AIR MONITORING STUDY IN THE AREA OF LOS ANGELES INTERNATIONAL AIRPORT

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

REPORT PREPARED
APRIL 2000

LAX AREA AIR MONITORING Follow-Up Study

Trichloroethene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	ND	ND	ND			
Site 2	ND	ND	ND			
Site 3	ND	ND	ND			
Site 4	ND	ND	ND			
Site 5	ND	ND	NS			
Site 6	ND	ND	ND			
Site 7			ND			
Site 8			ND			
Site 9			ND			

ND =Non Detectable
NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
Site 4 = Hindry Street
Site 5 = also known as Lennox or Felton School site
Site 6 = Hawthorne Air Monitoring Station
Site 7 = Imperial Street School
Site 8 = Wiseburn School Dist HQ
Site 9 = Cowan School

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
MONITORING AND ANALYSIS

AIR MONITORING STUDY IN THE AREA OF LOS ANGELES INTERNATIONAL AIRPORT

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APRIL 2000

LAX AREA AIR MONITORING-Follow Up Study

1,1-Dichloroethane (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	ND	ND	ND			
Site 2	ND	ND	ND			
Site 3	ND	ND	ND			
Site 4	ND	ND	ND			
Site 5	ND	ND	NS			
Site 6	ND	ND	ND			
Site 7			ND			
Site 8			ND			
Site 9			ND			

ND =Non Detectable
NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
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LAX AREA AIR MONITORING-Follow Up Study

1,3-Butadiene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	0.10	0.10	0.10	0.10	0.000	0.000
Site 2	0.30	0.30	0.40	0.33	0.058	0.115
Site 3	0.10	0.20	0.20	0.17	0.058	0.115
Site 4	0.20	0.20	0.30	0.23	0.058	0.115
Site 5	0.30	0.40	NS	0.35	0.071	0.141
Site 6	0.05	0.05	0.05	0.05	0.000	0.000
Site 7			0.05	0.05	0.000	0.000
Site 8			0.40	0.40	0.000	0.000
Site 9			0.05	0.05	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
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LAX AREA AIR MONITORING-Follow Up Study

1,1-Dichloroethene, Chloroform, 1,2-Dichloroethane, 1,2-Dibromoethane, p-Dichlorobenzene, o-Dichlorobenzene (ppbv)

Date (1999)

	9/10	9/14	9/16
Site 1	ND	ND	ND
Site 2	ND	ND	ND
Site 3	ND	ND	ND
Site 4	ND	ND	ND
Site 5	ND	ND	NS
Site 6	ND	ND	ND
Site 7			ND
Site 8			ND
Site 9			ND

ND =Non Detectable
NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
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1.0 ABSTRACT

During 1999, the South Coast Air Quality Management District (AQMD) performed sampling of ambient particulate matter (PM) and volatile organic compound (VOC) levels in the vicinity of the Los Angeles International Airport (LAX). Sampling was initially conducted at 11 residential and 3 "fixed" locations (listed in Table 1.1) to determine whether operations at LAX are impacting the air quality of communities near the airport. The AQMD conducted this study to address public concerns about air pollutants which may be attributed to LAX operations.

The initial study was conducted from June 2, 1999 through July 9, 1999. As a result of the data analysis from that period, an additional sampling program (follow-up study) was performed on September 10, 14, and 16, 1999. Table 1.2 lists the locations used in this follow-up study.

The advantage of a short-term study is that information can be quickly obtained and provided to the community in a timely fashion. Such information can be compared to long term sampling values from other locations. There are some drawbacks, however, with this approach. Due to the limited number of samples taken, risk assessments of toxic air contaminants are not appropriate because an estimate of true exposures requires, at minimum, a year-long study. It should also be noted that definitive conclusions regarding the exact sources of pollutants are difficult to determine due to limitations in current analytical technologies. However, even from this limited data set certain indications clearly exist.

The principal findings of this study are as follows:

- The key toxic contaminants detected are benzene, butadiene, and elemental carbon. (The latter is used as a surrogate for diesel particulates.)
- All key compounds are associated with mobile sources.
- All key compounds are lower at residential sites than at Aviation and Felton School sites, which are influenced by emissions from major arterials (Aviation Blvd. and 405 Freeway).
- Compared to the MATES-II Study, key compounds at residences north and south of the airport tend to be lower than the MATES-II monitoring network averages, while residences east of the airport tend to be near the network average.
- Fallout samples depict greater abundance of larger-than-PM_{10}-sized combusted oil soot particles than is observed at most other locations in the South Coast Air Basin.
- Limited sampling provides indicators of conditions. Longer term sampling is needed for more complete risk assessments.

LAX AREA AIR MONITORING-Follow Up Study

Chloroethene(VC), Carbon Tetrachloride (ppbv)

Date (1999)

	9/10	9/14	9/16
Site 1	ND	ND	ND
Site 2	ND	ND	ND
Site 3	ND	ND	ND
Site 4	ND	ND	ND
Site 5	ND	ND	NS
Site 6	ND	ND	ND
Site 7			ND
Site 8			ND
Site 9			ND

ND =Non Detectable
NS = No Sample
Detection Limit = 0.2 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
Site 4 = Hindry Street
Site 5 = also known as Lennox or Felton School site
Site 6 = Hawthorne Air Monitoring Station
Site 7 = Imperial Street School
Site 8 = Wiseburn School Dist HQ
Site 9 = Cowan School

TABLE 1.1

LAX Area Air Monitoring – Initial Study
Sampling Sites

Residential

Site 1 - 5300 Block of W. 98th St., Los Angeles

Site 2 - 1000 Block of S. Mansel Ave., Lennox

Site 3 - 10200 Block of S. 7th Ave., Inglewood

Site 4 - 4100 Block of W. 105th St., Lennox

Site 5 - 500 Block of E. Imperial Ave., El Segundo

Site 6 - 800 Block of Center St., El Segundo

Site 7 - 500 Block of Kansas St., El Segundo

Site 8 - 200 Block of Walnut Ave., El Segundo

Site 10 - 7500 Block of W. 89th St., Los Angeles

Site 11 - 7300 Block of W. 83rd St., Los Angeles

Site 12 - 7900 Block of Belton Dr., Los Angeles

Fixed Sites

Post Office on Aviation Blvd.

405 East - Also known as Lennox or Felton School

North - Cowan School

LAX AREA AIR MONITORING-Follow Up Study

Perchloroethylene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	0.05	0.05	0.05	0.05	0.000	0.000
Site 2	0.05	0.05	0.05	0.05	0.000	0.000
Site 3	0.05	0.05	0.10	0.07	0.029	0.058
Site 4	0.10	0.05	0.05	0.07	0.029	0.058
Site 5	0.05	0.05	NS	0.05	0.000	0.000
Site 6	0.05	0.05	0.20	0.10	0.087	0.173
Site 7			0.05	0.05	0.000	0.000
Site 8			0.05	0.05	0.000	0.000
Site 9			0.05	0.05	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
Site 4 = Hindry Street
Site 5 = also known as Lennox or Felton School site
Site 6 = Hawthorne Air Monitoring Station
Site 7 = Imperial Street School
Site 8 = Wiseburn School Dist HQ
Site 9 = Cowan School

TABLE 1.2

LAX Area Air Monitoring – Follow-up Study

Sampling Sites

Site 1 - 123rd and Aviation Blvd.

Site 2 - Post Office, 10600 Block of Aviation Blvd.

Site 3 - 405 West – 104th and Irwin St.

Site 4 - 200 Block of S. Hindry St.

Site 5 - 405 East – Also known as Lennox or Felton School
104th and Oceangate St.

Site 6 - AQMD's Hawthorne Air Monitoring Station
5200 Block of W. 120 St.

Site 7 - South – Imperial Street School
500 Block of Imperial Ave.

Site 8 - Wiseburn School District HQ
13500 Block of Aviation Blvd., Hawthorne

Site 9 - North – Cowan School
7600 Block of Cowan Ave.

2.0 PURPOSE AND SCOPE

As a result of community input during an AQMD Town Hall Meeting in Westchester in March 1999, the AQMD conducted an air monitoring program in the vicinity of the Los Angeles International Airport (LAX) and adjacent communities. Specifically, area residents expressed their concern and desire to know the emissions impact of aircraft during landing and take-off including fallout of particulate matter, the impact of LAX ground operations, and, if possible, to indicate the impact of the proposed expansion of LAX.

In response, the AQMD designed a sampling plan to attempt to address the communities' concerns regarding existing conditions. (While a monitoring program can provide useful information, it cannot measure impacts of future operations.) This plan was reviewed with the LAX Air Monitoring Advisory Group, a committee of local concerned individuals, commissioned at the request of AQMD.

The AQMD conducted an initial sampling study at 11 residential and 3 "fixed" locations. These sites are listed in Table 1.1. A second follow-up study was conducted using up to 9 sites.

LAX AREA AIR MONITORING-Follow Up Study

Elemental Carbon in ug/m^3

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	2.2	1.6	2.1	1.97	0.321	0.643
Site 2	5.7	4.3	6.4	5.47	1.069	2.139
Site 3	3.2	2.4	3.8	3.13	0.702	1.405
Site 4	3.6	3.2	5.1	3.97	1.002	2.003
Site 5	4.2	4.4	5.3	4.63	0.586	1.172
Site 6	1.5	0.8	1.3	1.20	0.361	0.721
Site 7			1.4	1.40	0.000	0.000
Site 8			3.7	3.70	0.000	0.000
Site 9			1.4	1.40	0.000	0.000

Detection Limit = 0.1 ug/m^3

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
Site 4 = Hindry Street
Site 5 = also known as Lennox or Felton School site
Site 6 = Hawthorne Air Monitoring Station
Site 7 = Imperial Street School
Site 8 = Wiseburn School Dist HQ
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Specific site locations are given in Table 1.2. Sampling was conducted to determine PM_{10}, carbon, and volatile organic compound (VOC) levels, including toxic compounds. Appendix A contains maps of the initial study sites; Appendix B, the follow-up study sites.

Initially the study design incorporated the use of 3 "fixed" sites and multiple residential sites. The fixed sites were utilized throughout the sampling program, whereas the residential locations were utilized for shorter timeframes. Three to four residential site samples were collected at each location over a 10-day period using portable sampling equipment that was relocated from one community to another.

Twenty-four-hour integrated air samples were collected in Tedlar® bags at the residential sites. Six-liter summa polished canisters were utilized at fixed sites. These samples analyzed for VOC using a gas chromatograph/mass spectrophotometer (GC/MS). Twenty-four-hour, integrated PM_{10} filter samples were collected at the Aviation and San Diego Freeway (405) east site using a high volume size selective inlet (SSI) sampler. These samples were analyzed for mass and carbon content. Detailed analysis method descriptions are given in Section 7.0.

When the data were analyzed at the conclusion of the first phase of the study, it became clear that supplementary sampling would be necessary to attempt to gain additional data regarding emission influence from vehicles traveling on both Aviation Blvd. and the 405 freeway. An added goal of this second phase was to again determine what, if any, impact operations at LAX may have on nearby air quality. Therefore, the second follow-up phase of sampling was conducted utilizing Tedlar® bags for VOC analysis and high volume SSI samples for PM_{10} mass and carbon content. Appendix B depicts the location of samples deployed in this follow-up study.

Samplers were located both well north and south of LAX but directly on the east side of Aviation Blvd. to assess the impact of vehicle emissions. The post office site on Aviation used in the initial study was again utilized as was the Felton School site west of the 405. Additionally, a new site immediately east of the 405 was used to assess both the impact from the 405 and also to evaluate, if possible, the "dilution" of emissions as function of distance. Two other sites not used in the first phase of the study were the AQMD's Hawthorne air monitoring station (AMS) and a site on Aviation Blvd. west of the AMS site. This pair of sites was employed to assess emissions from Aviation Blvd. and the dilution of emissions. The distances between these two sites and the pair at Aviation Post Office and west of the 405 were essentially identical and allowed for confirmation of observations through the data. For the last run in the follow-up study's three-run series, a sampler at Cowan School and Imperial Street School (south of LAX) were used as additional community-oriented sites.

Summary reports of the data collected for both phases of sampling and analysis can be found in the appendices.

APPENDIX E

FOLLOW-UP STUDY AIR MONITORING DATA

3.0 PROJECT DISCUSSION

With the concurrence of and input from the LAX Air Monitor Advisory Group, a sampling plan was devised. Sampling was conducted in an attempt to compare the impact of airport operations on communities north, east, and south of LAX. To do so, three rounds of sampling were conducted. Each round consisted of up to four, 24-hour integrated bag samples for VOCs and glass fall-out plates set out at 3 to 4 residences north, east, and south of the airport. This design was necessitated due to a limited number of integrated air samplers. Each group of residences (north, east, and south) was sampled in successive weeks. In other words during the first week, homes east of LAX were sampled. During the second week of monitoring samples were collected at homes to the north of the airport, and during the last week of sampling, at homes south of LAX.

These residential sites provided a direct comparison of areas to the north and south of the airport with areas east of the airport. This comparison allowed areas with presumed lower influence from LAX (north and south) to be compared with an area which may be more directly influenced by airport operations (east) because of prevailing wind directions. Further, area residents expressed concern that areas under the flight path were adversely impacted by landing aircraft. Residential sites east of LAX were selected to try to ascertain if this was occurring as well.

Concurrent with each residential sampling day, fixed sampling sites were also used. These were located at Felton School in Lennox, and at the post office parking lot on Aviation Blvd. immediately opposite LAX's southern runway used primarily for take-offs. About midway through the study a third fixed site was added at Cowan Elementary School. In total over 100 samples were collected over the month the initial study was conducted. Both VOC and PM_{10} samples were collected at the fixed sites, while VOCs and deposition samples were collected at the residences. The VOC data points provide a fixed site comparison for each of the residential site locations and show differences, if any, on a day-by-day basis.

Follow-up testing focused on gaining additional data to determine the influence of traffic emission on both Aviation Blvd. and the San Diego Freeway (405) on local air quality. An additional goal of this second phase was to again determine what, if any, impact operations at LAX may have on air quality.

In addition to reusing sites east of both Aviation Blvd. and the 405 Freeway, sampling was conducted at six other sites. A site immediately west of the 405 and the Felton School (Lennox) site were used to estimate the influence from vehicles on the 405 Freeway. Sites well to the north and south of LAX on Aviation Blvd. provided a comparison of sites away from the airport's influence which could be compared directly to those immediately east of the airport. Lastly, sampling sites were located at Cowan School (north) and Imperial Street School (south) on the last day of sampling to provide additional community sampling locations.

The follow-up study utilized Tedlar® bag samples for VOC determination and high volume SSI samplers for mass and carbon determination at all sites. Sampling was conducted for 8 hours from approximately 10 AM to 6 PM to assure that consistent measurement timeframes were utilized. This process enhances the comparability of data.

LAX AREA AIR MONITORING- Initial Study

o-Xylene (ppbv)

Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
							Date (1999)									
Lennox	0.05	0.4	0.2	0.1	0.2	0.1	0.05	0.2	0.05	0.1	0.1	0.3		0.15	0.110	0.219
Aviation	0.05	0.05	0.05	0.2	0.1	0.05	0.1	0.05	0.05	0.1	0.05		0.05	0.08	0.045	0.090
Cowan				0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.2	0.2		0.09	0.065	0.130
Site 1	0.05	0.2	0.1											0.12	0.076	0.153
Site 2	0.05	0.05												0.05	0.000	0.000
Site 3	0.05	0.05	0.1											0.07	0.029	0.058
Site 4	0.05	0.2	0.1											0.12	0.076	0.153
Site 5				0.05	0.05	0.1	0.1							0.08	0.029	0.058
Site 6				0.05	0.05	0.05								0.05	0.000	0.000
Site 7				0.05	0.3	0.05	0.05							0.11	0.125	0.250
Site 8				0.05	0.05	0.1	0.05							0.06	0.025	0.050
Site 10								0.05	0.05	0.05				0.05	0.000	0.000
Site 11								0.05	0.05					0.05	0.000	0.000
Site 12								0.05	0.05	0.05				0.05	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit = 0.1 ppb

Site 1 at 5322 W. 98th St. Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 540 E. Imperial Ave. , El Segundo
Site 6 at 825 Center St., El Segundo
Site 7 at 517 Kansas St.El Segundo
Site 8 at 208 Walnut Ave., El Segundo
Site 10 at 7503 W. 89th St. Los Angles
Site 11 at 7335 W 83rd St., Los Angles
Site 12 at 7931 Belton Drive Los Angles

4.0 TOPOGRAPHY

LAX is located approximately 12 miles southwest of the City of Los Angeles at an elevation approximately 100 feet above mean sea level (msl). Residential neighborhoods surround LAX on the north, east, and south. Areas of manufacturing and light industry are also located in close proximity to LAX. The closest major freeways are the 405 running almost north-south along LAX's eastern border and the east-west 105 Freeway to the south of LAX. Terrain in this area may be generally characterized as a relatively flat coastal plain with the Palos Verdes Hills rising to a peak elevation of 1,300 feet, four miles to the south.

5.0 CLIMATOLOGY

Late spring and early summer are characterized by stabilizing atmospheric conditions. Synoptic-scale wind systems are still apt to affect the area but the dominant features are strong temperature gradients caused by desert heating and cold waters along the coast. These conditions cause persistent coastal cloud cover. Further, the "Catalina eddy," a low-level cyclonic flow centered over Santa Catalina Island, is common during this period. This eddy produces a southeasterly flow that rotates counter-clockwise over Southern California waters. This pattern is responsible for frequent early morning fog along the coast, and occasional easterly component winds.

Two types of temperature inversions are found in the Basin: the surface inversion, produced by offshore descending air and nighttime radiational cooling, and the low-level elevated inversion, which caps the intruding marine layer. The latter is most frequent in June and July. In the spring and early summer months, clouds are still more persistent over coastal areas than other Basin regions.

Temperatures in June and July are typically much warmer in the inland valleys as compared to the coastal regions. Cool and persistent sea breezes dominate the daytime hours near the coast. Daytime temperatures near the coast typically are in the upper 60's to low 70's in June, and low to mid 70's in July. Rainfall is rare during these months.

6.0 SAMPLING METHODS

As detailed in Section 3.0 of this report, sampling was conducted at both residential and fixed sites. Sampling at residences were conducted using 24-hour battery-powered integrated bag samplers and glass deposition plates. Due to the availability of power and less concern for noise created by the sampling equipment, fixed sites used canister samplers and high-volume SSI samplers. No fallout plates were collected at fixed site locations. Appendix A shows the sampling locations used in this phase of the study.

Integrated air samplers were used to collect VOC samples in Tedlar® bags. High-volume size selective inlet (SSI) samplers were used to collect PM_{10} particulate matter (PM_{10}) samples for PM_{10} mass and carbon content determination. Canister samplers were employed to collect VOC samples in summa polished canisters, and glass plates were used to collect fallout (deposition) samples. Equipment and procedural descriptions follow.

LAX AREA AIR MONITORING-Initial Study

Ethylbenzene (ppbv)

Site	Date (1999) 6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
Lennox	0.05	0.20	0.05	0.10	0.20	0.05	0.05	0.10	0.05	0.05	0.05	0.20		0.10	0.066	0.131
Aviation	0.05	0.05	0.05	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.014	0.029
Cowan				0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.000	0.000
Site 1	0.05	0.20	0.10											0.12	0.076	0.153
Site 2	0.05	0.05												0.05	0.000	0.000
Site 3	0.05	0.05	0.10											0.07	0.029	0.058
Site 4	0.05	0.20	0.10											0.12	0.076	0.153
Site 5				0.05	0.05	0.05	0.05							0.05	0.000	0.000
Site 6				0.05	0.05	0.05								0.05	0.000	0.000
Site 7				0.05	0.10	0.05								0.07	0.029	0.058
Site 8				0.05	0.05	0.05	0.05							0.05	0.000	0.000
Site 10								0.05	0.05	0.05				0.05	0.000	0.000
Site 11								0.05	0.05					0.05	0.000	0.000
Site 12								0.05	0.05	0.05				0.05	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

Integrated Ambient Air Samplers for Volatile Organic Compounds (VOCs)

Two types of integrated ambient air samplers were used to draw quantifiable amounts of air for subsequent laboratory analysis. One sampler consists of a pump with a non-lubricated Viton rubber diaphragm, a borosilicate flow meter, and an internal power supply (battery). Ambient air samples were drawn into 15-liter EPA-approved Tedlar® bags which are housed in light-sealed cardboard boxes, using a battery-powered pump system. Tedlar® is a Dupont trade name for polyvinyl fluoride. During sampling, ambient air traverses either Teflon or stainless steel surfaces to minimize sample contamination and reactivity. The pump can move 10 cubic centimeters per minute of air into the evacuated bag over a 24-hour period. The Tedlar® bags were returned to the lab following chain-of-custody protocols. At the laboratory the air samples were analyzed by GC/MS for specific VOCs shown in Table 6.1. All concentrations are expressed as parts per billion volume (ppbv).

The second method used to sample VOCs utilized passivated (summa-polished) stainless steel 6-liter canisters. Canisters were evacuated and leak checked in the laboratory prior to use in the field. Air enters the canister through a pump and flow controller. The sampler is programmed such that over a predetermined period of time, up to 24 hours, the canister will be filled to approximately 7 psi. Unlike the bag sampler, these samplers are not battery powered and require a 110v power source but do offer more flexibility in programming. Once a sample is collected the canister is removed from the sampler and returned to the lab. As with the bag samples, all chain-of-custody protocols are followed, and the sample is analyzed on the GC/MS for the same VOCs at ppbv levels.

The design of the initial study included the use of Tedlar® bag samplers to collect 24-hour integrated samples at each of the residential sites as well as 8-hour integrated samples at the Aviation Blvd location. Six-liter electropolished (summa-polished) stainless steel bulbs were used to collect samples at the Felton School site. Sampling at Cowan School was initially conducted using Tedlar® bags, but later in the sampling program was switched to stainless steel bulbs after the arrival of the sampling container. The Cowan site was selected to serve as a background site.

VOCs were sampled and analyzed since many organic compounds are known to have health effects. For example, benzene and 1,3-butadiene have been declared a carcinogen by the both the USEPA and ARB. VOCs are emitted from a variety of sources such as industry, mobile sources, paints, and households. Certain compounds such as chlorinated hydrocarbons are indicators of solvent usage. Other species such as benzene and 1,3-butadiene are the result of the combustion of fossil fuels primarily in mobile sources such as buses, trucks, automobiles and aircraft

LAX AREA AIR MONITORING-Initial Study

Methylene Chloride (ppbv)

Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
							Date (1999)									
Lennox	0.05	0.30	0.10	0.10	0.10	0.20	0.05	0.05	0.10	0.20	0.05	0.30		0.13	0.094	0.187
Aviation	0.05	0.05	0.05	0.20	0.05	0.10	0.05	0.10	0.05	0.20	0.05		0.05	0.08	0.058	0.115
Cowan				0.20	0.20	0.30	0.30	0.20	0.05	0.20	0.05	0.30		0.20	0.097	0.194
Site 1	0.05	0.30	0.20											0.18	0.126	0.252
Site 2	0.05	0.10												0.08	0.035	0.071
Site 3	0.20	0.10	0.30											0.20	0.100	0.200
Site 4	0.05	0.30	0.20											0.18	0.126	0.252
Site 5				0.10	0.10	0.30	0.20							0.18	0.096	0.191
Site 6				0.30	0.20	0.30								0.27	0.058	0.115
Site 7				0.20	0.20	0.20								0.20	0.000	0.000
Site 8				0.20	0.10	0.30	0.20							0.20	0.082	0.163
Site 10								0.10	0.20	0.20				0.17	0.058	0.115
Site 11								0.20	0.05					0.13	0.106	0.212
Site 12								0.05	0.10	0.20				0.12	0.076	0.153

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

TABLE 6.1

COMPOUNDS MEASURED

	Chemical Name
Gases:	Benzene
	Butadiene
	Dichlorobenzene [ortho & para]
	Vinyl chloride
	Ethyl benzene
	Toluene
	Xylene [m-,p-,o-]
	Styrene
	Carbon tetrachloride
	Chloroform
	Dichloroethane [1,1]
	Dichloroethylene [1,1]
	Methylene chloride
	Perchloroethylene (Tetrachloroethene)
	Trichloroethylene
	Chloromethane
Particulates:	Elemental and Organic Carbon

SSI PM_{10} Sampler

The SSI sampler used in this study is the EPA's federal reference method (FRM) sampler found in 40CFR50 Appendix J. It is used to monitor PM less than 10 microns in size (PM_{10}). For the purposes of this study, the SSI samplers are used to collect PM_{10} samples which were also used for the determination of organic carbon (OC), elemental carbon (EC), and total carbon.

The SSI sampler is a pump controlled by a programmable timer. An elapsed time accumulator, linked in parallel with the pump, records total pump-operation time in hours. A known quantity of air is first drawn through a particle size separator and then through a quartz filter medium. Particle separation was achieved by impaction. The filter was weighed before and after sampling in controlled conditions to determine mass per volume of air sampled. The correct flow rate through the inlet is critical to the collection of the correct particle size. A programmable timer automatically turned the pump off at the end of each sampling period.

Once a sample has been collected it is returned to the laboratory, following chain-of-custody protocols, where both the PM_{10} mass and carbon content is determined. Ambient PM_{10} mass per cubic meter (ug/m3) is determined by subtracting the weight of the clean unsampled filter from the weight of the sampled filter, to yield the mass of the PM_{10} collected on the filter. This mass is then divided by the amount of air drawn through the filter to give the ambient concentration.

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Styrene (ppbv)

	Date (1999)															
Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
Lennox	0.05	0.1	0.1	0.2	0.2	0.05	0.2	0.2	0.05	0.1	0.05	0.3		0.13	0.083	0.167
Aviation	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.1	0.05	0.1	0.05		0.05	0.07	0.045	0.090
Cowan				0.2	0.2	0.8	0.1	0.2	0.1	0.3	0.2	0.2		0.26	0.213	0.426
Site 1	0.2	0.2	0.2											0.20	0.000	0.000
Site 2	0.1	0.1												0.10	0.000	0.000
Site 3	0.3	0.1	0.5											0.30	0.200	0.400
Site 4	0.05	0.2	0.3											0.18	0.126	0.252
Site 5				0.05	0.1	0.1	0.3							0.14	0.111	0.222
Site 6				0.2	0.1	0.1								0.13	0.058	0.115
Site 7				0.4	0.2	0.05								0.22	0.176	0.351
Site 8				0.1	0.2	0.4	0.2							0.23	0.126	0.252
Site 10								0.05	0.2	0.1				0.12	0.076	0.153
Site 11								0.1	0.05					0.08	0.035	0.071
Site 12								0.05	0.05	0.1				0.07	0.029	0.058

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

Ambient carbon levels are determined by taking a small portion of the PM_{10} filter and putting it into a carbon analyzer. The analyzer consists of a computer-controlled programmable oven, computer controlled gas flows, a laser, and a flame ionization detector (FID). The sample is heated in the oven in the presence of increasing amounts of oxygen. As the temperature rises, first organic carbon and then elemental carbon are evolved off the filter. The percentage of the transmitted laser beam intensity increases at the detector as carbon leaves the filter and it becomes less black. Likewise the FID detects carbon (in the form of methane) through the heating process. The computer which controls all these processes collects data on the temperature profile, laser light absorption, and FID response, to determine the EC and OC content of the filter. This information, combined with the volume of air sampled, provides the EC and OC concentration in the ambient air.

Elemental carbon (EC) was sampled and analyzed because it is an indicator of diesel particulate which has recently been declared a toxic air contaminant by the ARB. It is not known how much, if any, EC in the ambient air is due to aircraft emissions.

<u>Glass Plates</u>

Glass plates were used to collect deposition or fallout samples. These plates were located at each residential site and samples were collected concurrently with Tedlar® bag samples for VOCs. For each sample, a 48-hour to 72-hour collection period was utilized. Three or four deposition samples were collected at each residence and then returned to the lab where they were examined under polarized light microscopy (PLM) to evaluate the types and size of particulate deposited on the plate. Samples are characterized by the amount of material deposited on the plate (i.e. heavy, moderate, or light) and the amount of each type of particle deposited (i.e. >5%, 1-5%, and < 1% or trace).

7.0 METEOROLOGICAL DISCUSSION

In general, the weather during the study followed a normal seasonal pattern. The clouds present during the morning hours dispersed to few or no clouds by the afternoon. During the sampling periods, airflow in the vicinity of LAX was predominantly west-southwesterly during the day into the evening, but light easterly flow occurred during night and morning hours on some sampling days. On most sampling days, the daytime wind speeds were moderate, not high. Temperature inversion conditions varied, and the associated potential for trapping pollutants near the ground varied as well.

In Table 7.1, the characterization of the vertical temperature profiles as depicted by inversion conditions, and an estimated potential concentration level are identified.

