31.09	8.28	0	8.28
54	17.57	<7.	17.57	32.91	0	32.91
55	15	<4.	15	2.71	0	2.71
61	32.38	<7.	32.38	5.28	0	5.28
62	37.69	<7.	37.69	6.28	0	6.28
63	37.42	<7.	37.42	5.63	0	5.63
64	23.88	<7.	23.88	3.51	0	3.51
65	20.62	<3.	20.62	3.18	0	3.18
71	34.97	<7.	34.97	6.06	0	6.06
72	38.01	<7.	38.01	6.17	0	6.17
73	31.1	<7.	31.1	6.49	0	6.49
74	14.97	<7.	14.97	6.79	0	6.79
75	17.27	<3.	17.27	4.43	0	4.43
81	51.41	<7.	51.41	7.27	0	7.27
82	33.06	<7.	33.06	5.87	0	5.87
83	32.15	<8.	32.15	6.72	0	6.72
84	53.02	<7.	53.02	4.9	0	4.9
85	19.92	<4.	19.92	4.35	0	4.35
91	32.41	<7.	32.41	6.93	0	6.93
92	38.23	<7.	38.23	6.67	0	6.67
93	20.92	<7.	20.92	4.15	0	4.15
94	21.53	<7.	21.53	5.95	0	5.95
95	21.9	<4.	21.9	4.29	0	4.29
101	34.49	7.97	42.46	7.24	0	7.24
102	29.05	<7.	29.05	8.74	0	8.74
103	23.91	<7.	23.91	4.38	0	4.38
104	27.9	<7.	27.9	5.05	0	5.05
105	18.5	4.82	23.32	5.27	0	5.27

Table B2. SHORT-TERM SAMPLING FOR FINE PARTICLE CARBON: UCD & AIHL Data

UCD DFC=Teflon filter dwnstrm 2.5 um cyclone
AIHL T3P=HiVol particle filter
AIHL T3A=HiVol after filter

Group	UCD	AIHL	AIHL	AIHL	AIHL	AIHL	AIHL
Sampler	DFC	T3P	T3P	T3P	T3A	T3A	T3A
Species	Tot C	Org C	Elmt C	Tot C	Org C	Elmt C	Tot C
Units	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
Face Velocity		36	36	36	36	36	36
Precut (µm)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Period:							
21	25.1	18.79	9.84	28.63	5.04	0	5.04
22	13.0	22.88	5.91	28.79	5.51	0	5.51
23	4.5	12.94	3.47	16.41	3.56	0	3.56
24	10.1	11.08	4.76	15.84	2.55	0	2.55
25	8.3	7.69	5.22	12.91	2.35	0	2.35
31	11.8	16.45	8.65	25.1	4.1	0	4.1
32	15.0	17.99	6.04	24.03	3.74	0	3.74
33	11.7	19.01	4.63	23.64	3.75	0	3.75
34	5.4	10.77	4.23	15	2.48	0	2.48
35	8.9	7.71	4.4	12.11	1.74	0	1.74
41	10.3	18.47	6.96	25.43	6.2	0	6.2
42	9.8	21.54	5.7	27.24	5.22	0	5.22
43	7.3	22.51	5.32	27.83	5.2	0	5.2
44	6.5	11.26	4.01	15.27	2.22	0	2.22
45		5.66	3.76	9.42	1.55	0	1.55
51	13.1	15.91	7.78	23.69	2.61	0	2.61
52	17.4	26.22	7.71	33.93	6.46	0	6.46
53	8.3	16.16	4.17	20.33	3.2	0	3.2
54	5.8	8.45	3.32	11.77	1.85	0	1.85
55	5.0	7.13	3.66	10.79	1.78	0	1.78
61	13.3	17.43	5.2	22.63	5.25	0	5.25
62	10.2	21.67	3.25	24.92	4.03	0	4.03
63	8.0	23.95	2.9	26.85	4.02	0	4.02
64	6.2	12.5	2.74	15.24	2.76	0	2.76
65	7.8	12.51	2.49	15	1.96	0	1.96
71	12.6	23.19	3.34	26.53	3.85	0	3.85
72	12.9	25.85	3	28.85	3.98	0	3.98
73	9.3	17.8	1.95	19.75	3.79	0	3.79
74	2.7	11.13	1.83	12.96	2.35	0	2.35
75	6.9	8	3.46	11.46	2.24	0	2.24
81	15.3	17.72	6.97	24.69	3.59	0	3.59
82	6.9	20.72	4.46	25.18	3.63	0	3.63
83	12.5	15.6	3.29	18.89	2.8	0	2.8
84	6.4	13.5	3.22	16.72	2.64	0	2.64
85	4.1	10.15	2.85	13	3.02	0	3.02
91	14.4	17.69	4.74	22.43	3.51	0	3.51
92	7.3	20.19	4.59	24.78	4.2	0	4.2
93	7.1	10.76	2.45	13.21	2.96	0	2.96
94	6.0	11.14	3.13	14.27	2.87	0	2.87
95	9.0	11.34	3.31	14.65	2.68	0	2.68
101	8.9	23.88	11.04	34.92	5.98	0	5.98
102	6.0	23.91	5.21	29.12	5.05	0	5.05
103	9.3	14.04	3.51	17.55	3.13	0	3.13
104	12.4	12.41	4.1	16.51	3.28	0	3.28
105	9.9	13.11	5.25	18.36	0.1	0	0.1

Table B3. Elemental Carbon and Absorption Values: Citrus College, Aug 1986
(Short term Data)

LBL	Q = Aetholometer	UCLA/UW	YF = Nuclepore Filter	
AIHL	T3P = HiVol particle filter	UCD	DFC = Teflon filter following cyclone	
AIHL	T4P = LowVol particle filter			

Group	AIHL	AIHL	LBL	UCD	UCLA/UW	UCLA/UW
Sampler	T3P	T4P	Q	DFD&DFO	YF	YF
Species	Black Carbon	Black Carbon	Black Carbon	Babs	Babs	Carbon Babs
Units	(µg/m3)	(µg/m3)	(µg/m3)	(m-1)	(m-1)	(m-1)
Face Vel.	36 cm/s	11 cm/s	60-120 cm/s	-	7 cm/s	7 cm/s
Precut	2.5 µm	2.5 µm	2.5 µm ?	2.5 µm	2 µm	2 µm
Period:						
21	9.84	7.57	2.7	1.3 E-04	1.32 E-04	9.60 E-05
22	5.91	<7.78	1.2	1.0 E-04	8.14 E-05	3.70 E-05
23	3.47	<7.57	0.9	7.4 E-05	5.33 E-05	3.78 E-05
24	4.76	<7.	1.3	8.8 E-05	1.20 E-04	1.20 E-04
25	5.22	4.96	1.0	1.0 E-04	7.00 E-05	5.86 E-05
31	8.65	<7.	5.8	1.1 E-04	1.08 E-04	7.75 E-05
32	6.04	<7.	4.2	8.6 E-05	7.54 E-05	3.28 E-05
33	4.63	<7.	3.7	9.8 E-05	6.02 E-05	2.22 E-05
34	4.23	<7.	3.4	7.3 E-05	6.10 E-05	4.62 E-05
35	4.40	3.67	3.4	8.4 E-05	5.75 E-05	4.51 E-05
41	6.96	<7.	5.0	1.0 E-04	9.02 E-05	5.58 E-05
42	5.70	<7.	4.3	9.7 E-05	7.53 E-05	3.56 E-05
43	5.32	<7.	4.2	1.0 E-04	7.25 E-05	3.30 E-05
44	4.01	<7.	3.4	7.2 E-05	5.38 E-05	2.28 E-05
45	3.76	<4.	2.6	7.0 E-05	5.44 E-05	4.11 E-05
51	7.78	<7.	5.1	1.0 E-04	8.07 E-05	4.70 E-05
52	7.71	<7.	3.9	9.9 E-05	7.61 E-05	2.89 E-05
53	4.17	<7.	4.5	8.9 E-05	5.27 E-05	1.71 E-05
54	3.32	<7.	2.6	7.7 E-05	4.74 E-05	3.19 E-05
55	3.66	<4.	2.7	8.7 E-05	4.51 E-05	3.43 E-05
61	5.20	<7.	4.0	9.1 E-05	6.74 E-05	4.05 E-05
62	3.25	<7.	2.6	8.0 E-05	4.10 E-05	3.77 E-06
63	2.90	<7.	2.6	7.8 E-05	4.04 E-05	8.47 E-06
64	2.74	<7.	2.4	6.6 E-05	3.40 E-05	1.50 E-05
65	2.49	<3.	2.0	7.9 E-05	3.00 E-05	1.22 E-05
71	3.34	<7.	2.4	7.8 E-05	3.68 E-05	2.29 E-06
72	3.00	<7.	2.0	6.9 E-05	2.65 E-05	--
73	1.95	<7.	1.9	6.8 E-05	1.73 E-05	--
74	1.83	<7.	1.7	5.9 E-05	5.42 E-05	5.42 E-05
75	3.46	<3.	2.4	9.7 E-05	4.30 E-05	3.67 E-05
81	6.97	<7.	4.9	9.7 E-05	8.79 E-05	6.08 E-05
82	4.46	<7.	2.7	6.4 E-05	7.11 E-05	3.35 E-05
83	3.29	<8.	2.4	7.1 E-05	4.71 E-05	2.26 E-05
84	3.22	<7.	2.5	6.3 E-05	5.30 E-05	4.10 E-05
85	2.85	<4.	2.1	8.9 E-05	3.56 E-05	2.09 E-05
91	4.74	<7.	3.5	8.0 E-05	5.77 E-05	2.48 E-05
92	4.59	<7.	3.3	7.4 E-05	5.52 E-05	2.23 E-05
93	2.45	<7.	2.2	5.7 E-05	5.04 E-05	3.08 E-05
94	3.13	<7.	2.9	7.1 E-05	7.05 E-05	6.10 E-05
95	3.31	<4.	2.8	1.1 E-04	5.68 E-05	4.51 E-05
101	11.04	7.97	7.2	1.4 E-04	1.61 E-04	1.31 E-04
102	5.21	<7.	3.2	7.5 E-05	7.39 E-05	4.56 E-05
103	3.51	<7.	2.9	6.9 E-05	5.96 E-05	5.47 E-05
104	4.10	<7.	3.3	8.3 E-05	4.74 E-05	2.43 E-05
105	5.25	4.82	4.0	1.3 E-04	7.43 E-05	5.93 E-05

Table B4. LBL Aetholometer Hourly Black Carbon Data

Date	Hour (PDT)	Black Carbon (µg/m3)	Date	Hour (PDT)	Black Carbon (µg/m3)	Date	Hour (PDT)	Black Carbon (µg/m3)
8/12/86	0400	0.6	8/14/86	0600		8/16/86	0800	4.8
8/12/86	0500	0.8	8/14/86	0700		8/16/86	0900	4.1
8/12/86	0600	0.7	8/14/86	0800	3.0	8/16/86	1000	3.6
8/12/86	0700	3.8	8/14/86	0900	6.8	8/16/86	1100	3.4
8/12/86	0800	2.8	8/14/86	1000	5.1	8/16/86	1200	2.8
8/12/86	0900	3.2	8/14/86	1100	5.0	8/16/86	1300	2.2
8/12/86	1000	2.8	8/14/86	1200	4.2	8/16/86	1400	2.7
8/12/86	1100	2.1	8/14/86	1300	3.9	8/16/86	1500	2.7
8/12/86	1200	1.5	8/14/86	1400	4.0	8/16/86	1600	2.6
8/12/86	1300	1.2	8/14/86	1500	5.0	8/16/86	1700	2.6
8/12/86	1400	1.0	8/14/86	1600	4.8	8/16/86	1800	2.5
8/12/86	1500	1.1	8/14/86	1700	4.5	8/16/86	1900	2.7
8/12/86	1600	0.8	8/14/86	1800	3.7	8/16/86	2000	2.5
8/12/86	1700	0.6	8/14/86	1900	3.7	8/16/86	2100	2.6
8/12/86	1800	1.3	8/14/86	2000	3.8	8/16/86	2200	2.5
8/12/86	1900	0.9	8/14/86	2100	3.7	8/16/86	2300	1.9
8/12/86	2000	1.4	8/14/86	2200	3.2	8/17/86	0000	2.1
8/12/86	2100	1.5	8/14/86	2300	2.7	8/17/86	0100	2.3
8/12/86	2200	1.0	8/15/86	0000	2.2	8/17/86	0200	2.5
8/12/86	2300	1.2	8/15/86	0100	2.5	8/17/86	0300	2.4
8/13/86	0000	1.1	8/15/86	0200	2.3	8/17/86	0400	2.1
8/13/86	0100	0.9	8/15/86	0300	2.5	8/17/86	0500	1.8
8/13/86	0200	0.9	8/15/86	0400	2.4	8/17/86	0600	1.4
8/13/86	0300	1.0	8/15/86	0500	2.4	8/17/86	0700	1.5
8/13/86	0400	0.9	8/15/86	0600	3.5	8/17/86	0800	1.9
8/13/86	0500	0.9	8/15/86	0700	3.3	8/17/86	0900	2.8
8/13/86	0600	1.1	8/15/86	0800	5.2	8/17/86	1000	2.8
8/13/86	0700	1.4	8/15/86	0900	5.9	8/17/86	1100	2.2
8/13/86	0800		8/15/86	1000	4.8	8/17/86	1200	2.3
8/13/86	0900	6.8	8/15/86	1100	4.4	8/17/86	1300	1.7
8/13/86	1000	5.9	8/15/86	1200	3.9	8/17/86	1400	1.7
8/13/86	1100	4.7	8/15/86	1300	3.8	8/17/86	1500	2.4
8/13/86	1200	3.7	8/15/86	1400		8/17/86	1600	2.0
8/13/86	1300	3.6	8/15/86	1500		8/17/86	1700	1.2
8/13/86	1400	4.6	8/15/86	1600	4.8	8/17/86	1800	2.0
8/13/86	1500	4.7	8/15/86	1700	5.3	8/17/86	1900	2.4
8/13/86	1600	4.2	8/15/86	1800	4.6	8/17/86	2000	1.9
8/13/86	1700	3.5	8/15/86	1900	3.4	8/17/86	2100	1.6
8/13/86	1800	3.5	8/15/86	2000	2.4	8/17/86	2200	1.7
8/13/86	1900	3.7	8/15/86	2100	2.7	8/17/86	2300	1.7
8/13/86	2000	2.8	8/15/86	2200	2.5	8/18/86	0000	2.0
8/13/86	2100	3.3	8/15/86	2300	2.8	8/18/86	0100	2.0
8/13/86	2200	3.9	8/16/86	0000	2.8	8/18/86	0200	2.5
8/13/86	2300	3.6	8/16/86	0100	2.2	8/18/86	0300	2.0
8/14/86	0000	3.6	8/16/86	0200	3.2	8/18/86	0400	2.1
8/14/86	0100	4.3	8/16/86	0300	2.9	8/18/86	0500	1.8
8/14/86	0200	3.4	8/16/86	0400	2.7	8/18/86	0600	3.8
8/14/86	0300	3.2	8/16/86	0500	2.5	8/18/86	0700	3.3
8/14/86	0400	2.9	8/16/86	0600	2.3	8/18/86	0800	4.8
8/14/86	0500	2.7	8/16/86	0700	2.7	8/18/86	0900	5.4

Table B4. LBL Aetholometer Hourly Black Carbon Data

Date	Hour (PDT)	Black Carbon (µg/m3)	Date	Hour (PDT)	Black Carbon (µg/m3)	Date	Hour (PDT)	Black Carbon (µg/m3)
8/18/86	1000	4.8	8/19/86	1000	3.1	8/20/86	1000	7.0
8/18/86	1100	4.7	8/19/86	1100	2.9	8/20/86	1100	2.7
8/18/86	1200	2.7	8/19/86	1200	2.9	8/20/86	1200	3.2
8/18/86	1300	1.7	8/19/86	1300	3.0	8/20/86	1300	2.6
8/18/86	1400	2.7	8/19/86	1400	4.3	8/20/86	1400	3.7
8/18/86	1500	3.7	8/19/86	1500	2.9	8/20/86	1500	3.4
8/18/86	1600	3.2	8/19/86	1600	1.9	8/20/86	1600	2.4
8/18/86	1700	2.5	8/19/86	1700	2.2	8/20/86	1700	2.1
8/18/86	1800	2.2	8/19/86	1800	2.2	8/20/86	1800	3.1
8/18/86	1900	1.7	8/19/86	1900	2.3	8/20/86	1900	4.1
8/18/86	2000	2.5	8/19/86	2000	3.2	8/20/86	2000	3.8
8/18/86	2100	2.8	8/19/86	2100	2.9	8/20/86	2100	3.3
8/18/86	2200	2.5	8/19/86	2200	3.0	8/20/86	2200	3.0
8/18/86	2300	2.1	8/19/86	2300	2.6	8/20/86	2300	3.2
8/19/86	0000	1.9	8/20/86	0000	2.1	8/21/86	0000	3.2
8/19/86	0100	1.6	8/20/86	0100	2.1	8/21/86	0100	2.7
8/19/86	0200	1.4	8/20/86	0200	2.1	8/21/86	0200	3.5
8/19/86	0300	1.4	8/20/86	0300	2.0	8/21/86	0300	4.2
8/19/86	0400	1.5	8/20/86	0400	2.2	8/21/86	0400	4.0
8/19/86	0500	1.6	8/20/86	0500	2.5	8/21/86	0500	3.5
8/19/86	0600	3.4	8/20/86	0600	4.2	8/21/86	0600	4.6
8/19/86	0700	3.9	8/20/86	0700	4.9	8/21/86	0700	6.0
8/19/86	0800	4.0	8/20/86	0800	9.6			
8/19/86	0900	4.0	8/20/86	0900	9.6			

LBL Carbon Averages

	Period	Average Black Carbon (µg/m3)
Twelve-hour Periods:		
	26	1.6
	27	1.1
	36	4.6
	37	3.4
	46	4.5
	47	2.9
	56	4.5
	57	2.6
	66	3.1
	67	2.1
	76	2.1
	77	2.2
	86	3.3
	87	2.2
	96	3.0
	97	2.8
	106	4.5
	107	3.8

Table B5. OGC *In Situ* Fine Particle Carbon

PARTICULATE CARBON VALUES FOR INDIVIDUAL RUNS

DATE	START TIME PDT	STOP TIME PDT	PARTICULATE TOTAL CARBON $\mu gC/m^3$	TOTAL CARBON error	ORGANIC CARBON $\mu gC/m^3$	ORGANIC CARBON error	ELEMENTAL CARBON $\mu gC/m^3$	ELEMENTAL CARBON error
08/12	16:28	17:24	10.7	0.7				
08/12	18:08	19:28	10.3	0.5				
08/12	23.58	01:18	9.4	0.4				
08/13	01:57	07:57	8.2	0.3				
08/13	13:26	15:21	20.1	0.7				
08/13	16:18	18:38	19.0	0.7				
08/13	19:17	21:37	10.4	0.4				
08/13	22:16	00:36	11.0	0.4				
08/14	01:15	03:35	9.4	0.4				
08/14	04:14	06:34	9.2	0.4				
08/14	07:13	09:33	15.8	0.6				
08/14	10:19	12:39	19.0	0.7				
08/14	13:18	15:38	17.4	0.6				
08/14	16:17	18:37	22.4	0.7				
08/14	19:18	19:41	20.6	1.0				
08/14	22:59	07:19	7.1	0.2				
08/15	08:05	10:25	13.9	0.5				
08/15	11:04	13:24	21.3	0.7				
08/15	14:04	16:23	27.0	0.8				
08/15	20:33	22:53	9.4	0.4				
08/15	23:32	01:52	9.7	0.4				
08/16	02:31	04:51	9.4	0.3				
08/16	05:30	07:50	10.4	0.4				
08/16	16:54	17:54	17.6	0.8				
08/16	18:33	19:33	12.2	0.6				
08/16	20:12	21:12	8.7	0.5				
08/16	21:59	23:19	8.2	0.5				
08/16	23:58	01:18	7.0	0.4				
08/17	01:57	03:17	10.4	0.5				
08/17	03:56	05:16	12.3	0.5				
08/17	05:55	07:15	10.3	0.4				
08/17	07:54	09:14	12.9	0.5				
08/17	09:53	11:13	17.9	0.7				
08/17	11:52	13:12	18.8	0.8				
08/17	13:51	15:11	15.4	0.7				
08/17	15:50	17:10	15.5	0.7				
08/17	17:49	19:09	9.5	0.5				
08/17	20:45	23:05	7.2	0.3				
08/17	23:44	02:04	7.7	0.4				
08/18	02:43	05:03	7.7	0.3				
08/18	05:42	08:02	10.0	0.4				
08/18	08:44	10:04	14.0	0.6	8.6	1.9	5.4	0.5
08/18	10:43	12:03	19.7	0.8	12.5	2.5	7.2	0.7
08/18	12:42	14:02	13.0	0.6	9.5	2.1	3.5	0.3
08/18	14:41	16:01	18.2	0.8	13.9	2.7	4.3	0.4
08/18	21:49	23:44	8.3	0.4	5.7	1.3	2.6	0.3

Table B5 (cont'd.)

