4. VOC COLLECTED ALOFT

VOC data collected aloft during the summer were analyzed to assess spatial and temporal characteristics. The analysis included characterization of total NMOC levels and the NMOC composition. The analysis also included comparison of the aloft data to SCAQS surface data from nearby sites.

The analysis of VOCs aloft was far more limited than that for the surface data because there were far fewer samples and many of the samples did not pass the quality assurance tests. The summer data set consisted of 56 samples. C2-C12 hydrocarbons and carbonyl data were available for 35 samples. Of these, only 23 samples were valid. The other samples were flagged because of exceptionally high concentrations of one individual species, of total carbonyl compounds, or of C10+ hydrocarbons. The winter data were not analyzed because the winter carbonyl samples were collected at different times and locations than the hydrocarbon data. Each could have been analyzed separately, however, we chose to focus on the summer data.

The VOC samples collected aloft in SCAQS were obtained in orbits at elevations between 500 and 800 meters. The principal locations of the orbits were at Riverside (RIV), Pomona (POMA), 10 km east of downtown Los Angeles (AMTRA), northern Long Beach (LGB), southern Long Beach (GYB=Goodyear Blimp), 15 km west of Palos Verdes (DOYLE or TANDY-offshore), and 15 km south of Long Beach (PADDR-offshore). The AMTRA, LGB, POMA, and RIV orbit locations (Figure 2-2) were within 10 km of the SCAQS surface monitors (Figure 2-1) at downtown Los Angeles, Long Beach, Claremont, and Riverside, respectively.

4.1 TOTAL NMOC CONCENTRATIONS

The morning and afternoon VOC concentrations aloft are summarized in Table 4-1. It shows the minimum, maximum, median, mean, and 25th and 75th quartile values for NMHC, NMOC, and total carbonyl compound concentrations. The mean NMHC levels were 134 and 276 ppbC in the morning and afternoon, respectively. The mean total carbonyl levels were 64 and 139 ppbC in the morning and afternoon, respectively. The mean total NMOC levels were 197 and 416 ppbC in the morning and afternoon, respectively. Overall, the NMOC levels aloft were a factor of two to five lower than at the surface.

The comparison of the morning and afternoon NMOC concentrations indicates that the afternoon levels were about double those in the morning. This difference is consistent with the sampling elevations, which were generally above the inversion base height in the morning and within the mixed layer in the afternoon.

Table 4-1 also shows the percentage of NMOC contributed by carbonyl species aloft. The mean carbonyl percentage is 35 percent (carbon basis), which is more than twice that of the onshore surface data. However, it is consistent with the relative amount of carbonyl compounds observed on San Nicholas Island (Section 3.10). The high carbonyl content of the NMOC aloft is evidence that the aloft mixtures were more aged than the surface mixtures.

Table 4-1. Summary of NMHC, NMOC and Carbonyl Compound Concentrations Collected Aloft

	Concentration, ppbC						
	Minimum	25%	Median	Mean	75%	Maximum	Number of Samples
Morning							
NMHC	42.6	81.6	131	134	186	218	11
NMOC	66.9	134	194	198	253	324	11
Total Carbonyl	11.5	28.4	60.0	63.8	80.7	156	11
Carbonyl/NMOC (%)	5.0	25.2	36.3	32.4	41.8	49.7	11
Afternoon							
NMHC	103	145	204	276	407	560	12
NMOC	230	292	341	416	595	643	12
Total Carbonyl	83.0	89.1	137	139	188	207	12
Carbonyl/NMOC (%)	12.9	30.6	36.9	36.8	40.7	65.2	12

Table 4-2 lists the total concentrations of the major VOC groups for each sample. The average NMOC concentration from the two morning offshore samples was 129 ppbC which is lower than the onshore morning samples (212 ppbC). However, the offshore NMOC concentrations were more than five times higher than NMOC concentrations measured in 'clean' offshore samples (Main et al., 1990). This is not surprising since the SCAQS offshore sampling sites were not particularly far offshore and the nocturnal winds in the SoCAB, which are usually offshore, can easily transport pollutants emitted the previous day and in the early morning to distances far beyond 15 km from the shore (Main et al., 1991). The comparability of the morning offshore NMOC levels (and composition) to those onshore in the morning and afternoon is indirect confirmation of pollutant transport by the land breeze/sea breeze cycle.