LAX AREA AIR MONITORING-Initial Study

Toluene (ppbv)

Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
	Date (1999)															
Lennox	0.6	3.1	1.4	0.9	1.2	0.8	1.0	1.0	0.9	0.8	0.6	1.7		1.17	0.687	1.373
Aviation	0.4	0.5	0.4	1.5	0.7	0.6	0.5	0.6	0.5	0.6	0.6		0.5	0.62	0.292	0.584
Cowan				0.6	0.6	0.6	0.6	0.6	0.3	0.5	0.2	0.9		0.54	0.201	0.401
Site 1	0.5	1.4	1.1											1.00	0.458	0.917
Site 2	0.5	0.7												0.60	0.141	0.283
Site 3	0.6	0.7	1.2											0.83	0.321	0.643
Site 4	0.6	1.4	1.4											1.13	0.462	0.924
Site 5				0.5	0.7	0.8	0.5							0.63	0.150	0.300
Site 6				0.5	0.7	0.6								0.60	0.100	0.200
Site 7				0.7	0.9	0.5								0.70	0.200	0.400
Site 8				0.5	0.8	0.5	0.4							0.55	0.173	0.346
Site 10								0.2	0.3	0.4				0.30	0.100	0.200
Site 11								0.7	0.3					0.50	0.283	0.566
Site 12								0.3	0.3	0.4				0.33	0.058	0.115

Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

TABLE 7.1 Temperature Inversion Characteristics and Pollutant Concentration Potential

Date	Elevated Inversion Height (ft)	Inversion Strength	Concentration Potential
6/2	4400	Weak	Low
6/4	None	None	Low
6/5	3800	Weak	Low
6/8	2900	Moderate	Low
6/11	2500	Moderate	Low
6/15	1300	Strong	High
6/17	1700	Strong	High
6/23	1500	Moderate	Moderate
6/25	1600	Moderate	Moderate
6/29	1500	Strong	High
7/1	2000	Strong	Moderate
7/6	1400	Strong	High
7/8	1000	Moderate	Moderate
7/9	800	Weak	Low
9/10	1200	Moderate	Moderate
9/14	600	Moderate	Moderate
9/16	2100	Strong	Moderate

8.0 DATA SUMMARY RESULTS AND DISCUSSION

A discussion of each of the sampling analysis types follows. Data sets by site for the samples are included in the appendices.

8.1 Microscopic Data Summary

The photomicrographs shown in Appendix C are representative of the fallout samples collected in this study. In general, particulates found are typical of those observed at other residential locations throughout the Basin. The samples were largely comprised of crystal-abundant material, such as quartz and mica, and tire rubber. However, a noteworthy exception were combusted oil soot particles which were generally greater than 50 microns in size. While soot particles are normally found in fallout samples taken throughout the Basin, the size and number of such particles were distinctly different than those observed elsewhere. Another difference between the particles seen near LAX and those found elsewhere in the Basin is that the particles taken near LAX appear to be pitted. This is indicative of particles created at high temperatures.

While difficult to know for certain, it would appear that the observation detailed above would suggest aircraft as the source of these larger soot particles. Specifically, given the typical prevailing winds, nighttime flows, and sample collection duration (48-72 hours), and the

LAX AREA AIR MONITORING-Initial Study

Benzene (ppbv)

Site	Date (1999) 6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
Lennox	0.7	1.9	1.0	0.5	0.5	0.8	0.7	0.8	0.8	0.7	0.8	1.2		0.87	0.377	0.755
Aviation	0.3	0.6	0.6	1.7	0.9	0.5	0.5	0.7	0.7	0.7	0.4		0.6	0.68	0.356	0.713
Cowan				0.4	0.2	0.4	0.4	0.2	0.2	0.4	0.2	0.7		0.34	0.167	0.333
Site 1	0.2	0.5	0.5											0.40	0.173	0.346
Site 2	0.2	0.4												0.30	0.141	0.283
Site 3	0.2	0.3	0.5											0.33	0.153	0.306
Site 4	0.3	0.6	0.4											0.43	0.153	0.306
Site 5				0.4	0.3	0.7	0.3							0.43	0.189	0.379
Site 6				0.4	0.3	0.6								0.43	0.153	0.306
Site 7				0.4	0.3	0.3								0.33	0.058	0.115
Site 8				0.4	0.4	0.4	0.2							0.35	0.100	0.200
Site 10								0.2	0.2	0.3				0.23	0.058	0.115
Site 11								0.3	0.2					0.25	0.071	0.141
Site 12								0.1	0.3	0.4				0.27	0.153	0.306

Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
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Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

uniqueness of these particles to this area of the basin, aircraft seem the most likely source. Further, because of rather even distribution in the communities around LAX, it further suggests that aircraft aloft (either ascending or descending) may be the source of these particles. It should be noted however, that these particles are much larger than the sizes established by both the USEPA and the California Air Resources Board for health-based standards (at 10 microns or less). This is because particles greater than 10 microns are typically captured and expelled by the human respiratory system. Those larger particles may, in large enough concentration, trigger symptoms similar to allergies, and may cause a nuisance by the deposition of particles on surfaces (e.g., cars, patio furniture, etc.)

8.2 Hydrocarbon Data Summary

The community-oriented areas to the north and east of LAX showed lower levels of chlorinated VOCs (hydrocarbons that contain one or more chlorine atoms, also known as halocarbons) than to the south of LAX. Chlorinated VOCs are of interest since they are used in industrial processes, typically as solvents and degreasers, and are not emitted by either mobile sources or other combustion sources. During this study, most chlorinated VOCs were not found at levels above the method detection limits (usually 0.1 ppbv). The levels of halocarbons found were generally lower than the levels detected in the MATES II program. The only chlorinated hydrocarbon species consistently detected were perchloroethylene, methylene chloride and chloromethane. Perchloroethylene is typically associated with dry cleaning operations; the other two compounds are usually found in industrial applications such as parts cleaning.

Of other VOCs (non-chlorinated) measured, all but styrene are typically emitted by mobile sources. Those include benzene, 1,3 butadiene, toluene, ethylbenzene, and ortho, meta, and para (o,m,p-) xylene. Styrene is indicative of resin manufacturing and use, rather than mobile sources.

Samples collected in the initial study both north and south of the airport typically showed lower concentrations of VOCs than did samples collected east of LAX. This trend held for all mobile source related compounds except benzene, for which the areas east and south of the airport showed comparable values. These results were not altogether unexpected given that the prevailing wind at the time of the study was west to east, and areas east of the airport are influenced by major traffic corridors which generally do not impact areas north and south of the airport under these wind conditions. However, given the design of the initial study, it was not possible to characterize or differentiate the VOC contribution from either the airport or the major arterials.

In an effort to better characterize the contribution of both Aviation Blvd and the 405 Freeway, and differentiate them from those of LAX, a follow-up study was conducted. This study included up to nine sites. Sites were selected on the east side of Aviation Blvd opposite LAX's runways and both immediately west and east of the 405 freeway. Additional samples were collected on the eastern side of Aviation but well north and south of LAX in an effort to characterize and contrast sites with and without an airport influence. All samples were collected over the same 8-hour period and returned to the AQMD's lab for immediate analysis. Appendix B shows the location of follow-up study sites.

LAX AREA AIR MONITORING-Initial Study

Trichloroethene (ppbv)

	Date (1999)															
Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
Lennox	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Aviation	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND			
Cowan				0.05	0.05	0.10	0.05	0.05	0.05	0.05	0.05	0.05		0.06	0.017	0.033
Site 1	ND	ND	ND													
Site 2	ND	ND														
Site 3	ND	ND	ND													
Site 4	ND	ND	ND													
Site 5				ND	ND	ND	ND									
Site 6				ND	ND	ND										
Site 7				0.05	0.20	0.20								0.15	0.087	0.173
Site 8				ND	ND	ND	ND									
Site 10								ND	ND	ND						
Site 11								ND	ND							
Site 12								ND	ND	ND						

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

In general, sites 4 and 1, to the north and south of LAX, consistently showed lower levels of VOCs than the other sites. An evaluation of the follow-up study's north-to-south data along Aviation Blvd. (sites 4, 2, 1, and 8 respectively) revealed that site 8 located at the Wiseburn School District on Aviation Blvd. had the highest levels of VOCs. Site 2, immediately east of LAX, had the next highest VOC concentrations. While site 8 was expected to have low VOC values, both monitoring staff and speakers at a subsequent town hall meeting report dense traffic in the area of site 8. This traffic, made up of gasoline- and diesel-powered vehicles, could yield elevated VOC levels. It was also noted that there was a refinery upwind of this site.

Additional samples were collected at site 8 and one block west of site 8 (Chapman Way) to establish whether the industrial or mobile sources were responsible for the elevated VOC levels found. Two days of monitoring on October 7 and 8 were conducted. Winds on October 7 (Figure 1) were not typical of the direction of the prevailing winds found during earlier portions of the study, having a large south-southwest and southern component. This would be more parallel to the roadway, and would not provide a good evaluation of the roadway's influence. (To determine the influence of a source, monitors must be upwind and downwind of the source.) The data collected therefore was not used to evaluate influences to site 8.

Winds on October 8 (Figure 2) were consistent with typical prevailing wind conditions found earlier in the study with west-southwesterly winds as a primary component. Data at the Chapman Way site was consistent with background site (sites 7 and 9) averages for VOCs including benzene, 1,3 butadiene. Site 8 data were elevated over Chapman Way data consistent with increases seen across other areas of Aviation Blvd. and the 405 Freeway. It is believed therefore that levels of VOCs measured at site 8 are the result of mobile source emissions rather than the nearby industrial areas.

An evaluation of the follow-up study's west-to-east data, paralleling the prevailing wind, yields data regarding traffic-related pollution and dilution of the contaminants over a short distance. The data were considered in two west-to-east sets. One set consisting of sites 2, 3, and 5 was immediately east of LAX. The other set, sites 1 and 6, was located south of LAX and provided a comparison without a potential influence of the airport.

Using benzene and 1,3 butadiene as the indicators of mobile source activity, clear trends in the west-to-east data emerge. Background sites to the north and south of LAX showed lower levels of VOCs than did sampling locations to the east of these sites. The background sites, on average, were also consistent with respect to the levels of contaminants found. VOC levels were elevated at all locations on the east side of Aviation Blvd. Levels were typically 2 to 3 times higher on average than they were at background locations.

Moving west-to-east, benzene levels measured at site 2 (east of LAX) increased slightly as measured immediately west of the 405 freeway, and increased again directly east of the freeway. South of LAX, site 1 showed elevated benzene levels east of Aviation Blvd over background values; however, a short distance away at site 6, values returned to background levels. A map showing benzene data, averaged over the follow-up study period, is presented in Figure 3.

For 1,3 butadiene a slightly different though not inconsistent picture emerges. Again, background levels were lower and consistent both north and south of LAX as compared to all other sites. At all but site 1, downwind 1,3 butadiene levels increased 2 to 3 times over background levels across Aviation Blvd. Immediately opposite LAX, values of 1,3 butadiene

LAX AREA AIR MONITORING-Initial Study

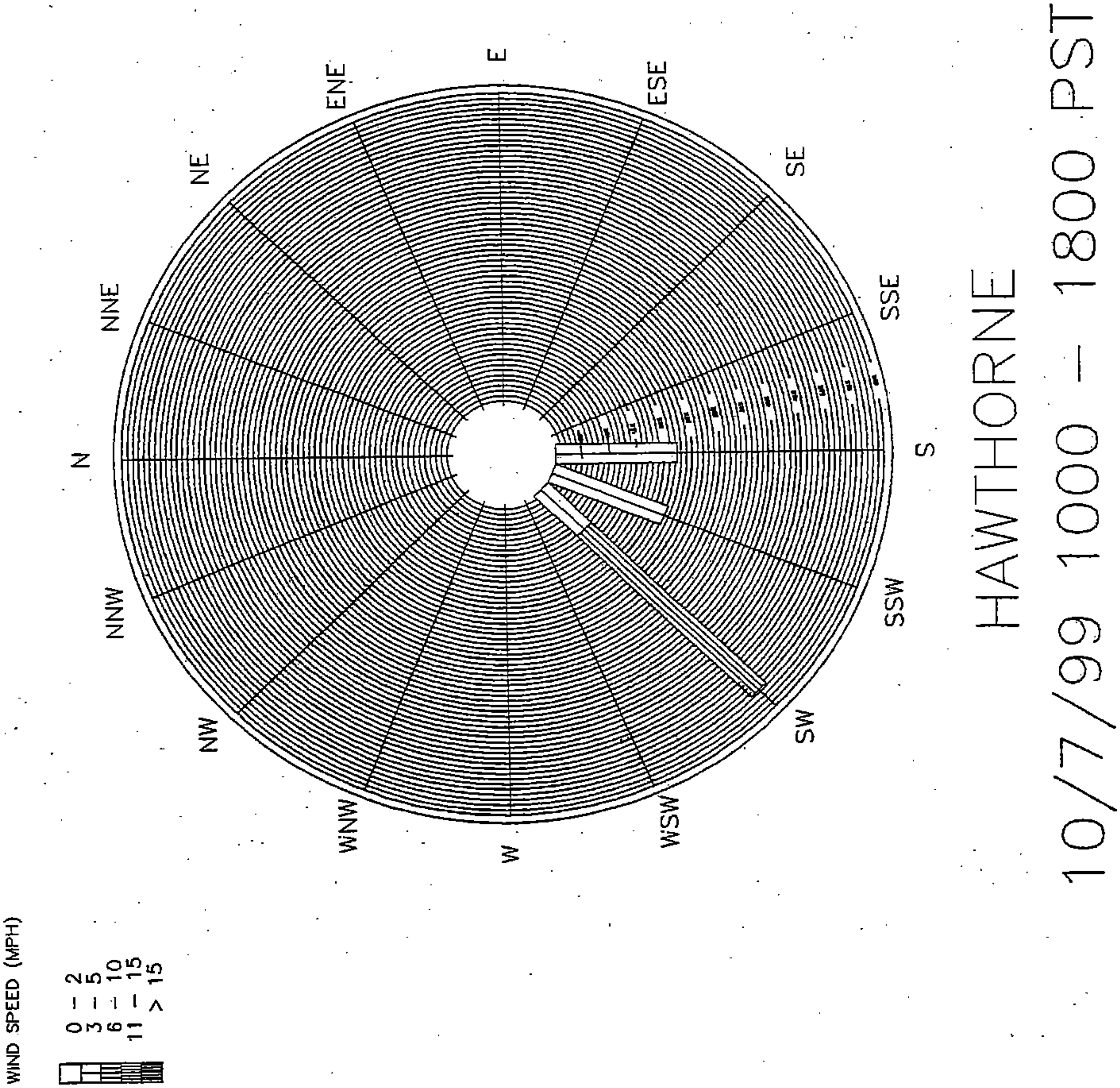
1,1-Dichloroethane (ppbv)

Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
							Date (1999)									
Lennox	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Aviation	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND			
Cowan				ND	ND	ND	ND	ND	ND	ND	ND	ND				
Site 1	ND	ND	ND													
Site 2	ND	ND														
Site 3	ND	ND	ND													
Site 4	ND	ND	ND													
Site 5				ND	ND	ND	ND									
Site 6				ND	ND	ND										
Site 7				0.05	0.10	0.05								0.07	0.029	0.058
Site 8				ND	ND	ND	ND									
Site 10								ND	ND	ND						
Site 11								ND	ND							
Site 12								ND	ND	ND						

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

Figure 1


HAWTHORNE
10/7/99 1000 – 1800 PST
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
WIND SPEED (MPH)
0 – 2
3 – 5
6 – 10
11 – 15
> 15

LAX AREA AIR MONITORING-Initial Study

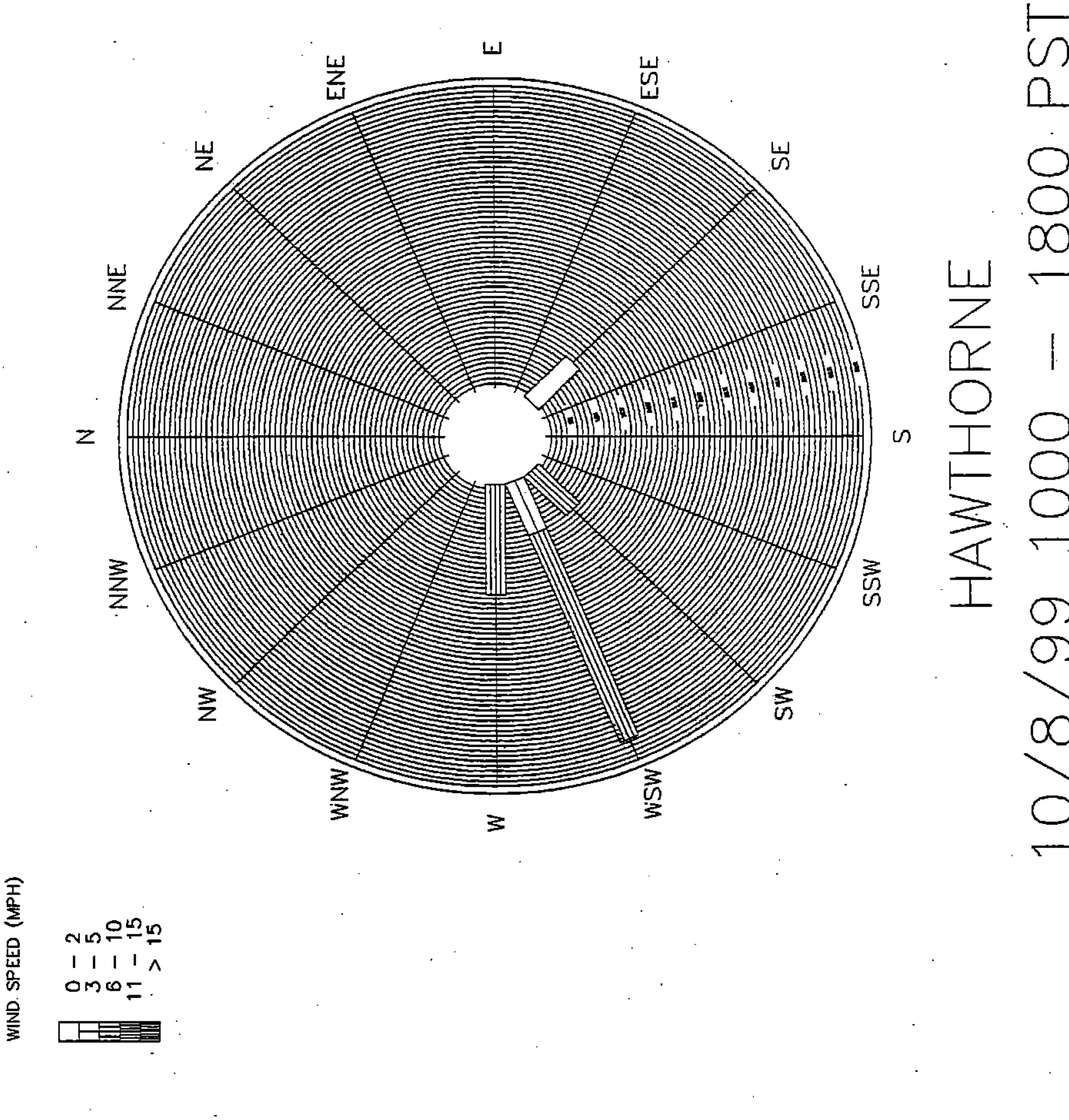
1,3-Butadiene (ppbv)

Site	Date (1999) 6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
Lennox	0.18	0.29	0.20	0.11	0.15	0.15	0.18	0.20	0.24	0.18	0.20	0.24		0.19	0.048	0.095
Aviation	0.11	0.15	0.18	0.40	0.26	0.15	0.18	0.20	0.24	0.22	0.18	0.00	0.20	0.19	0.090	0.180
Cowan				0.05	0.05	0.05	0.10	0.05	0.05	0.05	0.05	0.10		0.06	0.022	0.044
Site 1	0.05	0.10	0.11											0.09	0.032	0.064
Site 2	0.05	0.05												0.05	0.000	0.000
Site 3	0.05	0.05	0.13											0.08	0.047	0.095
Site 4	0.05	0.10	0.11											0.09	0.032	0.064
Site 5				0.05	0.05	0.10	0.05							0.06	0.025	0.050
Site 6				0.05	0.05	0.10								0.07	0.029	0.058
Site 7				0.05	0.05	0.05								0.05	0.000	0.000
Site 8				0.05	0.05	0.05	0.05							0.05	0.000	0.000
Site 10								0.05	0.05	0.05				0.05	0.000	0.000
Site 11								0.05	0.05					0.05	0.000	0.000
Site 12								0.05	0.05	0.05				0.05	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

Figure 2



WIND SPEED (MPH)
0 – 2
3 – 5
6 – 10
11 – 15
> 15
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
HAWTHORNE
10/8/99 1000 – 1800 PST

LAX AREA AIR MONITORING-Initial Study

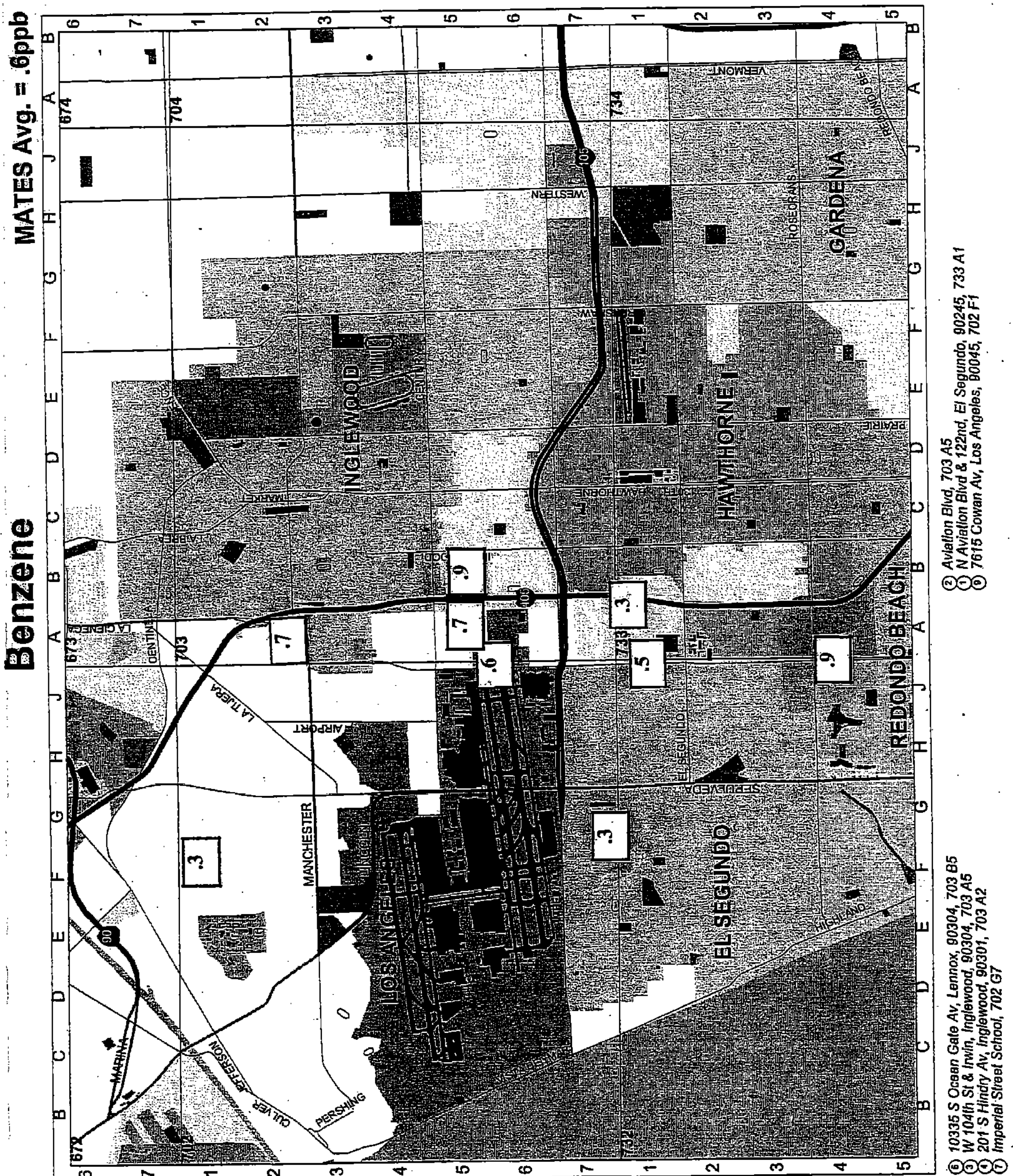
1,1-Dichloroethene, Chloroform, 1,2-Dichloroethane, 1,2-Dibromoethane, p-Dichlorobenzene, o-Dichlorobenzene (ppbv)

	Date (1999)												
Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9
Lennox	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Aviation	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND
Cowan				ND	ND	ND	ND	ND	ND	ND	ND	ND	
Site 1	ND	ND	ND										
Site 2	ND	ND											
Site 3	ND	ND	ND										
Site 4	ND	ND	ND										
Site 5				ND	ND	ND	ND						
Site 6				ND	ND	ND							
Site 7				ND	ND	ND							
Site 8				ND	ND	ND	ND						
Site 10								ND	ND	ND			
Site 11								ND	ND				
Site 12								ND	ND	ND			

ND= Non Detectable
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

Figure 3


Benzene
MATES Avg. = .6ppb
INGLEWOOD
HAWTHORNE
GARDENA
EL SEGUNDO
REDONDO BEACH
LOS ANGELES
MANCHESTER
Aviation Blvd, 703 A5
N Aviation Blvd & 122nd, El Segundo, 90245, 733 A1
7615 Cowan Av, Los Angeles, 90045, 702 F1
10335 S Ocean Gate Av, Lennox, 90304, 703 B5
W 104th St & Irwin, Inglewood, 90304, 703 A5
201 S Hindry Av, Inglewood, 90301, 703 A2
Imperial Street School, 702 G7
©1997 Thomas Bros. Maps

LAX AREA AIR MONITORING-Initial Study

Chloroethene(VC), Carbon Tetrachloride (ppbv)

Site	Date (1999) 6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9
Lennox	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Aviation	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND
Cowan				ND	ND	ND	ND	ND	ND	ND	ND	ND	
Site 1	ND	ND	ND										
Site 2	ND	ND											
Site 3	ND	ND	ND										
Site 4	ND	ND	ND										
Site 5				ND	ND	ND	ND						
Site 6				ND	ND	ND							
Site 7				ND	ND	ND							
Site 8				ND	ND	ND	ND						
Site 10								ND	ND	ND			
Site 11								ND	ND				
Site 12								ND	ND	ND			

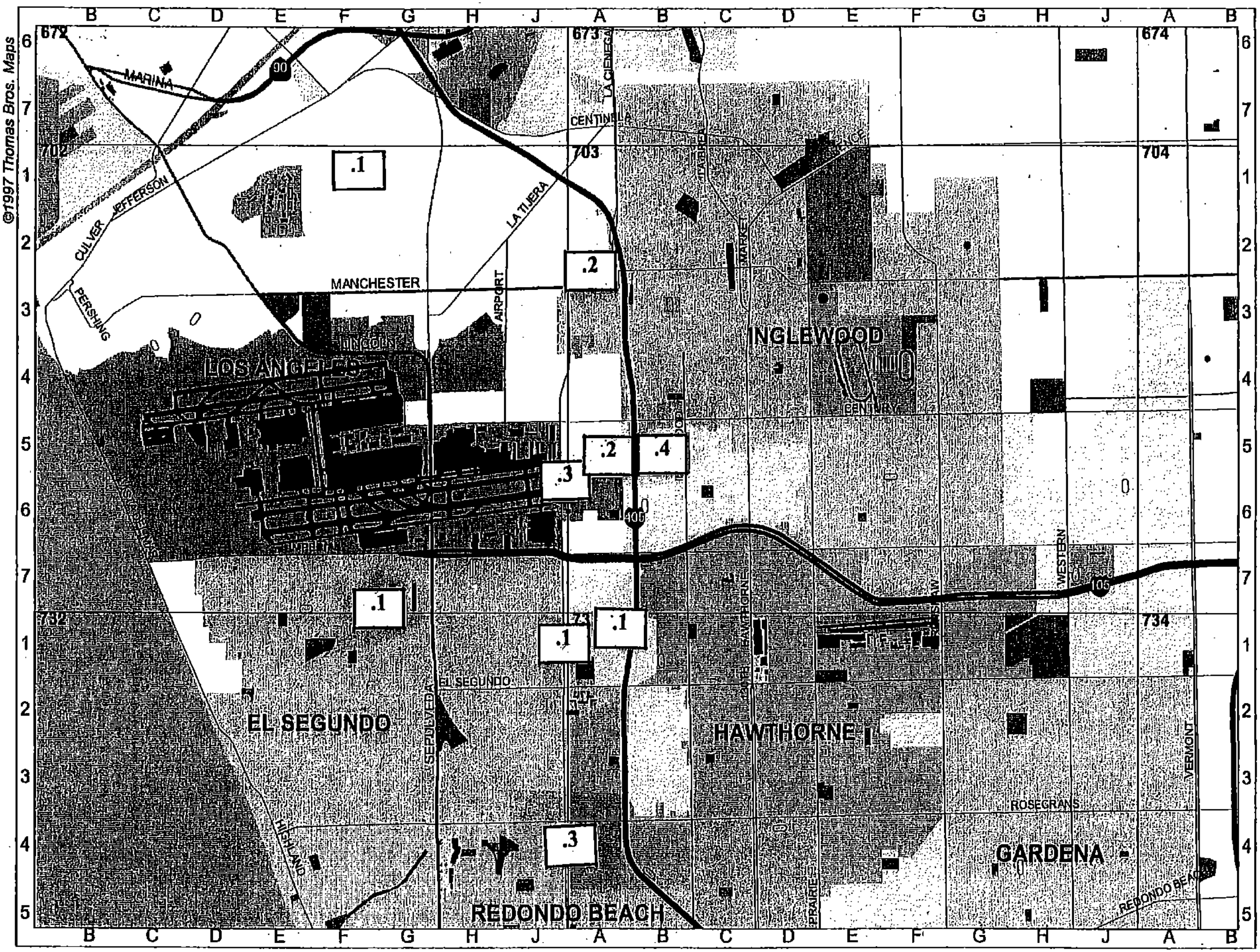
ND= Non Detectable
Detection Limit= 0.2 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