PARTICULATE CARBON VALUES FOR INDIVIDUAL RUNS (cont.)

DATE	START TIME PDT	STOP TIME PDT	PARTICULATE TOTAL CARBON $\mu gC/m^3$	error	ORGANIC CARBON $\mu gC/m^3$	error	ELEMENTAL CARBON $\mu gC/m^3$	error
08/18	00:23	02:18	5.8	0.4	3.9	1.2	1.9	0.2
08/19	02:57	04:52	6.4	0.4	4.9	1.3	1.5	0.1
08/19	05:31	07:26	10.6	0.5	7.2	1.6	3.5	0.3
08/19	08:08	09:28	14.6	0.6	10.4	2.3	4.2	0.4
08/19	10:07	11:27	15.5	0.7	11.8	2.4	3.8	0.4
08/19	12:06	13:26	15.1	0.7	11.3	2.4	3.8	0.4
08/19	14:05	15:25	18.5	0.8	14.2	2.9	4.3	0.4
08/19	16:04	17:24	6.7	0.5	4.5	1.6	2.2	0.2
08/19	18:03	19:23	6.7	0.4	4.3	1.4	2.4	0.2
08/19	20:51	23:11	8.0	0.4	5.1	1.2	2.9	0.3
08/19	23:50	02:10	8.3	0.4	6.0	1.4	2.3	0.2
08/20	02:49	05:09	9.6	0.4	7.5	1.6	2.1	0.2
08/20	05:48	08:08	14.1	0.5	9.5	1.8	4.7	0.5
08/20	08:51	10:11	26.0	1.0	15.1	3.0	10.9	1.1
08/20	10:53	11:53	21.9	0.9	15.8	3.3	6.1	0.6
08/20	12:32	13:32	25.5	1.0	20.0	3.6	5.4	0.5
08/20	14:11	15:11	18.6	0.8	15.7	3.2	2.9	0.3
08/20	15:50	16:50	11.8	0.7	8.9	2.4	2.9	0.3
08/20	17:29	18:29	9.3	0.6	6.7	2.1	2.6	0.3
08/20	19:08	20:08	11.0	0.6	7.5	2.0	3.5	0.3
08/20	20:50	23:10	10.7	0.4	7.9	1.6	2.8	0.3
08/20	23:49	02:09	13.1	0.5	10.1	1.8	3.1	0.3
08/21	02:48	05:08	11.1	0.4	7.7	1.6	3.4	0.3
08/21	05:47	08:07	15.9	0.6	10.4	1.9	5.5	0.6

Table B5 (cont'd.)

MEASURED CARBON VALUES FOR INDIVIDUAL RUNS. Total and Vapor Carbon

DATE	START TIME PDT	STOP TIME PDT	MEASURED VALUES TOTAL CARBON $\mu gC/m^3$	TOTAL CARBON error	VAPOR CARBON $\mu gC/m^3$	VAPOR CARBON error
08/12	16:28	17:24	27.4	0.6	16.7	0.4
08/12	18:08	19:28	19.4	0.4	9.1	0.2
08/12	23:58	01:18	17.5	0.4	8.1	0.2
08/13	01:57	07:57	12.0	0.3	3.8	0.1
08/13	13:26	15:21	29.8	0.7	9.7	0.2
08/13	16:18	18:38	29.3	0.6	10.3	0.2
08/13	19:17	21:37	18.5	0.4	8.1	0.2
08/13	22:16	00:36	18.5	0.4	7.5	0.2
08/14	01:15	03:35	16.3	0.4	6.9	0.2
08/14	04:14	06:34	16.2	0.4	7.0	0.2
08/14	07:13	09:33	24.6	0.5	8.8	0.2
08/14	10:19	12:39	29.4	0.6	10.4	0.2
08/14	13:18	15:38	26.9	0.6	9.5	0.2
08/14	16:17	18:37	32.4	0.7	10.0	0.2
08/14	19:18	19:41	40.8	0.9	20.2	0.4
08/14	22:59	07:19	9.7	0.2	2.6	0.1
08/15	08:05	10:25	20.2	0.4	6.3	0.1
08/15	11:04	13:24	29.1	0.6	7.8	0.2
08/15	14:04	16:23	36.4	0.8	9.4	0.2
08/15	20:33	22:53	15.5	0.3	6.1	0.1
08/15	23:32	01:52	15.2	0.3	5.5	0.1
08/16	02:31	04:51	14.4	0.3	5.0	0.1
08/16	05:30	07:50	15.6	0.3	5.2	0.1
08/16	16:54	17:54	32.6	0.7	15.0	0.3
08/16	18:33	19:33	24.3	0.5	12.1	0.3
08/16	20:12	21:12	20.3	0.4	11.6	0.3
08/16	21:59	23:19	18.0	0.4	9.8	0.2
08/16	23:58	01:18	15.5	0.3	8.5	0.2
08/17	01:57	03:17	19.5	0.4	9.1	0.2
08/17	03:56	05:16	21.3	0.5	9.0	0.2
08/17	05:55	07:15	18.2	0.4	7.9	0.2
08/17	07:54	09:14	22.5	0.5	9.6	0.2
08/17	09:53	11:13	30.8	0.7	12.9	0.3
08/17	11:52	13:12	32.3	0.7	13.5	0.3
08/17	13:51	15:11	28.1	0.6	12.7	0.3
08/17	15:50	17:10	28.9	0.6	13.4	0.3
08/17	17:49	19:09	21.6	0.5	12.1	0.3
08/17	20:45	23:05	13.6	0.3	6.4	0.1
08/17	23:44	02:04	14.5	0.3	6.8	0.1
08/18	02:43	05:03	14.1	0.3	6.4	0.1
08/18	05:42	08:02	15.6	0.3	5.6	0.1
08/18	08:44	10:04	23.8	0.5	9.8	0.2
08/18	10:43	12:03	32.2	0.7	12.5	0.3
08/18	12:42	14:02	24.0	0.5	11.0	0.2
08/18	14:41	16:01	31.6	0.7	13.4	0.3

Table B5 (cont'd.)

MEASURED CARBON VALUES FOR INDIVIDUAL RUNS. Total and Vapor Carbon (cont.)

DATE	START TIME PDT	STOP TIME PDT	MEASURED VALUES TOTAL CARBON $\mu gC/m^3$	TOTAL CARBON error	VAPOR CARBON $\mu gC/m^3$	VAPOR CARBON error
08/18	21:49	23:44	15.9	0.3	7.6	0.2
08/18	00:23	02:18	14.1	0.3	8.3	0.2
08/19	02:57	04:52	14.5	0.3	8.1	0.2
08/19	05:31	07:26	18.8	0.4	8.2	0.2
08/19	08:08	09:28	26.6	0.6	12.0	0.3
08/19	10:07	11:27	28.0	0.6	12.5	0.3
08/19	12:06	13:26	27.8	0.6	12.7	0.3
08/19	14:05	15:25	32.7	0.7	14.2	0.3
08/19	16:04	17:24	18.2	0.4	11.5	0.3
08/19	18:03	19:23	16.7	0.4	10.0	0.2
08/19	20:51	23:11	15.0	0.3	7.0	0.2
08/19	23:50	02:10	16.4	0.4	8.1	0.2
08/20	02:49	05:09	17.7	0.4	8.1	0.2
08/20	05:48	08:08	22.6	0.5	8.5	0.2
08/20	08:51	10:11	40.8	0.9	14.8	0.3
08/20	10:53	11:53	38.9	0.9	17.0	0.4
08/20	12:32	13:32	41.5	0.9	16.0	0.4
08/20	14:11	15:11	34.8	0.8	16.2	0.4
08/20	15:50	16:50	26.5	0.6	14.7	0.3
08/20	17:29	18:29	23.3	0.5	14.0	0.3
08/20	19:08	20:08	23.2	0.5	12.2	0.3
08/20	20:50	23:10	18.2	0.4	7.5	0.2
08/20	23:49	02:09	20.9	0.5	7.8	0.2
08/21	02:48	05:08	18.9	0.4	7.8	0.2
08/21	05:47	08:07	24.7	0.5	8.8	0.2

Table C1. DATA FROM THE INTERLABORATORY ANALYSIS COMPARISON (ROUND-ROBIN)

Smpl No.	Type	Group	Total Carbon Loading (µg C/cm2)	Total Carbon Error	Organic Carbon Loading (µg C/cm2)	Organic Carbon Error	Non-vol/Bl Carbon Loading (µg C/cm2)	Non-vol/Bl Carbon Error
1	Day, Prd. 86	Appel, AIHL	39.5	± 0.5	31.0	± 0.5	8.5	± 0.1
1	Day, Prd. 86	Cadle, GM (preheated)	41.9	± 0.2	31.7	± 0.2	10.2	± 0.0
1	Day, Prd. 86	Cadle, GM (untreated)	41.9	± 0.2	29.3	± 0.2	12.5	± 0.1
1	Day, Prd. 86	Cary, Sunset	39.5	± 1.8	33.1	± 1.5	6.4	± 0.5
1	Day, Prd. 86	Chow, DRI	40.4	--	27.9	--	12.5	--
1	Day, Prd. 86	Countess, EMSI (initial, adipic)	31.3	± 0.1	26.1	± 0.3	5.2	± 0.3
1	Day, Prd. 86	Countess, EMSI (revised, KHP)	38.5	--	32.4	--	6.1	--
1	Day, Prd. 86	Fung, ERT	38.6	± 1.4	30.5	± 1.0	8.2	± 0.9
1	Day, Prd. 86	Gates, DEQ	27.0	± 2.0	23.0	± 1.5	4.0	± 2.5
1	Day, Prd. 86	Gordon, GGC	39.4	± 1.0	27.9	± 0.7	11.5	± 1.0
1	Day, Prd. 86	Hansen, LBL	--	--	--	--	7.9	± 0.4
1	Day, Prd. 86	Howes, EMSI (blind, adipic)	31.2	--	25.7	--	5.5	--
1	Day, Prd. 86	Huntzicker, OGC	41.2	± 2.9	30.7	± 2.6	10.5	± 0.7
1	Day, Prd. 86	Knapp, EPA	36.6	± 2.5	32.0	± 1.7	4.6	± 1.0
1	Day, Prd. 86	McMurry, UM	46.5	± 4.4	44.6	± 3.9	1.9	± 0.5
1	Day, Prd. 86	Zeller, Coulometrics	47.8	± 5.9	36.2	± 5.2	11.6	± 1.1
10	Day, Prd. 86	Appel, AIHL	40.1	± 0.5	31.4	± 0.5	8.7	± 0.1
10	Day, Prd. 86	Cadle, GM (preheated)	39.1	± 0.7	30.4	± 0.7	8.7	± 0.2
10	Day, Prd. 86	Cadle, GM (untreated)	39.1	± 0.7	27.8	± 0.6	11.3	± 0.2
10	Day, Prd. 86	Cary, Sunset	--	--	--	--	--	--
10	Day, Prd. 86	Chow, DRI	--	--	--	--	--	--
10	Day, Prd. 86	Countess, EMSI (initial, adipic)	31.3	± 0.1	26.1	± 0.3	5.2	± 0.3
10	Day, Prd. 86	Countess, EMSI (revised, KHP)	38.2	--	31.5	--	6.7	--
10	Day, Prd. 86	Fung, ERT	36.5	± 1.3	28.7	± 1.0	7.8	± 0.8
10	Day, Prd. 86	Gates, DEQ	28.0	± 2.0	17.0	± 1.5	11.0	± 2.5
10	Day, Prd. 86	Gordon, GGC	39.9	± 1.0	28.6	± 0.7	11.3	± 1.0
10	Day, Prd. 86	Hansen, LBL	--	--	--	--	± 7.3	± 0.3
10	Day, Prd. 86	Howes, EMSI (blind, adipic)	31.4	--	26.4	--	5.0	--
10	Day, Prd. 86	Huntzicker, OGC	36.7	± 2.6	25.9	± 2.2	10.8	± 0.7
10	Day, Prd. 86	Knapp, EPA	37.6	± 2.6	33.0	± 1.8	4.6	± 0.9
10	Day, Prd. 86	McMurry, UM	39.8	± 0.0	36.8	± 0.2	3.0	± 0.2
10	Day, Prd. 86	Zeller, Coulometrics	--	--	--	--	--	--
16	Day, Prd. 86	Appel, AIHL	39.7	± 0.5	31.2	± 0.5	8.5	± 0.1
16	Day, Prd. 86	Cadle, GM (preheated)	39.4	± 0.5	27.9	± 0.6	11.5	± 0.4
16	Day, Prd. 86	Cadle, GM (untreated)	39.4	± 0.5	28.7	± 0.2	10.7	± 0.3
16	Day, Prd. 86	Cary, Sunset	--	--	--	--	--	--
16	Day, Prd. 86	Chow, DRI	--	--	--	--	--	--
16	Day, Prd. 86	Countess, EMSI (initial, adipic)	31.3	± 0.1	26.1	± 0.3	5.2	± 0.3
16	Day, Prd. 86	Countess, EMSI (revised, KHP)	38.7	--	31.3	--	7.4	--
16	Day, Prd. 86	Fung, ERT	38.7	± 1.4	31.7	± 1.1	7.0	± 0.8
16	Day, Prd. 86	Gates, DEQ	31.0	± 2.0	23.0	± 1.5	8.0	± 2.5
16	Day, Prd. 86	Gordon, GGC	42.3	± 1.0	30.3	± 0.7	12.0	± 1.0
16	Day, Prd. 86	Hansen, LBL	--	--	--	--	7.6	± 0.6
16	Day, Prd. 86	Howes, EMSI (blind, adipic)	33.6	--	27.9	--	5.6	--
16	Day, Prd. 86	Huntzicker, OGC	41.8	± 2.9	30.7	± 2.6	11.1	± 0.8
16	Day, Prd. 86	Knapp, EPA	39.5	± 2.7	35.3	± 1.9	4.2	± 0.9
16	Day, Prd. 86	McMurry, UM	42.0	± 0.4	37.6	± 0.4	4.4	± 0.7
16	Day, Prd. 86	Zeller, Coulometrics	--	--	--	--	--	--
3	Night, Prd. 87	Appel, AIHL	25.6	± 0.4	19.8	± 0.4	5.8	± 0.1
3	Night, Prd. 87	Cadle, GM (preheated)	25.1	± 0.3	19.6	± 0.3	5.5	± 0.2
3	Night, Prd. 87	Cadle, GM (untreated)	25.1	± 0.3	19.0	± 0.3	6.1	± 0.1
3	Night, Prd. 87	Cary, Sunset	23.1	± 1.1	20.0	± 1.0	3.1	± 0.3
3	Night, Prd. 87	Chow, DRI	25.2	--	17.7	--	7.5	--
3	Night, Prd. 87	Countess, EMSI (initial, adipic)	20.7	± 0.4	17.4	± 0.2	3.3	± 0.2
3	Night, Prd. 87	Countess, EMSI (revised, KHP)	24.3	--	19.9	--	4.4	--

Table C1. DATA FROM THE INTERLABORATORY ANALYSIS COMPARISON (ROUND-ROBIN)