4.2 NMOC COMPOSITION

4.2.1 Abundant Species

Hydrocarbons and carbonyl compounds in each sample were ranked by carbon fraction of NMOC and a frequency distribution was determined which showed the number of times each NMOC was one of the 30 most abundant species. This frequency distribution was then ranked to identify the 25 most abundant species in aircraft samples. The procedure was also performed using reactivity-weighted carbon fractions. Table 4-3 lists the most abundant species on a carbon basis and reactivity basis. It shows the number of samples in which the species was among the 30 most abundant and 30 most reactive. The 25 most abundant species accounted for 71 percent of the NMOC carbon on average.

It is important to note that the species that were abundant aloft are mostly the same as those that were abundant at the surface. The primary difference in the surface and aloft lists of abundance (on a carbon basis) is the presence of the C4+ carbonyl compounds on the aloft list. The higher carbonyl species accounted for more than 20% of the carbon in the aloft samples and displaced o-xylene, methylcyclohexane, methylcyclopentane, heptane, ethylbenzene, and 1,2,4-trimethylbenzene. Comparison of the surface and aloft species abundance based on reactivity also shows many of the same compounds. The most notable difference between the two lists is that acetone, MEK, butanal, other C5 carbonyl compounds, 3-methylhexane, and styrene were among the 25 largest contributors to reactivity aloft, but not at the surface. Although acetone's reactivity is fairly low, it made the reactivity-based list because of its high relative abundance (second most abundant species on a carbon basis). Other abundant but less reactive species like ethane, acetylene, propane, and benzene were not among the 25 largest contributors to reactivity aloft.

The average concentrations of most of the abundant species, as well as their average contributions to NMOC, are illustrated in Figure 4-1. The upper graph shows that the average aloft concentrations of most abundant species was two to five times lower than the average surface concentrations in SCAQS. The lower graph shows there are strong similarities in the composition of aloft and surface VOCs. The contributions of acetaldehyde, acetone, and C4+

Table 4-2. Summer SCAQS Aircraft Sample Total Concentrations

Date	Site	Time (PDT)	Altitude meters msl	Aromatic Hydrocarbons	Paraffins	Olefins	Total Unidentified	Total Carbonyl Compounds	NMHC	NMOC
870715	AMTR	457	975	28.6	115	23.0	35.5	121	202	323
870624	AMTR	508	914	19.7	81.5	23.9	32.8	156	158	314
870713	AMTR	530	610	20.2	80.6	12.1	18.5	62.2	131	194
870828	AMTR	551	671	17.4	48.1	11.8	35.5	25.3	113	138
870903	AMTR	558	610	19.3	124	10.2	31.9	31.5	186	217
870902	AMTR	610	762	6.3	24.4	2.1	9.8	24.3	42.6	66.9
870625	AMTR	1354	762	49.1	220	26.7	66.8	200	362	562
870902	AMTR	1540	457	88.3	353	52.6	66.9	83.0	560	643
870619	AMTR	1544	792	67.8	235	83.6	75.6	181	462	643
870715	AMTR	1545	762	66.4	273	33.1	48.1	207	421	627
870713	DOY	653	488	6.0	48.8	5.6	18.5	48.7	78.9	128
870903	GYB	735	762	26.4	151	12.4	27.9	11.5	218	229
870715	LGB	538	762	7.7	48.2	8.8	19.5	70.3	84.3	155
870624	LGB	556	792	22.4	99.0	22.4	42.7	91.0	186	277
870625	LGB	1435	762	12.6	82.8	20.8	71.3	114	187	301
870715	LGB	1507	762	2.1	64.3	10.6	26.2	194	103	297
870715	PAD	723	762	5.4	41.2	1.6	22.2	60.0	70.4	130
870625	POMA	1519	792	25.8	120	15.4	50.1	148	211	359
870714	POMA	1612	762	12.1	77.8	13.1	25.8	159	129	288
870625	RIV	1603	792	23.9	78.5	21.3	73.8	125	198	322
870714	RIV	1648	792	11.9	62.5	4.7	59.0	92.3	138	230
870902	RIV	1805	457	47.8	240	21.4	83.3	85.9	392	478
870619	RIV	1814	762	12.5	44.3	49.7	44.4	84.7	151	236

Table 4-3. Twenty-Five Most Abundant Species in Aircraft Samples Collected During the Summer SCAQS 1987