Figure 4

1,3-Butadiene

MATES Avg. = .2 ppb



⑤ 10335 S Ocean Gate Av, Lennox, 90304, 703 B5
③ W 104th St & Irwin, Inglewood, 90304, 703 A5
④ 201 S Hindry Av, Inglewood, 90301, 703 A2
⑦ Imperial Street School, 702 G7
② Aviation Blvd, 703 A5
① N Aviation Blvd & 122nd, El Segundo, 90245, 733 A1
⓪ 7615 Cowan Av, Los Angeles, 90045, 702 F1

LAX AREA AIR MONITORING-Initial Study

Perchloroethylene (ppbv)

Site	6/2	6/4	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
							Date (1999)									
Lennox	0.05	0.7	0.2	0.2	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.2		0.14	0.188	0.376
																0.000
Aviation	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.10	0.000	0.000
																0.000
Cowan				0.05	0.05	0.4	0.05	0.05	0.05	0.05	0.05	0.2		0.11	0.121	0.242
																0.000
Site 1	0.05	0.2	0.1											0.12	0.076	0.153
Site 2	0.05	0.05												0.05	0.000	0.000
Site 3	0.05	0.05	0.05											0.05	0.000	0.000
Site 4	0.05	0.1	0.1											0.08	0.029	0.058
Site 5				0.05	0.05	0.1	0.1							0.08	0.029	0.058
Site 6				0.05	0.05	0.05								0.05	0.000	0.000
Site 7				0.05	0.6	0.6								0.42	0.318	0.635
Site 8				0.05	0.05	0.05	0.3							0.11	0.125	0.250
Site 10								0.05	0.05	0.05				0.05	0.000	0.000
Site 11								0.05	0.05					0.05	0.000	0.000
Site 12								0.05	0.05	0.05				0.05	0.000	0.000

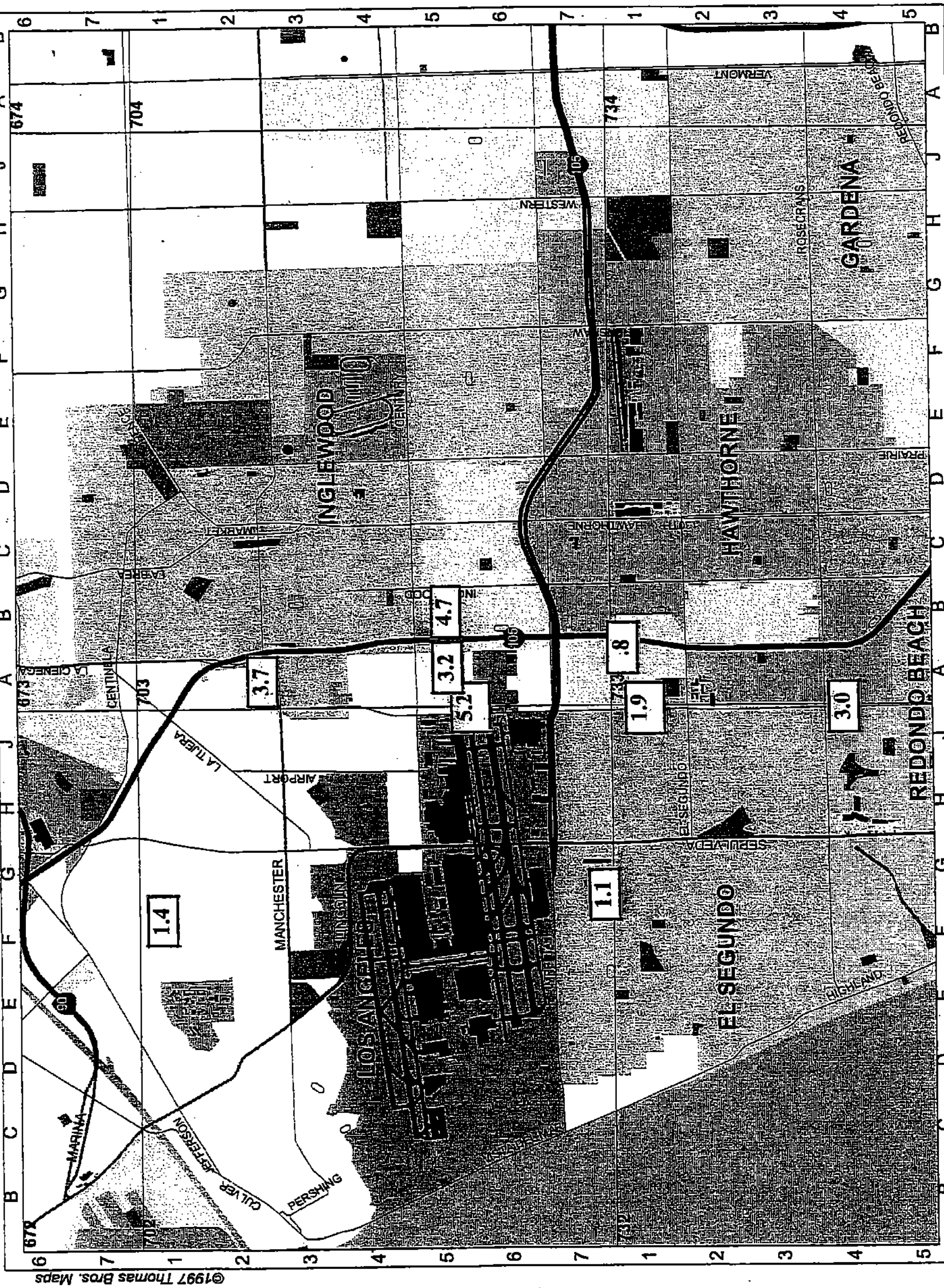
0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
Detection Limit= 0.1 ppbv

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

Figure 5

Elemental Carbon

MATES Avg. = 2.95 ug/cm



(6) 10335 S Ocean Gate Av, Lennox, 90304, 703 B5
(3) W 104th St & Irwin, Inglewood, 90304, 703 A5
(4) 201 S Hindry Av, Inglewood, 90301, 703 A2
(7) Imperial Street School, 702 G7

(2) Aviation Blvd, 703 A5
(1) N Aviation Blvd & 122nd, El Segundo, 90245, 733 A1
(8) 7615 Cowan Av, Los Angeles, 90045, 702 F1

LAX AREA AIR MONITORING-Initial Study

Elemental Carbon in ug/m^3

Site	Date (1999) 6/2	6/4	6/5	6/8	6/11	6/15	6/17	6/23	6/25	6/29	7/1	7/6	7/8	7/9	Ave	Std Dev	95% Confidence
Lennox	1.9		2.3	2.2	2.0	2.7	3.5	3.1	2.4	2.4	3.0	2.4	3.4		2.61	0.530	1.060
Aviation	5.2	4.6		4.7	4.8	4.6	6.1	4.1	4.3	4.4	5.3	3.7		4.7	4.71	0.619	1.237
Cowan											1.1	0.3	1.5		0.97	0.611	1.222
Site 1																	
Site 2																	
Site 3																	
Site 4																	
Site 5																	
Site 6																	
Site 7																	
Site 8																	
Site 10																	
Site 11																	
Site 12																	

Detection Limit = 0.1 ug/m^3

Site 1 at 5300 block of W. 98th St., Los Angeles
Site 2 at 10600 block of S. Mansel Ave., Lennox
Site 3 at 10200 block of S. 7th Ave., Inglewood
Site 4 at 4100 block of W. 105th St., Lennox
Site 5 at 500 block of E. Imperial Ave., El Segundo
Site 6 at 800 block of Center St., El Segundo
Site 7 at 500 block of Kansas St., El Segundo
Site 8 at 200 block of Walnut Ave., El Segundo
Site 10 at 7500 block of W. 89th St., Los Angeles
Site 11 at 7300 block of W. 83rd St., Los Angeles
Site 12 at 7900 block of Belton Drive, Los Angeles

declined between Aviation Blvd and the west side of the 405, but increased by a factor of 2 at the east side of the freeway. A map showing 1,3-butadiene data, averaged over the follow-up study period, is presented in Figure 4.

During the initial study, VOC levels north, east, and south of LAX were lower than those seen in the MATES II study. VOCs as measured during the follow-up study, collected near major arterials were of similar concentration to those found throughout the basin during the MATES II study. It should be noted however, there are no analytical methods available to determine whether the VOCs are from aircraft or ground traffic. Likewise, it cannot be determined through field measurements what portion of the VOCs measured near roadways are associated with the movement of goods and passengers in and out of LAX as compared to other sources.

Appendices D and E contain hydrocarbon data for both the initial and follow-up studies.

8.3 ELEMENTAL CARBON DATA SUMMARY

The design of the initial study included limited numbers of high volume samples. They were collected in the early part of the study at both the post office and Felton School sites. Later a sample was located at Cowan School to serve as a background site. As with the VOC portion of the study, when the data was reviewed from the initial study a follow-up study was designed in an effort to better resolve the sources of EC found in the initial study. As mentioned previously, the follow-up study design included up to 9 sites.

While a limited amount of EC data was collected in the initial study at two locations, too little comparable data was gathered for evaluation; therefore, indicators from the EC analyses are based primarily on the follow-up study results. A map showing elemental carbon data, averaged over the follow-up study period, is presented in Figure 5. Complete EC and PM_{10} mass data sets can be found in Tables 8.1 and 8.2.

The community-oriented areas to the north and south of LAX showed low levels of EC. Typically EC was 1.1 - 1.5 $\mu g/m^3$. This compares to a basin average during the MATES II program of approximately 3.0 $\mu g/m^3$ for the same time of year. EC levels at other locations were indicative of, and showed influence from, traffic. An evaluation of the west-to-east sites clearly demonstrates the influence of both Aviation Blvd. and the 405 freeway. Also the dilution of EC over a relatively short distance is seen. While daily variations exist, as seen in the data in the appendix, EC values declined on average by 37% from site 2 to 3 and 57% from site 1 to 6, indicating the dilution of EC over a short distance. The average EC data from site 3 located just west of the 405 to site 5 immediately east of the 405 showed an average increase of 48%. However, this increase did not result in EC levels as high as those measured at site 2, taken at the post office parking lot on the eastern side of Aviation Blvd.

An evaluation of north-to-south data along Aviation Blvd., sites 4, 2, 1, and 8 respectively, reveals that site 2 located at the post office on Aviation Blvd. had the highest EC values. Site 8, well south of LAX, had the next highest EC concentration. While site 8 was expected to have low EC values, both monitoring staff and speakers at a subsequent town hall meeting report dense traffic in the area of site 8. This traffic, made up of gasoline- and diesel-powered vehicles, could yield elevated EC and VOC levels found in this study.

APPENDIX D

INITIAL STUDY AIR MONITORING DATA

These data sets, when combined with the VOC data discussed above, provide an insight as to the contribution of major arterials on local air quality. Clearly, major corridors such as Aviation Blvd and the 405 freeway are major sources of VOC and diesel emissions (as measured by EC).

TABLE 8.1

Initial Study Carbon Analysis

Run ID	Date	Site	Air Vol. m^3	Mass * $\mu g/m^3$	Average ($\mu g/m^3$) OC**	EC**	Total
LEN0602	6/2/99	Lennox	1620	21	3.4	2.0	5.4
LAX0602	6/2/99	Aviation	540	29	8.5	4.8	13.3
LAX0604	6/4/99	Aviation	540	41	7.7	4.5	12.3
LEN0605	6/5/99	Lennox	1630	32	4.4	2.4	6.7
LEN0608	6/8/99	Lennox	1610	53	4.0	2.3	6.4
LAX0608	6/8/99	Aviation	540	61	8.4	4.7	13.1
LEN0611	6/11/99	Lennox	1630	62	4.1	2.2	6.3
LAX0611	6/11/99	Aviation	540	75	9.6	4.8	14.4
LEN0615	6/15/99	Lennox	1610	57	4.4	2.8	7.2
LAX0615	6/15/99	Aviation	540	61	9.1	4.6	13.7
LEN0617	6/17/99	Lennox	1580	70	4.8	3.6	8.4
LAX0617	6/17/99	Aviation	540	77	9.1	6.1	15.2
LEN0623	6/23/99	Lennox	1600	43	3.7	3.1	6.8
LAX0623	6/23/99	Aviation	540	51	8.6	4.1	12.7
LEN0625	6/25/99	Lennox	1610	43	3.1	2.5	5.6
LAX0625	6/25/99	Aviation	540	49	7.3	4.5	11.8
LEN0629	6/29/99	Lennox	1610	42	3.1	2.4	5.5
LAX0629	6/29/99	Aviation	540	49	8.7	4.4	13.2
LEN0701	7/1/99	Lennox	1590	51	3.9	2.9	6.8
COW0701	7/1/99	Cowan	1690	32	3.2	1.1	4.3
LAX0701	7/1/99	Aviation	540	56	8.6	5.2	13.8
LEN0706	7/6/99	Lennox	1600	50	4.2	2.4	6.6
COW0706	7/6/99	Cowan	1840	32	2.2	0.3	2.5
LAX0706	7/6/99	Aviation	540	56	7.4	3.7	11.1
LEN0708	7/8/99	Lennox	1600	52	5.7	3.4	9.1
COW0708	7/8/99	Cowan	1690	34	3.3	1.5	4.8
LAX0709	7/9/99	Aviation	540	51	8.0	4.7	12.7

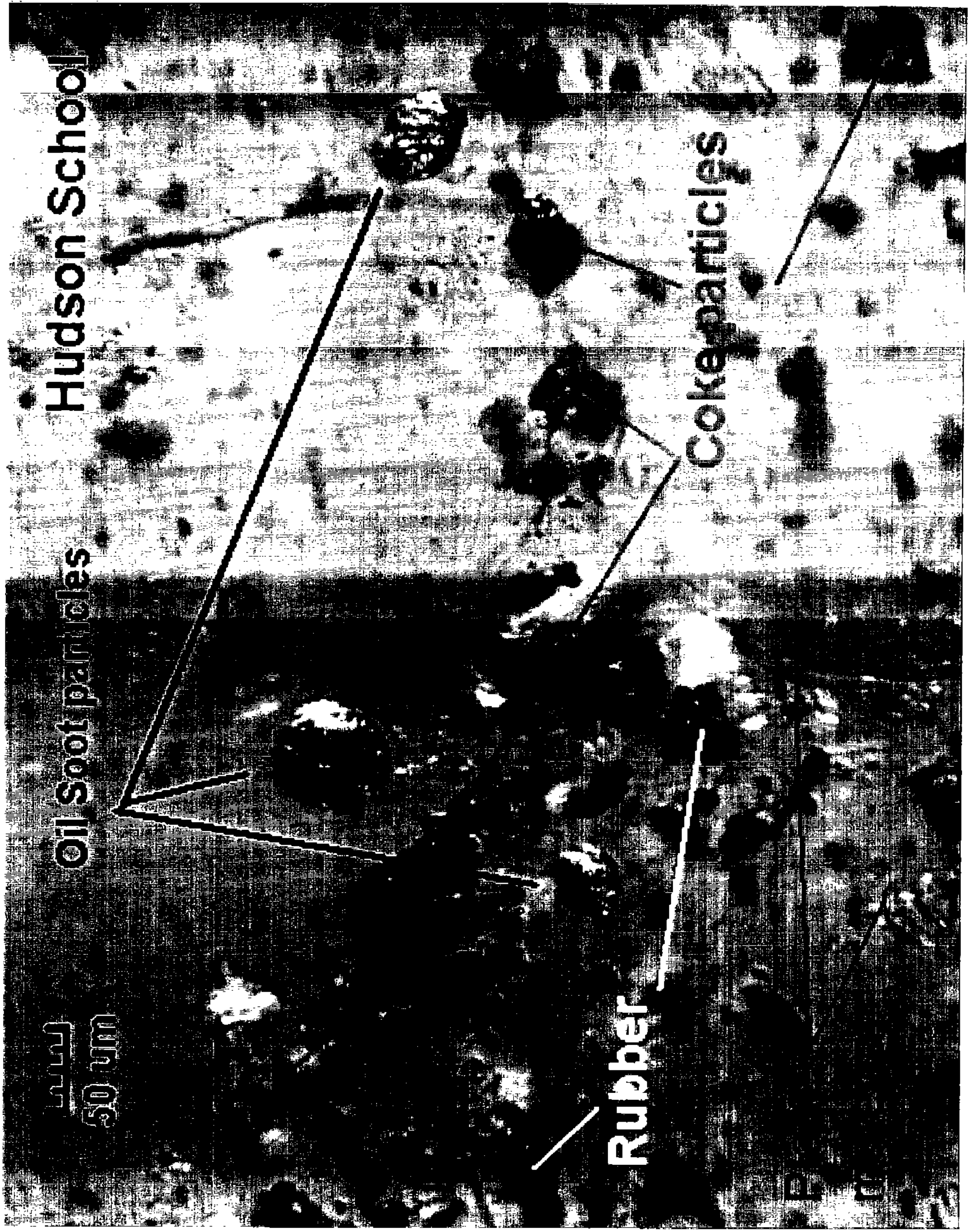
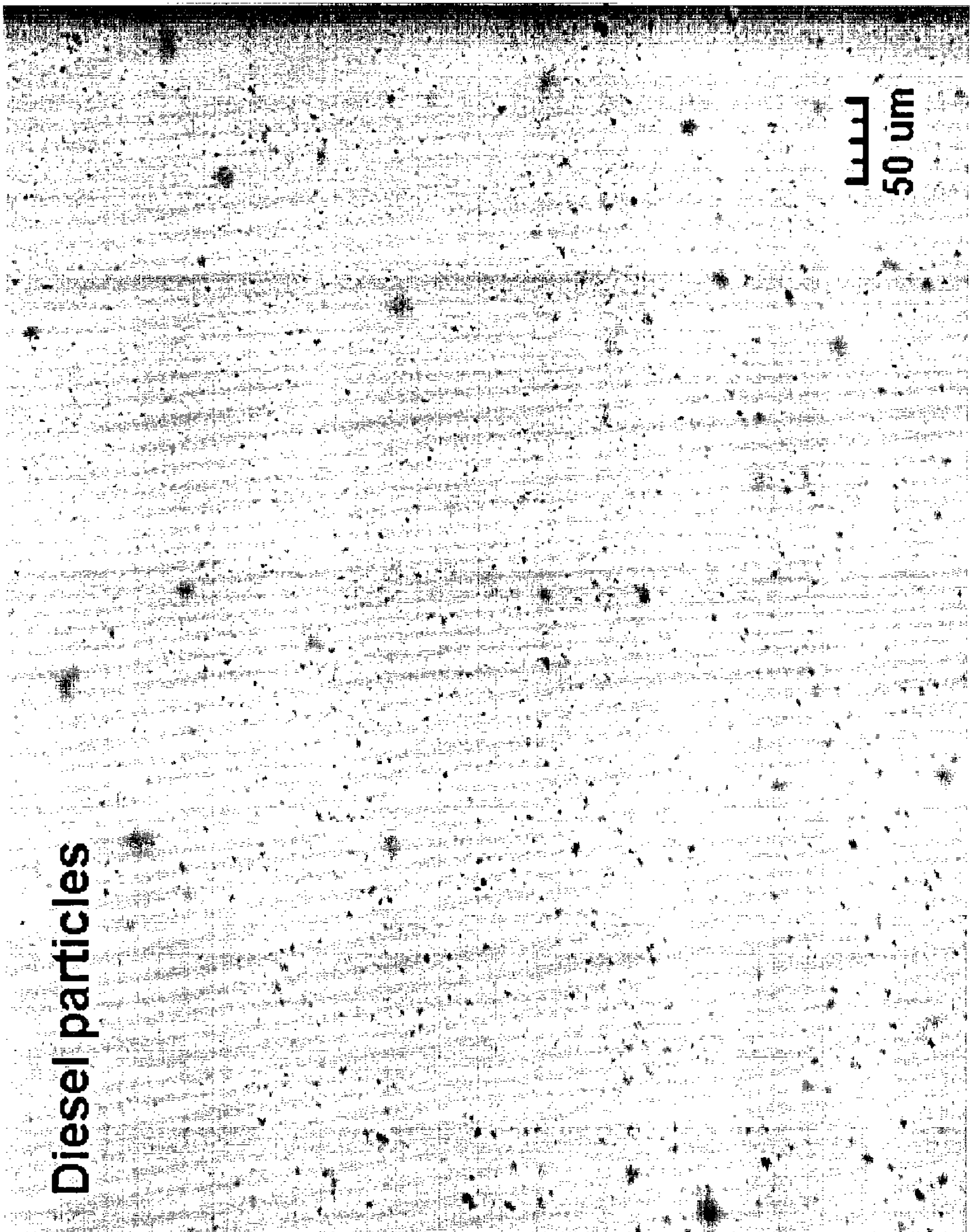

Hudson School
Oil Soot particles
50 um
Coke particles
Rubber

TABLE 8.2

Follow-up Study Carbon Analysis

Site	Date	Air Vol. m^3	Mass $\mu g/m^3$	Organic $\mu g/m^3$	Elemental $\mu g/m^3$	Total $\mu g/m^3$
1	9/10/99	520	50	6.6	2.1	8.7
2	9/10/99	510	70	8.4	5.0	13.5
3	9/10/99	530	55	9.0	3.6	12.6
4	9/10/99	510	56	10.4	3.7	14.1
5	9/10/99	510	58	8.8	4.2	13.0
6	9/10/99	530	43	5.9	0.7	6.6
1	9/14/99	470	73	9.1	1.6	10.7
2	9/14/99	520	66	9.6	4.5	14.1
3	9/14/99	610	63	7.9	2.5	10.4
4	9/14/99	430	76	9.9	3.2	13.1
5	9/14/99	520	80	9.6	4.5	14.1
6	9/14/99	520	63	7.8	0.7	8.5
1	9/16/99	510	78	10.3	2.1	12.3
2	9/16/99	500	80	10.2	6.2	16.4
3	9/16/99	500	93	11.1	3.8	14.9
4	9/16/99	520	75	10.3	4.3	14.6
5	9/16/99	500	97	11.0	5.6	16.6
6	9/16/99	560	57	8.1	1.1	9.2
7	9/16/99	470	75	9.4	1.6	11.0
8	9/16/99	520	76	10.2	3.6	13.7
9	9/16/99	500	59	9.6	1.3	10.9

Site1= N. Aviation & 122nd St.
Site 2= Post Office
Site 3= W 104th St. Inglewood
Site 4= S. Hindry Ave, Inglewood
Site 5= Felton School, Lennox
Site 6= Hawthorne Air Monitoring Station
Site 7=Imperial School
Site 8=Wiseburn School District
Site 9= Cowan Elementary School


Diesel particles
50 um

These levels are elevated adjacent to these sources but monitored values decline significantly over relatively short distances. However, as is the case with VOCs, there are no analytical methods available to determine whether the source of the EC is from aircraft or ground traffic. Likewise, it is not possible with current analytical techniques to establish what portion of the EC measured near roadways are associated with the movement of goods and passengers in and out of LAX.

In examining the results from both west-to-east and north-to-south analyses, the Aviation Blvd (post office) site measured the highest EC levels. Since this pattern is not observed for other key VOCs, there are strong indications that operations at LAX account for this result. However, there are no analytical methods available to determine whether these influences are from aircraft or ground traffic. Because diesel trucks servicing the LAX cargo areas routinely travel upwind of the Aviation Blvd site, this truck activity could account for the elevated EC levels observed.

8.4 PM_{10} Data Summary

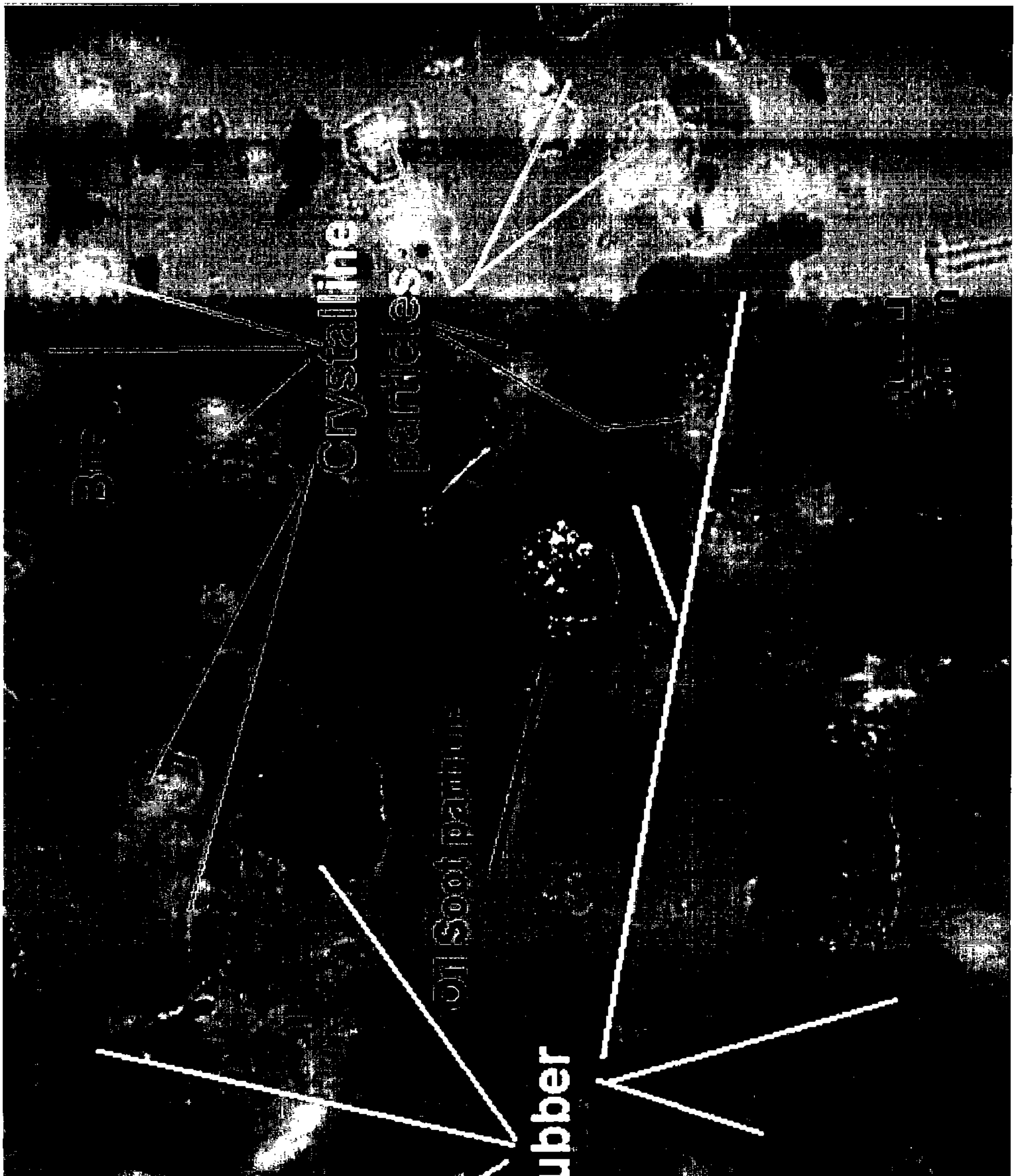
PM_{10} was not a main focus of the study and in the initial phase was only collected at fixed sites. This was due in part to the noise created by PM_{10} samplers and the desire not to create a 24-hour nuisance for homeowners at residences where VOC and fallout sampling occurred. Further, because the Aviation Blvd. site was only available for sampling approximately 8 hours a day it is inappropriate to compare this site to the two other fixed sites where 24-hour samples were collected.

The observation that the Aviation site yielded higher PM_{10} results when compared to same-day samples at the other locations is expected, since sampling was conducted during business hours when traffic is heaviest and winds are consistently blowing west to east. The 24-hour samples at both Cowan School and Felton School by comparison would be "diluted" by shifting nighttime air flows and reduced traffic and other activities during the nighttime hours.

It is interesting to note, however, that a comparison of same-day samples collected at Cowan and Felton Schools does show greater PM10 at the Felton School Site (Lennox). This is an expected result given that the Lennox site is immediately adjacent to and downwind of the 405 freeway. Further, unlike the Cowan School site, it is downwind of Aviation Blvd and LAX. It is not possible to determine what portion of the measured PM10 values are due to operations at LAX, traffic associated with the movement of goods and passengers in and out of LAX, non-LAX related traffic on the major arterials (Aviation Blvd. and the 405 freeway), or some other source.

The follow-up study PM_{10} data, shown in Table 8.1, were collected during the same timeframe on each sampling day. Samples were typically collected over a 7-to-8 hour period from approximately 10 a.m. to about 6 p.m. While the follow-up study was limited to three sampling dates, certain indications may be noted.

Comparing sites immediately east and west of the 405 freeway (sites 3 and 5), the influence of the freeway on PM_{10} can be seen. Comparisons between sites 2 and 4, and 1 and 2 indicate that there may be a slight increase in PM_{10} due to airport operations.


Crystalline particles
Oil Soot particle
Rubber

9.0 CONCLUSIONS

From the analysis of the samples collected, the following conclusions are drawn:

Initial Study

- Fallout samples depict greater abundance of larger-than-PM_{10}-sized oil soot particles than is observed at other locations in the South Coast Air Basin. Though not conclusive, the pattern of fallout is suggestive of aircraft (aloft) as the source.
- Key toxic compounds detected are benzene, 1,3-butadiene, and elemental carbon. (The latter is used as a surrogate for diesel particulates.)
- All key compounds are associated with mobile sources.
- All key compounds are lower at residential community sites than at Aviation Blvd and Felton school sites, which are likely influenced by airport and local traffic.
- Key compounds are lower to the north and south of the airport than east of the airport.
- Compared to results now being compiled for the MATES II Study, benzene and 1,3-butadiene levels at residences north and south of the airport tend to be lower than the corresponding seasonal MATES II monitoring network averages, while residences east of the airport tend to be near the network average.