Smpl No.	Type	Group	Total Carbon Loading (µg C/cm2)	Total Carbon Error	Organic Carbon Loading (µg C/cm2)	Organic Carbon Error	Non-vol/Bl Carbon Loading (µg C/cm2)	Non-vol/Bl Carbon Error
3	Night, Prd. 87	Fung, ERT	23.9	± 0.8	20.2	± 0.7	3.7	± 0.4
3	Night, Prd. 87	Gates, DEQ	19.0	± 2.0	15.0	± 1.5	4.0	± 2.5
3	Night, Prd. 87	Gordon, GGC	27.9	± 1.0	20.0	± 0.7	7.9	± 1.0
3	Night, Prd. 87	Hansen, LBL	--	--	--	--	5.0	± 0.4
3	Night, Prd. 87	Howes, EMSI (blind, adipic)	20.8	--	17.1	--	3.7	--
3	Night, Prd. 87	Huntzicker, OGC	26.6	± 1.9	21.3	± 1.8	5.3	± 0.4
3	Night, Prd. 87	Knapp, EPA	23.7	± 1.8	20.8	± 1.2	2.9	± 0.6
3	Night, Prd. 87	McMurry, UM	26.3	± 1.4	24.0	± 1.6	2.3	± 0.1
3	Night, Prd. 87	Zeller, Coulometrics	32.4	± 1.6	26.1	± 0.9	6.3	± 0.7
5	Night, Prd. 87	Appel, AIHL	26.2	± 0.4	20.2	± 0.4	6.0	± 0.1
5	Night, Prd. 87	Cadle, GM (preheated)	26.9	± 3.2	20.9	± 3.2	6.0	± 0.2
5	Night, Prd. 87	Cadle, GM (untreated)	26.9	± 3.2	20.4	± 3.0	6.5	± 0.3
5	Night, Prd. 87	Cary, Sunset	24.1	± 1.2	20.9	± 1.0	3.2	± 0.3
5	Night, Prd. 87	Chow, DRI	--	--	--	--	--	--
5	Night, Prd. 87	Countess, EMSI (initial, adipic)	20.7	± 0.4	17.4	± 0.2	3.3	± 0.2
5	Night, Prd. 87	Countess, EMSI (revised, KHP)	24.2	--	19.9	--	4.3	--
5	Night, Prd. 87	Fung, ERT	24.5	± 0.9	19.8	± 0.7	4.7	± 0.5
5	Night, Prd. 87	Gates, DEQ	21.0	± 2.0	18.0	± 1.5	3.0	± 2.5
5	Night, Prd. 87	Gordon, GGC	26.0	± 1.0	18.9	± 0.7	7.1	± 1.0
5	Night, Prd. 87	Hansen, LBL	--	--	--	--	5.0	± 0.3
5	Night, Prd. 87	Howes, EMSI (blind, adipic)	21.0	--	16.9	--	4.1	--
5	Night, Prd. 87	Huntzicker, OGC	27.7	± 1.9	20.7	± 1.7	7.0	± 0.5
5	Night, Prd. 87	Knapp, EPA	23.8	± 1.7	21.0	± 1.1	2.8	± 0.6
5	Night, Prd. 87	McMurry, UM	25.5	± 0.1	23.7	± 0.2	1.8	± 0.2
5	Night, Prd. 87	Zeller, Coulometrics	28.1	± 4.3	17.9	± 3.4	10.2	± 1.3
14	Night, Prd. 87	Appel, AIHL	25.9	± 0.4	20.0	± 0.4	5.9	± 0.1
14	Night, Prd. 87	Cadle, GM (preheated)	25.6	± 0.8	20.4	± 0.8	5.2	± 0.0
14	Night, Prd. 87	Cadle, GM (untreated)	25.6	± 0.8	19.0	± 0.2	6.6	± 0.8
14	Night, Prd. 87	Cary, Sunset	23.7	± 1.2	20.3	± 1.0	3.4	± 0.3
14	Night, Prd. 87	Chow, DRI	--	--	--	--	--	--
14	Night, Prd. 87	Countess, EMSI (initial, adipic)	20.7	± 0.4	17.4	± 0.2	3.3	± 0.2
14	Night, Prd. 87	Countess, EMSI (revised, KHP)	23.8	--	19.8	--	4.0	--
14	Night, Prd. 87	Fung, ERT	24.0	± 0.8	19.7	± 0.7	4.3	± 0.5
14	Night, Prd. 87	Gates, DEQ	17.0	± 2.0	13.0	± 1.5	4.0	± 2.5
14	Night, Prd. 87	Gordon, GGC	26.1	± 1.0	19.3	± 0.7	6.8	± 1.0
14	Night, Prd. 87	Hansen, LBL	--	--	--	--	5.2	± 0.2
14	Night, Prd. 87	Howes, EMSI (blind, adipic)	19.1	--	16.4	--	2.7	--
14	Night, Prd. 87	Huntzicker, OGC	31.2	± 2.2	23.9	± 2.0	7.3	± 0.5
14	Night, Prd. 87	Knapp, EPA	23.2	± 1.7	20.4	± 1.2	2.8	± 0.6
14	Night, Prd. 87	McMurry, UM	27.7	± 0.5	25.7	± 0.5	2.0	± 0.4
14	Night, Prd. 87	Zeller, Coulometrics	28.7	± 1.3	18.3	± 2.8	10.4	± 2.3
6	Day, Prd. 96	Appel, AIHL	36.2	± 0.4	28.7	± 0.4	7.5	± 0.1
6	Day, Prd. 96	Cadle, GM (preheated)	34.4	± 0.3	28.4	± 0.3	6.0	± 0.1
6	Day, Prd. 96	Cadle, GM (untreated)	34.4	± 0.3	25.7	± 0.4	8.7	± 0.1
6	Day, Prd. 96	Cary, Sunset	32.8	± 1.5	29.0	± 1.4	3.8	± 0.4
6	Day, Prd. 96	Chow, DRI	34.4	--	24.2	--	10.1	--
6	Day, Prd. 96	Countess, EMSI (initial, adipic)	28.2	± 0.5	23.8	± 0.7	4.4	± 0.4
6	Day, Prd. 96	Countess, EMSI (revised, KHP)	35.3	--	29.2	--	6.1	--
6	Day, Prd. 96	Fung, ERT	33.1	± 1.2	27.0	± 0.9	6.1	± 0.7
6	Day, Prd. 96	Gates, DEQ	22.0	± 2.0	19.0	± 1.5	3.0	± 2.5
6	Day, Prd. 96	Gordon, GGC	35.4	± 1.0	25.7	± 0.7	9.7	± 1.0
6	Day, Prd. 96	Hansen, LBL	--	--	--	--	6.0	± 0.8
6	Day, Prd. 96	Howes, EMSI (blind, adipic)	27.8	--	24.3	--	3.5	--
6	Day, Prd. 96	Huntzicker, OGC	35.4	± 2.5	27.1	± 2.3	8.3	± 0.6
6	Day, Prd. 96	Knapp, EPA	33.4	± 2.3	29.8	± 1.6	3.7	± 0.8

Table C1. DATA FROM THE INTERLABORATORY ANALYSIS COMPARISON (ROUND-ROBIN)

Smpl No.	Type	Group	Total Carbon Loading (µg C/cm2)	Total Carbon Error	Organic Carbon Loading (µg C/cm2)	Organic Carbon Error	Non-vol/Bl Carbon Loading (µg C/cm2)	Non-vol/Bl Carbon Error
6	Day, Prd. 96	McMurry, UM	36.4	± 0.1	34.0	± 0.2	2.4	± 0.2
6	Day, Prd. 96	Zeller, Coulometrics	42.2	± 5.6	28.9	± 2.9	13.3	± 5.0
17	Day, Prd. 96	Appel, AIHL	35.6	± 0.4	28.2	± 0.4	7.4	± 0.1
17	Day, Prd. 96	Cadle, GM (preheated)	38.2	± 1.7	30.5	± 1.7	7.7	± 0.3
17	Day, Prd. 96	Cadle, GM (untreated)	38.2	± 1.7	27.8	± 1.3	10.4	± 0.4
17	Day, Prd. 96	Cary, Sunset	--	--	--	--	--	--
17	Day, Prd. 96	Chow, DRI	35.9	--	25.4	--	10.4	--
17	Day, Prd. 96	Countess, EMSI (initial, adipic)	28.2	± 0.5	23.8	± 0.7	4.4	± 0.4
17	Day, Prd. 96	Countess, EMSI (revised, KHP)	34.5	--	28.8	--	5.7	--
17	Day, Prd. 96	Fung, ERT	32.2	± 1.1	26.6	± 0.9	5.6	± 0.6
17	Day, Prd. 96	Gates, DEQ	25.0	± 2.0	20.0	± 1.5	5.0	± 2.5
17	Day, Prd. 96	Gordon, GGC	35.5	± 1.0	25.2	± 0.7	10.3	± 1.0
17	Day, Prd. 96	Hansen, LBL	--	--	--	--	6.4	± 0.2
17	Day, Prd. 96	Howes, EMSI (blind, adipic)	29.2	--	24.3	--	4.8	--
17	Day, Prd. 96	Huntzicker, OGC	38.4	± 2.7	29.3	± 2.5	9.1	± 0.6
17	Day, Prd. 96	Knapp, EPA	33.8	± 2.3	29.9	± 1.6	4.0	± 0.7
17	Day, Prd. 96	McMurry, UM	35.1	± 0.3	32.3	± 0.3	2.8	± 0.1
17	Day, Prd. 96	Zeller, Coulometrics	--	--	--	--	--	--
20	Day, Prd. 96	Appel, AIHL	35.9	± 0.4	28.2	± 0.4	7.7	± 0.1
20	Day, Prd. 96	Cadle, GM (preheated)	34.7	± 1.1	28.4	± 1.1	6.3	± 0.1
20	Day, Prd. 96	Cadle, GM (untreated)	34.7	± 1.1	25.8	± 0.9	8.8	± 0.3
20	Day, Prd. 96	Cary, Sunset	--	--	--	--	--	--
20	Day, Prd. 96	Chow, DRI	35.8	--	25.0	--	10.7	--
20	Day, Prd. 96	Countess, EMSI (initial, adipic)	28.2	± 0.5	23.8	± 0.7	4.4	± 0.4
20	Day, Prd. 96	Countess, EMSI (revised, KHP)	35.5	--	29.8	--	5.7	--
20	Day, Prd. 96	Fung, ERT	34.1	± 1.2	27.3	± 0.9	6.9	± 0.7
20	Day, Prd. 96	Gates, DEQ	27.0	± 2.0	19.0	± 1.5	8.0	± 2.5
20	Day, Prd. 96	Gordon, GGC	36.3	± 1.0	25.4	± 0.7	10.9	± 1.0
20	Day, Prd. 96	Hansen, LBL	--	--	--	--	6.3	± 0.4
20	Day, Prd. 96	Howes, EMSI (blind, adipic)	27.1	--	23.1	--	4.1	--
20	Day, Prd. 96	Huntzicker, OGC	37.3	± 2.6	28.2	± 2.4	9.1	± 0.6
20	Day, Prd. 96	Knapp, EPA	34.2	± 2.4	30.4	± 1.6	3.8	± 0.8
20	Day, Prd. 96	McMurry, UM	33.5	± 0.4	19.7	± 1.0	13.7	± 1.4
20	Day, Prd. 96	Zeller, Coulometrics	--	--	--	--	--	--
2	Night, Prd. 97	Appel, AIHL	29.8	± 0.4	23.2	± 0.4	6.6	± 0.1
2	Night, Prd. 97	Cadle, GM (preheated)	28.8	± 0.2	24.0	± 0.4	4.8	± 0.4
2	Night, Prd. 97	Cadle, GM (untreated)	28.8	± 0.2	21.2	± 0.1	7.6	± 0.1
2	Night, Prd. 97	Cary, Sunset	29.0	± 1.4	24.7	± 1.2	4.3	± 0.4
2	Night, Prd. 97	Chow, DRI	28.8	--	20.2	--	8.6	--
2	Night, Prd. 97	Countess, EMSI (initial, adipic)	24.6	± 0.3	21.1	± 0.3	3.5	± 0.3
2	Night, Prd. 97	Countess, EMSI (revised, KHP)	29.9	--	24.4	--	5.5	--
2	Night, Prd. 97	Fung, ERT	27.6	± 1.0	23.5	± 0.8	4.1	± 0.4
2	Night, Prd. 97	Gates, DEQ	22.0	± 2.0	20.0	± 1.5	2.0	± 2.5
2	Night, Prd. 97	Gordon, GGC	31.3	± 1.0	23.3	± 0.7	8.0	± 1.0
2	Night, Prd. 97	Hansen, LBL	--	--	--	--	5.9	± 0.6
2	Night, Prd. 97	Howes, EMSI (blind, adipic)	24.8	--	21.6	--	3.2	--
2	Night, Prd. 97	Huntzicker, OGC	27.3	± 1.9	20.0	± 1.7	7.3	± 0.5
2	Night, Prd. 97	Knapp, EPA	27.8	± 1.9	25.5	± 1.4	2.4	± 0.5
2	Night, Prd. 97	McMurry, UM	31.4	± 2.1	29.6	± 2.0	1.8	± 0.6
2	Night, Prd. 97	Zeller, Coulometrics	40.7	± 0.6	31.1	± 1.5	9.6	± 2.0
4	Night, Prd. 97	Appel, AIHL	30.1	± 0.4	23.3	± 0.4	6.8	± 0.1
4	Night, Prd. 97	Cadle, GM (preheated)	29.4	± 0.4	24.8	± 0.6	4.6	± 0.5
4	Night, Prd. 97	Cadle, GM (untreated)	29.4	± 0.4	21.9	± 0.2	7.5	± 0.2
4	Night, Prd. 97	Cary, Sunset	--	--	--	--	--	--
4	Night, Prd. 97	Chow, DRI	--	--	--	--	--	--

Table C1. DATA FROM THE INTERLABORATORY ANALYSIS COMPARISON (ROUND-ROBIN)

Smpl No.	Type	Group	Total Carbon Loading (µg C/cm2)	Total Carbon Error	Organic Carbon Loading (µg C/cm2)	Organic Carbon Error	Non-vol/Bl Carbon Loading (µg C/cm2)	Non-vol/Bl Carbon Error
4	Night, Prd. 97	Countess, EMSI (initial, adipic)	24.6	± 0.3	21.1	± 0.3	3.5	± 0.3
4	Night, Prd. 97	Countess, EMSI (revised, KHP)	29.0	--	24.0	--	5.0	--
4	Night, Prd. 97	Fung, ERT	28.2	± 1.0	23.7	± 0.8	4.5	± 0.5
4	Night, Prd. 97	Gates, DEQ	19.0	± 2.0	18.0	± 1.5	1.0	± 2.5
4	Night, Prd. 97	Gordon, GGC	31.7	± 1.0	23.6	± 0.7	8.1	± 1.0
4	Night, Prd. 97	Hansen, LBL	--	--	--	--	5.8	± 0.3
4	Night, Prd. 97	Howes, EMSI (blind, adipic)	24.1	--	20.7	--	3.4	--
4	Night, Prd. 97	Huntzicker, OGC	32.4	± 2.3	25.1	± 2.1	7.3	± 0.5
4	Night, Prd. 97	Knapp, EPA	28.0	± 1.8	26.1	± 1.4	1.9	± 0.4
4	Night, Prd. 97	McMurry, UM	31.7	± 1.3	30.0	± 0.8	1.7	± 0.5
4	Night, Prd. 97	Zeller, Coulometrics	--	--	--	--	--	--
8	Night, Prd. 97	Appel, AIHL	30.1	± 0.4	23.2	± 0.4	6.9	± 0.1
8	Night, Prd. 97	Cadle, GM (preheated)	29.6	± 0.7	22.5	± 0.8	7.1	± 0.2
8	Night, Prd. 97	Cadle, GM (untreated)	29.6	± 0.7	22.2	± 0.8	7.3	± 0.2
8	Night, Prd. 97	Cary, Sunset	--	--	--	--	--	--
8	Night, Prd. 97	Chow, DRI	--	--	--	--	--	--
8	Night, Prd. 97	Countess, EMSI (initial, adipic)	24.6	± 0.3	21.1	± 0.3	3.5	± 0.3
8	Night, Prd. 97	Countess, EMSI (revised, KHP)	29.6	--	24.0	--	5.6	--
8	Night, Prd. 97	Fung, ERT	28.5	± 1.0	24.5	± 0.8	4.0	± 0.4
8	Night, Prd. 97	Gates, DEQ	18.0	± 2.0	14.0	± 1.5	4.0	± 2.5
8	Night, Prd. 97	Gordon, GGC	30.4	± 1.0	22.9	± 0.7	7.5	± 1.0
8	Night, Prd. 97	Hansen, LBL	--	--	--	--	6.2	± 0.3
8	Night, Prd. 97	Howes, EMSI (blind, adipic)	23.1	--	19.3	--	3.8	--
8	Night, Prd. 97	Huntzicker, OGC	29.7	± 2.1	21.9	± 1.8	7.8	± 0.5
8	Night, Prd. 97	Knapp, EPA	28.0	± 1.8	25.8	± 1.4	2.2	± 0.4
8	Night, Prd. 97	McMurry, UM	29.6	± 0.8	27.7	± 0.3	1.9	± 0.5
8	Night, Prd. 97	Zeller, Coulometrics	--	--	--	--	--	--
7	Catalyst Buick	Appel, AIHL	40.6	± 0.5	24.1	± 0.7	16.5	± 0.5
7	Catalyst Buick	Cadle, GM (preheated)	48.1	± 3.6	12.1	± 4.0	36.0	± 1.7
7	Catalyst Buick	Cadle, GM (untreated)	48.1	± 3.6	14.3	± 1.2	33.8	± 3.8
7	Catalyst Buick	Cary, Sunset	30.6	± 1.4	10.3	± 0.6	20.3	± 1.0
7	Catalyst Buick	Chow, DRI	34.8	--	6.8	--	30.0	--
7	Catalyst Buick	Countess, EMSI (initial, adipic)	34.2	± 0.2	10.7	± 0.2	23.4	± 0.2
7	Catalyst Buick	Countess, EMSI (revised, KHP)	34.4	--	11.0	--	23.4	--
7	Catalyst Buick	Fung, ERT	32.6	± 1.1	9.5	± 0.3	23.0	± 2.5
7	Catalyst Buick	Gates, DEQ	28.0	± 2.0	10.0	± 1.5	18.0	± 2.5
7	Catalyst Buick	Gordon, GGC	34.2	± 1.0	9.0	± 0.7	25.2	± 1.0
7	Catalyst Buick	Hansen, LBL	--	--	--	--	11.3	± 1.4
7	Catalyst Buick	Howes, EMSI (blind, adipic)	36.3	--	11.0	--	25.3	--
7	Catalyst Buick	Huntzicker, OGC	35.7	± 2.5	9.0	± 0.8	26.7	± 1.8
7	Catalyst Buick	Knapp, EPA	30.0	± 3.9	15.1	± 0.8	14.9	± 3.1
7	Catalyst Buick	McMurry, UM	35.7	± 0.6	32.0	± 0.6	3.7	± 0.1
7	Catalyst Buick	Zeller, Coulometrics	36.6	± 2.3	7.7	± 0.2	28.9	± 2.3
18	Leaded Chevrole	Appel, AIHL	71.5	± 0.7	63.5	± 0.7	8.0	± 0.1
18	Leaded Chevrole	Cadle, GM (preheated)	66.3	± 1.0	47.3	± 1.5	19.0	± 1.1
18	Leaded Chevrole	Cadle, GM (untreated)	66.3	± 1.0	39.8	± 0.4	26.5	± 0.6
18	Leaded Chevrole	Cary, Sunset	64.2	± 2.8	50.7	± 2.2	13.5	± 0.7
18	Leaded Chevrole	Chow, DRI	69.4	--	41.0	--	28.4	--
18	Leaded Chevrole	Countess, EMSI (initial, adipic)	60.9	± 0.2	47.5	± 0.2	13.4	± 0.2
18	Leaded Chevrole	Countess, EMSI (revised, KHP)	68.3	--	56.1	--	12.2	--
18	Leaded Chevrole	Fung, ERT	65.5	± 2.3	55.1	± 1.9	10.4	± 1.1
18	Leaded Chevrole	Gates, DEQ	39.0	± 2.0	38.0	± 1.5	1.0	± 2.5
18	Leaded Chevrole	Gordon, GGC	75.1	± 1.0	47.2	± 0.7	27.9	± 1.0
18	Leaded Chevrole	Hansen, LBL	--	--	--	--	5.8	± 0.4
18	Leaded Chevrole	Howes, EMSI (blind, adipic)	56.8	--	44.0	--	12.8	--

Table C1. DATA FROM THE INTERLABORATORY ANALYSIS COMPARISON (ROUND-ROBIN)