Species	Number of Occurrences in Top 30 Abundant Species	
	Weight Fraction[a]	Reactivity-Weighted
Butane	23*	23*
Ethane	23*	
C5 Carbonyl	23	23
Propane	23*	22*
Acetaldehyde	23*	23*
Acetylene	22*	
Toluene	22*	23*
Acetone	22*	22
Ethene	23*	23*
C6 Carbonyl	22	22*
3-Methylpentane	22*	17*
i-Butane	22*	16*
C7 Carbonyl	22	
i-Pentane	21*	22*
Methyl Ethyl Ketone	21	21
Butanal	20	22
Propanal	20	22*
Formaldehyde	20*	22*
Pentane	20*	18*
3-Methylhexane	22*	16
2-Methylpentane	19*	19*
Benzene	19*	
m- & p-Xylene	18*	21*
Pentanal	17	17*
Hexane	15*	
1,2,4-Trimethylbenzene	(8)*	22*
Styrene	(14)	14
o-Xylene	(12)*	19*
Propene	(1)*	20*
C4 Olefin	(0)	13*

[a] Parentheses indicate species was not one of the twenty-five most abundant. The number of occurrences in the 'top 25' by weight fraction is listed for comparison to the reactivity-weighted list.

* One of the twenty-five most abundant species on the corresponding list of surface data.