Follow-up Study

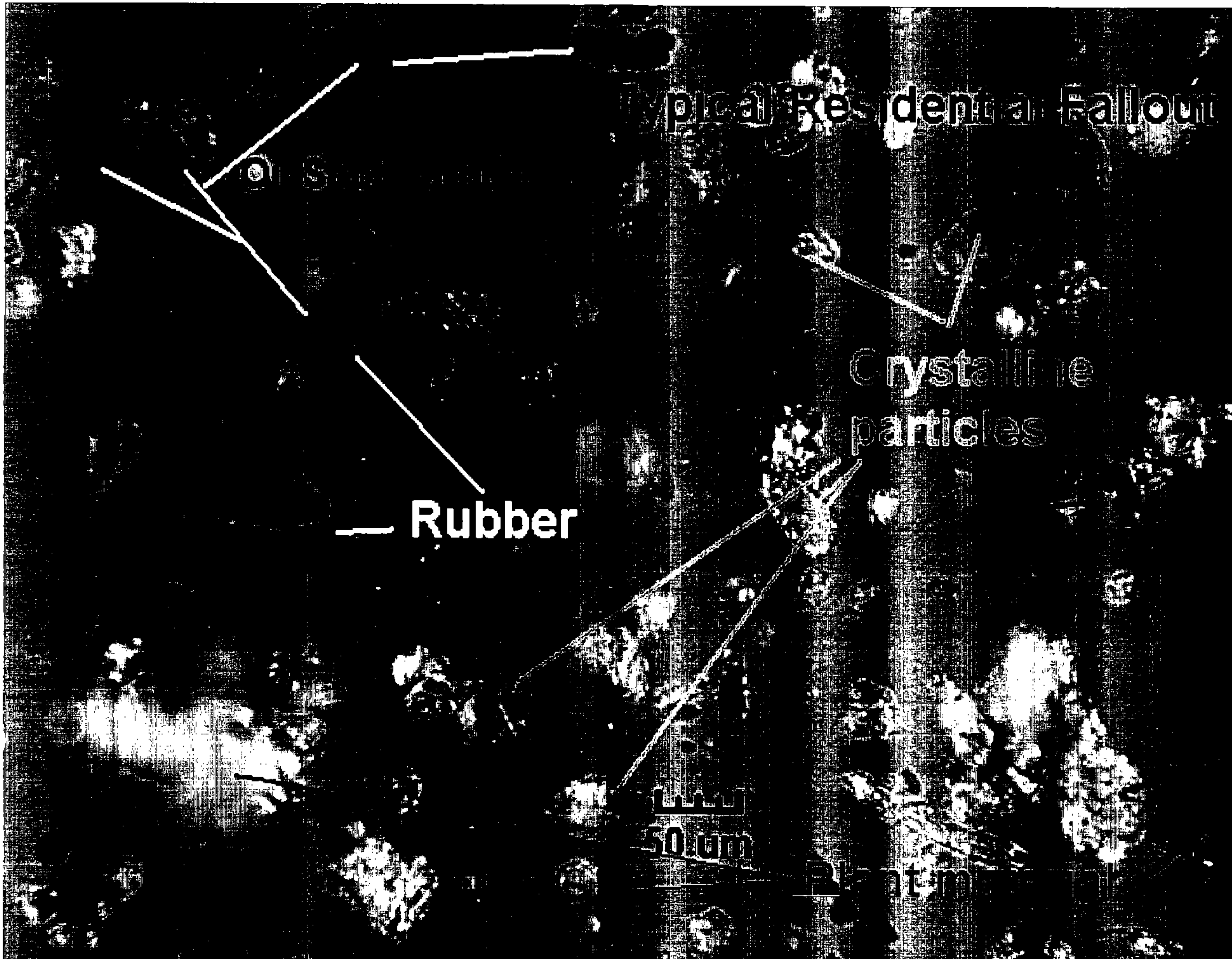
- Vehicle traffic on Aviation Blvd. and the 405 freeway are sources of toxic air contaminants. It is not possible to determine what portion of the contaminants are due to operations at LAX, traffic associated with the movement of goods and passengers in and out of LAX, non-LAX related traffic on the major arterials, or some other source.
- Higher elemental carbon at the LAX-Aviation Blvd site is suggestive of an influence from airport operations, though it cannot be determined if these influences are from aircraft or trucks servicing the airport, or both.

Limitations

- Limited sampling provides indicators of conditions. Longer term sampling is needed for more complete risk assessments.

10.0 Additional Study

The AQMD, along with the FAA, EPA, and CARB is participating in the design and oversight of an upcoming sampling program funded by Los Angeles World Airways (LAWA). The primary goal of the program is to assess the incremental impact of LAX operations on local air quality. That study is expected to take place during 2000 – 2001.


Typical Residential Fallout
Crystalline
particles
Rubber
50 um

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
MONITORING AND ANALYSIS

Part II

AIR MONITORING STUDY AT LOS ANGELES INTERNATIONAL AIRPORT TERMINALS

WRITTEN BY

STEVEN BARBOSA
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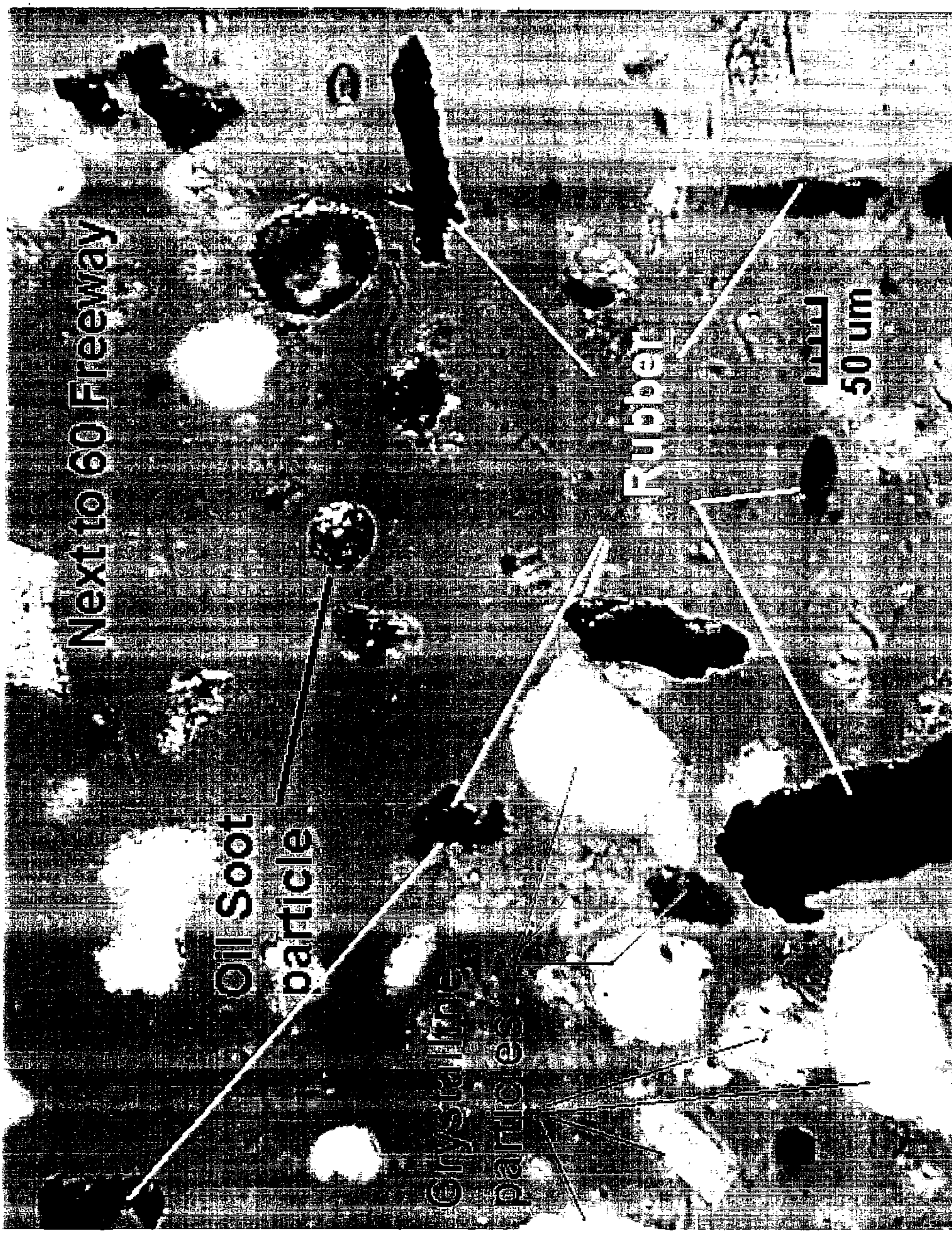

Next to 60 Freeway
Oil Soot
particle
Rubber
50 um
Crystalline
particles

Air Monitoring Study At Los Angeles International Airport Terminals

Part II

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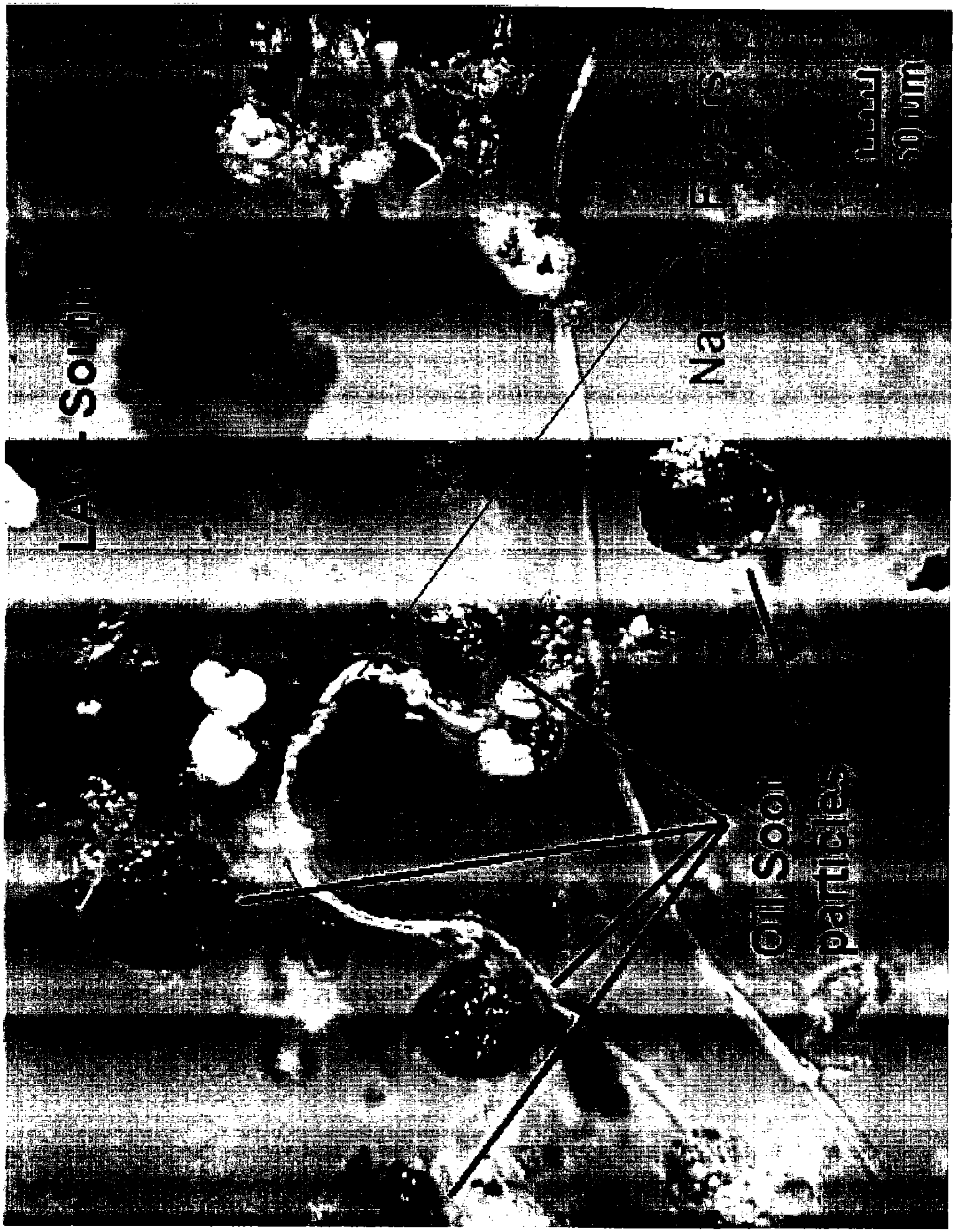
Na
Fibers
50 µm
Oil Soot
particles

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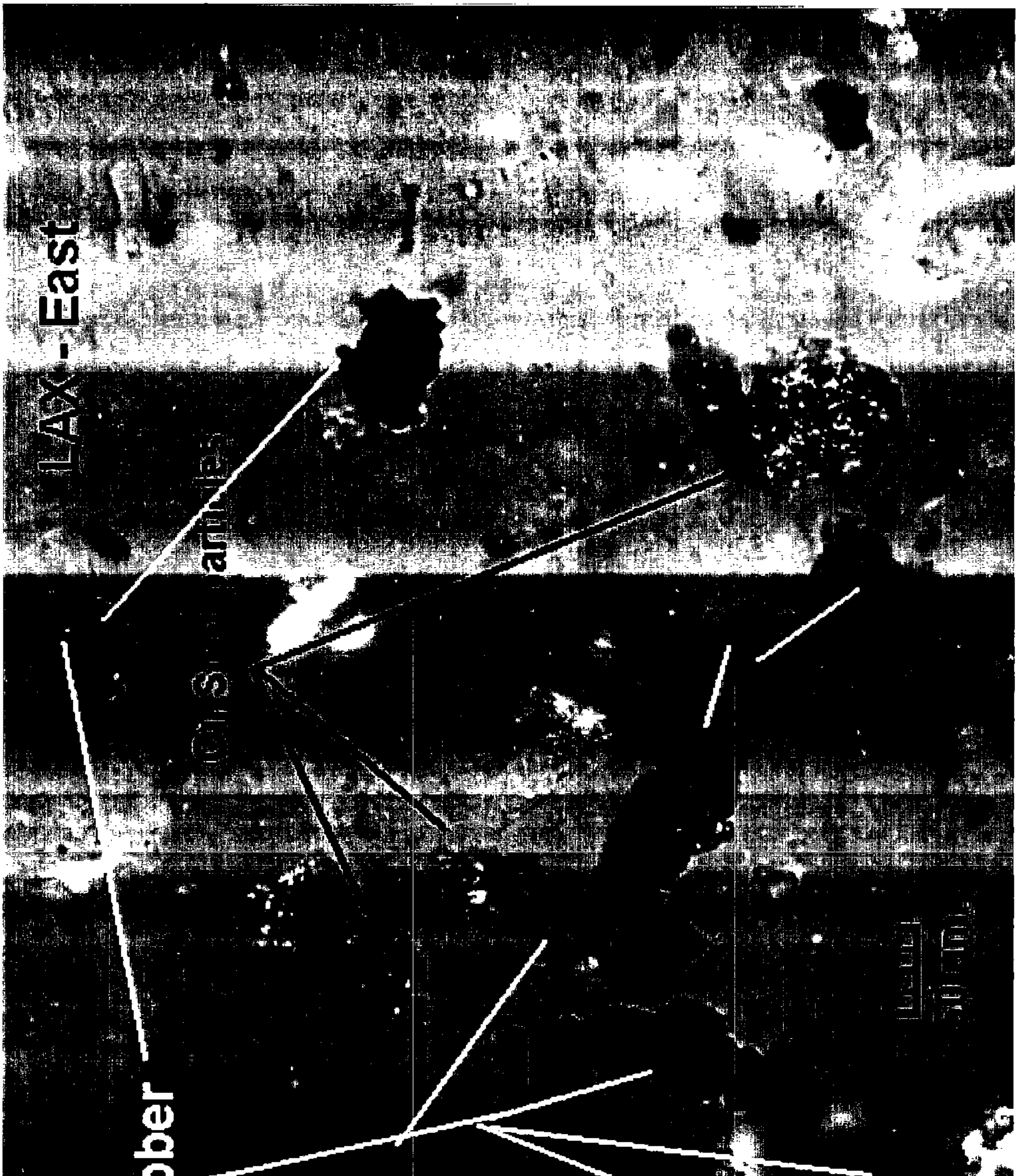

LAX - East
Rubber

1.0 ABSTRACT

During November 1999, the South Coast Air Quality Management District (AQMD) performed sampling at lower level terminals at Los Angeles International Airport in the passenger loading and unloading areas. This sampling occurred one week prior to and during the Thanksgiving Day week, November 1999. This period was chosen for two reasons: (1) Thanksgiving weekend is one of the busiest of the year; and (2) weather conditions in late November typically lead to stagnant air and higher pollutant levels. The pollutants sampled included benzene, 1,3-butadiene, carbon monoxide (CO), and elemental carbon (EC). The first three pollutants are associated with mobile emissions, and EC is used as a surrogate for estimating diesel particulate emissions. This study was a follow-up to the May/June 1998 monitoring study at 2 locations on the upper level. This study looked at the previous upper level locations in addition to 5 sites at lower level terminals. The specific sites for this study were the lower level terminals 1, 3, 6, 7, and the Bradley upper (same as the May/June study) and lower terminals (See Figure 1).

The initial study was conducted in May and June of 1998 at two upper level curbside locations: Bradley Terminal and Terminal 7. The purpose of the initial study (and this study) was to determine the concentrations of pollutant generated by motor vehicle and avionics activities. This was to address concerns about the pollutant levels to which LAX staff and the public may be exposed. The pollutants measured during the first study were not out of the normal range for the Basin. It was concluded that the fresh sea breezes prevalent during that time of the year and the siting of the samplers on the open, upper level might have diluted concentrations of CO and VOC's. This study was conducted during the fall/winter month of November when the sea breezes are less prevalent and when the Airport is at its peak travel season of Thanksgiving Day weekend. Also, the samplers were sited to include the covered lower level where pollutants could be trapped by slow air exchange.

The principal findings of this study are as follows:

- Higher concentrations of monitored pollutants were observed at Terminals 6 and 7; lower at the Bradley Terminal.
- Higher concentrations of monitored pollutants were observed on Thanksgiving weekend compared to the prior week.
- Benzene and 1,3-butadiene levels at Terminals 6 and 7 were about twice the levels observed during the November (1998) MATES II sampling and the Hawthorne fall microscale sampling. Pollutant levels at the Bradley terminal were lower than the levels observed during the November MATES II sampling and the Hawthorne fall microscale sampling.
- At Terminals 1 and 3, levels of benzene and 1,3-butadiene were slightly lower, during the first week, and slightly higher during the Thanksgiving week, as compared to the MATES II November (1998) average.
- Elemental carbon at all terminal sites were higher than the MATES II average. Compared to the harbor area measurements (of which the 1999 study collected samples during the same two-week period as the LAX study), levels at LAX were slightly higher during the first week, but substantially higher during Thanksgiving

APPENDIX C

PHOTOMICROGRAPHS OF FALLOUT

week. (Note: There is a higher uncertainty with the portable particulate matter samplers used in this study.)

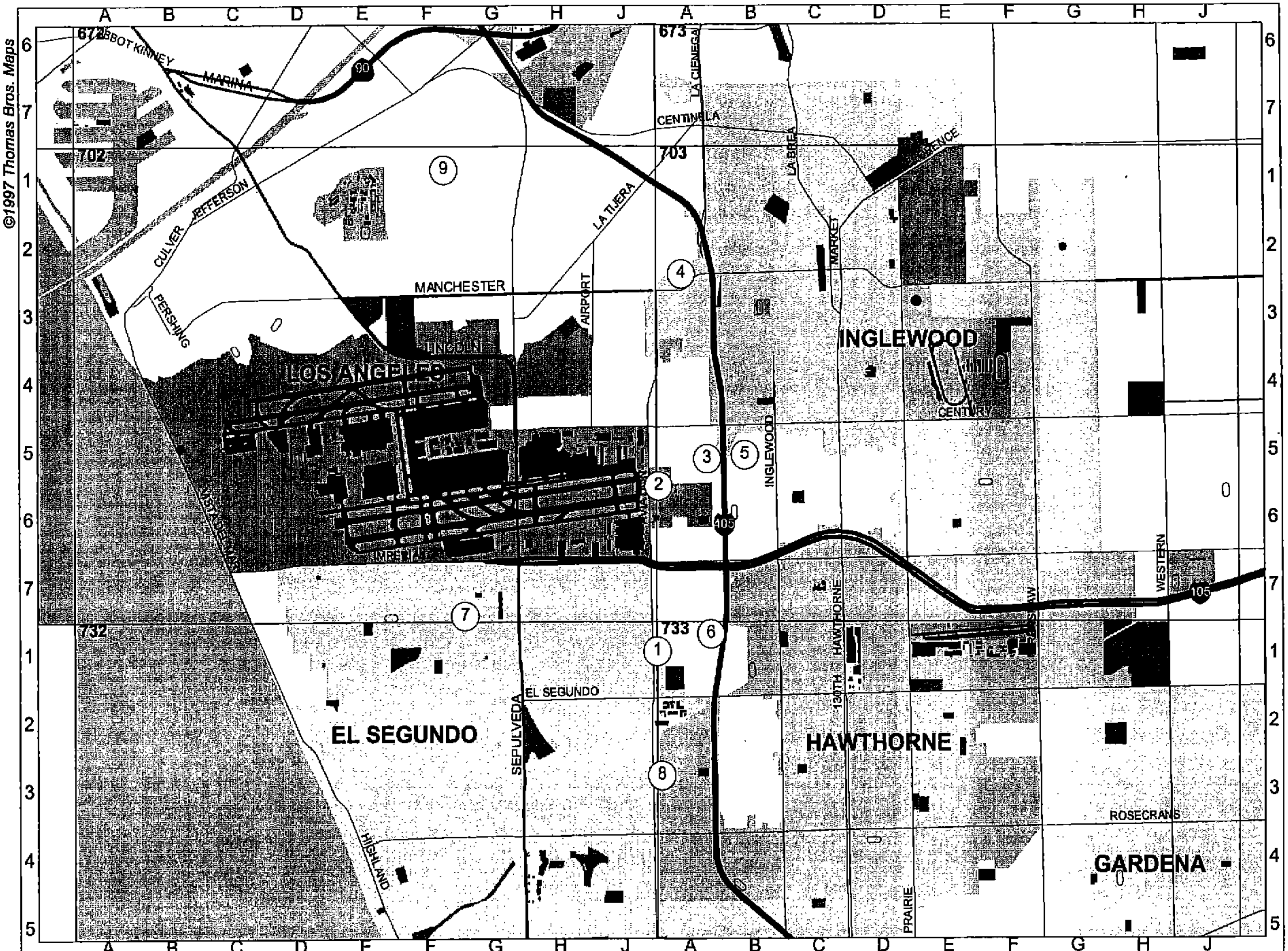
- Carbon monoxide measurements, showing maximum 8-hour levels, were slightly higher at LAX as compared to the Hawthorne air monitoring site. Results from continuous portable monitors are subject to significant uncertainty, but suggest that federal standard levels for CO may have been exceeded at Terminal 7. Eight-hour integrated canister samples did not show any exceedance of the CO standard.
- Based on meteorological conditions and high traffic volumes, the measurements taken during the Thanksgiving weekend period likely represent a near-worst-case scenario at the LAX Terminals.

2.0 Purpose and Scope

The purpose of this study was to expand the scope of a study performed in May/June of 1998. During that study the AQMD sampled at 2 locations on the upper level of the LAX terminal. Sampling was conducted to determine CO, PM, and other potentially noxious volatile organic compound (VOC) levels generated by the motor vehicle and avionics activities at LAX. Concerns were greatest regarding concentrations of these pollutants in the passenger staging areas.

In the study conducted in 1998 the sites selected and the season of the study were questioned as to their effect on the outcome of the study. The spring/early summer weather patterns may have dispersed the pollutants before they were measured. Similarly, the choice of sampling only on the upper deck where ocean breezes could clear the air called into question exposures on the lower level where airflow is more stagnant and sheltered. It is to be noted that LAX staff (primarily Skycaps) are stationed on the upper level for departures, but ground transportation dispatchers are more typically stationed on the lower levels to assist arriving passengers. This study was undertaken to measure pollutants at LAX during the peak travel season and also at more sites, primarily on the lower level. The upper level sampling at the Bradley Terminal was undertaken as a common site for both studies to compare the effect of seasonality. The cool fall/winter season coincidentally falls during the peak travel weekend of the year.

Table 1 lists the sites sampled in the present LAX Terminal Air Quality Study. Figure 1 is a sampling site map of the airport terminal with the District logo designating the five general sampling areas. Three (3) eight-hour samples were taken by summa canister at Terminals 1, 3, 6 and 7 on each of the sampling days. One (1) twenty-four hour Tedlar bag sample was taken at the upper level of the Bradley Terminal for each sampling day. These samples were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) for toxic compounds and by Total Combustion Analysis (TCA) for carbon monoxide (CO). One 24-hour, integrated PM10 filter sample was collected per site per sampling day using a MiniVol Portable Sampler. Detailed analysis method descriptions follow in Section 7.0. It should be noted the MiniVol Portable samplers have a greater uncertainty factor than the Federal Reference Method PM10 network sampler. The network uses EPA approved instruments and while this sampler is meant to be similar, it is not equivalent. Additionally, at two sites, Terminals 6 & 7, five-minute integrated CO data were obtained using Drager Pac III personal CO monitors outfitted with data-loggers. CO samplers at the other locations proved to be unreliable and therefore the data were not used.



(5) 10335 S Ocean Gate Av, Lennox, 90304, 703 B5
(3) W 104th St & Irwin, Inglewood, 90304, 703 A5
(4) 201 S Hindry Av, Inglewood, 90301, 703 A2
(9) 7615 Cowan Av, Los Angeles, 90045, 702 F1

(2) Aviation Blvd, 703 A5
(1) N Aviation Blvd & 122nd, El Segundo, 90245, 733 A1
(7) Imperial Street School, 702 G7
(8) 13530 N Aviation Blvd, Hawthorne, 90260, 733 A3

TABLE 1

LAX Terminal Air Quality Study
Sampling Locations

Terminal 1, Lower Level

Terminal 3, Lower Level

Terminal 6, Lower Level

Terminal 7, Lower Level

Bradley Terminal, Lower Level

Bradley Terminal, Upper Level (same as in May/June 1998)

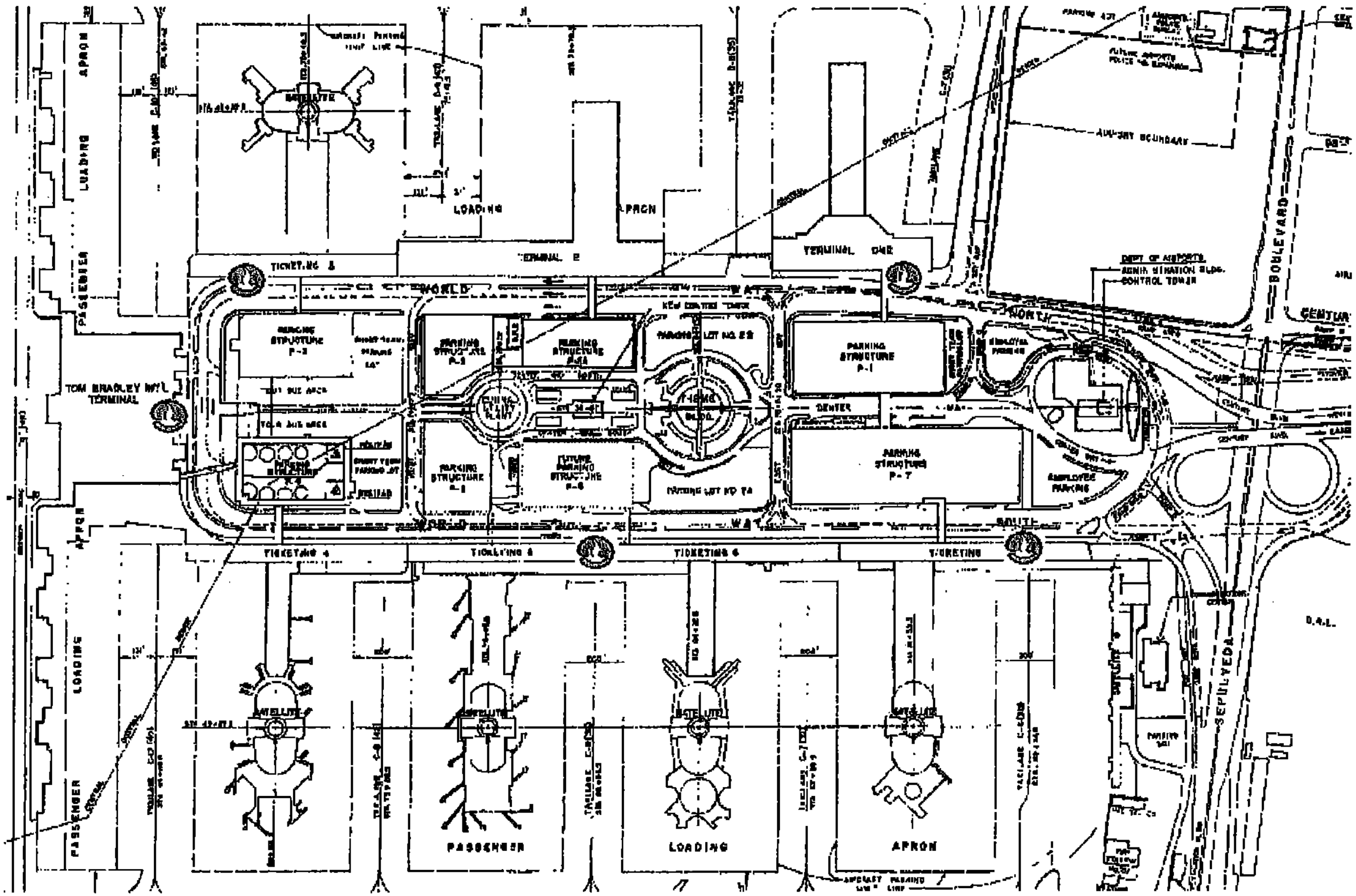
Offsite Location

Hawthorne Air Monitoring Station, 5000 Block, 120th St.