Smpl No.	Type	Group	Total Carbon Loading (µg C/cm2)	Total Carbon Error (µg C/cm2)	Organic Carbon Loading (µg C/cm2)	Organic Carbon Error (µg C/cm2)	Non-vol/Bl Carbon Loading (µg C/cm2)	Non-vol/Bl Carbon Error (µg C/cm2)
18	Leaded Chevrole	Huntzicker, OGC	71.7	± 5.0	48.9	± 4.1	22.8	± 1.6
18	Leaded Chevrole	Knapp, EPA	67.1	± 3.9	65.2	± 3.6	1.9	± 0.4
18	Leaded Chevrole	McMurry, UM	65.2	± 1.5	60.5	± 0.2	4.7	± 1.6
18	Leaded Chevrole	Zeller, Coulometrics	82.9	± 1.8	57.8	± 1.3	25.1	± 0.6
11	Diesel Oldsmobil	Appel, AIHL	129.0	± 1.2	--	--	--	--
11	Diesel Oldsmobil	Cadle, GM (preheated)	106.0	± 2.9	21.3	± 3.2	87.7	± 1.3
11	Diesel Oldsmobil	Cadle, GM (untreated)	106.0	± 2.9	20.5	± 0.8	85.3	± 3.4
11	Diesel Oldsmobil	Cary, Sunset	101.7	± 4.3	13.2	± 0.7	88.5	± 3.7
11	Diesel Oldsmobil	Chow, DRI	108.2	--	15.5	--	92.7	--
11	Diesel Oldsmobil	Countess, EMSI (initial, adipic)	94.4	± 0.2	11.9	± 0.2	82.6	± 0.2
11	Diesel Oldsmobil	Countess, EMSI (revised, KHP)	98.0	--	14.0	--	84.0	--
11	Diesel Oldsmobil	Fung, ERT	102.3	± 3.6	16.6	± 0.6	85.7	± 9.1
11	Diesel Oldsmobil	Gates, DEQ	43.0	± 2.0	14.0	± 1.5	29.0	± 2.5
11	Diesel Oldsmobil	Gordon, GGC	99.7	± 1.0	16.1	± 0.7	83.6	± 1.0
11	Diesel Oldsmobil	Hansen, LBL	--	--	--	--	15.5	± 3.7
11	Diesel Oldsmobil	Howes, EMSI (blind, adipic)	100.3	--	11.9	--	88.3	--
11	Diesel Oldsmobil	Huntzicker, OGC	123.3	± 8.6	41.2	± 18.8	82.1	± 19.3
11	Diesel Oldsmobil	Knapp, EPA	106.2	± 19.0	30.9	± 1.8	75.3	± 17.2
11	Diesel Oldsmobil	McMurry, UM	108.6	± 0.2	29.9	± 6.3	78.7	± 6.1
11	Diesel Oldsmobil	Zeller, Coulometrics	116.4	± 5.2	15.4	± 3.8	101.0	± 2.0
13	Wood Smoke	Appel, AIHL	101.0	± 1.0	84.5	± 1.1	16.5	± 0.5
13	Wood Smoke	Cadle, GM (preheated)	107.0	± 2.6	84.9	± 2.7	21.8	± 0.7
13	Wood Smoke	Cadle, GM (untreated)	107.0	± 2.6	78.2	± 2.6	28.5	± 0.1
13	Wood Smoke	Cary, Sunset	91.9	± 3.9	83.3	± 3.5	8.5	± 0.5
13	Wood Smoke	Chow, DRI	99.9	--	63.7	--	36.1	--
13	Wood Smoke	Countess, EMSI (initial, adipic)	98.7	± 0.2	87.2	± 0.2	11.6	± 0.2
13	Wood Smoke	Countess, EMSI (revised, KHP)	98.7	--	89.5	--	9.2	--
13	Wood Smoke	Fung, ERT	90.9	± 3.2	87.1	± 2.9	3.8	± 0.4
13	Wood Smoke	Gates, DEQ	66.0	± 2.0	49.0	± 1.5	17.0	± 2.5
13	Wood Smoke	Gordon, GGC	100.1	± 1.0	93.6	± 0.7	6.5	± 1.0
13	Wood Smoke	Hansen, LBL	--	--	--	--	11.2	± 1.0
13	Wood Smoke	Howes, EMSI (blind, adipic)	95.9	--	85.7	--	10.2	--
13	Wood Smoke	Huntzicker, OGC	101.8	± 7.1	75.2	± 6.3	26.6	± 1.8
13	Wood Smoke	Knapp, EPA	90.5	± 5.8	85.0	± 5.1	5.5	± 1.7
13	Wood Smoke	McMurry, UM	95.9	± 1.1	92.5	± 1.4	3.4	± 0.4
13	Wood Smoke	Zeller, Coulometrics	107.0	± 5.2	95.1	± 6.1	11.9	± 0.8
15	Wood Smoke	Appel, AIHL	388.0	± 3.3	--	--	--	--
15	Wood Smoke	Cadle, GM (preheated)	472.0	± 12.0	393.0	± 12.8	78.7	± 4.5
15	Wood Smoke	Cadle, GM (untreated)	472.0	± 12.0	384.0	± 10.0	87.4	± 1.4
15	Wood Smoke	Cary, Sunset	332.9	± 13.5	321.1	± 13.0	11.8	± 0.7
15	Wood Smoke	Chow, DRI	329.8	--	254.7	--	75.1	--
15	Wood Smoke	Countess, EMSI (initial, adipic)	409.8	± 0.2	383.0	± 0.2	26.8	± 0.2
15	Wood Smoke	Countess, EMSI (revised, KHP)	383.0	--	366.3	--	16.7	--
15	Wood Smoke	Fung, ERT	367.0	± 12.9	365.4	± 12.3	1.6	± 0.2
15	Wood Smoke	Gates, DEQ	231.0	± 2.0	197.0	± 1.5	34.0	± 2.5
15	Wood Smoke	Gordon, GGC	404.7	± 1.0	392.8	± 0.7	11.9	± 1.0
15	Wood Smoke	Hansen, LBL	--	--	--	--	12.0	± 2.1
15	Wood Smoke	Howes, EMSI (blind, adipic)	389.9	--	363.0	--	26.9	--
15	Wood Smoke	Huntzicker, OGC	397.3	± 27.8	302.6	± 25.4	94.7	± 6.5
15	Wood Smoke	Knapp, EPA	336.6	± 35.5	258.8	± 14.4	77.8	± 22.7
15	Wood Smoke	McMurry, UM	376.7	± 7.0	371.8	± 6.8	4.9	± 0.0
15	Wood Smoke	Zeller, Coulometrics	418.0	± 6.8	405.1	± 6.3	12.9	± 0.6
12	Soot	Appel, AIHL	13.9	± 0.3	8.8	± 0.3	5.1	± 0.1
12	Soot	Cadle, GM (preheated)	13.2	± 1.0	5.0	± 1.1	8.2	± 0.4
12	Soot	Cadle, GM (untreated)	13.2	± 1.0	4.2	± 0.3	9.0	± 0.9

Table C1. DATA FROM THE INTERLABORATORY ANALYSIS COMPARISON (ROUND-ROBIN)

Smpl No.	Type	Group	Total Carbon Loading (µg C/cm2)	Total Carbon Error	Organic Carbon Loading (µg C/cm2)	Organic Carbon Error	Non-vol/Bl Carbon Loading (µg C/cm2)	Non-vol/Bl Carbon Error
12	Soot	Cary, Sunset	14.3	± 0.8	3.5	± 0.3	10.8	± 0.6
12	Soot	Chow, DRI	15.6	--	2.4	--	13.2	--
12	Soot	Countess, EMSI (initial, adipic)	11.2	± 0.2	2.7	± 0.2	8.5	± 0.2
12	Soot	Countess, EMSI (revised, KHP)	14.3	--	5.4	--	8.9	--
12	Soot	Fung, ERT	14.5	± 0.5	5.3	± 0.2	9.3	± 1.0
12	Soot	Gates, DEQ	8.0	± 2.0	5.0	± 1.5	3.0	± 2.5
12	Soot	Gordon, GGC	14.1	± 1.0	4.8	± 0.7	9.3	± 1.0
12	Soot	Hansen, LBL	--	--	--	--	3.2	± 0.3
12	Soot	Howes, EMSI (blind, adipic)	10.9	--	3.3	--	7.6	--
12	Soot	Huntzicker, OGC	18.4	± 1.3	6.3	± 0.5	12.1	± 0.8
12	Soot	Knapp, EPA	11.4	± 1.4	6.2	± 0.4	5.2	± 1.1
12	Soot	McMurry, UM	16.5	± 0.2	15.9	± 0.5	0.5	± 0.3
12	Soot	Zeller, Coulometrics	23.4	± 1.3	8.7	± 1.6	14.7	± 1.3
19	Smog Chamber	Appel, AIHL	11.5	± 0.2	11.5	± 0.2	0.0	± 0.0
19	Smog Chamber	Cadle, GM (preheated)	11.6	± 2.4	10.3	± 2.6	1.3	± 1.0
19	Smog Chamber	Cadle, GM (untreated)	11.6	± 2.4	10.6	± 1.8	1.0	± 0.8
19	Smog Chamber	Cary, Sunset	8.5	± 0.5	8.5	± 0.5	0.0	± 0.2
19	Smog Chamber	Chow, DRI	10.8	--	10.1	--	0.7	--
19	Smog Chamber	Countess, EMSI (initial, adipic)	9.1	± 0.2	9.1	± 0.2	0.0	± 0.2
19	Smog Chamber	Countess, EMSI (revised, KHP)	9.8	--	9.6	--	0.2	--
19	Smog Chamber	Fung, ERT	10.6	± 0.4	9.8	± 0.3	0.8	± 0.1
19	Smog Chamber	Gates, DEQ	4.0	± 2.0	4.0	± 1.5	0.0	± 2.5
19	Smog Chamber	Gordon, GGC	9.5	± 1.0	8.5	± 0.7	1.0	± 1.0
19	Smog Chamber	Hansen, LBL	--	--	--	--	0.0	± 0.1
19	Smog Chamber	Howes, EMSI (blind, adipic)	8.1	--	8.1	--	0.0	--
19	Smog Chamber	Huntzicker, OGC	10.1	± 0.7	10.1	± 0.9	0.0	± 0.1
19	Smog Chamber	Knapp, EPA	10.1	± 0.6	9.4	± 0.5	0.7	± 0.1
19	Smog Chamber	McMurry, UM	11.4	± 0.3	8.2	± 0.7	3.2	± 0.7
19	Smog Chamber	Zeller, Coulometrics	12.6	± 2.0	9.3	± 1.6	3.3	± 0.6
9	Blank	Appel, AIHL	1.3	± 0.2	1.3	± 0.2	0.0	± 0.0
9	Blank	Cadle, GM (preheated)	2.5	± 0.1	2.5	± 0.1	0.0	± 0.0
9	Blank	Cadle, GM (untreated)	2.5	± 0.1	2.5	± 0.1	0.0	± 0.0
9	Blank	Cary, Sunset	0.6	± 0.2	0.6	± 0.2	0.1	± 0.2
9	Blank	Chow, DRI	1.6	--	1.2	--	0.3	--
9	Blank	Countess, EMSI (initial, adipic)	0.0	± 0.2	0.0	± 0.2	0.0	± 0.2
9	Blank	Countess, EMSI (revised, KHP)	0.0	--	0.0	--	0.0	--
9	Blank	Fung, ERT	1.0	± 0.0	1.0	± 0.0	0.0	± 0.0
9	Blank	Gates, DEQ	3.0	± 2.0	2.0	± 1.5	1.0	± 2.5
9	Blank	Gordon, GGC	0.6	± 1.0	0.7	± 0.7	-0.1	± 1.0
9	Blank	Hansen, LBL	--	--	--	--	0.0	± 0.1
9	Blank	Howes, EMSI (blind, adipic)	0.5	--	0.3	--	0.2	--
9	Blank	Huntzicker, OGC	3.4	± 0.2	3.4	± 0.3	0.0	± 0.4
9	Blank	Knapp, EPA	1.5	± 0.1	1.2	± 0.1	0.3	± 0.1
9	Blank	McMurry, UM	3.7	± 0.5	2.2	± 0.4	1.6	± 0.9
9	Blank	Zeller, Coulometrics	10.7	± 1.1	7.1	± 1.3	3.6	± 0.4

Table D1. Hourly Averages for Ozone, Carbon Monoxide, Nitrogen Oxides and Meteorological Parameters.
Carbonaceous Species Measurement Methods Comparison Study
GLENDORA, CALIFORNIA -- August 11-21, 1986

		AQMD O3	SCE: Citrus College Data						ARB: Citrus College Data			
DATE	Hour (PDT)	Glendora (pphm)	Temp (deg C)	Rel. Hum. (%)	Solar Rad. (Ly/m2)	Wind Spd. (mph)	Wind Dir. (Deg)	B. Pres. (mbars)	Ozone (pphm)	CO (ppm)	NO (pphm)	NOx (pphm)
8/12	0	1	19.7	75	0.005	2	270	987	0	2	5	14
	1	0	18.7	81	0.005	2	259	987	0	2	5	13
	2	0	18.1	84	0.005	1	227	987	0	2	5	13
	3	0	17.6	88	0.005	1	265	987	0	2	5	13
	4	0	17.2	91	0.006	1	267	987	0	2	5	12
	5	0	16.8	92	0.006	1	255	987	0	2	8	15
	6	0	16.4	92	0.033	1	107	987	0	3	8	16
	7	1	18.5	83	0.242	1	161	987	0	3	8	11
	8	2	21.7	67	0.489	2	235	986	1	3	8	19
	9	3	23.9	59	0.704	2	255	985	2	3	5	20
	10	7	25.9	50	0.930	3	273	984	5	3	2	15
	11	11	28.2	42	1.089	3	277	983	9	2	1	12
	12	14	29.8	34	1.176	4	262	982	12	2	0	8
	13	16	30.8	32	1.162	6	277	981	15	2	0	7
	14	20	23.0	30	1.064	6	262	981	20	2	0	6
	15	21	31.3	34	0.797	8	265	980	19	2	0	7
	16	13	30.3	31	0.337	7	269	980	6	1	0	6
	17	8	23.9	27	0.389	6	242	978	5	1	0	6
	18	5	27.2	38	0.160	4	251	981	5	2	0	7
	19	3	24.6	25	0.017	3	255	982	2	2	0	9
	20	1	22.6	56	0.004	4	277	983	0	2	1	10
	21	1	21.5	62	0.005	2	264	894	0	2	2	11
	22	1	20.5	67	0.005	2	260	985	0	2	4	12
	23	0	19.4	75	0.005	2	266	985	0	2	7	14
8/13	0	0	18.0	82	0.006	2	251	985	0	2	6	14
	1	0	17.4	85	0.006	1	256	985	0	2	5	12
	2	0	17.2	88	0.006	2	272	985	0	2	5	12
	3	0	16.6	91	0.006	1	250	985	0	2	4	11
	4	0	16.2	94	0.006	1	282	985	0	2	5	11
	5	0	16.0	93	0.006	1	131	985	0	2	5	11
	6	0	16.0	93	0.038	1	158	985	0	2	7	13
	7	1	18.1	85	0.215	1	280	985	0	3	9	16
	8	1	19.4	77	0.456	3	278	984	1	2	8	17
	9	2	22.2	65	0.710	2	271	983	1	2	6	18
	10	4	24.1	58	0.934	3	252	982	4	2	2	14
	11	8	26.3	47	1.103	4	266	981	8	2	1	10
	12	12	28.2	40	1.171	4	271	980	11	1	0	8
	13	13	29.5	35	1.167	5	263	979	12	1	0	8
	14	15	30.8	30	1.084	5	268	978	14	1	0	6
	15	17	31.3	33	0.858	6	251	977	16	1	0	7
	16	17	30.5	38	0.322	6	259	977	15	1	0	7
	17	14	29.2	41	0.363	7	266	977	12	1	0	7
	18	9	27.3	45	0.170	7	280	978	7	2	0	8
	19	5	24.5	54	0.019	5	271	979	4	2	0	8
	20	2	22.2	64	0.005	3	262	981	1	2	0	8
	21	1	20.8	71	0.005	2	254	982	0	2	1	10
	22	0	19.9	77	0.006	2	261	983	0	2	2	11
	23	0	19.0	83	0.006	3	263	983	0	2	2	11
8/14	0	0	18.1	88	0.007	3	278	983	0	2	3	11
	1	0	17.5	90	0.006	2	265	983	0	2	4	12

Table D1. Hourly Averages for Ozone, Carbon Monoxide, Nitrogen Oxides and Meteorological Parameters.
Carbonaceous Species Measurement Methods Comparison Study
GLENDORA, CALIFORNIA -- August 11-21, 1986

		AQMD O3	SCE: Citrus College Data						ARB: Citrus College Data			
DATE	Hour (PDT)	Glendora (pphm)	Temp (deg C)	Rel. Hum. (%)	Solar Rad. (Ly/m2)	Wind Spd. (mph)	Wind Dir. (Deg)	B. Pres. (mbars)	Ozone (pphm)	CO (ppm)	NO (pphm)	NOx (pphm)
	2	0	16.7	94	0.006	2	256	983	0	2	3	11
	3	0	16.2	96	0.007	2	252	984	0	1	2	9
	4	0	16.4	96	0.007	1	184	984	0	1	2	10
	5	0	16.6	95	0.007	1	211	984	0	1	3	10
	6	0	16.8	94	0.027	2	274	984	0	2	3	10
	7	1	17.3	91	0.158	1	304	984	0	2	4	11
	8	2	19.5	78	0.458	2	280	984	1	2	4	13
	9	4	22.3	65	0.772	3	296	983	2	2	3	14
	10	7	23.6	62	0.928	3	243	982	6	2	1	11
	11	11	26.7	51	1.112	3	255	981	9	2	0	9
	12	15	28.1	44	1.184	4	274	980	13	2	0	7
	13	15	29.4	38	1.188	5	279	979	13	1	0	7
	14	16	30.5	33	1.110	6	276	978	14	1	0	6
	15	21	30.8	37	0.837	7	266	978	21	2	0	7
	16	21	29.1	43	0.339	7	267	978	18	2	0	8
	17	19	28.0	45	0.369	7	280	978	16	2	0	8
	18	15	26.6	49	0.161	5	276	978	12	2	0	8
	19	9	24.0	56	0.019	6	285	980	8	2	0	8
	20	4	21.6	67	0.006	5	269	981	3	2	0	10
	21	1	19.5	77	0.006	3	260	983	1	2	0	10
	22	1	18.2	83	0.007	2	262	984	0	2	1	10
	23	1	17.3	87	0.006	3	259	984	0	2	2	10
8/15	0	0	16.6	90	0.005	2	250	984	0	1	3	10
	1	0	16.2	92	0.007	2	265	984	0	1	4	10
	2	0	16.0	94	0.006	2	270	984	0	1	3	9
	3	0	15.4	96	0.006	1	246	984	0	1	4	9
	4	0	15.1	97	0.006	1	263	984	0	1	5	10
	5	0	14.9	98	0.006	1	280	985	0	1	6	10
	6	0	15.0	100	0.022	1	268	985	0	2	9	14
	7	0	15.9	96	0.081	1	207	986	0	2	7	13
	8	1	17.2	86	0.360	2	221	985	0	2	6	12
	9	2	19.5	74	0.732	3	250	985	1	2	5	13
	10	4	22.1	65	0.964	3	253	983	3	2	2	11
	11	8	24.6	56	1.123	3	260	982	7	2	1	9
	12	14	26.7	47	1.201	4	256	981	12	2	0	8
	13	17	28.6	40	1.189	5	275	980	15	2	0	7
	14	21	30.0	37	1.085	6	259	979	21	2	0	7
	15	23	30.3	39	0.839	6	254	979	19	2	0	7
	16	14	28.3	44	0.326	8	267	979	12	2	0	8
	17	11	26.2	48	0.409	6	275	979	9	2	0	7
	18	7	24.8	52	0.155	5	263	979	6	2	0	8
	19	4	21.7	62	0.016	5	263	981	3	2	0	9
	20	1	19.7	69	0.005	3	264	982	0	2	1	9
	21	0	18.6	76	0.005	3	276	983	0	2	2	9
	22	0	17.7	80	0.006	2	265	984	0	2	2	9
	23	1	17.4	83	0.006	1	291	984	0	2	4	11
8/16	0	0	16.9	85	0.006	1	225	984	0	2	5	12
	1	0	16.3	87	0.006	1	146	984	0	2	4	10
	2	0	16.1	91	0.006	2	180	984	0	2	4	11
	3	0	15.7	93	0.006	2	267	984	0	2	4	11

Table D1. Hourly Averages for Ozone, Carbon Monoxide, Nitrogen Oxides and Meteorological Parameters.
Carbonaceous Species Measurement Methods Comparison Study
GLENDORA, CALIFORNIA -- August 11-21, 1986