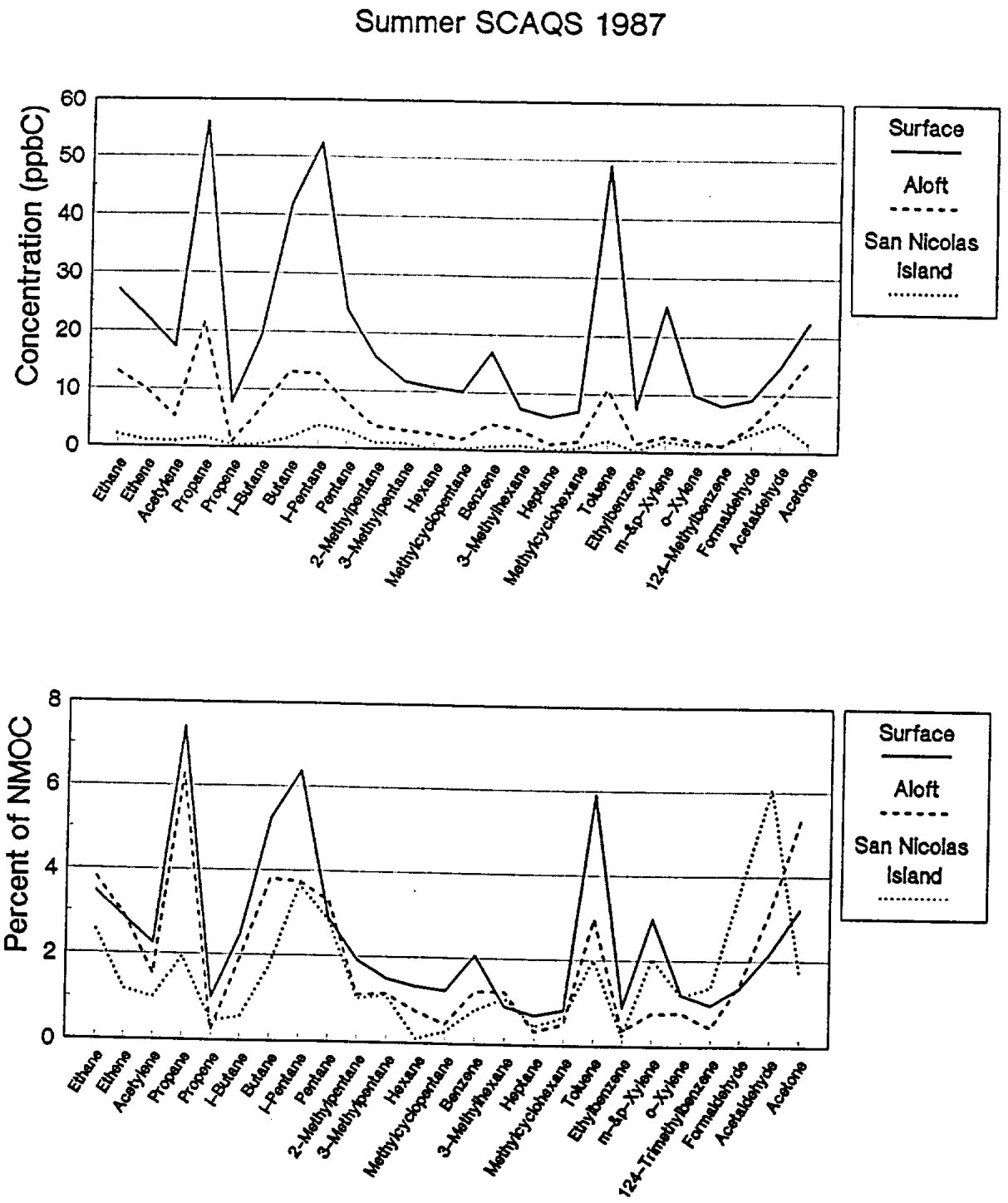


Figure 4-1. Spatial and Temporal Variations in Carbonyl Composition of Aircraft Data.

carbonyl compounds to NMOC aloft were significantly greater than in the surface data. The contributions of ethene, isobutane, and pentane to NMOC aloft were about the same as in the surface data. The contributions of all other abundant hydrocarbons were less than in the surface data.

4.2.2 Temporal and Spatial Variability

The variability of the carbon fraction of each species was examined as a function of the time of day using the coefficient of variation. As with the surface data, a number of fairly reactive species that were occasionally present at low levels were found to be highly variable (see Table 4-4). The high variability of these species is probably due to their high reactivity or the analytical detection limits for these species. Because we assumed a species' concentration was zero when it was below the detection limit, the apparent variability in concentrations of species that only occasionally exceed the detection limit is large on a relative basis. The variability of most of the abundant species aloft was comparable to the surface data.

The average concentrations and NMOC contributions of the abundant species and species groups aloft are summarized by sampling time in Tables 4-5 and 4-6. To facilitate comparison with the surface data, the tables include the same species as the surface data summaries. On average, the concentrations of important abundant species like ethene, propane, n-butane, isopentane, toluene, acetone, and acetaldehyde are higher in the afternoon samples than the morning samples. The increases in concentrations over the day are particularly large for carbonyl compounds which are produced by photochemical reactions. This temporal difference is generally consistent with the sampling elevations, which were usually above the inversion base height in the morning and within the mixed layer in the afternoon.

The spatial variation in average concentrations and NMOC contributions of the abundant species and species groups aloft are shown Tables 4-7 and 4-8. Note only one valid sample was available at DOYLE, Goodyear, and PADDR. The average morning concentrations at Long Beach and AMTRA were quite similar (about 210 ppbC NMOC) and higher than the concentrations offshore at DOYLE and PADDR. The average afternoon concentrations at Long Beach, Pomona, and Riverside were quite similar (about 310 ppbC NMOC). However, the afternoon concentrations over the central basin (AMTRA) were more than twice those at western and eastern sites (about 620 ppbC NMOC). The afternoon concentration pattern aloft is similar to the pattern observed at the surface, which makes sense because both the surface and aloft data are within the mixed layer.

4.2.3 Carbonyl Compound Composition

Figure 4-2 shows the aloft carbonyl composition by site and time of day. Note the unknown C5 carbonyl species is the most abundant carbonyl compound at every site. Acetone is the second most abundant carbonyl compound in most samples. The carbonyl composition profiles do not show large spatial or temporal variations. With the exception of one odd composition sample at the Goodyear Blimp site, the profiles are similar in morning and afternoon and from site-to-site. The C5 carbonyl compound is much more abundant aloft than at the surface; otherwise, the distribution of carbonyl species aloft is like the surface.

Table 4-4. Highly Variable Species in Both Morning and Afternoon Aircraft Samples (Weight Fraction Coefficient of Variation Greater Than One)

Species	Mean Concentration (ppbC)	Standard Deviation
1,3-Butadiene	<0.1	0.1
t-2-Butene	1.0	2.1
3-Methyl-1-butene	0.42	2.0
1-Pentene	0.77	3.1
2-Methyl-1-butene	0.14	0.3
Isoprene	<0.1	0.1
t-2-Pentene	0.21	0.5
3,3-Dimethylpentane	0.15	0.2
Cyclohexene	<0.1	0.2
2,4-Dimethylhexane	0.53	0.7
2,2,5-Trimethylhexane	0.25	0.3
3-Methyl-cis-hexene	0.13	0.3
n-Propylbenzene	0.22	0.3