APPENDIX B

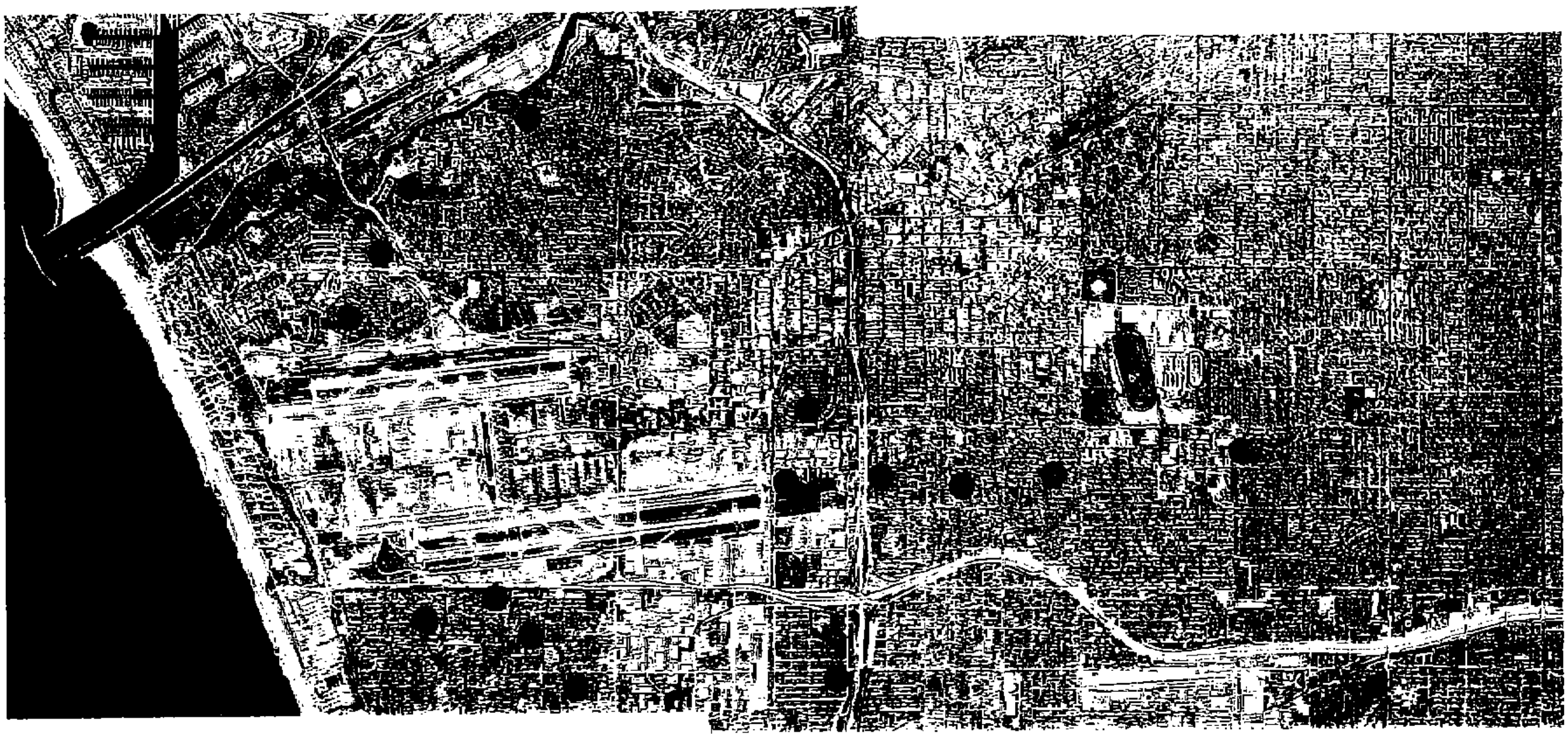
FOLLOW-UP STUDY SITE MAP

FIGURE 1: Location of Air Monitoring Equipment



= Air Monitoring Site

LAX AREA AIR MONITORING



Red dots indicate residential sampling sites

Green dots indicate "fixed" sampling sites

Blue dot indicates AQMD's Hawthorne air monitoring station

3.0 Project Discussion

In the May/June 1998 study, focus was placed on the exposure of LAX staff in the upper level departure zone. The November 1999 study was to expand on the two sites previously studied by looking at the lower level, arrival zone, and the effect of the airport design in trapping possible noxious pollutants. The concrete overhangs above the main roadway might trap motor vehicle exhaust in the area of arriving passenger traffic. This study focused on one of the busiest travel weeks of the year, Thanksgiving week. This would tend towards a worst case scenario for exposure. The previous study occurred during the spring/summer season when prevailing sea breezes are strong and provide good ventilation. This study occurred during the fall/winter season when weather conditions are stagnant and the effect of less air movement is more pronounced.

4.0 Topography

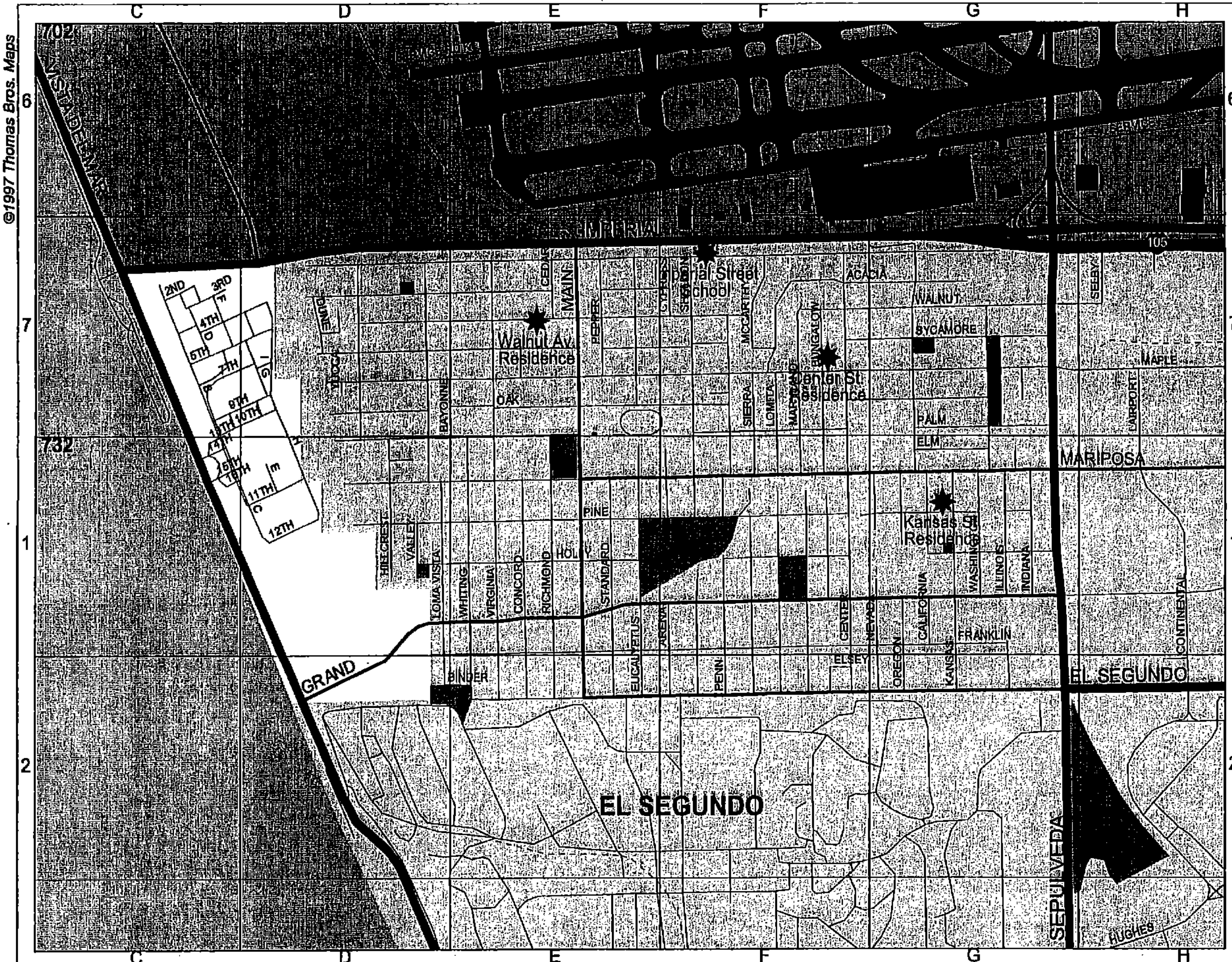
LAX is located approximately 12 miles southwest of the City of Los Angeles at an elevation approximately 100 feet above mean sea level (msl). Residential neighborhoods surround LAX on the north, east, and south. Areas of manufacturing and light industry are also located in close proximity to LAX. The closest major freeways are the 405 running almost north-south along LAX's eastern border and the east-west 105 Freeway to the south of LAX. Terrain in this area may be generally characterized as a relatively flat coastal plain with the Palos Verdes Hills rising to a peak elevation of 1,300 feet, four miles to the south

5.0 Climatology

In late November, the climate of the Los Angeles basin, including the area around LAX, can vary markedly. Relatively, warm and sunny days are not uncommon with a cool, onshore sea breeze of light westerly winds in the afternoon, often weakened by competing offshore pressure gradients and warm, northeasterly Santa Ana winds. At night, cool-air drainage flows from the mountains combine with the land-breeze, caused by the temperature difference between the land and moderate ocean temperatures, to create relatively strong offshore flows. When the winds are light on cool nights, dense fog can form near the coast, as the moist marine air cools under the radiation temperature inversion that forms as the land mass cools. In contrast, Los Angeles often sees winter storms in November, with unstable conditions and significant amounts of precipitation.

Temperatures near LAX are moderated by the nearby ocean and typically do not vary as widely as they might inland. The average maximum temperature in November at LAX is 70.3 and the average minimum temperature is 52.8. The average rainfall for LAX in November is 1.76 inches, with measurable precipitation on 4 days of the month, one of which experiences rain in excess of 0.5 inches. However, wide variations from the average can be experienced in a given year. In nearly 70 years of data from LAX, rainfall has ranged from zero to 7.92 inches for the month.

Air quality is typically good to moderate near LAX in November. Concentrations of photochemically formed ozone are normally low in the late fall through winter and early



Walnut Av. Residence: 200 W. Walnut Av, El Segundo, 90245,
Center St. Residence: 800 Center St, El Segundo, 90245,

Imperial Street School: 540 E. Imperial Av, El Segundo, 90245,
Kansas St. Residence: 500 Kansas St, El Segundo, 90245,

spring, due to the low sun angle and shortened hours of daylight. However, levels of directly emitted pollutants, especially carbon monoxide and particulates, can reach unhealthful levels at this time of year near LAX, with the strong radiational temperature inversion holding emissions near the ground, and weak offshore or stagnant flows confining them near the coast.

6.0 Equipment

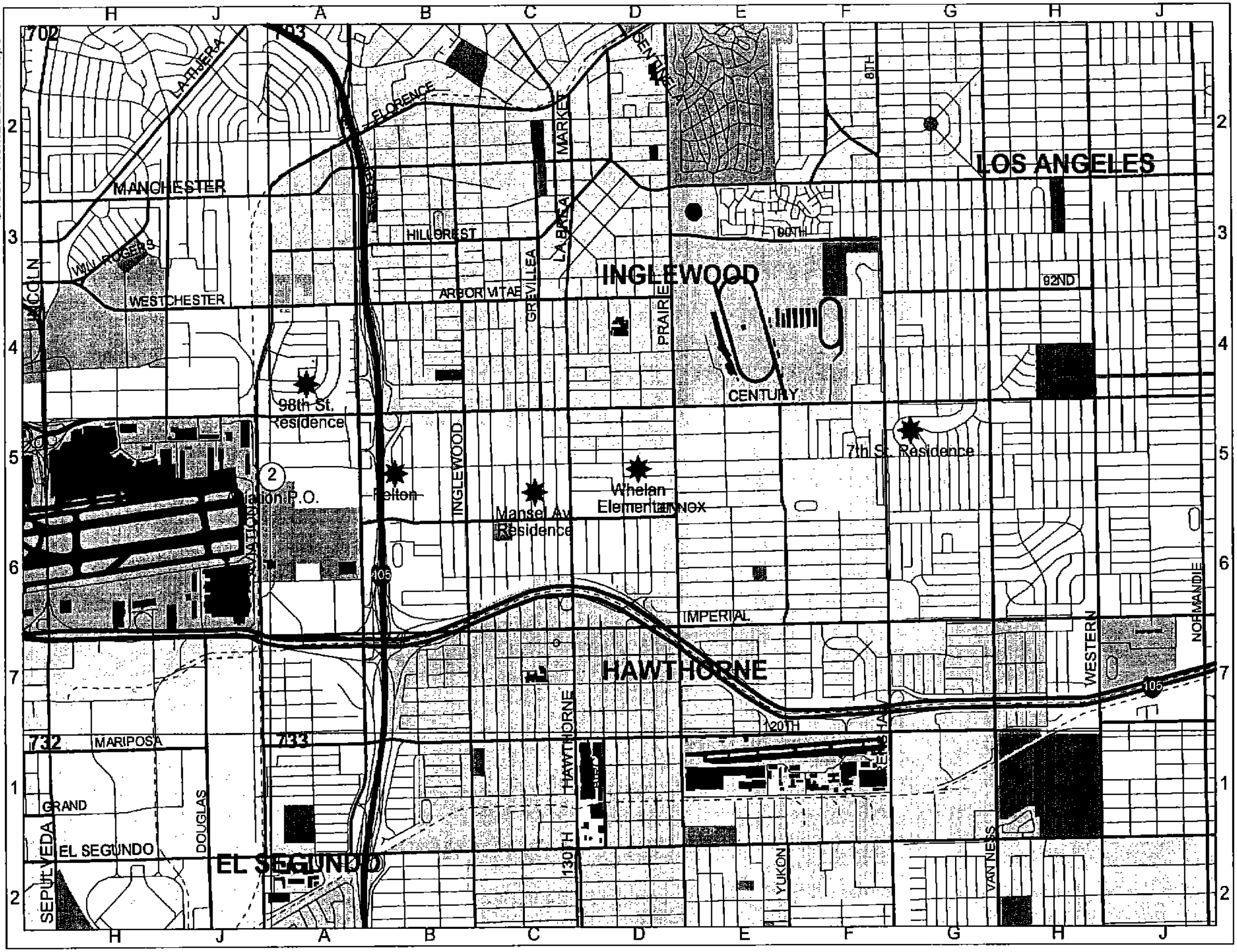
The District's Special Monitoring Group set up and deployed the ambient air samplers used at the LAX Terminal study. The equipment consisted of the same equipment used in the May/June 1998 study with the addition of summa canister sampling. The canisters were used just like Tedlar® bags, and have the advantage of longer holding times and less degradation of the sample. It should be noted that in the initial study, 110 volt power sources were not available, and only battery-operated equipment could be used. In the current study, all lower-level sampling locations were provided with 110v power accessibility. Equipment descriptions follow:

6.1 Integrated Ambient Air Samplers for Volatile Organic Compounds (VOCs)

Two types of integrated ambient air samplers were used to draw quantifiable amounts of air for subsequent laboratory analysis. One sampler consists of a pump with a non-lubricated Viton rubber diaphragm, a borosilicate flow meter, and an internal power supply (battery). Ambient air samples were drawn into 15-liter EPA-approved Tedlar® (polyvinyl fluoride) bags which are housed in light-sealed cardboard boxes, using a battery-powered pump system. During sampling, ambient air traverses either Teflon or stainless steel surfaces to minimize sample contamination and reactivity. The pump can move 10 cubic centimeters per minute of air into the evacuated bag over a 24-hour period. The Tedlar® bags were returned to the lab following chain-of-custody protocols. At the laboratory the air samples were analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) for specific VOCs shown in Table 2. All concentrations are expressed as parts per billion volume (ppbv).

The second method used to sample VOCs utilized passivated (summa-polished) stainless steel 6-liter canisters. Canisters were evacuated and leak-checked in the laboratory prior to use in the field. Air enters the canister through a pump and flow controller. The sampler is programmed such that over a predetermined period of time, up to 24 hours, the canister will be filled to a pressure of approximately 7 psi. Unlike the bag sampler, these samplers are not battery powered and require a 110v power source but do offer more flexibility in programming. Once a sample is collected the canister is removed from the sampler and returned to the lab. As with the bag samples, all chain-of-custody protocols are followed, and the sample is analyzed on the GC/MS for the same VOCs at ppbv levels.

The canister samples have the advantage of a longer holding time for the compounds of interest. Tedlar® bags must be analyzed within three days of sampling before deterioration of the sample compromises the results. Bags were used at the Bradley upper level so that a direct comparison could be made with the previous study in May/June 1998 in which Tedlar® bags were used at the upper level.



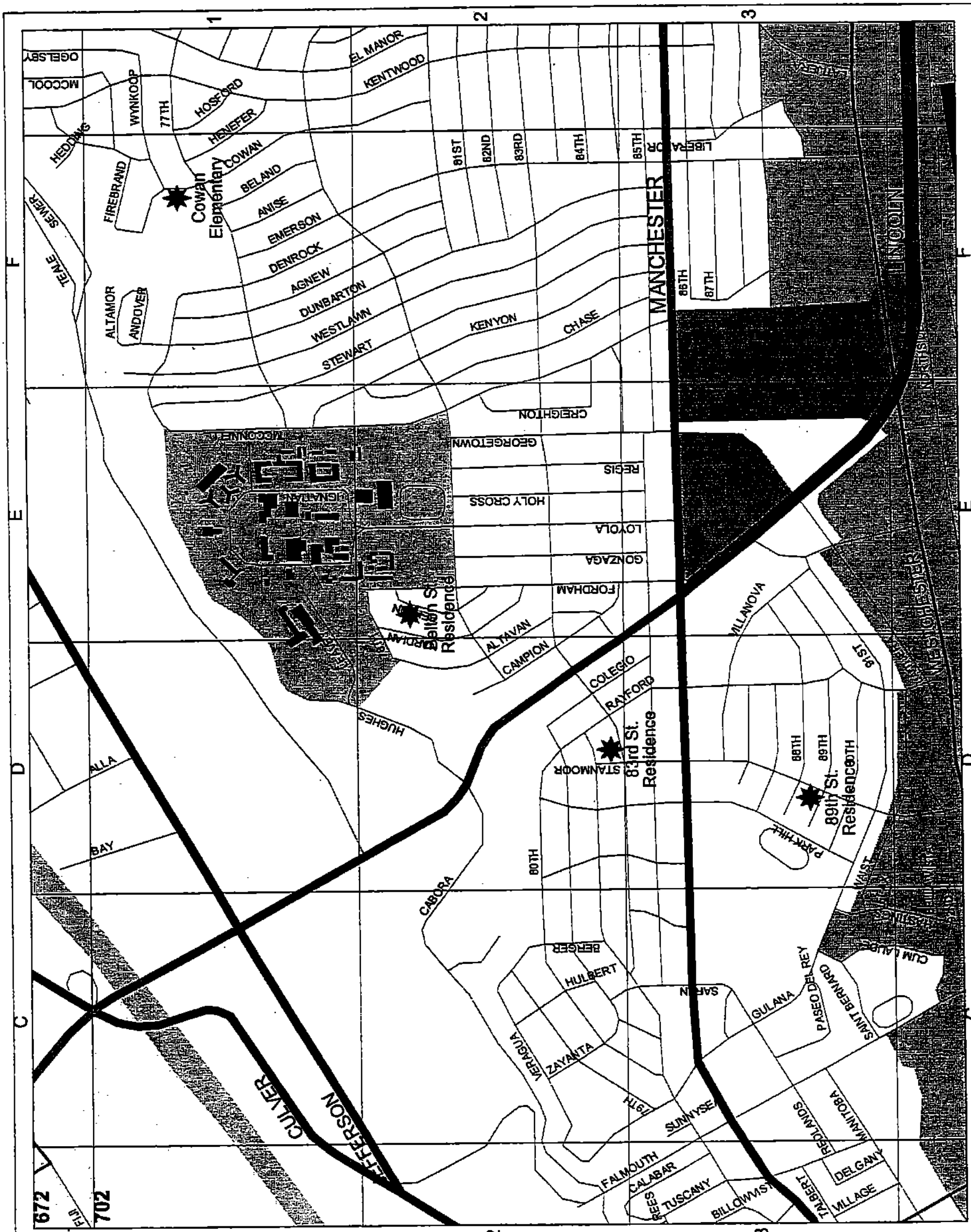
- Felton: 10335 S Oceangate Av., Lennox, 90304, 703 B5
- 7th St. Residence: 10200 S 7th Av, Inglewood, 90303, 703 G5
- Mansel Av. Residence: 10600 S Mansel Av, Lennox, 90304, 703 C5
- 98th St. Residence: 5300 W 98th St, Los Angeles, 90045, 703 A4
- (2) Aviation P.O.: Aviation Blvd., Los Angeles, 703 A5
- Whelan Elementary: 4100 W 105th St, Lennox, 90304, 703 D5

VOCs were sampled and analyzed since many organic compounds are known to have health effects. For example, benzene and 1,3-butadiene have been declared a carcinogen by the both the U. S. Environmental Protection Agency (EPA) and the California Air Resources Board (ARB). VOCs are emitted from a variety of sources such as industry, mobile sources, paints, and households. Certain compounds such as chlorinated hydrocarbons are indicators of solvent usage. Other species such as benzene and 1,3-butadiene are the result of the combustion of fossil fuels primarily in mobile sources such as buses, trucks, automobiles and aircraft. The canisters were also used for Total Combustion Analysis (TCA) of carbon monoxide.

TABLE 2

COMPOUNDS MEASURED

	Chemical Name
Gases:	Benzene
	Butadiene
	Dichlorobenzene [ortho & para]
	Vinyl chloride
	Ethyl benzene
	Toluene
	Xylene [m-,p-,o-]
	Styrene
	Carbon tetrachloride
	Chloroform
	Dichloroethane [1,1]
	Dichloroethylene [1,1]
	Methylene chloride
	Perchloroethylene (Tetrachloroethene)
	Trichloroethylene
	Chloromethane
	Carbon Monoxide
Particulates:	Elemental and Organic Carbon



* Cowan Elementary: 7600 Cowan Av, Los Angeles, 90045,
** 83rd St. Residence: 7300 W 83rd St, Los Angeles, 90045,
** 89th St. Residence: 7500 W 89th St, Los Angeles, 90045,
** Belton St. Residence: 7900 Belton Dr, Los Angeles, 90045.

6.2 Airmetrics miniVOL Portable Sampler

The battery-operated miniVOL portable sampler is small and lightweight. It is used to monitor gaseous pollutants and PM less than 10 microns in size (PM_{10}). For this study the miniVOL sampler was used to capture PM_{10} for subsequent carbon analysis. The sampler is a pump controlled by a programmable timer. The battery pack allows operation of the instrument independent of line power for up to 24 hours on a single charge. An elapsed time accumulator, linked in parallel with the pump, records total pump-operation time in hours.

A known quantity of air is first drawn through a particle size separator and then through quartz filter media. Particle separation was achieved by impaction. The filter was weighed before and after sampling under controlled conditions to determine mass per volume of air sampled. The correct flow rate through the inlet is critical to the collection of the correct particle size. The miniVOL volumetric flow rate was 5 liters per minute (lpm) at ambient conditions. The inlet tube downstream from the filter conducts air to the twin cylinder diaphragm pump. From the pump, air is forced though a standard rotometer where it is exhausted to atmosphere inside the sampler body. To assure a constant 5-lpm flow rate through the size separator at differing air temperatures and atmospheric pressures, the sampler was adjusted for each sampling period. The programmable timer automatically turned the pump off at the end of each sampling period.

The sampling technique used by the miniVOL is a modification of the standard PM_{10} reference method outlined in the Code of Federal Regulations (40 CFR 50, Appendix J). The miniVOL's flow rate is generally less than those used by reference method devices. This results in a greater deviation of accuracy, especially at low particle concentrations. The miniVOL sampler is not an EPA-approved reference method sampler nor is it an approved equivalent method sampler. Because of its size and portability, it allows for measurements in locations (usually space-limited) where EPA-approved samplers cannot be used.

6.3 Drager Pac III

The Drager Pac III is a compact, personal gas detector designed to continuously monitor a single gas in ambient air. The sensor installed in the instrument determines the type of gas monitored. For this study, CO sensors with a detection range of 0 to 2000 parts per million (PPM) were used.

The main component of the Pac III is the plug-in electrochemical sensor. The plug-in sensor configures the detector to the gas and measurement range. Sampling was achieved by simple diffusion of the air sample into the detector head. Simple diffusion refers to the migration of gas molecules down a concentration gradient. Air is allowed to diffuse across the CO sensor inside the detector head, which produces an electrical signal proportional to the actual CO concentration. An advantage of the diffusion method is that it introduces the air sample directly to the sensor without chemical or physical change. The PAC III is equipped with a microprocessor that logs the values of the

APPENDIX A

INITIAL STUDY SITE MAPS

monitored gas at a predetermined interval and computed time weighted average (TWA) values. It is capable of taking TWA values continuously over two weeks.

7.0 Sampling and Methods

Samples were collected at six LAX locations (See Table 1) over a two-week period in November 1999, the week prior to Thanksgiving and the week of Thanksgiving. The samples were collected on Wednesday (midnight to midnight), Friday (noon) to Saturday (noon), and Sunday (midnight to midnight) for the weeks of November 15 and November 22, 1999. Since equipment needed to be serviced between sampling events, this schedule allowed for three 24-hour sampling periods during the Wednesday-to-Sunday periods. Sampling was performed to determine the levels of key pollutants and the degree of variability between sites. For comparative purposes sampling was done on a normal week and a busy holiday week. Also used in the data set is data collected at AQMD's Hawthorne station.

The samples were returned to the laboratory in a timely manner for analysis following standard chain-of-custody protocols. The bags and canisters were returned to the laboratory for VOC analysis by Gas Chromatography/Mass Spectrometry (GC/MS) and carbon monoxide (CO) analysis by TCA. The filters were returned for gravimetric analysis and carbon analysis by thermal/optical carbon analyzer.

The analysis by GC/MS consists of taking 300 cubic centimeters (cc) of the sample into an Entech cryoconcentrator where a super-cooled trap (-150 °C) captures compounds with a boiling point of –30 °C or greater. The trap is rapidly heated, releasing the trapped VOC's and focuses the compounds at the head of the Gas Chromatograph (GC) column. After this transfer has occurred the DB-1 column in the Hewlett-Packard 6890 GC separates the chemical compounds by boiling point. The Mass Selective Detector then detects the compounds and positive identification is accomplished by matching the spectrogram to a library of spectra. The compounds quantified were the same compounds looked for in the MATES II project run in 1998/99. These compounds can be found in Table 2. A subset of these compounds was carefully examined for trends in the present study. All concentrations are expressed as parts per billion by volume by direct comparison to National Institute of Standards and Technology (NIST) traceable standards.

The carbon monoxide (CO) analysis was performed by Total Combustion Analysis (TCA) using an Flame Ionization Detector (FID) detector. An aliquot of sample is transferred to a sample loop that introduces the sample to the GC. The GC column separates the compound of interest, CO, from other carbon containing compounds, which are then combusted in the presence of Hopcalite at elevated temperature to carbon dioxide. The carbon dioxide is methanized by using an active nickel catalyst with hydrogen gas supplied to the sample stream. The result is all gaseous carbon compounds are converted to methane (CH_4) and quantified against a NIST traceable CH_4 standard. The CO is measured and expressed in parts per million carbon (ppbc).

In addition, real time CO analysis was performed at Terminals 6 and 7 by the Drager PAC III CO analyzer. A discussion of its operation is found in Section 6.3. There were a

10.0 Conclusions

From the analysis of the samples collected, the following conclusions are drawn:

- Key pollutants detected were carbon monoxide, benzene, 1,3-butadiene, and elemental carbon.
- Higher concentrations of all key compounds were found at Terminals 6 and 7.
- Higher concentrations of the monitored pollutants were observed Thanksgiving week as compared to the week prior.
- Elemental carbon concentrations were higher at all terminals when compared to harbor area measurements.
- Pollutant levels at the Bradley Terminal were lowest of the terminals studied.
- Mobile source emissions cause higher levels of toxic (benzene and 1,3-butadiene) pollutants, and other key pollutants (elemental carbon and carbon monoxide) than is observed in comparable studies in the South Coast Air Basin.
- It is apparent that the configuration of the LAX terminal areas, coupled with meteorological and emissions factors, leads to substantial concentration differences. Terminals 6 and 7, and to some extent, Terminal 1, have the highest concentrations of the key pollutants, whereas the western-most terminal, the Bradley Terminal, typically has the lowest concentrations.
- Based on meteorological conditions and high traffic volumes, the measurements taken during the Thanksgiving weekend period likely represent a near-worst-case scenario at the LAX Terminals.

total of five real time instruments used in the study. The analyses at Terminal 1, Bradley upper terminal and the Bradley lower terminals were invalidated due to problems with the instrument operating beyond its lower detection limits. When the instrument is operating at its lowest detection limits, temperature fluctuations can lead to erroneous data. The zero reading of the instrument will fluctuate and create inaccurate data. The Instrument Specialists trained in its operation determined that the instruments were not delivering accurate data at the Bradley terminals and Terminal 1 and the data was invalidated.