		AQMD O3	SCE: Citrus College Data						ARB: Citrus College Data			
DATE	Hour (PDT)	Glendora (pphm)	Temp (deg C)	Rel. Hum. (%)	Solar Rad. (Ly/m2)	Wind Spd. (mph)	Wind Dir. (Deg)	B. Pres. (mbars)	Ozone (pphm)	CO (ppm)	NO (pphm)	NOx (pphm)
	4	0	15.1	94	0.006	2	104	984	0	2	4	10
	5	0	14.7	94	0.006	2	140	984	0	2	3	9
	6	1	14.5	94	0.035	1	098	984	0	2	2	8
	7	1	16.7	83	0.238	2	249	984	0	2	3	10
	8	2	18.7	76	0.498	3	281	984	1	2	4	13
	9	4	20.7	67	0.754	3	275	983	3	2	2	11
	10	7	23.4	58	0.971	3	237	982	6	2	1	10
	11	11	25.7	49	1.128	3	274	981	11	2	0	8
	12	16	27.1	45	1.210	5	262	980	14	2	0	6
	13	17	28.6	40	1.216	5	261	979	16	1	0	5
	14	19	29.7	37	1.117	6	271	979	18	1	0	5
	15	24	30.6	37	0.916	6	263	978	22	2	0	5
	16	23	30.8	38	0.352	6	262	978	20	2	0	6
	17	19	29.3	40	0.336	7	271	977	17	2	0	7
	18	14	27.1	43	0.172	6	274	978	12	2	0	7
	19	8	24.4	50	0.006	6	265	980	6	2	0	8
	20	4	21.9	60	0.005	3	246	981	2	2	0	10
	21	3	20.5	66	0.006	1	269	983	1	2	0	10
	22	3	20.0	69	0.006	3	305	983	0	2	1	10
	23	2	18.8	74	0.006	2	282	984	0	2	3	11
8/17	0	3	17.8	79	0.006	1	129	984	0	2	4	12
	1	4	17.1	81	0.006	1	124	984	0	2	2	10
	2	7	16.2	84	0.006	2	091	983	0	2	1	9
	3	8	15.7	81	0.006	1	083	983	1	2	0	6
	4	7	15.3	80	0.006	1	078	983	2	2	0	5
	5	8	15.0	76	0.006	1	094	984	3	1	0	4
	6	7	14.8	73	0.026	2	137	984	3	1	0	4
	7	7	18.3	59	0.245	1	122	984	3	1	0	4
	8	8	23.9	43	0.510	1	275	983	6	1	0	6
	9	10	27.4	39	0.767	2	257	982	8	2	0	9
	10	14	29.6	36	0.972	3	291	981	13	2	0	8
	11	20	31.5	32	1.130	4	267	981	17	2	0	7
	12	23	33.0	30	1.198	5	275	980	21	2	0	6
	13	24	34.7	24	1.211	5	265	979	22	1	0	6
	14	24	35.6	21	1.136	6	267	978	22	1	0	6
	15	25	36.0	24	0.917	6	264	978	24	1	0	6
	16	25	35.4	24	0.353	7	267	977	20	1	0	6
	17	15	34.7	21	0.336	6	267	977	12	1	0	6
	18	10	32.6	27	0.179	5	256	978	7	1	0	7
	19	5	29.1	33	0.024	3	255	981	3	2	0	9
	20	1	25.8	39	0.005	3	267	983	0	2	0	10
	21	1	24.1	45	0.005	3	317	984	0	1	0	9
	22	1	23.3	47	0.005	2	298	985	0	1	0	9
	23	1	22.3	53	0.005	2	281	985	0	1	0	9
8/18	0	1	21.4	60	0.005	2	315	985	0	2	0	9
	1	0	21.3	65	0.006	1	250	985	0	2	1	9
	2	0	21.3	65	0.006	2	116	985	0	2	1	9
	3	2	21.7	60	0.006	1	169	985	0	2	1	9
	4	4	21.9	60	0.006	1	139	985	0	2	2	9
	5	3	21.7	51	0.005	2	099	985	0	1	1	7

Table D1. Hourly Averages for Ozone, Carbon Monoxide, Nitrogen Oxides and Meteorological Parameters.
Carbonaceous Species Measurement Methods Comparison Study
GLENDORA, CALIFORNIA -- August 11-21, 1986

		AQMD O3	SCE: Citrus College Data						ARB: Citrus College Data			
DATE	Hour (PDT)	Glendora (pphm)	Temp (deg C)	Rel. Hum. (%)	Solar Rad. (Ly/m2)	Wind Spd. (mph)	Wind Dir. (Deg)	B. Pres. (mbars)	Ozone (pphm)	CO (ppm)	NO (pphm)	NOx (pphm)
	6	3	22.4	44	0.024	2	088	986	0	2	2	7
	7	3	23.8	40	0.085	2	105	986	0	2	3	9
	8	4	26.1	36	0.286	2	223	985	2	2	2	8
	9	4	29.0	32	0.451	2	205	984	2	2	4	13
	10	5	33.0	28	0.907	4	338	983	4	2	1	12
	11	8	33.6	26	0.722	4	288	983	8	2	1	13
	12	14	35.9	21	1.154	5	260	982	8	2	0	10
	13	17	36.6	17	1.143	5	267	981	15	1	0	5
	14	16	37.6	17	1.058	6	268	980	15	1	0	3
	15	22	38.0	17	0.864	7	271	980	22	2	0	5
	16	21	37.1	17	0.447	7	260	980	18	2	0	6
	17	14	35.4	16	0.284	7	257	980	12	2	0	7
	18	9	32.8	18	0.135	6	252	981	7	1	0	7
	19	5	29.7	20	0.015	4	267	983	4	1	0	6
	20	3	28.0	25	0.005	3	275	985	1	2	0	8
	21	2	26.8	30	0.005	1	250	986	0	2	1	9
	22	2	25.3	33	0.005	2	081	986	0	2	2	10
	23	5	24.4	34	0.005	2	112	986	0	2	1	9
8/19	0	4	23.7	38	0.005	1	167	986	0	1	0	7
	1	5	23.1	44	0.005	1	076	986	0	1	0	6
	2	5	23.3	46	0.005	1	109	986	1	1	0	4
	3	4	23.5	45	0.005	2	090	986	1	1	0	3
	4	5	23.4	44	0.005	3	091	986	2	1	0	3
	5	6	23.0	44	0.005	2	072	986	3	1	0	3
	6	5	22.0	50	0.027	1	090	986	2	1	1	5
	7	5	24.6	44	0.200	1	083	985	1	2	1	8
	8	7	29.9	31	0.441	1	253	984	4	2	0	7
	9	8	32.1	27	0.681	2	286	983	7	2	0	7
	10	11	34.7	24	0.893	3	265	982	10	1	0	6
	11	15	35.0	23	1.050	4	268	981	15	2	0	6
	12	18	35.8	23	1.116	5	275	981	17	1	0	5
	13	19	37.2	23	1.056	5	245	980	19	1	0	5
	14	24	36.6	25	0.656	7	264	980	23	2	0	6
	15	18	36.0	24	0.832	9	273	980	16	1	0	6
	16	11	34.4	27	0.364	8	270	980	9	1	0	5
	17	7	32.7	31	0.185	5	260	980	5	2	0	6
	18	5	30.6	34	0.046	4	245	982	3	2	0	7
	19	2	28.5	35	0.008	3	250	982	1	2	1	9
	20	0	27.2	36	0.004	2	259	983	0	2	1	10
	21	1	26.2	34	0.004	1	187	984	0	2	2	11
	22	1	25.1	45	0.004	2	075	984	0	2	2	12
	23	3	24.3	48	0.005	2	076	984	0	2	1	9
8/20	0	3	23.6	51	0.005	1	071	984	0	2	0	7
	1	5	23.7	52	0.005	2	086	984	0	2	0	7
	2	7	23.9	52	0.005	2	094	983	3	1	0	4
	3	7	23.2	56	0.006	1	125	983	3	1	0	3
	4	6	22.3	59	0.005	2	082	984	2	1	0	3
	5	6	21.8	61	0.006	1	090	984	2	1	0	4
	6	5	21.7	61	0.028	1	090	985	3	2	1	6
	7	5	23.6	56	0.153	2	205	985	1	2	2	9

Table D1. Hourly Averages for Ozone, Carbon Monoxide, Nitrogen Oxides and Meteorological Parameters.
Carbonaceous Species Measurement Methods Comparison Study
GLENDORA, CALIFORNIA -- August 11-21, 1986

		AQMD O3	SCE: Citrus College Data						ARB: Citrus College Data			
DATE	Hour (PDT)	Glendora (pphm)	Temp (deg C)	Rel. Hum. (%)	Solar Rad. (Ly/m2)	Wind Spd. (mph)	Wind Dir. (Deg)	B. Pres. (mbars)	Ozone (pphm)	CO (ppm)	NO (pphm)	NOx (pphm)
	8	4	25.5	50	0.195	1	276	984	0	4	9	11
	9	6	28.6	-	0.400				2	4	7	14
	10	6	31.7	35	0.907	3	291	982	4	3	3	12
	11	10	34.0	31	1.040	3	261	981	11	2	0	9
	12	18	35.5	30	1.099	5	261	980	18	2	0	8
	13	23	36.3	28	1.116	6	269	979	20	1	0	6
	14	24	37.0	28	1.031	6	256	979	22	1	0	5
	15	18	36.6	29	0.876	7	270	979	15	1	0	5
	16	13	35.3	28	0.411	7	265	979	10	1	0	5
	17	7	34.3	30	0.292	6	255	979	8	1	0	5
	18	8	32.6	32	0.161	4	259	979	6	2	0	8
	19	3	29.5	30	0.018	4	254	981	2	2	0	10
	20	1	27.0	27	0.004	3	254	983	2	2	0	11
	21	1	25.5	26	0.004	2	297	984	1	2	0	11
	22	1	24.9	25	0.004	1	302	985	0	2	0	10
	23	1	24.1	24	0.005	1	119	985	0	2	1	10
8/21	0	2	23.5	24	0.005	2	112	985	0	2	1	10
	1	2	22.9	23	0.005	1	178	985	0	2	0	8
	2	2	22.0	22	0.005	1	120	985	0	2	1	9
	3	1	21.5	22	0.005	1	174	985	0	2	4	11
	4	1	20.7	66	0.005	2	086	985	0	2	5	13
	5	0	20.5	65	0.005	2	075	985	0	2	3	11
	6	1	20.6	66	0.020	3	088	986	0	2	5	12
	7	2	23.6	56	0.202	1	157	986	0	3	4	13
	8	3	26.5	48	0.069	3	283	985	1	4	10	25
	9	5	28.7	43	0.689	3	253	985	3	4	4	21
	10	10	31.5	37	0.882	3	266	984	6	3	1	18

Table D2. PM10 Mass, Sulfate and Nitrate

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
9150 Flair Drive, El Monte CA 91731

LABORATORY SERVICES BRANCH
REPORT OF ANALYSIS

TO: William G. Bope
Manager, Atmospheric Measurements

REPORT DATE: September 25, 1986

LABORATORY NO. 82626-5

REFERENCE NO. see below

SAMPLE DESCRIPTION:

Nine Whatman QMA Quartz Fiber Filter Samples (24-hr. Samples)

DATE SAMPLE RECEIVED: 8/22/86

SUBMITTED BY: S. Hom

SAMPLE SOURCE: Citrus College Carbon Study

ANALYTICAL WORK PERFORMED, METHOD OF ANALYSIS, AND RESULTS

I.D. Code	Sampling Date	PM_{10} $\mu g/M^3$	Cl^- $\mu g/M^3$	NO_3^- $\mu g/M^3$	SO_4^{-2} $\mu g/M^3$
28 BPM	8-12-86	73	0.7	7.2	9.5
38 BPM	8-13-86	78	0.4	10.2	10.3
48 BPM	8-14-86	75	0.3	7.1	11.8
58 BPM	8-15-86	60	0.0	1.6	10.7
68 BPM	8-16-86	58	0.0	2.0	9.4
78 BPM	8-17-86	54	0.0	3.9	5.8
88 BPM	8-18-86	57	0.1	4.4	3.6
98 BPM	8-19-86	60	0.1	5.2	4.3
108 BPM	8-20-86	71	0.0	5.5	5.4

Ref: SP5-157, PCI-1-14, PNO_3-2-9, PSO_4-2-9

Approved By: Margil W. Wadley
Margil W. Wadley, Ph.D.
Manager of Laboratory Services

Monday, August 11, 1986

Synoptic--Mesoscale Discussion

An upper level high pressure cell was centered over southern Arizona, with moist southeasterly flow into the deserts of southern California. An easterly wave was evident over northwest Mexico, south of the Arizona border near Tucson, moving northwestward. Rather weak onshore pressure gradients existed. During the morning hours of August 11, the base of the inversion was at 1,000 ft. MSL, with the top indicated at 3,900 ft. MSL. Tops of the clouds were reported at 1,000 ft. AGL at LAX, and 1,500 ft. AGL at Santa Ana. Though not evident in the wind field, a weak coastal eddy circulation may have existed, with stratus well into the coastal valleys.

Tuesday, August 12, 1986

Synoptic--Mesoscale Discussion

The upper high pressure cell continued over southeastern Arizona. An upper low developed near 22N/122W, moving slowly to the north. This feature helped maintain the southerly flow aloft and enhanced the dynamics for isolated convection over the mountains and deserts. The coastal marine layer showed little change in depth with the base and top of the inversion lowering slightly. Onshore pressure gradients increased and allowed further inland penetration of the coastal low clouds.

Wednesday, August 13, 1986

Synoptic--Mesoscale Discussion

The upper high pressure cell over Arizona weakened, allowing increasing southwesterly flow aloft. The resulting decrease in mid- and high-level moisture over the southeastern deserts allowed more heating of interior and an increase in the onshore pressure gradients. An upper low near 30N/125W continued to move slowly to the north. Coastal low clouds were generally more extensive over the coastal plain, with the base of the inversion at 1,700 ft. Bases of the clouds were as low as 200 ft. AGL at Santa Barbara and up to 1,300 ft. AGL at San Diego.

Thursday, August 14, 1986

Synoptic--Mesoscale Discussion

The upper high pressure cell shifted to the east. The onshore pressure gradients remained fairly strong as low clouds and reduced visibilities persisted over the coastal plain. The inversion base lifted to 2,200 ft, while the strength of the inversion remained at about 10°C. Bases of the clouds were as low as 300 ft. AGL at Van Nuys, with tops reported at 2,000 ft. Long Beach reported bases at 1,400 ft. AGL and tops at 1,800 ft.

Friday, August 15, 1986

Synoptic--Mesoscale Discussion

The upper flow pattern backed around to the south-southwest in response to the upper low, now located at 33N/134W. Further deepening of the marine layer allowed the marine airmass to penetrate into the intermediate valleys. The onshore flow increased slightly with low clouds and fog being reported into the San Bernardino and Riverside valleys. The base and top of the inversion showed little change with the base at 2,000 ft. and the top at 3,500 ft. The strength of the inversion increased slightly. Bases of the clouds were reported as low as 300 ft. AGL at Santa Barbara and Van Nuys. Cloud bases were as high as 1,900 ft. AGL along the south coast near San Diego. A weak coastal eddy circulation was evident in the wind and pressure patterns between San Nicholas Island and Long Beach.

Saturday, August 16, 1986

Synoptic--Mesoscale Discussion

The upper low shifted northwestward off the central California coast, and allowed the upper level ridge to build and become reestablished over southwestern Arizona. The resulting height rises caused the inversion base and top to lower, while pressure gradients shifted to an offshore trend. The lower inversion still maintained a shallow marine airmass, confined to the coastal plain. Morning low clouds burned off rather quickly.

Sunday, August 17, 1986

Synoptic--Mesoscale Discussion

The upper low filled to form a broad trough off the central California coast as the upper high continued to build over southern California. Dry southwesterly flow aloft continued over the area. As heights increased, the inversion continued to lower to 950 ft. and gradients trended more offshore. The marine airmass and associated low clouds and fog were confined to the coastal plain.

Monday, August 18, 1986

Synoptic--Mesoscale Discussion

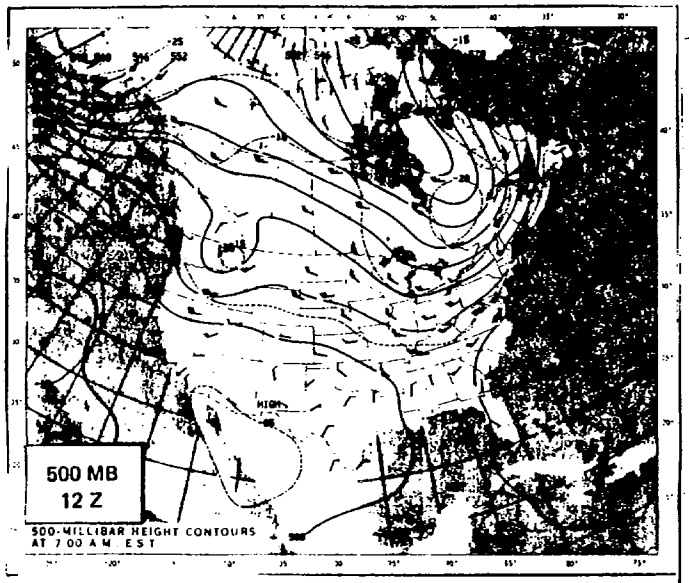
The upper high expanded and reestablished over the four corners region. Flow aloft shifted to the southeast allowing an abundance of tropical moisture to be advected in the area. Mid and high clouds covered southern California with stratus and stracocumulus clouds along the coast. An area of light rain showers developed south of San Diego. Under strong subsidence, the base of the inversion lowered to the surface with the top at 2,900 ft.

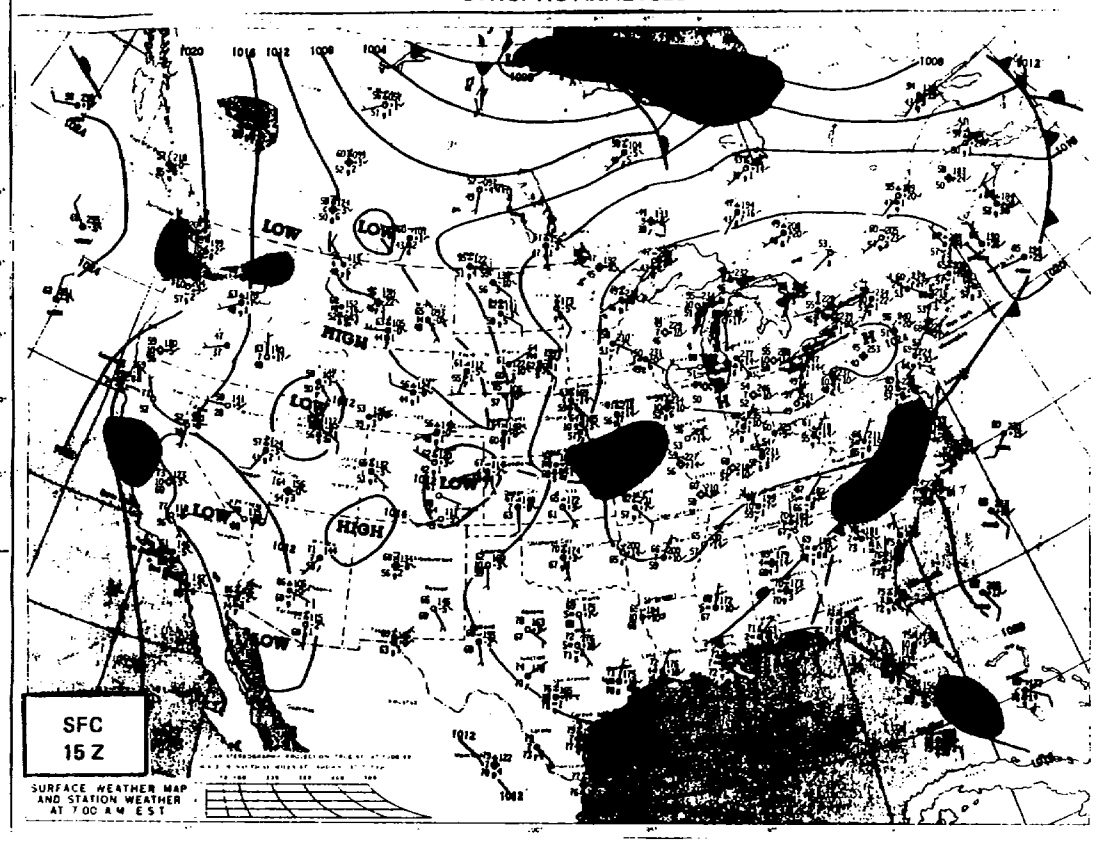
Tuesday, August 19, 1986

Synoptic--Mesoscale Discussion

An elongated ridge, from New Mexico southwestward to the northern tip of Baja, maintained flow from the southwest to southeast over most of southern California. Most of the area remained covered by mid and high level cloud cover. Ceilings were generally 10,000 ft. to 12,000 ft. with good visibilities. Surface pressure gradients were offshore with only a weak onshore influence to the southern deserts. The inversion remained surface based with an unstable tropical airmass above.