Table 4-5. Mean Concentration of Abundant Species and Species Groups for Aircraft Samples Collected During the Summer SCAQS 1987

	Concentration, ppbC					
	Overall		Morning		Afternoon	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Altitude, meters msl	729	126	701	129	754	117
Ethane	13.0	11.4	7.7	4.4	17.8	13.6
Ethene	10.0	14.9	5.2	5.6	14.5	18.9
Acetylene	5.3	4.1	2.9	2.0	7.4	4.5
Propane	21.5	17.2	14.1	11.2	28.3	18.9
Propene	0.8	0.7	0.4	0.2	1.1	0.7
i-Butane	6.7	6.3	4.8	4.9	8.6	6.9
Butane	13.1	11.6	8.2	4.9	17.7	13.9
i-Pentane	12.9	11.2	7.8	5.7	17.5	12.9
Pentane	8.0	6.1	7.5	5.5	8.5	6.6
2-Methylpentane	3.9	3.3	1.9	1.5	5.8	3.4
3-Methylpentane	3.2	2.2	2.6	0.8	3.8	2.8
Hexane	2.6	2.2	1.6	0.9	3.4	2.7
Methylcyclopentane	1.8	2.0	0.8	0.9	2.7	2.3
Benzene	4.5	4.2	2.5	2.0	6.3	4.8
3-Methylhexane	3.5	2.0	2.3	0.7	4.6	2.2
Heptane	1.2	1.2	0.6	0.5	1.7	1.5
Methylcyclohexane	1.7	2.0	0.8	0.5	2.6	2.4
Toluene	10.9	10.6	6.6	4.8	14.9	12.6
Ethylbenzene	1.4	1.5	0.7	0.6	2.0	1.7
m & p-Xylene	2.7	2.6	1.7	1.1	3.7	3.1
o-Xylene	2.0	1.5	1.7	1.1	2.3	1.8
1,2,4-Trimethylbenzene	1.1	0.7	0.8	0.4	1.3	0.9
Formaldehyde	4.4	3.1	2.8	2.2	5.8	3.0
Acetaldehyde	9.5	6.2	5.0	2.4	13.6	5.8
Acetone	15.9	9.3	10.3	6.0	20.6	9.0
Aromatics	26.1	22.2	16.3	8.1	35.0	26.8
Paraffins	118	85.2	78.4	38.4	154	99.2
Olefins	21.2	18.5	12.2	7.6	29.4	21.5
Unidentified C2-C9	15.4	9.2	11.1	4.9	19.4	10.3
Unidentified C10+	27.4	16.1	15.7	6.3	38.2	14.7
Total Carbonyls	103	58.2	63.8	42.2	139	46.1
NMHC	208	134	134	57.2	276	148
NMOC	311	167	198	79.2	416	157
MPAR23	34.5	27.7	21.8	15.5	46.1	31.2
MPAR45	40.8	31.8	28.4	13.2	52.2	38.8
MPAR6+	42.6	27.8	28.2	11.7	55.9	31.4
MTOLEF	2.8	4.1	1.9	3.1	3.6	4.8
MIOLEF	3.0	3.1	2.1	2.2	3.9	3.4
MONAROM	12.5	12.3	7.4	5.6	17.2	14.7
DIAROM	8.1	5.9	5.6	1.5	14.7	7.4

Table 4-6. Mean Carbon Percent of Abundant Species and Species Groups for Aircraft Samples Collected During the Summer SCAQS 1987