The Elemental Carbon analysis consists of capturing PM_{10} on a quartz fiber filter and taking an approximately 1 square centimeter fraction into the Thermal/Optical Carbon Analyzer. In the analyzer the filter piece is subjected to gradual heating under an inert atmosphere (helium) to a point where the organic carbon is entirely driven off the filter, about 500 degrees centigrade. As the temperature of the filter rises above 500 degrees centigrade the atmosphere is changed to add oxygen to the carrier gas. This will then combust the elemental carbon (EC) on the filter. As the EC is evolved off the filter it is swept through a combustor consisting of Hopcalite and converted to carbon dioxide (CO_2). The CO_2 is then swept through a methanizer with hydrogen gas added and the carbon dioxide is converted to methane. This is analogous to the operation of the TCA. The optical portion of the instrument consists of a laser and a reflectance measurement device to determine a cut-off point of elemental versus organic carbon. The laser reflects upon the filter sample and as the analysis proceeds the organic carbon present is partially combusted (and not simply boiled off) and this decreases the reflectance of the filter. As the filter is further heated above 500 °C this carbon formed is evolved off the filter. At the point where the reflectance returns to its initial reading (pre-analysis start) the evolution of the EC has begun. Response of the FID beyond this time is quantified as the EC concentration.

8.0 Meteorological Discussion

In general, the weather during the study followed patterns that are normal for the season: the passage of storm systems followed by a period of offshore pressure gradients, with weak onshore or offshore wind flows, and then a return to the on-shore pressure gradients and a stronger afternoon sea breeze. During the November 1999 sampling periods, airflow in the afternoon and early evening hours at LAX was predominantly onshore, from the west through west-southwest. During the night and morning hours, weak to moderate offshore flows occurred at LAX. Temperature inversion conditions varied, along with the associated potential for trapping pollutants near the ground.

On Wednesday November 17, 1999, a weak storm system passed through the area early in the morning, bringing widely scattered light rain showers with only 0.01 inches measured at LAX. By afternoon, the skies had mostly cleared but temperatures remained relatively cool, with a high temperature of 63°F measured at LAX. Onshore wind flows started early in the morning, exceeding 12 mph in the mid-afternoon, before becoming offshore in the evening. The morning temperature sounding indicated well-mixed conditions with the base of a weak, elevated inversion at 4200 feet. Thus, the potential for the trapping of pollutants near the ground was relatively low.

Elemental Carbon

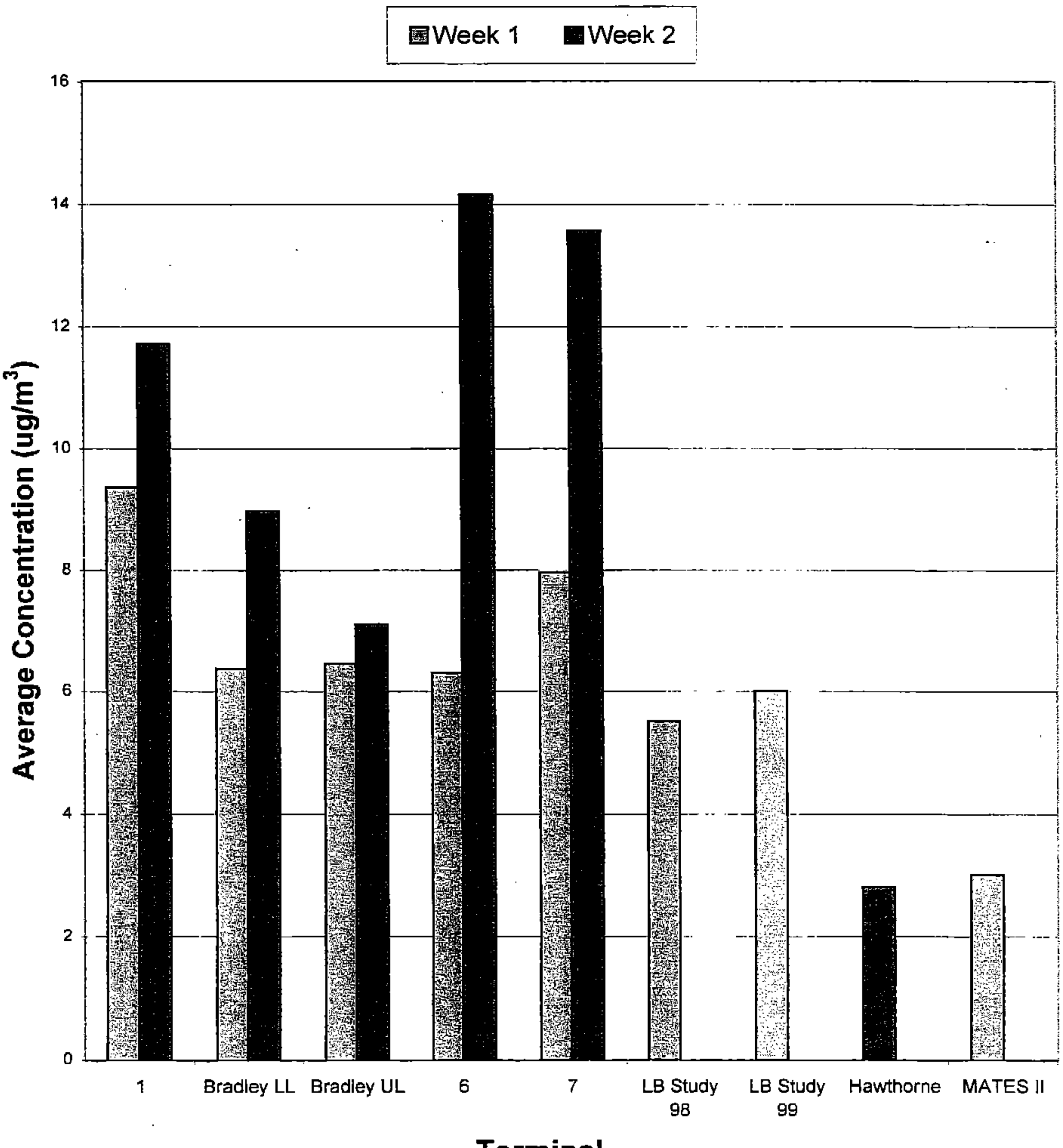


Chart 6

On Thursday, November 18, patchy morning fog gave way to mostly sunny skies and slightly warmer temperatures, under a high-pressure ridge aloft and weak offshore pressure gradients. The high temperature at LAX on this day was 67°F. Drizzle from the morning fog brought 0.01 inches of rain to LAX. Moderate offshore winds in the morning gave way to a moderate sea breeze in the afternoon, followed by fairly calm nighttime flows. Mixing heights in the coastal plain were again relatively deep with a very weak elevated inversion near 3000 feet. The potential to trap pollutants near the ground was again relatively low.

A storm system approaching the central California coast weakened the ridge and brought increased high clouds throughout the afternoon of Friday, November 19. The LAX maximum temperature for the day was 64°F. Calm wind conditions persisted through the morning and afternoon at LAX, becoming onshore in the evening hours. The morning temperature inversion was elevated with a base near 1400 feet. While the morning sounding indicates that the potential to trap pollutants near the surface was increasing but still relatively low, the stagnant wind conditions indicate that the potential may have in fact been greater for this day.

A weak frontal system and upper level trough of low pressure moved through by mid-morning of Saturday, November 20, bringing partly cloudy skies and some gusty winds. Only 0.01 inches of precipitation was measured near LAX. Temperatures cooled slightly to a maximum of 63°F. Except for a few hours of offshore flows in the early morning, winds were primarily onshore from the southwest then the west in the late evening. Mixing was again relatively deep and the potential to trap pollutants near the ground was low.

Sunday, November 21 was clear, cool and breezy, with a high temperature of 67°F at LAX. At LAX, calm winds were replaced by north-northwesterly winds gusting over 22 mph by 10 AM. Then, after four hours of onshore flows, north-northerly winds, peaking at 40 mph, started at 3 PM that lasted into the next morning. A weak, surface-based radiation temperature inversion was present in the morning on November 21, increasing the potential to trap pollutants during the morning hours to moderate levels, although this did not last for much of the day due to ventilation from the gusty winds.

Clear skies, cooler nighttime temperatures and continued moderate offshore pressure gradients help to strengthen the surface-based inversion by the morning of Wednesday, November 24. Daytime high temperatures warmed to 73°F. Flows at LAX were weakly offshore or calm until the sea breeze picked up at 1 PM. Pollutant trapping potential was relatively high for much of this day in the coastal area.

Clear, cool nights again kept the surface radiation inversion intact for much of the day in the coastal area on Thursday, November 25 and again on Friday, November 26. With the continuing offshore flow event throughout the Basin, daytime high temperatures at LAX reached 75°F on Thursday and 78°F on Friday. Winds at LAX were predominantly weak offshore on both days, except for a few hours each afternoon when the onshore sea breeze prevailed. Pollutant trapping potential was again relatively high on both days.

9.3 Elemental Carbon Data Summary

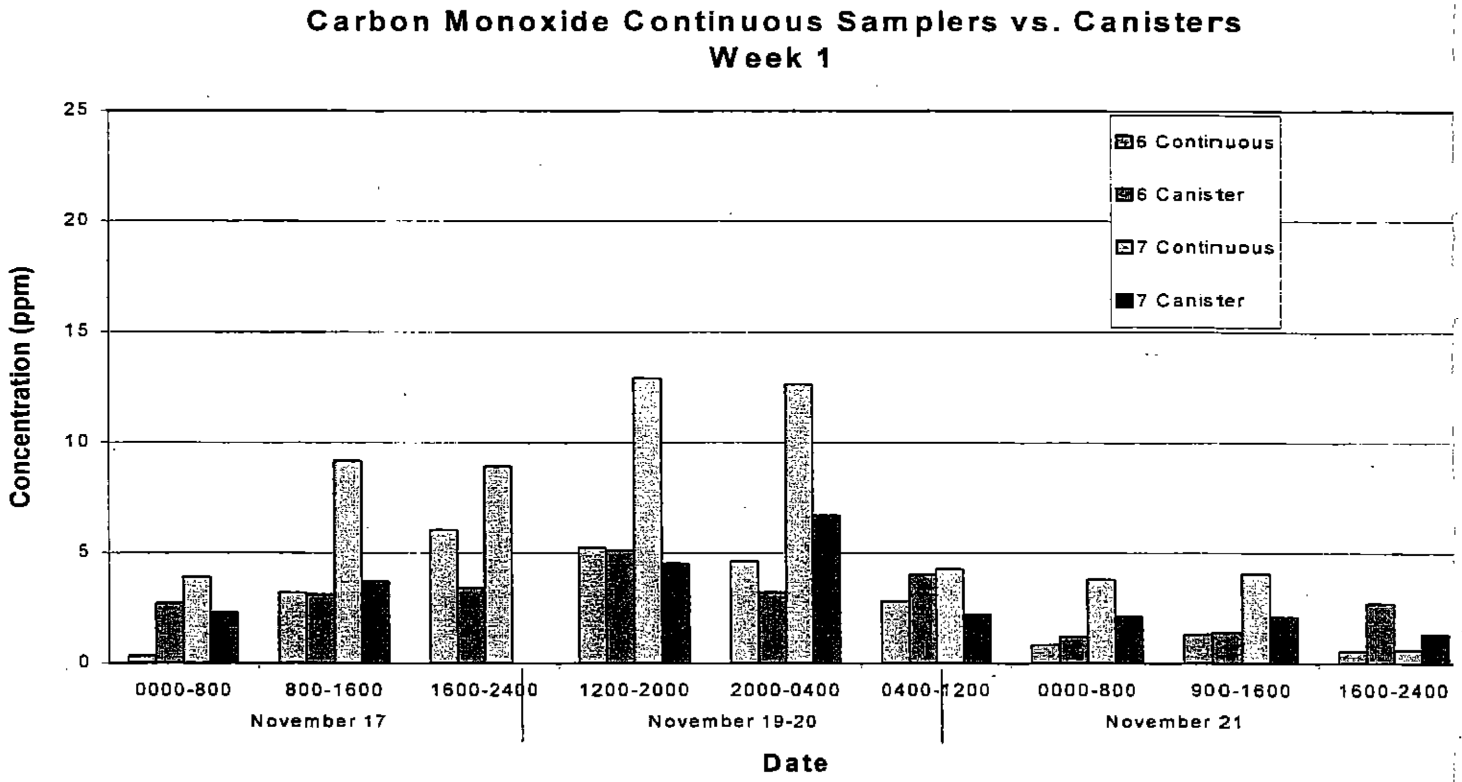
Elemental Carbon was sampled Terminals 1, 6, 7, and the Bradley upper and lower terminals. Results are depicted in Chart 6, along with comparative data collected during other previous studies, including MATES II, and the harbor area studies conducted during the same seasonal period in 1998 and 1999. In fact, data from the Long Beach 1999 study were taken during the same period of time as this LAX study. It can be seen that the EC at the terminals is elevated over the comparative averages in the other studies. Further from this chart it can be seen that week 2 (Thanksgiving week) had higher levels of EC reflecting the increase traffic during this time period. As with the benzene, 1,3-butadiene and CO, the EC is elevated at Terminals 6 and 7, as well as Terminal 1. The results indicate that, during the first week, levels of EC observed at Terminal 6 and the Bradley Terminal were approximately the same as the EC levels observed in Long Beach, and that EC levels at Terminals 1 and 7 were about 30% higher than the others. During Thanksgiving week, however, EC levels were higher than those in Long Beach at all locations, with the highest levels of approximately 14 ug/m3-almost two and one-half times the levels observed in Long Beach. This could indicate a substantial influence of diesel particulates at LAX during Thanksgiving week.

The offshore pressure gradients started to relax on Saturday, November 27, allowing the sea breeze to penetrate further inland by afternoon. This cooled the coastal afternoon temperatures at LAX to a high of 69°F and likely allowed the strong surface-based inversion that was seen in the morning to stay intact for much of the day. Thus, the pollutant trapping potential was again relatively high.

On Sunday, November 28, the onshore pressure gradient returned and the stronger sea breeze kept the afternoon temperatures cooler, with a high of 68°F measured at LAX. The offshore winds overnight and in the morning were weak. Fog and low clouds formed near the coast in the afternoon and spread inland, as the onshore flow continued from through the afternoon and evening. The radiation inversion was weaker on this morning, but the potential to trap pollutants near the surface was moderate, or higher, for much of the day.

In summary, the meteorological conditions during the Thanksgiving weekend period were more stable and conducive to pollutant build-up than occurred during the prior weekend period.

LAX Terminal Study



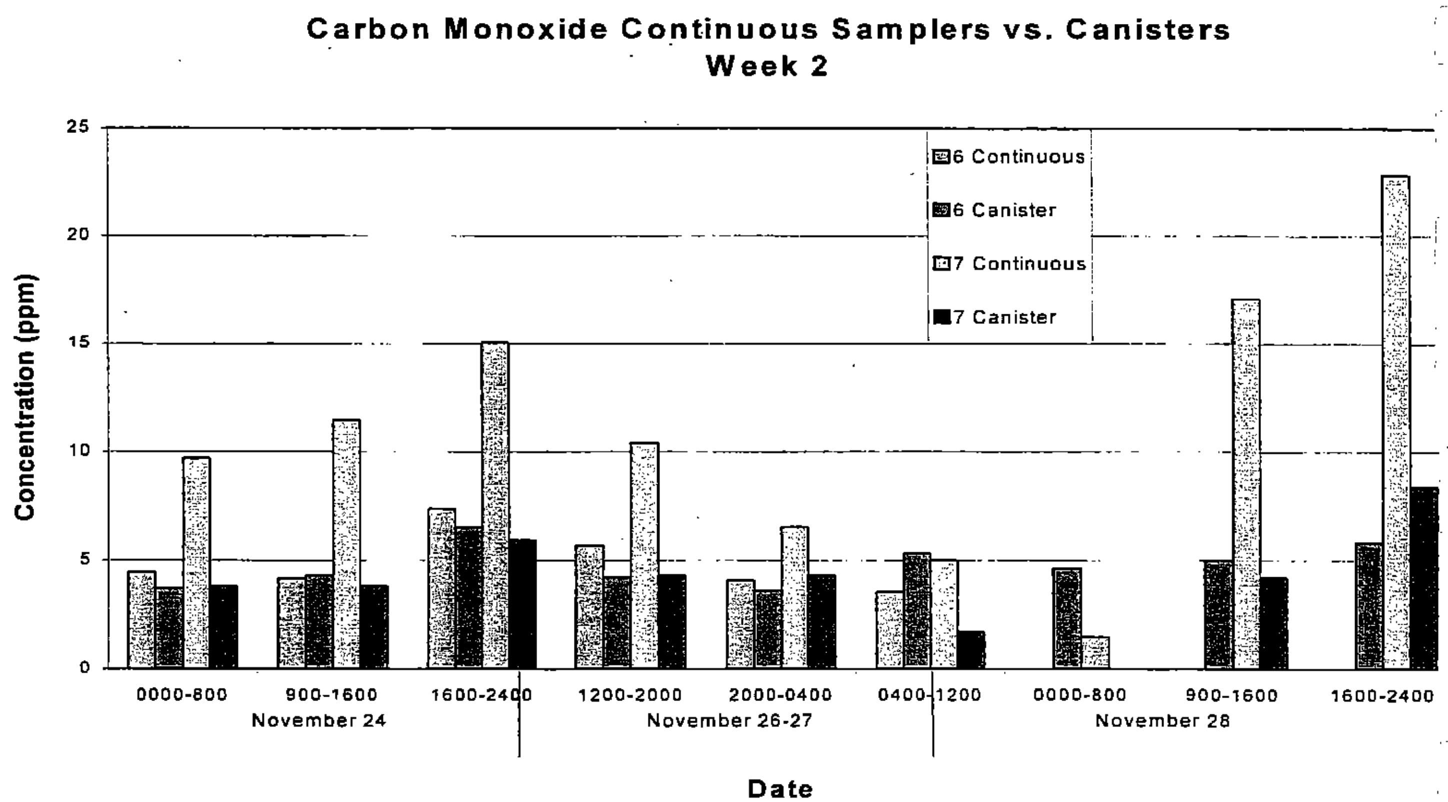


Chart 5

9.0 Data Summary Results and Discussion

A discussion of the results of each sampling analysis type follows. Laboratory reports for each site and sample type are included in the appendices.

9.1 Hydrocarbon Data Summary

During this study, most chlorinated VOCs were not found at levels above the method detection limits (usually 0.1 ppb). The levels of halocarbons found were generally lower than the levels detected in the MATES II program. Chlorinated VOCs are of interest since they are used in industrial processes, typically as solvents and degreasers, and are not emitted by either mobile sources or other combustion sources. The only chlorinated hydrocarbon species consistently detected were perchloroethylene, methylene chloride and chloromethane. These compounds are typically found in the entire basin and represent a global background level. The half-life of these compounds is extremely long and the control of their release has reduced their concentration in the atmosphere over time.

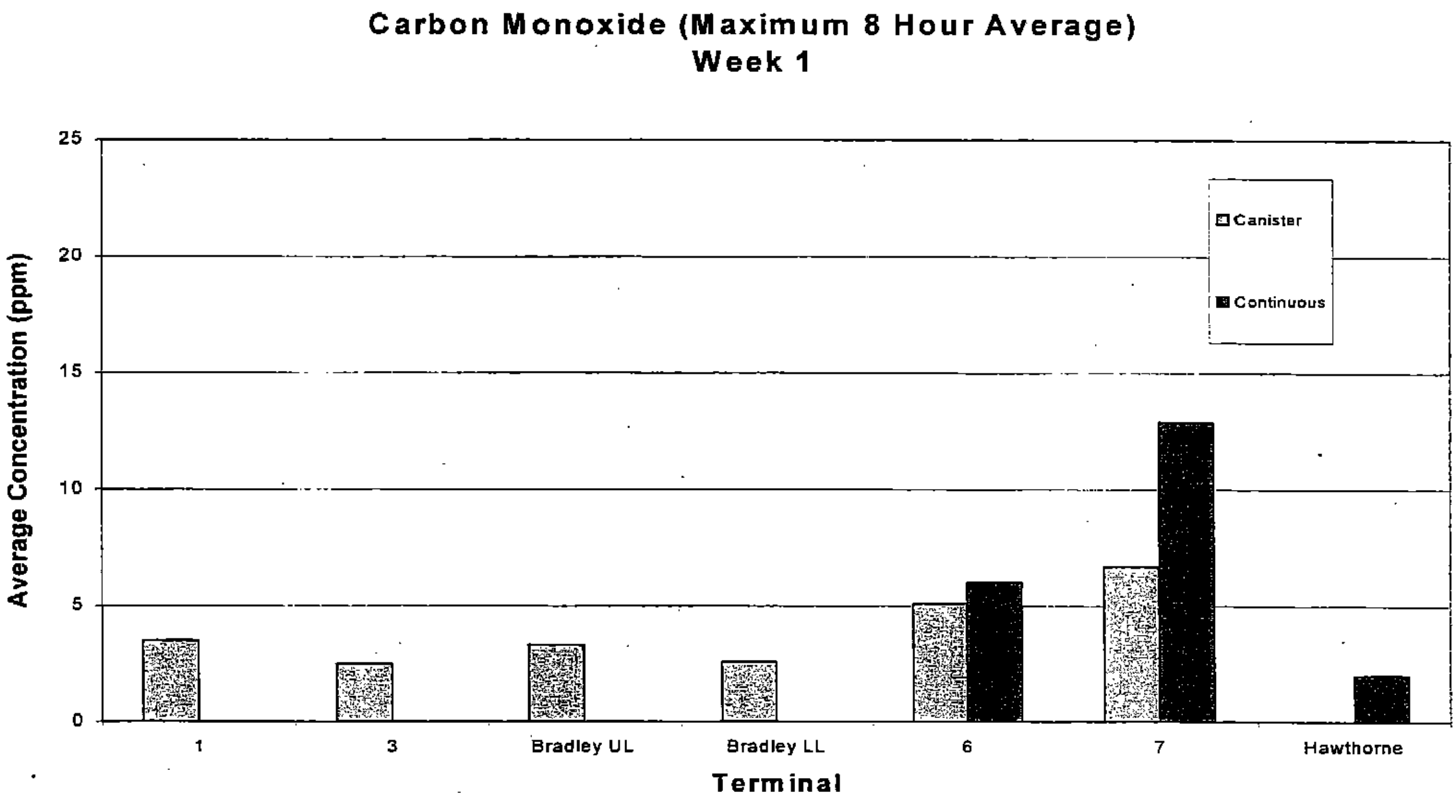
Of the other VOCs (non-chlorinated) measured, all but styrene are typically emitted by mobile sources. Those include benzene, 1,3-butadiene, toluene, ethyl benzene, o-, m-, & p- xylenes. Styrene is indicative of manufacturing of resins and its uses, rather than mobile sources.

The two main indicators of mobile source emissions, benzene and 1,3-butadiene will be the focus of this discussion. It should be noted that 1,3-butadiene is a byproduct of combustion from aircraft, diesels and cars. Benzene is primarily emitted by incomplete combustion of gasoline.

Three eight hour canister samples were taken at each site with the exception of the Bradley Terminal upper level. The time period for the samples was from (in military time) 0000-0800 hours, 0800-1600 hours and 1600-2400 hours. The Bradley Terminal upper level sampling used 24 hour integrated samples into Tedlar® bags. A total of six sampling days covered; Wednesday, 11-17, Friday, 11-19, and Sunday, 11-21 of the week before Thanksgiving. The week of Thanksgiving the sampling occurred on Wednesday, 11-24, Friday, 11-26, and Sunday 11-28. The Terminals 1, 3, 6, 7, and the Bradley lower terminal were sampled with summa canisters (three 8-hour samples). Charts 1a through 1c contain the bar-charted data for the individual samples grouped by day of the week for benzene. The 24-hour average for sites 1, 3, 6, 7 and Bradley lower are the mean of the three 8-hour samples. Charts 2a through 2c contain the bar-charted data for the same grouped sampling days but for 1,3-butadiene. The groupings are Wednesday to Wednesday, Friday to Friday, and Sunday to Sunday of the week prior to Thanksgiving and Thanksgiving week.

The data indicates above average concentrations for benzene and 1,3-butadiene as compared to basin wide averages found in the MATES II study. The MATES II sites were chosen to indicate regional scale exposures and this study was sited to look at a

LAX Terminal Study 1999



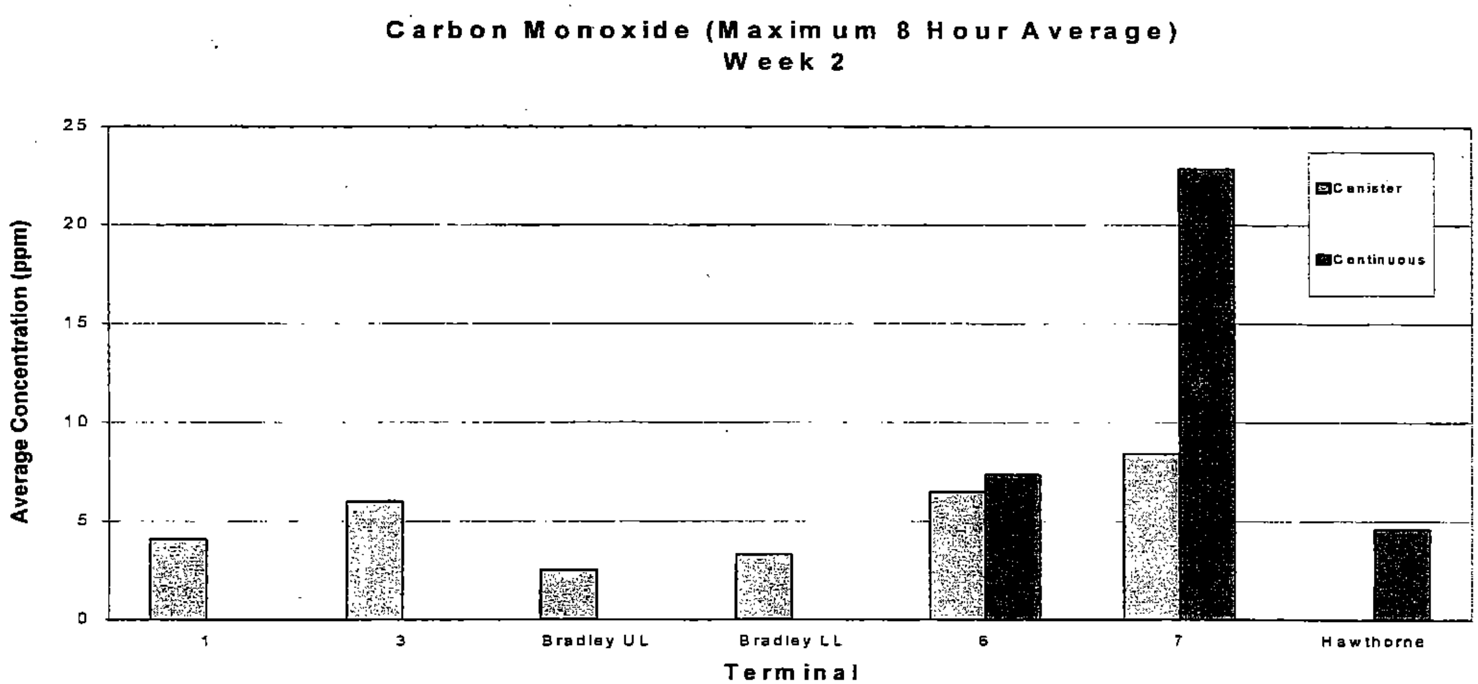


Chart 4

small scale, local exposure. At Terminals 6 and 7, concentrations appear to be well above the annual average levels found in MATES II.

The data for benzene and 1,3-butadiene for each individual day track each other very well. That is, the sites with high benzene have high concentrations of 1,3-butadiene and vice-versa. This implies the same source for these two compounds (i.e. mobile sources).