MZ:db
164
12/29/86





UPPER AIR DATA FOR SAN FOR 12Z, 12-AUG-86

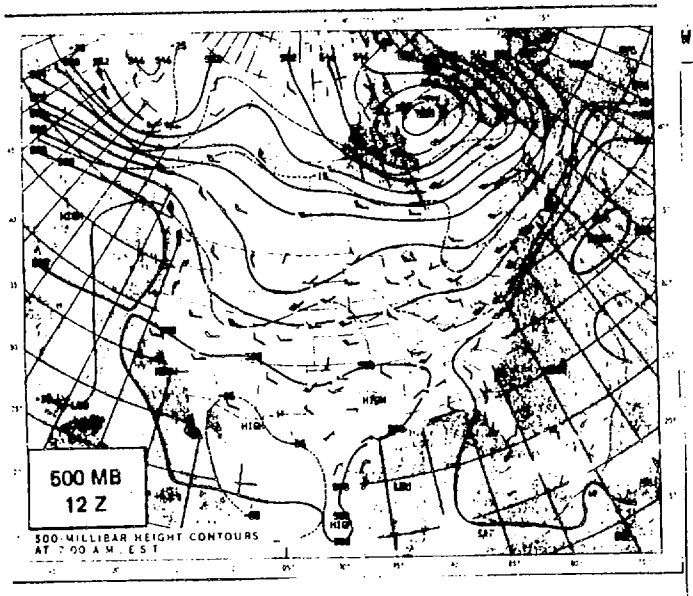
LEVEL (MB)	HEIGHT (M)	TMP (C)	DPT (C)	DDFFF (KTS)
500	5900	-5.1	-23.1	34010
517		-3.7	-33.7	
532		-3.1	-9.1	
613		2.6	0.8	
655		7.0	0.0	
700	3181	11.4	3.4	12004
716		11.6	6.6	
850	1527	22.6	3.6	31508
901		25.0	-5.0	
940		22.0	1.0	
946		17.0	16.2	
956		16.6	16.3	
979	SURF	18.6	17.3	31003
1000	119			

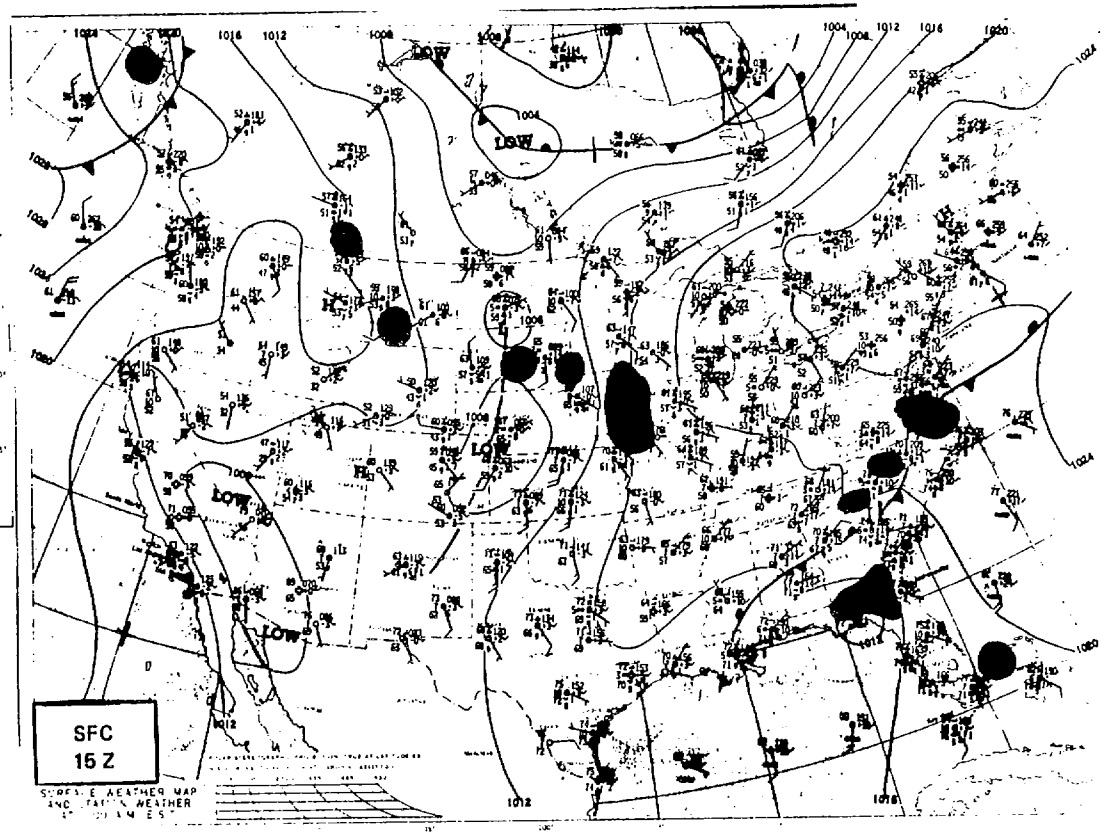
LEVEL MB	THICKNESS (M)	AVG PRECIPITABLE WATER (IN)
500	5781	1.27
700	3062	0.86
850	1408	0.42

MORNING INVERSION SUMMARY - LMU						WIND		PRESSURE GRADIENTS (MB						
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB.	SAN (20Z)	Date	SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-DAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)
1000	3900	14.8	25.0	10.2	23.6	2903	11	0.5	1.1		-0.3	2.2	1.2	3.5
900	3100	14.2	24.0	9.8	21.6	3110	12	0.6	2.7		0.7	3.2	2.0	4.6

WEDNESDAY, AUGUST 13, 1986

SYNOPTIC ANALYSES



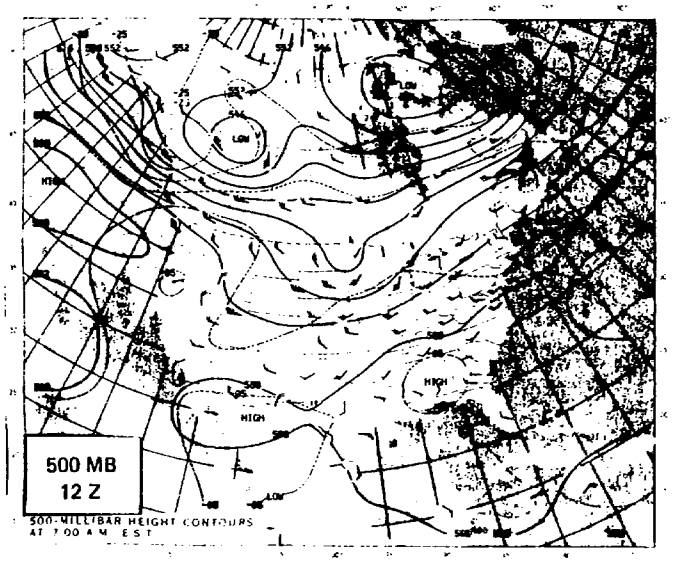


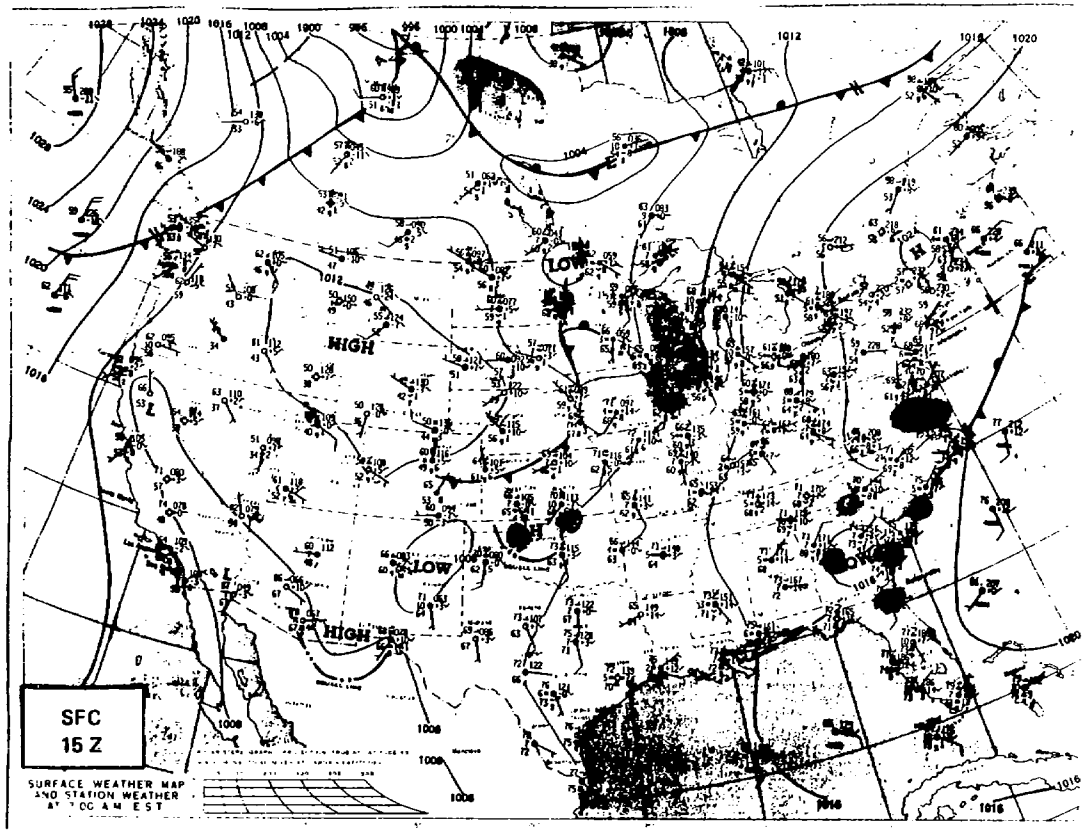
UPPER AIR DATA FOR: SAN FOR 12Z, 12-AUG-86

LEVEL (MB)	HEIGHT (M)	TMP (C)	DPT (C)	DDFFF (KTS)
500	5900	-5.1	-23.1	34010
517		-3.7	-33.7	
532		-3.1	-9.1	
613		2.6	0.8	
655		7.0	0.0	
700	3181	11.4	3.4	12004
716		11.6	6.6	
850	1527	22.6	3.6	31508
901		25.0	-5.0	
940		22.0	1.0	
946		19.0	16.2	
956		16.6	16.3	
999	SURF	18.6	17.3	31003
1000	119			

LEVEL MB	THICKNESS (M)	AVG PRECIPITABLE WATER (IN)
500	5781	1.27
700	3062	0.86
850	1408	0.42

MORNING INVERSION SUMMARY						WIND		PRESSURE GRADIENTS (MB)						
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB	SAN (20Z)	Date	SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-DAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)
900	3100	14.2	24.0	9.8	21.6	3116	12	0.6	2.7		0.7	3.2	2.0	4.6
1700	4300	13.2	24.0	10.8	22.6	3109	13	1.7	5.3		1.8	4.8	4.5	6.3



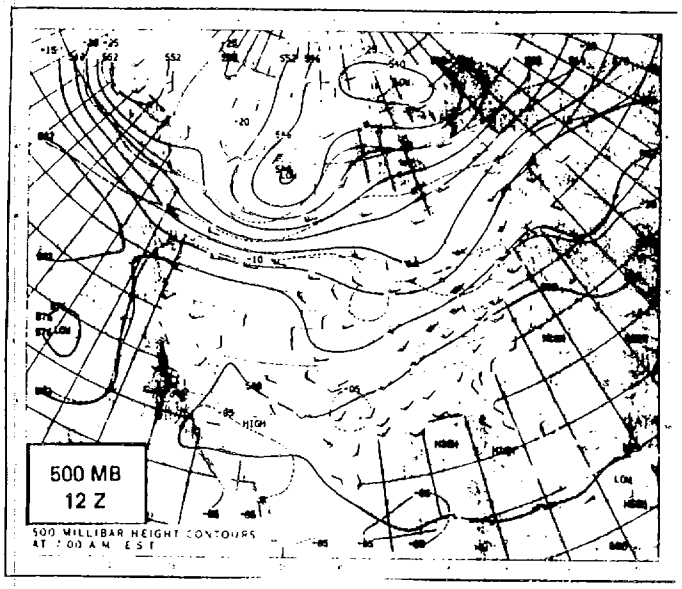


UPPER AIR DATA FOR: SAN FOR 12Z, 14-AUG-86

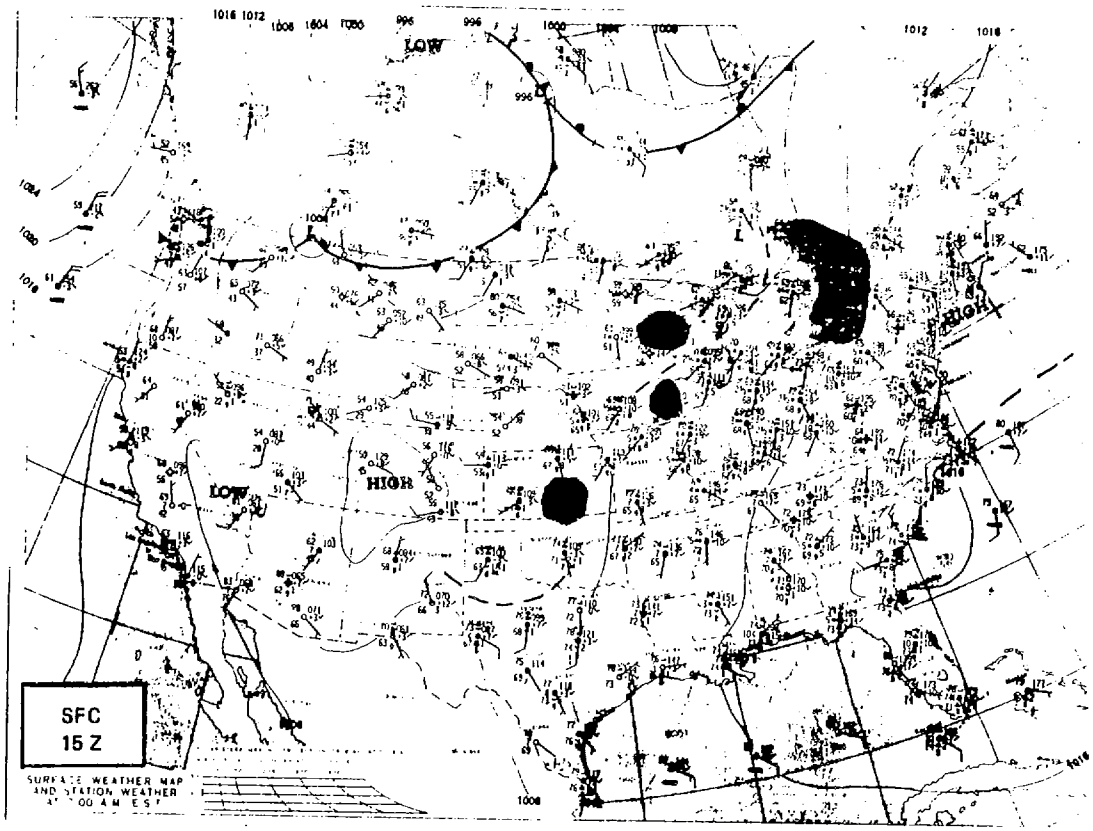
LEVEL (MB)	HEIGHT (M)	TMP (C)	DPT (C)	DDFFF (KTS)
500	5880	-5.5	-22.5	22511
618		6.0	-24.0	
626		5.2		
700	3147	12.0	-18.0	26008
797		19.6	-10.4	
825		19.6	-3.4	
850	1493	21.4	-8.6	30511
889		23.2	-6.8	
938		21.6	-8.4	
948		13.4	13.0	
996	SURF	17.6	15.4	01009
1000	93			

LEVEL MB	THICKNESS (M)	AVG PRECIPITABLE WATER (IN)
500	5787	0.52
700	3054	0.44
850	1400	0.30

MORNING INVERSION SUMMARY						WIND		PRESSURE GRADIENTS (MB)							
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB	SAN (20Z)	Date	SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-DAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)	Σ (15Z)
1700	4200	13.2	24.0	10.8	22.6	3109	13	1.7	5.3		1.8	4.8	4.5	6.3	11.1
~~2200~~	3900	13.0	23.0	10.0	21.2	3109	14	2.3	2.9		2.2	4.4	3.2	5.8	9.8



FRIDAY, AUGUST 15, 1986



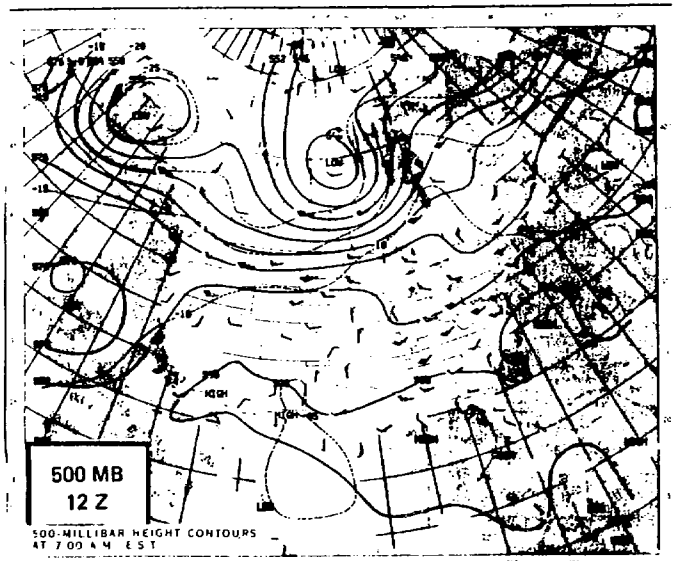
UPPER AIR DATA FOR: SAN FOR 12Z, 15-AUG-86

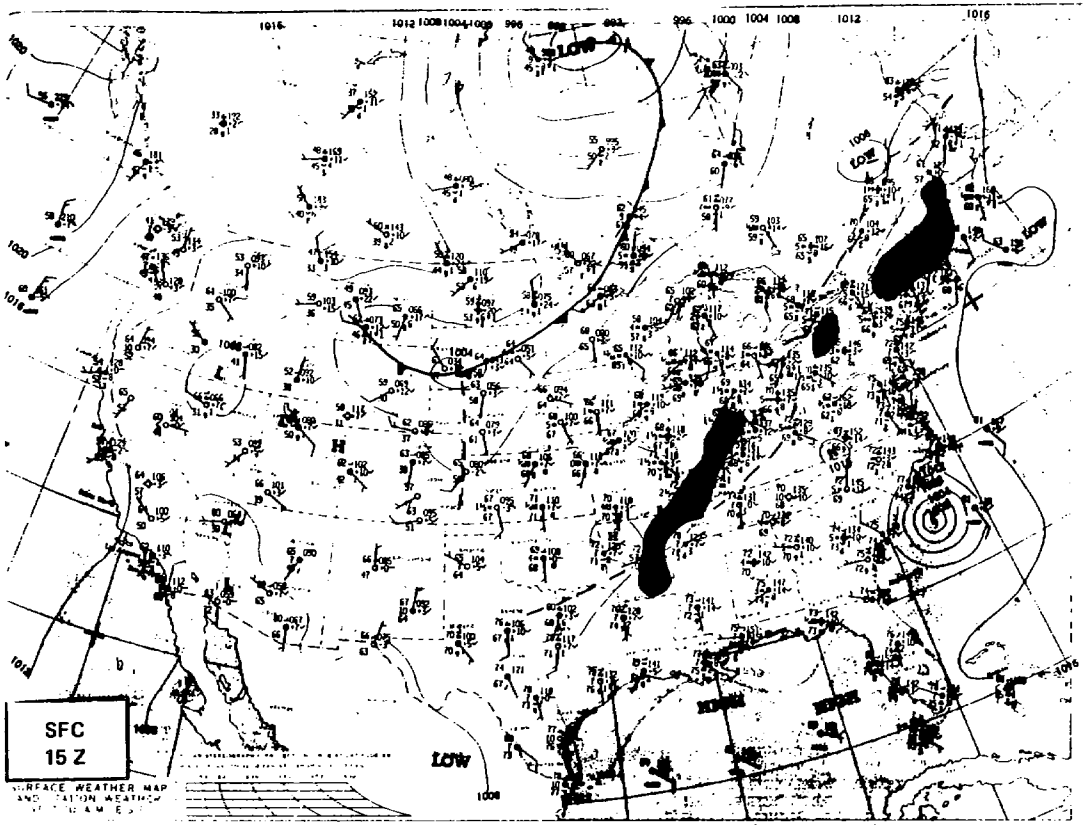
LEVEL (MB)	HEIGHT (M)	TMP (C)	DPT (C)	DDFFF (KTS)
500	5870	-5.5	-35.5	22515
649		9.2	-20.8	
700	3142	11.0	-19.0	18515
718		11.2	-4.8	
809		20.0	-3.0	
850	1492	20.0	3.0	30507
885		21.4	5.4	
895		22.4	-7.6	
924		21.6	-8.4	
932		14.0	-16.0	
941		13.8	13.4	
975		15.8	15.2	
997	SURF	18.8	16.1	33004
1000	96			

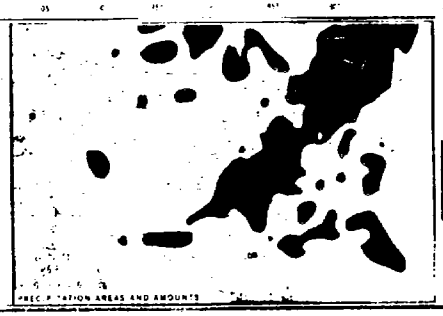
LEVEL MB	THICKNESS (M)	AVG PRECIPITABLE WATER (IN)
500	5774	0.69
700	3046	0.62
850	1396	0.39

MORNING INVERSION SUMMARY						WIND		PRESSURE GRADIENTS (MB)							
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB.	SAN (20Z)	Date	SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-DAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)	Σ (15Z)
2200	3900	13.0	23.0	10.0	21.2	3109	14	2.3	2.9		2.2	4.4	3.2	5.8	9.8
2000	3500	12.6	23.0	10.4	22.4	3009	15	1.7	5.4		1.8	4.3	4.7	4.7	10.7

SATURDAY, AUGUST 16, 1986

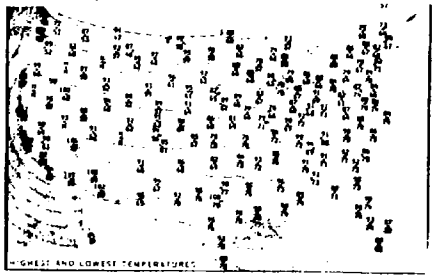




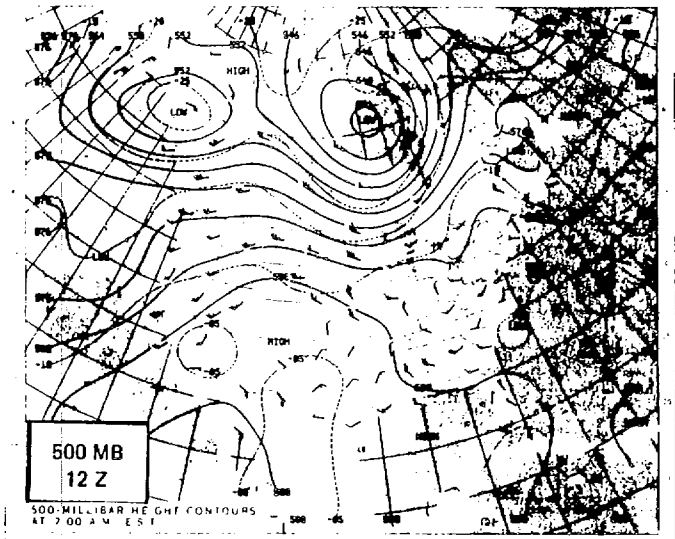


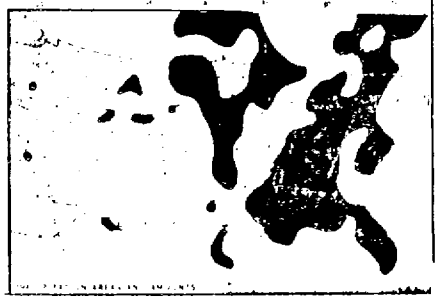
MORNING INVERSION SUMMARY						WIND
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB.	SAN (20 Z)
2000	3500	12.6	23.0	10.4	22.4	3009
1700	3100	13.2	22.2	9.0	21.8	

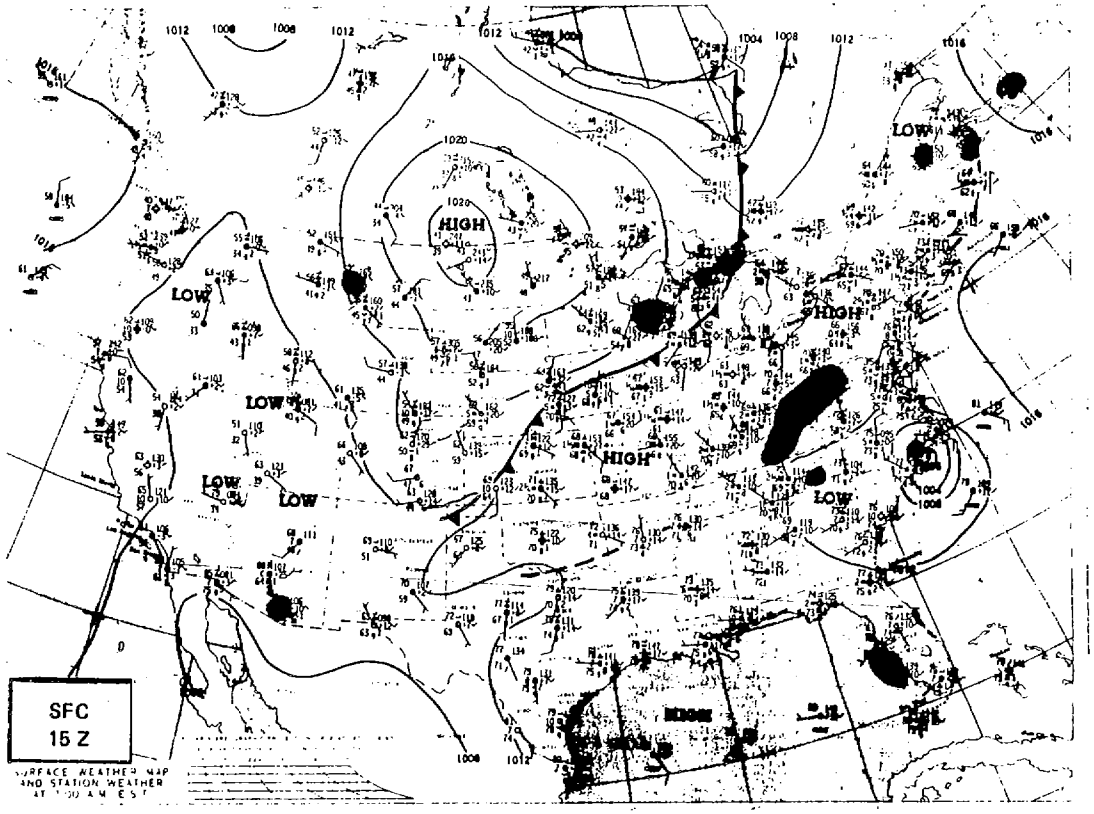
Date	PRESSURE GRADIENTS (MB						
	SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-DAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)
15	1.7	5.4		1.8	4.3	4.7	4.7
16							



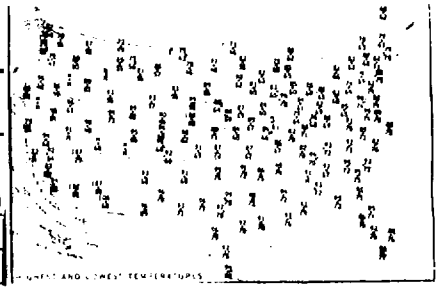
SUNDAY, AUGUST 17, 1986



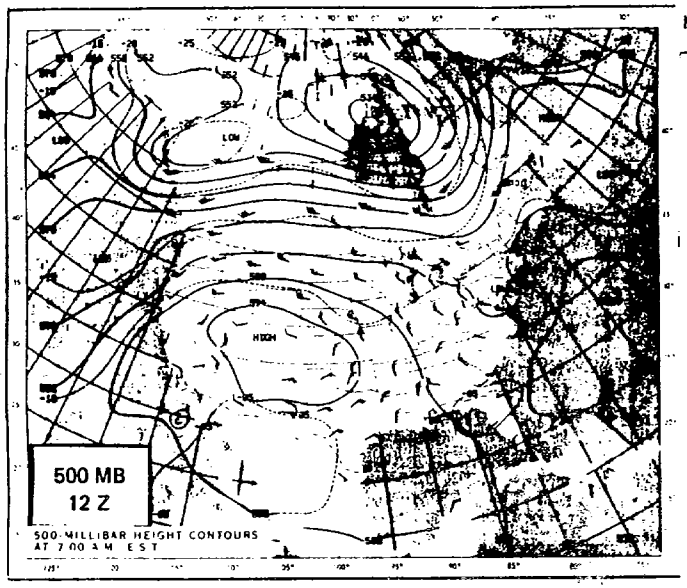


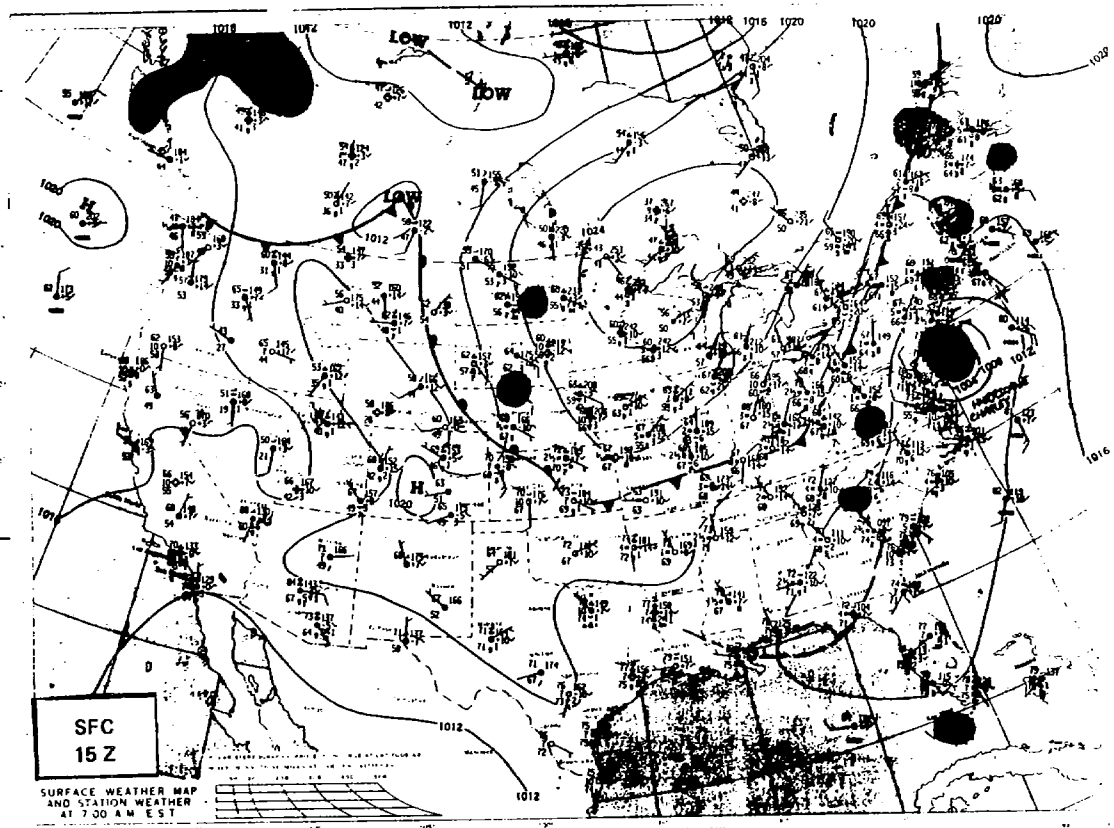


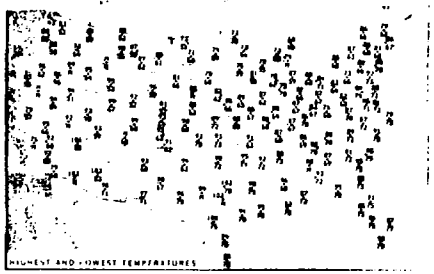
MORNING INVERSION SUMMARY						WIND		PRESSURE GRADIENTS (MB)							
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB.	SAN (20Z)	Date	SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-BAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)	Σ (15Z)
1700	3100	13.2	22.2	9.0	21.8		16								
950	2900	16.0	24.2	8.2	22.0		17				-0.8	0.3	0.4	1.2	-0.1



MONDAY, AUGUST 18, 1986







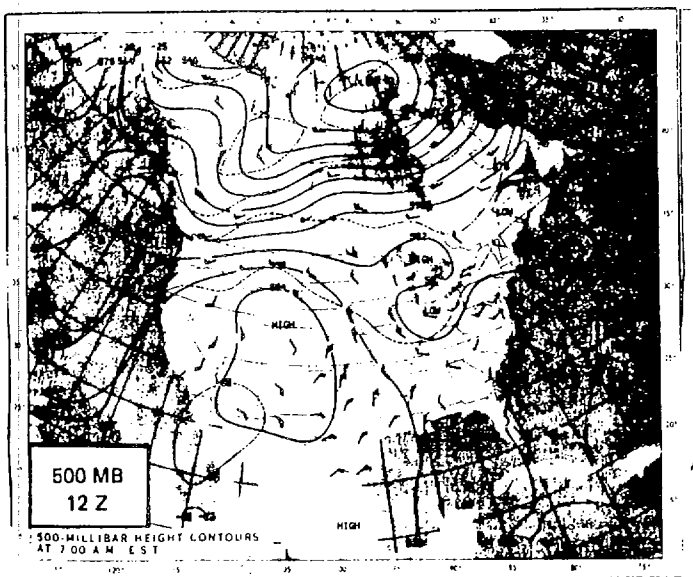
UPPER AIR DATA FOR: SAN FOR 12Z, 19-AUG-86

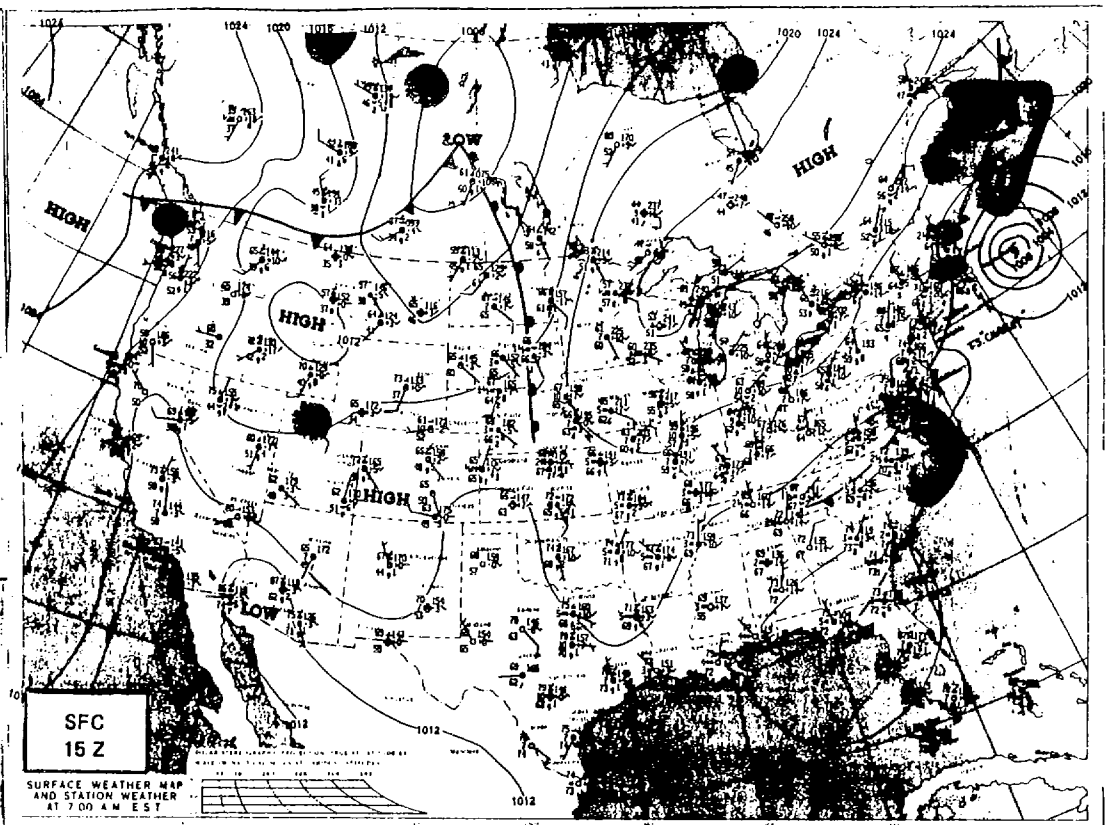
LEVEL (MB)	HEIGHT (M)	TMP (C)	DPT (C)	DDFFF (KTS)
500	5910	-6.7	-7.1	13024
590		1.2	0.3	
613		3.0	-0.7	
650		5.4	4.3	
700	3190	9.0	7.9	12016
738		12.4	11.2	
781		16.6	5.6	
790		17.0	10.0	
827		20.8	-9.2	
850	1539	23.0	-1.0	02504
927		26.2	6.2	
944		25.0	16.0	
971		26.2	13.2	
999	SURF	21.8	19.4	34001
1000	113			

LEVEL MB	THICKNESS (M)	AVG PRECIPITABLE WATER (IN)
500	5797	1.47
700	3077	0.94
850	1426	0.47

MORNING INVERSION SUMMARY						WIND	Date	PRESSURE GRADIENTS (MB)							
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB	SAN (20Z)		SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-DAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)	Σ (15Z)
SFC	1700	20.4	26.0	5.6	23.0	1811	17				-0.8	0.3	0.4	1.2	-0.1
SFC	1900	20.6	27.0	6.4	21.4	3013	18	-1.0	-0.1		-0.5	0.2	-0.8	1.3	-1.1

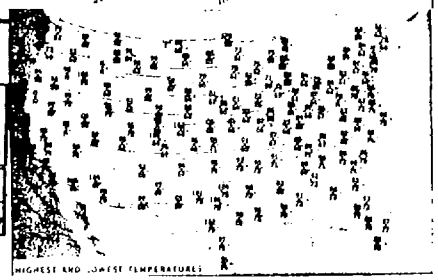
TUESDAY, AUGUST 19, 1986





MORNING INVERSION SUMMARY						WIND
BASE HT (ft)	TOP HT (ft)	BASE TEMP (°C)	TOP TEMP (°C)	ΔT (°C)	850 MB	SAN (20 Z)
950	2900	16.0	24.2	8.2	22.0	
SFC	1700	20.4	26.0	5.6	23.0	7811

	PRESSURE GRADIENTS (MB)							
Date	SBD-VCV (12Z)	SAN-LAS (12Z)	LAX-TRM (12Z)	SBD-VCV (15Z)	LGB-DAG (15Z)	SAN-LAS (15Z)	LAX-TRM (15Z)	Σ (15Z)
18	-1.0	-0.1		-0.5	0.2	-0.8	1.3	-1.1
19	-1.9	-1.8		-2.4	-1.5	-2.1	8.0	-6.0



CARBONACEOUS SPECIES METHODS COMPARISON STUDY (CSMCS) PROTOCOL

1. PROJECT OVERVIEW

Based on previous work, we expect some significant differences between measurement methods for carbonaceous aerosols. Our objective in the Carbon Study (CSMCS) is not only to quantify these differences, but to better understand the underlying reasons for the differences. Additionally, we wish to evaluate possible sampling methods for the nine-site intensive monitoring network to be operated in the 1987 Southern California Air Quality Study (SQACS).