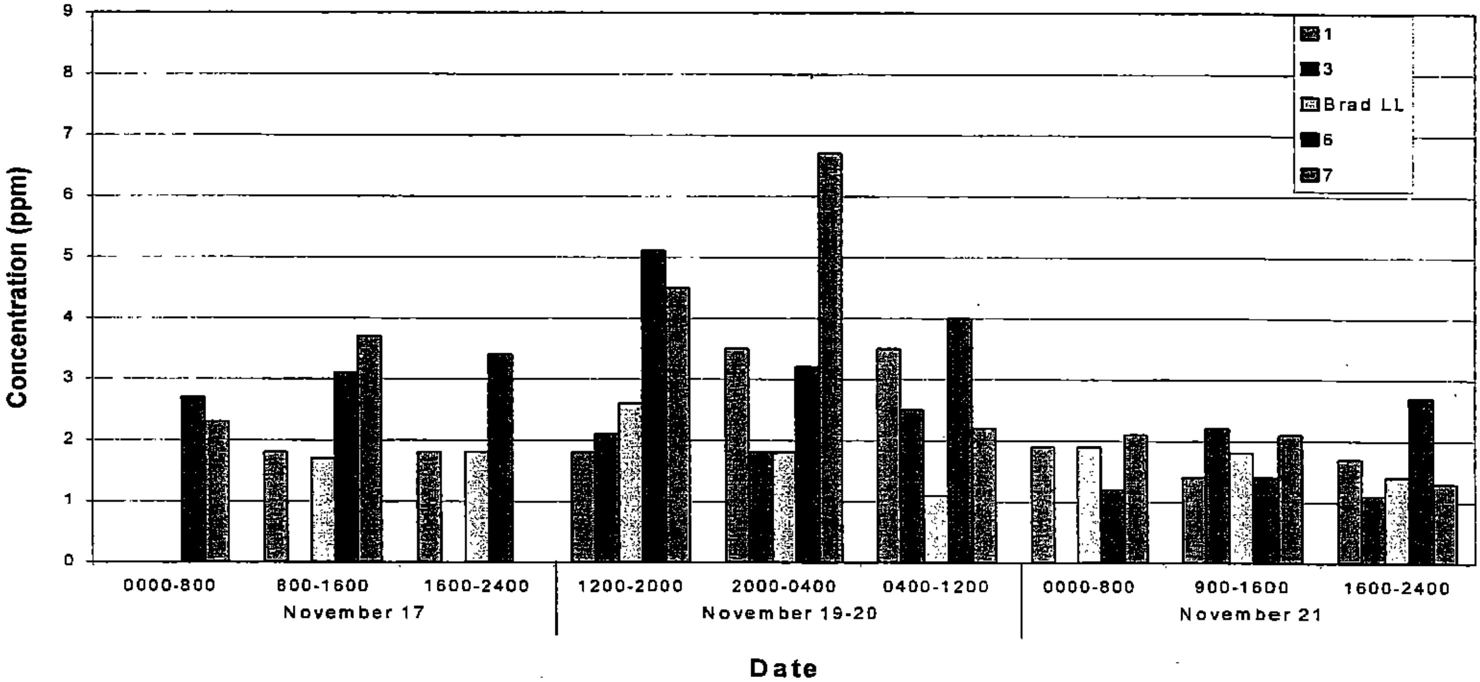
The pattern of the emissions indicates that the highest emissions occur at in the evening hours typically between 4:00 pm and midnight. There are occasions when the emissions are highest in the midnight to 8 am period. This is most likely due to meteorological conditions when ventilation is low, and low level temperature inversion conditions strengthen.

The week to week comparison of the same day of the week indicate the week prior to Thanksgiving has lower concentration than occur during Thanksgiving Day week, which is to be expected if traffic emissions are affecting the concentration levels. According to LAX staff, traffic was 2.5 to 3 times greater during Thanksgiving week than during the prior week.

There are no analytical methods available to determine the contributions of ground traffic versus aircraft traffic. From the siting of the samplers it can be assumed that the predominate factor is automobile traffic. Hydrocarbon results for the six days of sampling can be found in the appendices.

LAX Terminal Study 1999

Carbon Monoxide Canister Data
Week 1



Carbon Monoxide Canister Data
Week 2

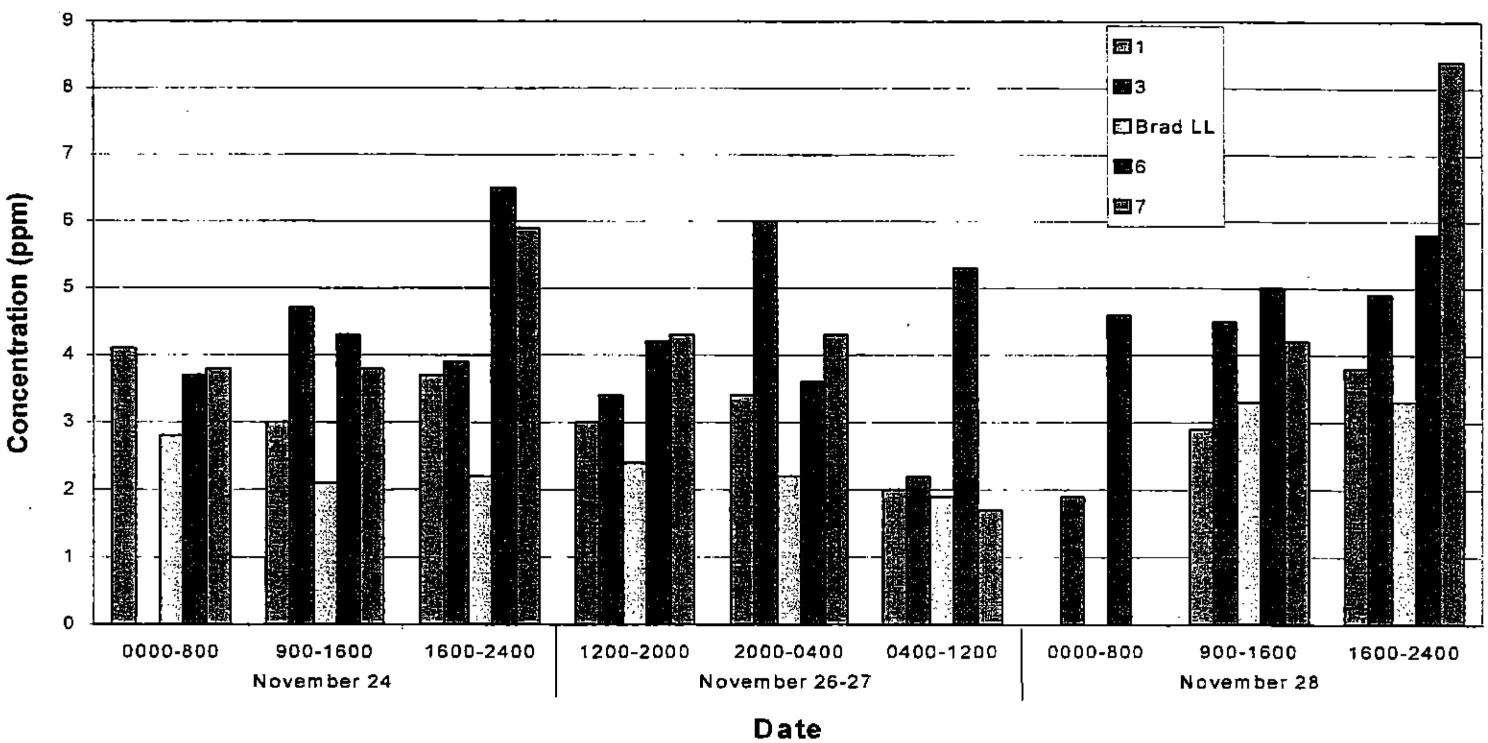
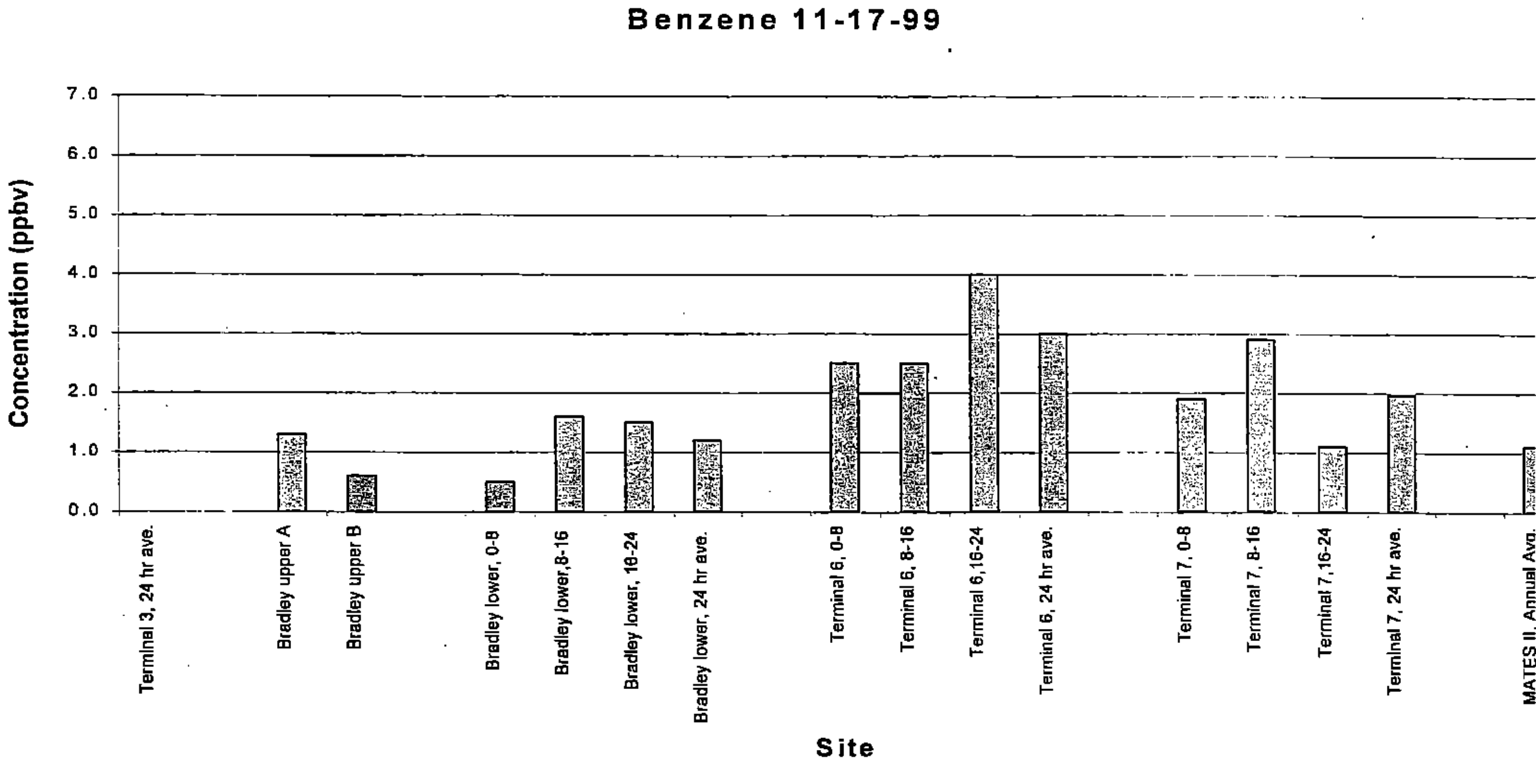


Chart 3

LAX Terminal Study 1999
Hydrocarbon Data



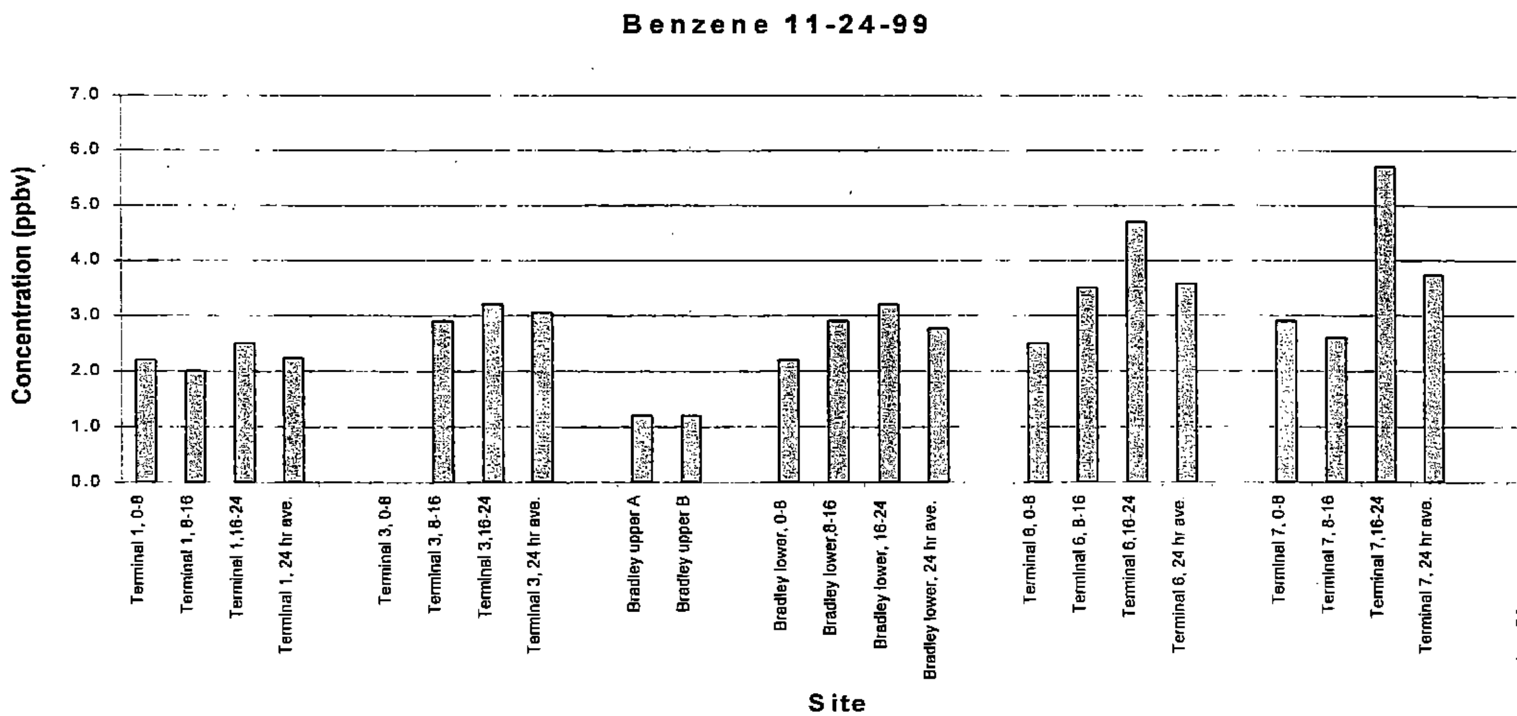


Chart 1a

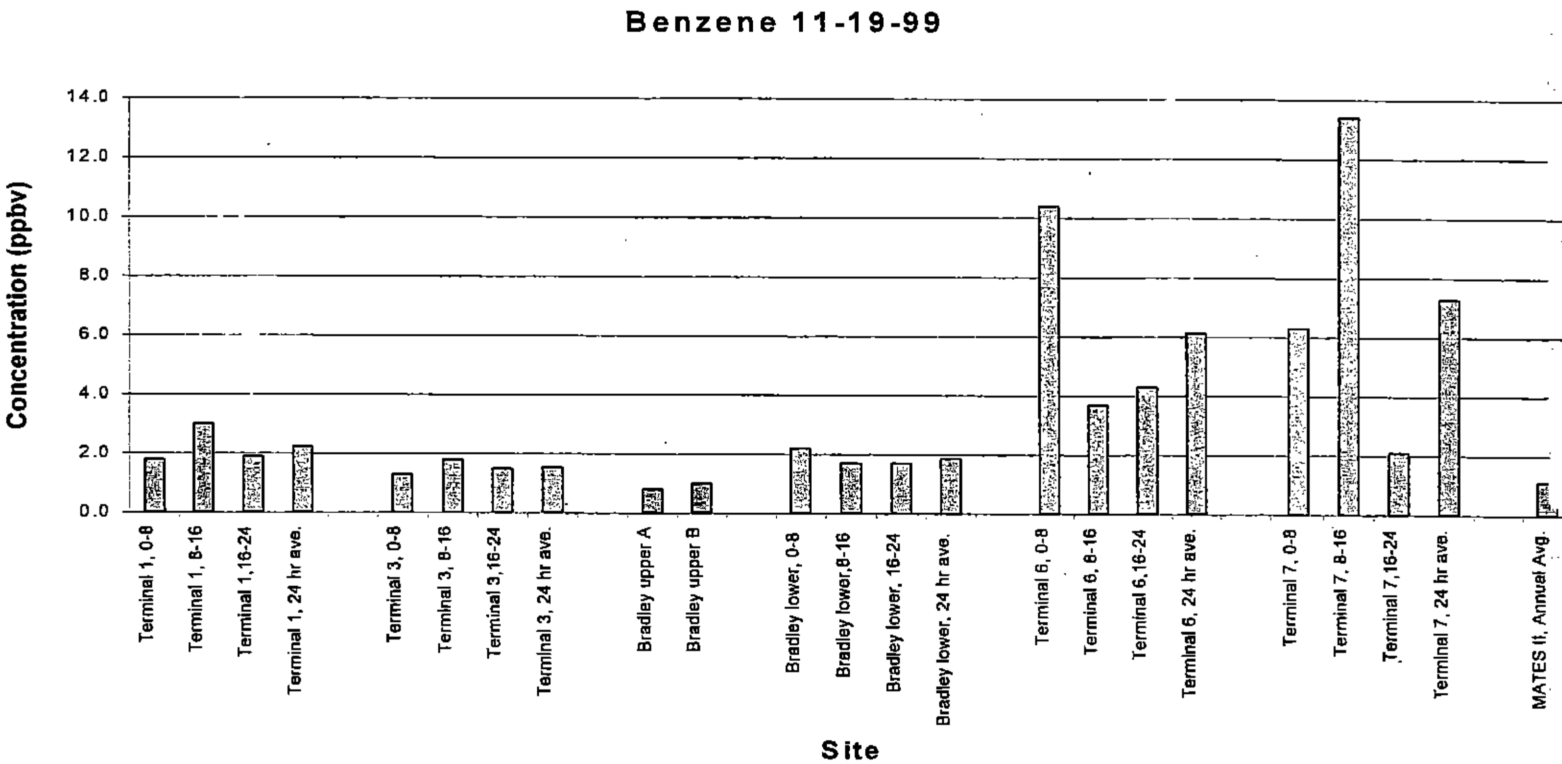
9.2 Carbon Monoxide Data Summary

Carbon monoxide was analyzed by TCA from the three 8-hour canisters taken at Terminals 1, 3, 6, 7, and Bradley lower level. At Terminals 6 and 7 continuous Drager Pac III measurements were made. The CO data from the canister samples are identified in Chart 3. It can be seen that the eight-hour samples did not exceed the state (9.0 ppm) or federal (9.5 ppm) 8-hour standard during the course of the study. During Thanksgiving week, higher concentrations were measured as compared to the previous week, following the pattern seen with the hydrocarbon concentrations. The highest concentrations occurred during the late evening, early morning hours, as would be expected from meteorological conditions. In both weeks of the study, Terminals 6 and 7 showed higher concentrations of CO than the rest of the locations.

Maximum 8-hour averages at Terminals 6 and 7 have been charted along with the continuous Drager Pac III measurements as shown in Chart 4. The canister maxima were taken as the highest sample concentration of the day. The Drager measurements are in 5-minute increments that have been averaged for 8 hours to produce the data found in Chart 4. It can be seen that the continuous measurements are slightly higher at Terminal 6 and significantly higher at Terminal 7. As described previously, problems with the Drager Pac III devices at other locations did not produce valid measurements. Although there is no basis to invalidate the data measured at Terminals 6 and 7, there is not a high confidence level in the reported results. Hence, the data from the Drager Pac II are presented. The Drager continuous CO measurements reflect an exceedance of the state and federal standard for CO at Terminal 7.

Chart 5 identifies the highest sample concentrations for Terminals 6 and 7 from both the continuous monitor and the canister sample. It can be seen that the continuous monitor almost always overstates the CO concentration in comparison to the canister sample. Neither method is a federal reference method. It can be seen that the highest levels of CO concentration occurred on Sunday, November 28. This was presumably during the busiest travel day of the period. The CO results are consistent with the benzene and 1,3-butadiene results indicating a common source for these pollutants.

LAX Terminal Study 1999
Hydrocarbon Data



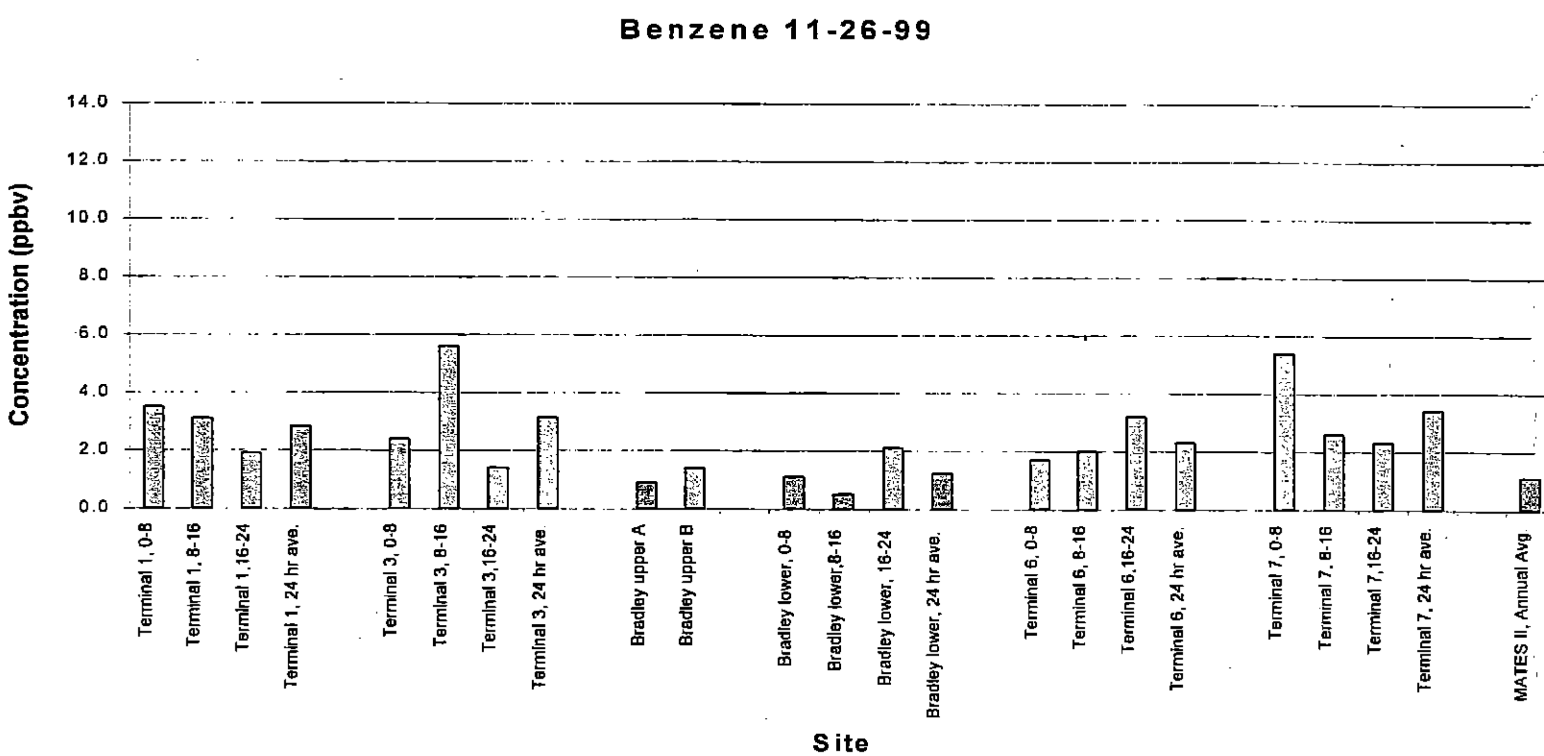
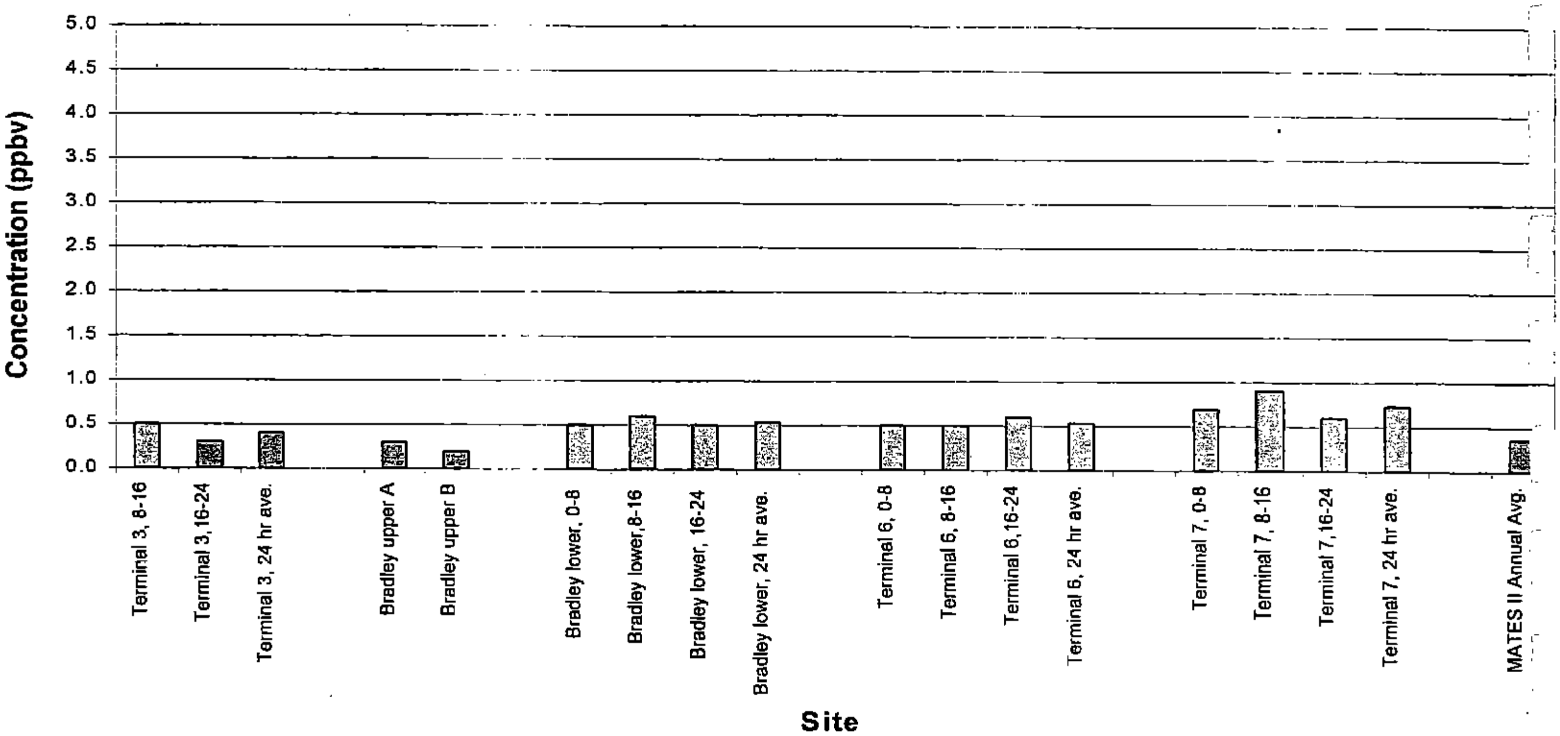