For aerosol carbon there are three components to the study:

(1) Interlaboratory Round Robin. The objective of this round robin is to compare analytical methods for total and organic carbon. Fifteen quartz filter samples will be split among the participating laboratories to compare analytical methods. The samples will consist of nine ambient air samples, three vehicle exhaust samples, an organic carbon sample (collected from a smog chamber), an soot carbon sample, and a blank. Ambient wood smoke samples and three NBS standards will also be available.

(2) Evaluation of systematic differences among carbon measurement methods. Samplers will be compared under field conditions during the nine days of sampling at Citrus College. Investigators are asked to operate their samplers using standard procedures, while adhering to one of the two sampling schedules outlined below.

(3) Comparison of adsorption/volatilization/chemical transformation artifacts. During the field study some groups will be participating is special experiments to assess the magnitude of these artifacts, described below. We wish to compare relative magnitude of volatiliazation and adsorption artifacts, and the differences in these artifacts for different sampling methods.

For gaseous hydrocarbons, organic acids, formaldehyde and hydrogen peroxide, measurement methods will be compared under field conditons under the same schedule as used for the aerosol carbon study.

Management: Doug Lawson is the CARB project officer. Susanne Hering, UCLA, is responsible for the study design, the field coordination and data analysis. Richard Countess of EMSI, Newbury Park is responsible for quality assurance, and for the analytical methods intercomparison (item 1, above).

2. BASIC INFORMATION

Study site: Citrus College, 1000 W. Foothill Blvd, Glendora, CA
Study dates: August 11-21, 1986
Headquarters location:
ARB trailer at the site
Phone: (818)-
Official motel:
San Dimas Inn (Best Western)
204 N. Village Court, San Dimas, CA 91773
Phone: (818)-967-6321

A special group rate of $40/$45 for single/double rooms is available. Mention that you need reservations for the air resources Board Study. The block of rooms for the study will not be held after July 21, 1986.

A tentative list of sampling and analysis methods to be operated by each of the participating groups is given in Table 1. The current list of participants, with addresses and phone numbers, is also included. Please send corrections and additions to Susanne Hering.

3. FIELD STUDY SAMPLING PROTOCOL

Schedule

Two sampling schedules, consisting of either 5 samples per day, or 2 samples per day, will be used, as listed below. Depending on the requirements for their sampler, investigators are asked to choose one of these two options. Please use the same schedule and sampling configuration throughout the study

period.

Option 1: 5 samples/day

Period #1: 0800-1200 PDT
Period #2: 1200-1600 PDT
Period #3: 1600-2000 PDT
Period #4: 2000-0000 (midnight) PDT
Period #5 0000-0800 PDT

Option 2: 2 samples/day

Period #6: 0800-2000 PDT
Period #7: 2000-0800 PDT

Particle Size Fraction

The comparison study is for the *fine* fraction of the ambient aerosol. Samplers should have a precut between 1μm and 3.5μm.

Pump Exhaust must be Filtered

Since most pumps use either carbon vanes or oil, we ask that investigators filter the exhaust from their pumps to avoid sample contamination. Pleated fiber filters, such as those available from Gelman or Mine Saftey Appliance, should do the job.

Shade or Sun Protection

The sampling platform will be located in an open, unshaded parking lot. Direct radiant heating can cause sampler temperatures to be significantly elevated above ambient air temperature. Precautions such as shading or thermally insulating your samplers will be necessary to maintain the sampler temperature close to ambient.

Investigators are asked to provide sun protection for their samplers. Metal shades, or aluminized insulation materials could be used. Please do not use materials which will outgas in the heat, as other investigators will be measuring formaldehyde and other hydrocarbons.

It was deemed unwise to shade the entire sampling platform because of problems with airflow around a 15 by 140 foot canopy, and outgassing problems from the canvas. A small portion of the platform will be shaded for studies to assess the importance of this effect. However most samplers will be sited in the direct sunlight.

Sampler Siting

Samplers will be sited along a platform 3 feet above the ground, with inlets approximately 8 feet above the ground (ie, 5 feet above the platform). The platform will be oriented perpendicular to the prevailing winds. A small portion of the platform will be shaded.

Sample Storage

A freezer will be provided on site for sample storage.

Quality Assurance

Field Blanks - Investigators are asked to provide the values for 5 (five) blanks, handled in the field. For example, a field blank can be obtained by loading substrates into the sampler, and running for ten seconds. For those with several samplers, please provide five blanks for each type of substrate.

Flow rate checks - EMSI will conduct flow rate checks against a common dry test meter, or other appropriate monitor, for each participating group. These checks will be made on August 11.

Logbooks

Standard forms will be provided to record all sample collections. These must be completed by each participating group, and submitted at the end of the field study. We will make copies and return the originals within twentyfour hours.

Replicate Samplers

Those who have replicate samplers are asked to contact Susanne Hering, so the samplers may be used to advantage. Some replicates will be needed to assess variability across the sampling platform. Others may best be used in the special artifact experiments, described in Part 5 below.

Central Laboratory Analysis

EMSI has offered to act as a central laboratory, and will provide separate analysis of a portion of investigator's samples, where feasible. On two days of the study, EMSI will ask for an alliquot (ie, a punch from a filter) from the filters collected by one of the samplers from each group. EMSI is not acting as a reference laboratory, rather they will be providing a common analysis technique to help us distinguish between analytical and sampling differences between the various measurement techniques.

Sample Numbers

For the purposes of this study, sampling days begin at 0800, and end 24 hours later, at 0800 the following morning. The sampling day, not the calendar date will be used in the sample number. (This way, twelve hour samples beginning at 2000 will have the same sampling day identifier as the shorter 4 and 8 hour samples running from 2000-0000 and 0000-0800.) Accordingly, samples should be numbered as follows:

24GXX-zzz

where

2 = sampling day, corresponding to the 24-hour period beginning at 0800, August 12. The day beginning 0800 August 20 is day 10.

4 = sampling period, as given by the schedule above.
"24" indicates a sample from 2000-midnight on August 12.
"25" indicates a sample from midnight-0800 on August 13.
"27" indicates a sample from 2000 on August 12 to 0800 on August 13.

G = Group ID as given in Table 1.

XX= Sampler code, consisting of two or three characters (letters or numbers) to be chosen by the investigator. We recommend the first character be a letter indicating the type of sampler, as follows:

F=filter sampler
T=tandom filter sampler
D=sampling system with a denuder
I=impactor
E=Electrostatic precipitator
H=HiVol

zzz= Optional identifiers, for the convenience of the investigator.

4. SCHEDULE, COMMUNICATIONS & MEETINGS

Wed., August 6:	Power available at the site, nighttime guard begins.
Monday, August 11:	0900-1000 Kick-off meeting, Citrus College, Physical Science Bldg
	Set-up
	Flow rate checks
	Artifact studies: Those with denuder systems will be running with Teflon filters on their sampler inlets to test for adsorption artifacts as in the 0% aerosol measurement (see Section 7)
	1615-1630 Briefing at the sampling site in the headquarters trailer.
Tuesday, August 12:	0800 Sampling begins
	1615 Meeting at the headquarters trailer.
August 13-20:	Sampling per schedule
	1615 Daily meeting at the headquarters trailer.
Thursday, Aug 21:	0800 Sampling ends
	Turn in logbooks to S. Hering for duplication
	1130 Wrap-up meeting at Citrus College, Physical Science Bldg
Friday, August 22:	Scaffolding comes down, guard duty ends.

5. FACILITIES AT THE SITE

Bench and lab space: One laboratory in the Physical Science Building at Citrus College will be available. Bench space at the site is very limited.

Distilled water: Will be available.
Phone: Will located at in the headquarters trailer at the site. The number will be announced at the kick-off meeting.

6. COMPARISON OF ANALYTICAL METHODS (R. Countess)

Samples to be provided: 15 "required" and 5 "optional" samples will be given to each laboratory at the end of the study period. The "required" samples will all be on Pallflex QAO quartz filters, with the exception of the auto exhaust samples which will be on QAST quartz filters. Each sample will be a 25mm diameter punch taken from a Hivol filter. (If you require more sample, then contact R. Countess directly before July 15.) These "required" samples will consist of:

9 ambient samples (to be collected by EMSI during the study)
3 automotive exhaust samples (1 diesel, 1 catalyst and 1non-cat. auto; provided by GM)
1 soot sample
1 organic aerosol sample from a smog chamber
1 QAO blank

The "optional" samples will include:

3 NBS standards, not on filters
2 ambient wood smoke samples on Whatman quartz filters

Sample Distribution: The analytical intercomparison samples will be distributed on the last day of the study. It is recommended that they be kept as cold as possible during transport, and stored in a freezer before analysis.

Data Reporting: Organic, non-volatile (ie soot-like) and total carbon found on each test filter should be reported in units of µg-Carbon/sample. Data should be sent to S. Hering.

7. SAMPLING ARTIFACT STUDIES

One of the objectives of the Carbon Study (CSMCS) is to evaluate the reasons for differences between aerosol carbon sampling methods. Several 'special studies' have been designed to estimate the magnitude of artifact due to volatilization, gaseous adsorption and chemical reaction during collection. Each of these involves additional samples collected in parallel with the regular samples which form part of the methods comparison. Some of the experiments planned are outlined below. If you are planning additional artifact experiments, please give S. Hering a brief description, either by phone or in writing.

Volatilization vs Adsorption on Filters and Impactors (Huntzicker & McMurry): Modeling of volatilization losses from filters and impactors indicates that after a short period of sampling the volatilization losses are constant, independent of the aerosol collection rate. Therefore one expects the greatest percent losses under conditions of light aerosol carbon loadings. On the other hand, adsorption artifacts are expected to depend on the collection substrate and the gaseous hydrocarbon concentrations. To separate these two effects, Huntzicker and McMurry will (if possible) operate three samplers in parallel, one regular sample, one sample with Teflon pre-filtered air, and one sampler with ~70% of the air pre-filtered. The concentrations of the gaseous species will be the same for each of the three samplers, but the aerosol concentrations will vary from 0% to 100% of ambient. The completely filtered sample (0% aerosol) gives an estimation of the adsorption artifact, A. The regular sample (100% aerosol) is expected (to a first approximation) to give the aerosol carbon loading, L, plus adsorption, minus volatilization, or L+A-V. The partially filtered sample (30% aerosol) is expected to have roughly the same volatilization and adsorption artifact as the regular sample, and gives 0.3*L +A-V.

Chemical Transformation Artifacts (Gordon & Grosjean): Two quartz filter samplers will be operated in parallel, one regular sample, and one with a diffusion denuder upstream to remove oxidants prior to filter collection. Organic/non-volatile carbon analyses and possibily organic speciation analyses are planned.

Sampler Temperature (Colovos): Two identical samplers will be run, one shaded and the other

in the direct sunlight.

Adsorption Artifacts for Denuded Samples: (Appel and Fitz) Prior to the regular sampling, samples will be collected using a Teflon prefilter, essentially as a test of the denuders under field conditions.

Effect of Face Velocity for Quartz Filters (Huntzicker, Appel and others) Parallel filter samples will be collected using different face velocity. Huntzicker's experiment is designed so that the volume of air collected by each filter is the same.

8. FORMAT FOR DATA TRANSMITTAL

Participants are asked to supply the following data to S. Hering & D. Lawson:

(1) A brief description of their sampling methods, including QA procedures.
(2) A brief description of their analysis methods, including QA.
(3) Data from analysis intercomparison, giving μg-C/sample (see section 6).
(4) Values for 5 field blanks
(5) Field data.

Please send your reduced data in tablular form, ie col#1: sample no., col#2: start-stop times, col#3 : organic carbon, col#4: non-volatile carbon, etc. If there is alot of data, magnetic form such as an IBM PC floppy or Lotus 123 file, is appreciated. When sending data on floppies, also send a hard copy. Magnetic copies of the data need only be sent to S. Hering.

ARB CARBONACEOUS SPECIES METHODS COMPARISON STUDY
PARTICIPANTS

October 6, 1986

David T. Allen
University of California,
Los Angeles
Chemical Engineering Department
405 Hilgard Avenue
Los Angeles, CA 90024
(213) 206-0300

Bruce R. Appel
Air & Industrial Hygiene
Laboratory
California Department
of Health Services
2151 Berkeley Way
Berkeley, CA 94704-9980
(415) 540-2477

William G. Bope
South Coast Air Quality
Management District
9150 East Flair Drive
El Monte, CA 91731
(818) 572-6398

Thomas A. Cahill
Air Quality Group, Crocker
Nuclear Laboratory
University of California
Davis, CA 95616
(916) 752-1460/752-1120

Richard J. Countess/
George Colovos
EMSI
4765 Calle Quetzal
Camarillo, CA 93010
(805) 388-5700

Purnendu K. Dasgupta
Department of Chemistry
and Biochemistry
Texas Tech University
Box 4260
Lubbock, TX 79409-4260
(806) 742-3064

E. Carol Ellis/Laura Games
Southern California Edison
P. O. Box 800
Rosemead, CA 91770
(818) 302-1866/302-3646 for LG

Dennis R. Fitz
AeroVironment, Inc.
825 Myrtle Avenue
Monrovia, CA 91016-3424
(818) 357-9983

Kochy K. Fung
ERT
975 Business Center Circle
Newbury Park, CA 91320
(805) 499-1922

Robert J. Gordon/Robert Brewer
Global Geochemistry Corp.
6919 Eton Avenue
Canoga Park, CA 91303-2194
(818) 992-4103

Daniel Grosjean
Suite 205
4526 Telephone Road
Ventura, CA 93003
(805) 644-0125

Susanne V. Hering
University of California,
Los Angeles
Chemical Engineering Department
405 Hilgard Avenue
Los Angeles, CA 90024
(213) 206-6193/825-2046

Michael W. Holdren/Darrel Joseph
Battelle Columbus Laboratory
505 King Avenue
Columbus, OH 43201
(614) 424-5307

James J. Huntzicker/John Rau/
Barbara Turpin
Oregon Graduate Center
19600 NW Von Neumann Dr.
Beaverton, OR 97006-1999
(503) 690-1072

Ian R. Kaplan/Hiroshi Sakugawa
University of California,
Los Angeles
Institute of Geophysics and
Planetary Physics
405 Hilgard Avenue
Los Angeles, CA 90024
(213) 825-1805

Kenneth T. Knapp/Thomas G. Ellestad/
Len Stockburger/Walt Weathers
Environmental Protection Agency
MD-46 (MD-57 for TGE)
Research Triangle Park, NC 27711
(919) 541-3085/2253 for TGE

Gregory L. Kok
National Center for
Atmospheric Research
P.O. Box 3000
Boulder, CO 80307-3000
(303) 497-1415

Douglas R. Lawson
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812
(916) 324-8496/445-0753

Gervase L. Mackay/Kim Mayne
Unisearch Associates
222 Snidercroft Road
Concord, Ontario L4K 1B5
CANADA
(416) 669-2280

William A. McClenny
Environmental Protection Agency
MD-44
Research Triangle Park, NC 27711
(919) 541-3158

Peter H. McMurry/X.Q. Zhang
Department of Mechanical Engineering
University of Minnesota
111 Church Street
Minneapolis, MN 55455
(612) 625-3345

David McTavish
Atmospheric Environment
Service
4905 Dufferin Street
Downsview, Ontario M3H 5T4
Canada
(416) 667-4901

Patricia A. Mulawa/Steven H. Cadle/
Peter J. Groblicki
Environmental Science Department
GM Research Laboratories
Warren, MI 48090-9055
(313) 986-1604 (1603 for
SHC; 1610 for PJG)

Kenneth E. Noll/Ken Y.P. Fang
Department of Environmental Engineering
Illinois Institute of Technology
3200 South State Street
Chicago, IL 60616
(312) 567-3538

Tihomir Novakov/Tony Hansen
Building 73
Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720
(415) 486-5319

William R. Pierson/Wanda Brachaczek
Research Staff
Ford Motor Company
P. O. Box 2053
Dearborn, MI 48121-2053
(313) 845-8072

Martin J. Pollard
Lawrence Berkeley Laboratory
Building 70, Room 110
Berkeley, CA 94720
(415) 486-5647

Reinhold A. Rasmussen
Oregon Graduate Center
19600 NW Von Neumann Drive
Beaverton, OR 97006
(503) 690-1077

Jim Shikiya/John Kowalski/
Pat Harrington/John Jung
Haagen-Smit Laboratory Division
California Air Resources Board
9528 Telstar Avenue
El Monte, CA 91731
(818) 575-6815 for JS
(6856 for others)

Roger L. Tanner/Ji Shen
Brookhaven National Laboratory
Environmental Chemistry Division
Department of Applied Science,
Building 426
Upton, Long Island, NY 11973
(506) 282-3578

Arthur M. Winer/Ernesto C. Tuazon/
Heinz W. Biermann/Roger Atkinson
Statewide Air Pollution
Research Center
University of California
Riverside, CA 92521
(714) 787-4651

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ASSET