Chart 1b

LAX Terminal Study 1999
Hydrocarbon Data

1,3-Butadiene 11-21-99



1,3-Butadiene 11-28-99

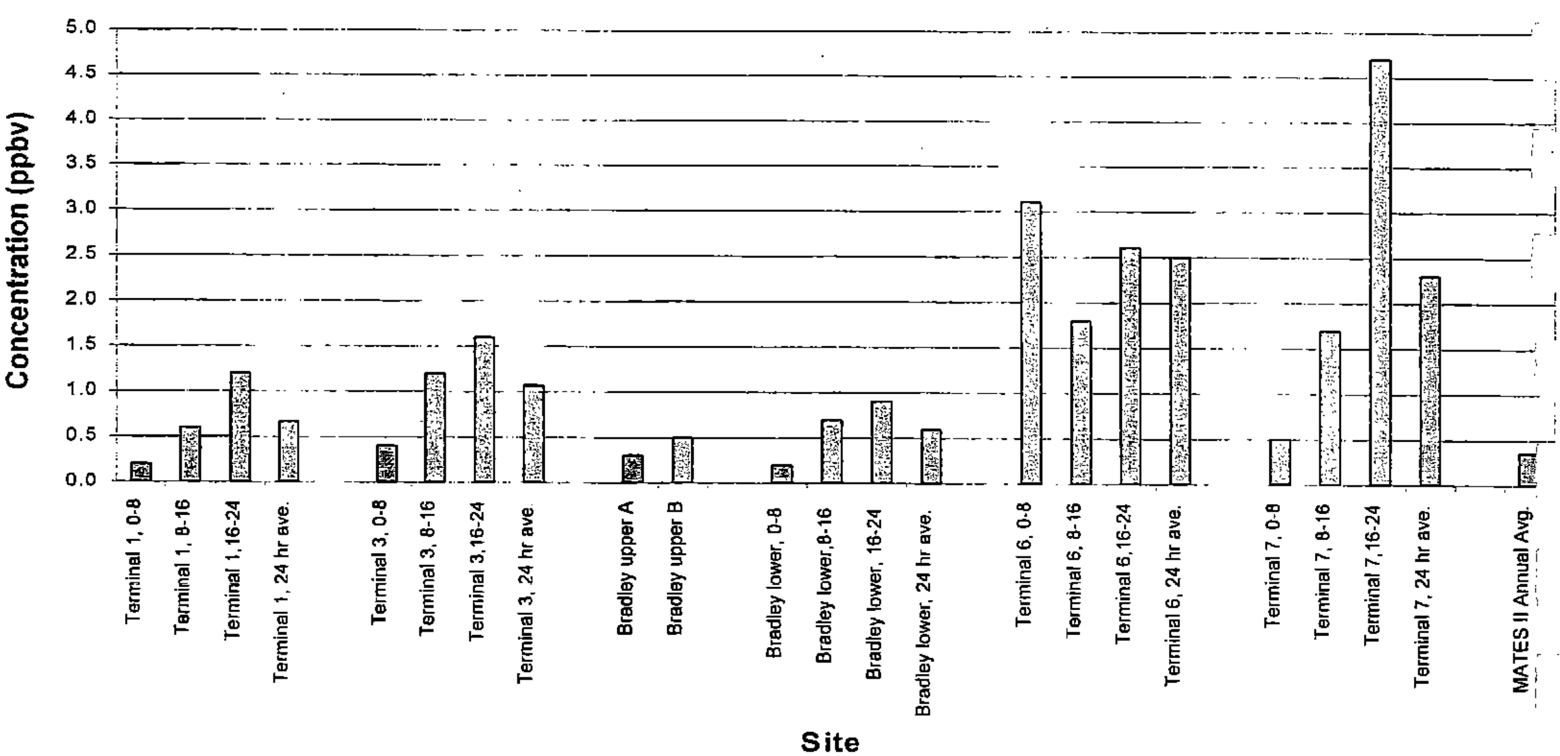
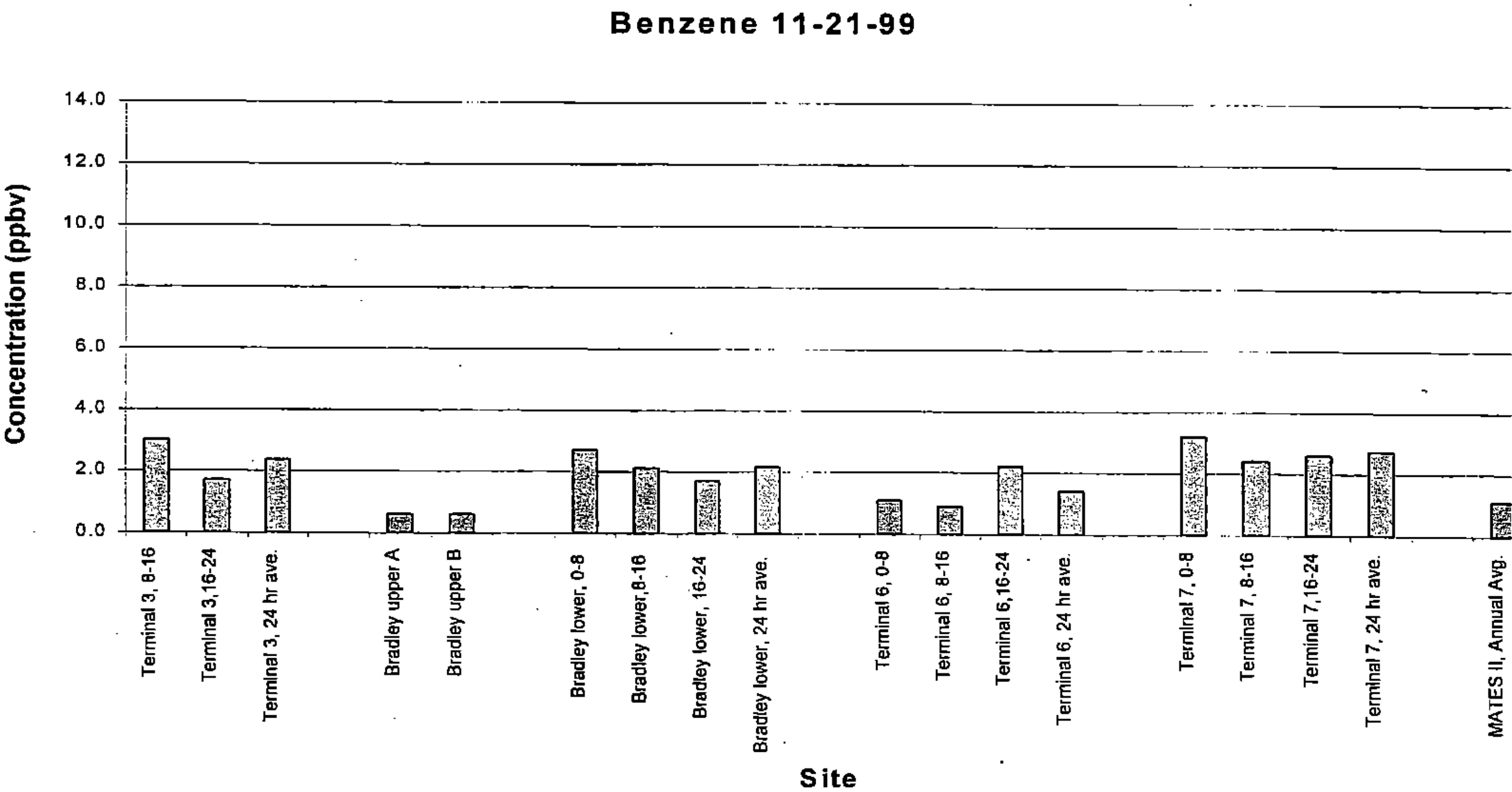


Chart 2c

LAX Terminal Study 1999
Hydrocarbon data



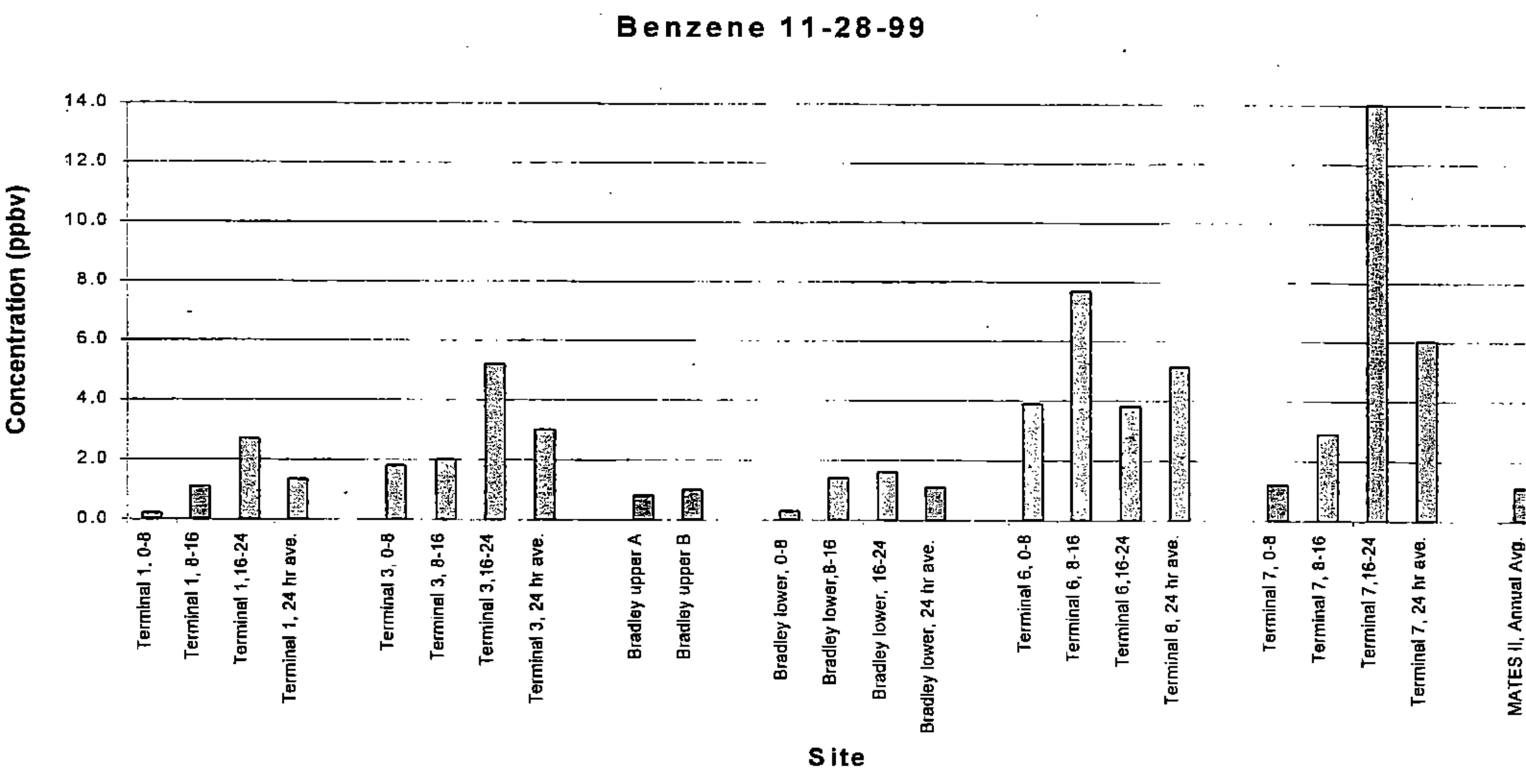
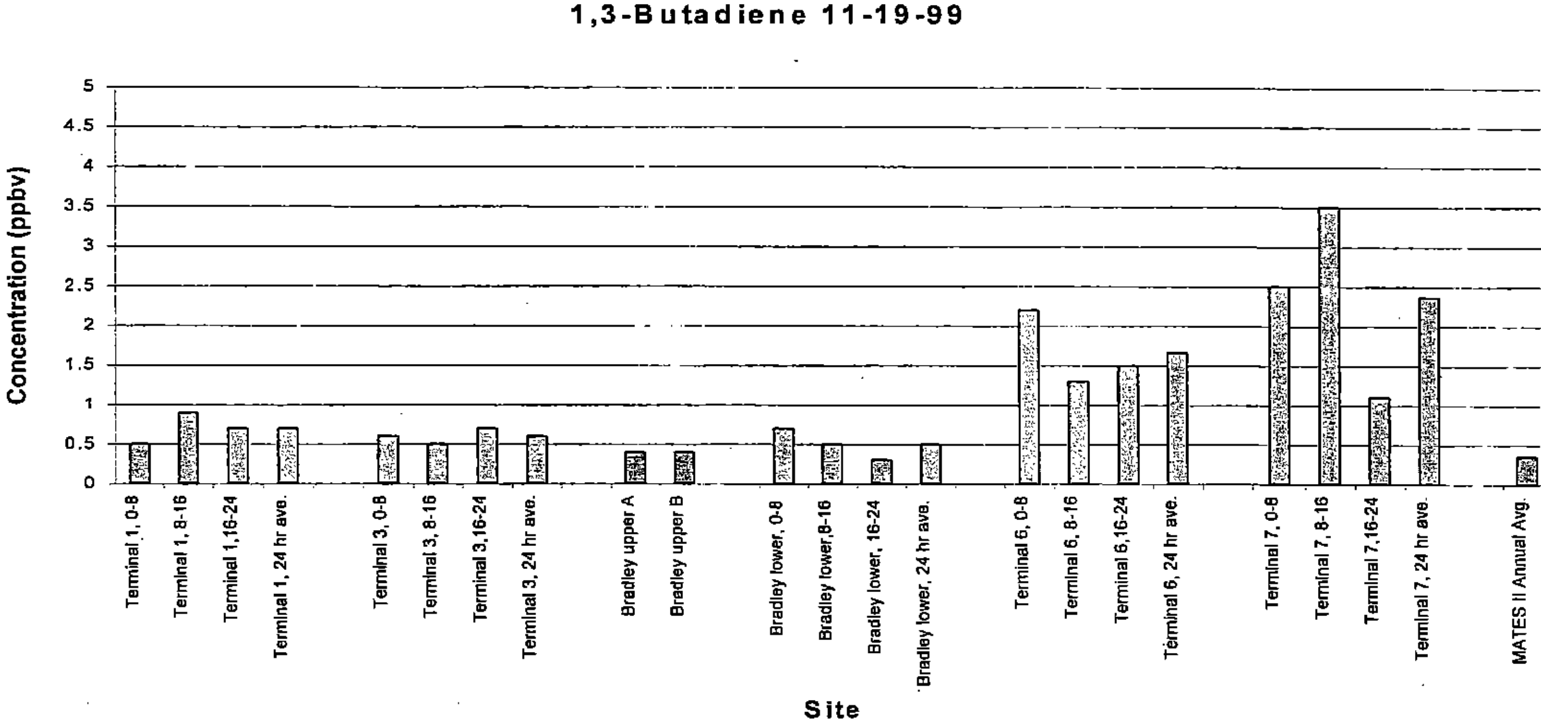


Chart 1c

LAX Terminal Study
Hydrocarbon Data



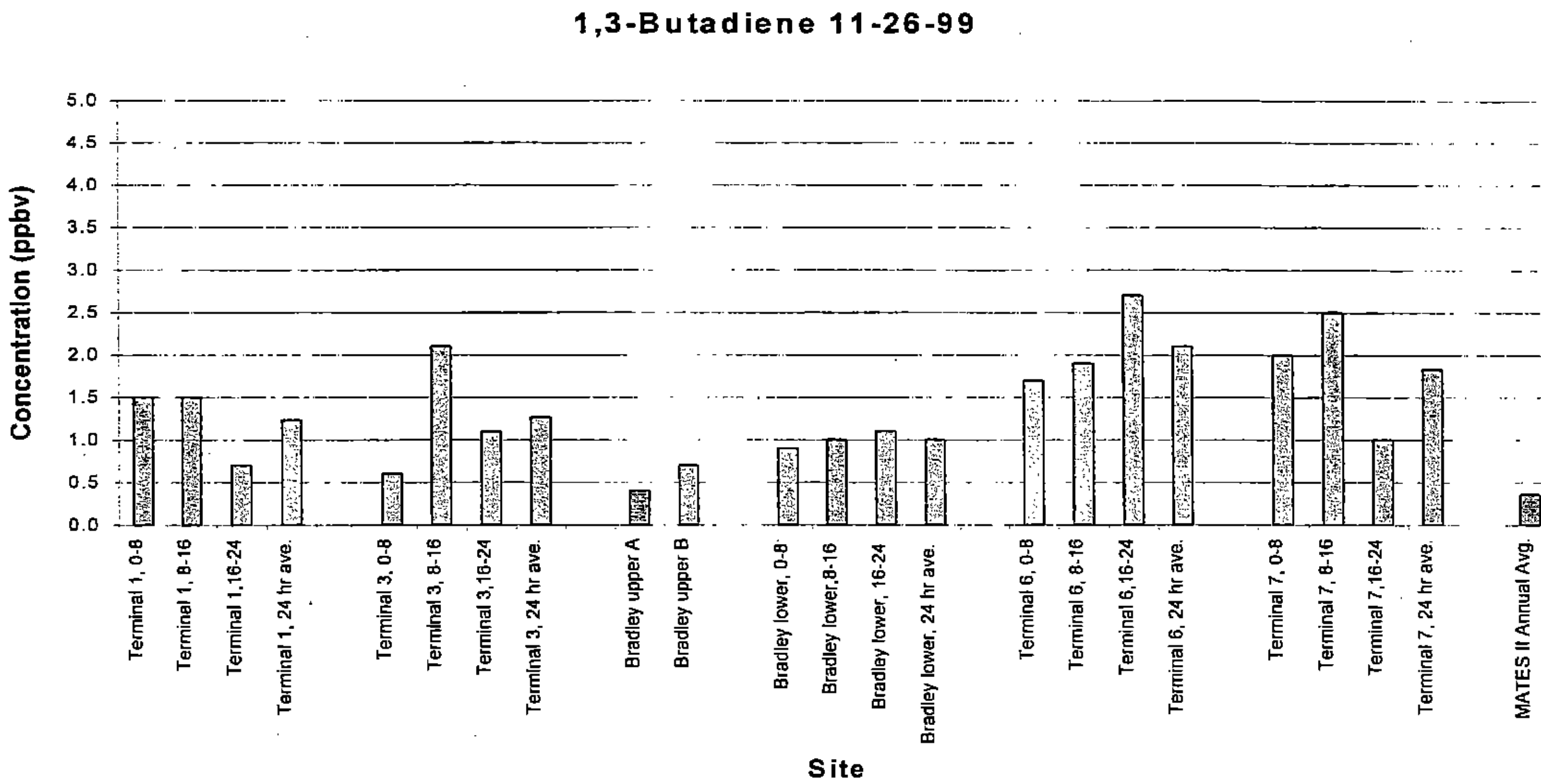
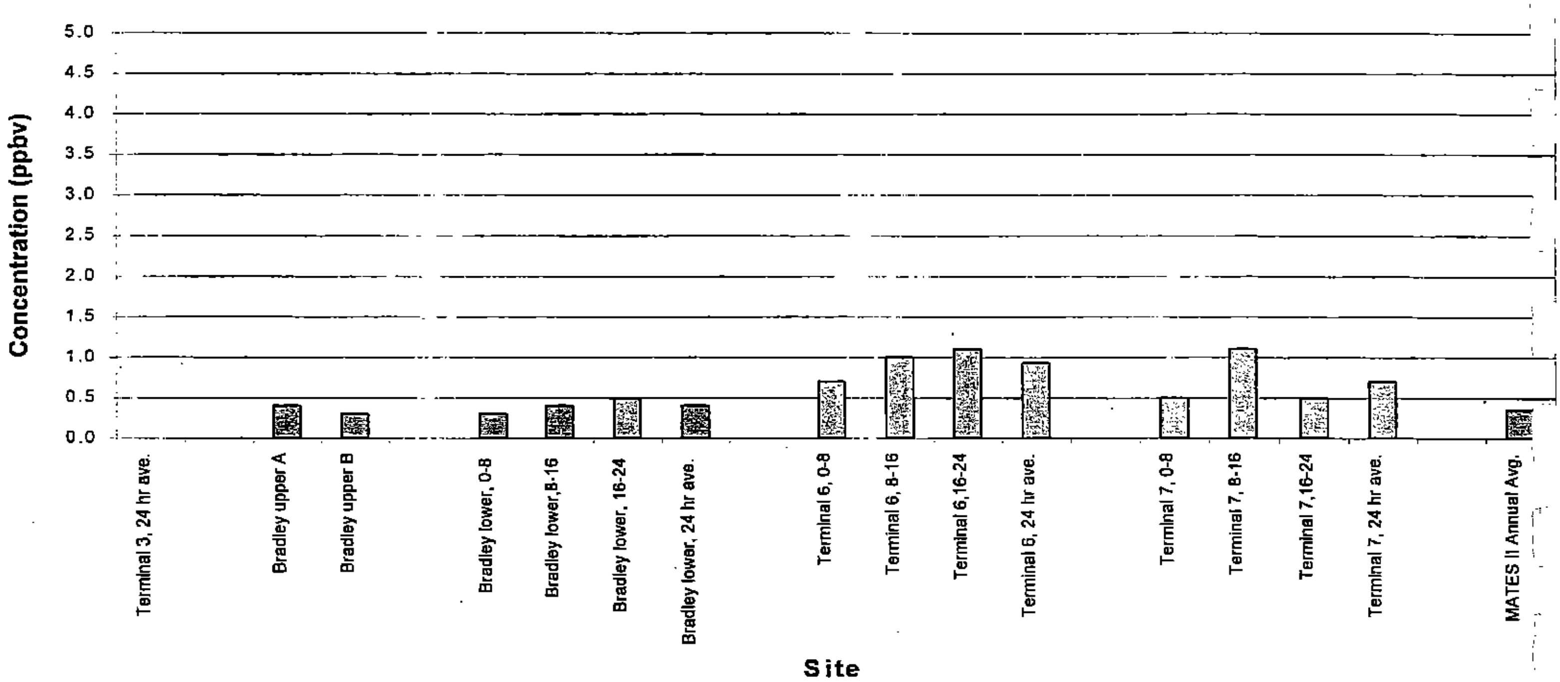


Chart 2b

LAX Terminal Study
Hydrocarbon Data



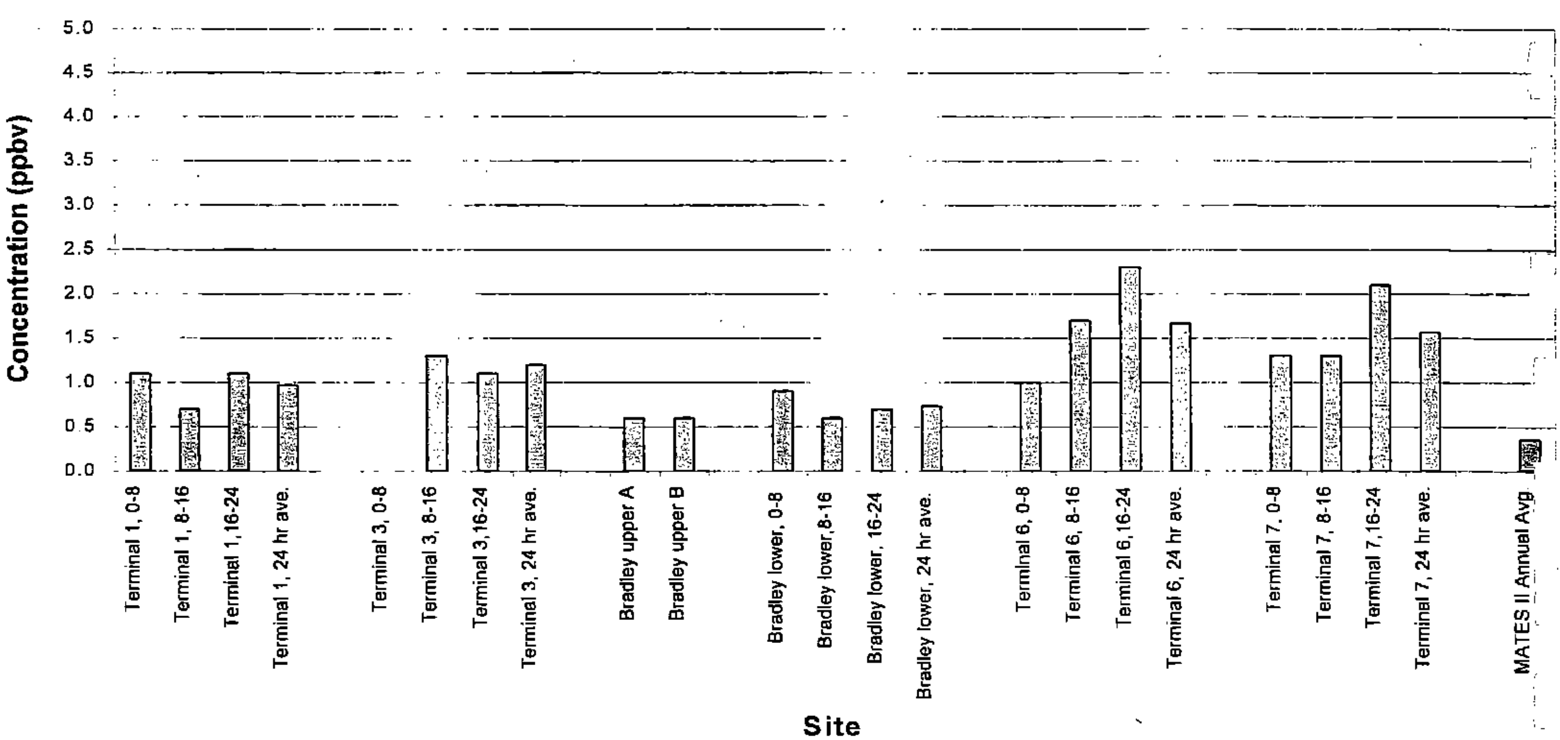


Chart 2a

LAX AREA AIR MONITORING-Follow Up Study

Benzene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	0.4	0.6	0.6	0.53	0.115	0.231
Site 2	0.5	0.7	0.7	0.63	0.115	0.231
Site 3	0.4	0.6	1.2	0.73	0.416	0.833
Site 4	0.5	0.8	0.9	0.73	0.208	0.416
Site 5	0.8	0.9	NS	0.85	0.071	0.141
Site 6	0.2	0.2	0.4	0.27	0.115	0.231
Site 7			0.3	0.30	0.000	0.000
Site 8			1.0	1.00	0.000	0.000
Site 9			0.3	0.30	0.000	0.000

NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
Site 4 = Hindry Street
Site 5 = also known as Lennox or Felton School site
Site 6 = Hawthorne Air Monitoring Station
Site 7 = Imperial Street School
Site 8 = Wiseburn School Dist HQ
Site 9 = Cowan School

LAX AREA AIR MONITORING-Follow Up Study

o-Xylene (ppbv)

SITE	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
	Date (1999)					
1	0.20	0.10	0.10	0.13	0.058	0.115
2	0.10	0.20	0.10	0.13	0.058	0.115
3	0.20	0.10	7.10	2.47	4.013	8.026
4	0.40	0.20	0.40	0.33	0.115	0.231
5	0.20	0.10	NS	0.15	0.071	0.141
6	0.05	0.05	0.20	0.10	0.087	0.173
7			0.20	0.20	0.000	0.000
8			0.20	0.20	0.000	0.000
9			0.20	0.20	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
NS = No Sample
Detection Limit = 0.1 ppb

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
Site 4 = Hindry Street
Site 5 = also known as Lennox or Felton School site
Site 6 = Hawthorne Air Monitoring Station
Site 7 = Imperial Street School
Site 8 = Wiseburn School Dist HQ

LAX AREA AIR MONITORING-Follow up Study

Toluene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	1.40	1.20	2.40	1.67	0.643	1.286
Site 2	1.60	1.20	0.90	1.23	0.351	0.702
Site 3	0.90	0.80	9.60	3.77	5.052	10.10
Site 4	2.30	1.50	1.80	1.87	0.404	0.808
Site 5	1.30	0.90	NS	1.10	0.283	0.566
Site 6	0.40	0.30	2.10	0.93	1.012	2.023
Site 7			0.60	0.60	0.000	0.000
Site 8			1.50	1.50	0.000	0.000
Site 9			0.80	0.80	0.000	0.000

NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
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LAX AREA AIR MONITORING-Follow Up Study

Ethylbenzene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	0.05	0.05	0.05	0.05	0.000	0.000
Site 2	0.05	0.10	0.05	0.07	0.029	0.058
Site 3	0.05	0.05	3.40	1.17	1.934	3.87
Site 4	0.20	0.05	0.20	0.15	0.087	0.173
Site 5	0.10	0.05	NS	0.08	0.035	0.071
Site 6	0.05	0.05	0.05	0.05	0.000	0.000
Site 7			0.05	0.05	0.000	0.000
Site 8			0.10	0.10	0.000	0.000
Site 9			0.10	0.10	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
NS = No Sample
Detection Limit = 0.1 ppbv

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LAX AREA AIR MONITORING-Follow Up Study

Styrene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	0.05	0.10	0.05	0.07	0.029	0.058
Site 2	0.05	0.10	0.05	0.07	0.029	0.058
Site 3	0.05	0.20	0.05	0.10	0.087	0.173
Site 4	0.05	0.20	0.05	0.10	0.087	0.173
Site 5	0.05	0.10	NS	0.08	0.035	0.071
Site 6	0.05	0.05	0.05	0.05	0.000	0.000
Site 7			0.05	0.05	0.000	0.000
Site 8			0.05	0.05	0.000	0.000
Site 9			0.05	0.05	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
NS = No Sample
Detection Limit = 0.1 ppbv

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LAX AREA AIR MONITORING-Follow Up Study

Methylene Chloride (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	0.05	0.10	0.30	0.15	0.132	0.265
Site 2	0.10	0.10	0.20	0.13	0.058	0.115
Site 3	0.10	0.10	0.20	0.13	0.058	0.115
Site 4	0.20	0.20	0.30	0.23	0.058	0.115
Site 5	0.10	0.20	NS	0.15	0.071	0.141
Site 6	0.20	0.20	0.40	0.27	0.115	0.231
Site 7			0.20	0.20	0.000	0.000
Site 8			0.20	0.20	0.000	0.000
Site 9			0.20	0.20	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
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Site 7 = Imperial Street School
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Site 9 = Cowan School

LAX AREA AIR MONITORING-Follow Up Study

Ethylbenzene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
Site 1	0.05	0.05	0.05	0.05	0.000	0.000
Site 2	0.05	0.10	0.05	0.07	0.029	0.058
Site 3	0.05	0.05	3.40	1.17	1.934	3.87
Site 4	0.20	0.05	0.20	0.15	0.087	0.173
Site 5	0.10	0.05	NS	0.08	0.035	0.071
Site 6	0.05	0.05	0.05	0.05	0.000	0.000
Site 7			0.05	0.05	0.000	0.000
Site 8			0.10	0.10	0.000	0.000
Site 9			0.10	0.10	0.000	0.000

0.05 = Non Detectable, value of 1/2 Detection Limit used for calculations
NS = No Sample
Detection Limit = 0.1 ppbv

Site 1 = 123 rd & Aviation
Site 2 = PO on Aviation
Site 3 = 405 West-104 & Irwin
Site 4 = Hindry Street
Site 5 = also known as Lennox or Felton School site
Site 6 = Hawthorne Air Monitoring Station
Site 7 = Imperial Street School
Site 8 = Wiseburn School Dist HQ
Site 9 = Cowan School

LAX AREA AIR MONITORING-Follow Up Study

o-Xylene (ppbv)

	Date (1999)					
	9/10	9/14	9/16	Ave	Std Dev	95% Confidence
SITE						
1	0.20	0.10	0.10	0.13	0.058	0.115
2	0.10	0.20	0.10	0.13	0.058	0.115
3	0.20	0.10	7.10	2.47	4.013	8.026
4	0.40	0.20	0.40	0.33	0.115	0.231
5	0.20	0.10	NS	0.15	0.071	0.141
6	0.05	0.05	0.20	0.10	0.087	0.173
7			0.20	0.20	0.000	0.000
8			0.20	0.20	0.000	0.000
9			0.20	0.20	0.000	0.000

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