	Carbon Percent of NMOC					
	Overall		Morning		Afternoon	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Altitude, meters msl:	729	126	737	132	721	119
Ethane	3.81	1.59	3.77	1.51	3.85	1.66
Ethene	2.91	3.84	2.23	1.72	3.53	4.98
Acetylene	1.53	0.65	1.39	0.75	1.65	0.52
Propane	6.27	3.59	6.46	4.59	6.10	2.30
Propene	0.23	0.10	0.20	0.10	0.25	0.10
i-Butane	1.95	1.67	2.16	2.11	1.76	1.07
Butane	3.82	1.95	4.00	1.87	3.66	2.01
i-Pentane	3.76	2.38	3.84	2.96	3.68	1.68
Pentane	3.30	3.66	4.86	4.60	1.87	1.45
2-Methylpentane	1.12	0.63	0.88	0.49	1.35	0.66
3-Methylpentane	1.15	0.64	1.51	0.67	0.81	0.36
Hexane	0.75	0.41	0.79	0.41	0.70	0.40
Methylcyclopentane	0.46	0.36	0.39	0.37	0.53	0.34
Benzene	1.23	0.70	1.13	0.74	1.33	0.64
3-Methylhexane	1.23	0.61	1.27	0.42	1.19	0.74
Heptane	0.32	0.18	0.29	0.15	0.34	0.20
Methylcyclohexane	0.50	0.46	0.42	0.22	0.59	0.58
Toluene	2.98	1.79	2.96	1.87	2.99	1.70
Ethylbenzene	0.35	0.25	0.30	0.24	0.39	0.24
m & p-Xylene	0.77	0.44	0.80	0.43	0.74	0.44
o-Xylene	0.78	0.70	1.10	0.84	0.48	0.34
1,2,4-Trimethylbenzene	0.44	0.41	0.59	0.54	0.31	0.16
Formaldehyde	1.38	0.79	1.26	0.74	1.49	0.82
Acetaldehyde	3.18	1.68	2.83	1.61	3.50	1.67
Acetone	5.11	2.53	4.80	2.39	5.40	2.62
Total Carbonyls	34.7	13.7	32.4	13.5	36.8	13.5
Unidentified C2-C9	5.21	2.19	5.82	2.46	4.65	1.73
Unidentified C10+	9.56	4.98	8.52	3.38	10.5	5.92
Paraffins	36.4	11.5	39.5	11.3	33.7	10.9
Olefins	6.38	3.96	5.65	2.11	7.06	5.00
Aromatics	7.72	3.15	8.17	2.70	7.31	3.45
MPAR23	10.1	4.93	10.2	6.02	9.95	3.66
MPAR45	12.8	5.38	14.9	4.64	11.0	5.34
MPAR6+	13.5	3.19	14.4	2.92	12.7	3.21
MTOLEF	0.78	0.82	0.81	0.94	0.74	0.69
MIOLEF	1.14	1.30	1.16	1.44	1.11	1.16
MONAROM	3.37	2.06	3.29	2.12	3.45	1.99
DIAROM	2.75	1.44	3.33	1.64	2.22	0.97

Table 4-7. Mean Concentrations of Abundant Species and Species Groups for Aircraft Samples Collected at Various Locations During the Summer SCAQS 1987

	Concentration, ppbC														
	AMTRA				DOYLE	GYB	LONG BEACH				PADDR	POMONA		RIVERSIDE	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Mean	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Mean	Standard Deviation	Mean	Standard Deviation
Time	AM	AM	PM	PM	AM	AM	AM	AM	PM	PM	AM	PM	PM	PM	PM
Mean Altitude, m msl	757	143	693	137	488	762	777	20	762	0	762	777	20	701	133
Ethane	8.2	3.6	32.8	12.7	2.0	13.5	8.5	4.7	11.1	0.8	3.1	9.4	1.5	10.4	7.3
Ethene	5.4	5.8	25.8	23.5	3.6	4.6	8.1	7.0	3.1	0.1	0.4	4.0	1.9	14.1	16.3
Acetylene	3.4	1.7	12.4	3.5	0.4	4.4	3.2	2.1	5.8	1.0	0.5	4.7	1.1	4.6	3.0
Propane	15.7	8.9	50.9	5.4	1.3	34.2	12.1	9.0	16.1	2.6	2.0	16.7	2.4	17.7	16.4
Propene	0.3	0.1	2.0	0.4	0.2	1.0	0.4	0.0	0.6	0.2	0.3	0.7	0.2	0.8	0.4
i-Butane	4.9	3.3	15.7	2.3	0.3	16.6	3.0	2.4	1.8	1.2	0.5	5.0	1.5	6.6	7.3
Butane	8.4	4.4	32.2	7.0	6.3	17.0	6.2	4.9	4.8	1.2	4.2	10.7	4.1	13.1	13.5
i-Pentane	7.6	4.6	31.8	7.9	0.5	16.4	5.0	4.8	7.6	1.5	13.9	9.6	4.2	12.0	10.7
Pentane	6.7	4.4	14.9	3.5	13.8	7.0	11.0	6.6	1.1	1.1	0.0	11.2	5.2	4.5	3.9
2-Methylpentane	1.9	1.5	9.4	2.2	0.6	3.9	1.8	1.6	3.7	2.2	1.6	2.6	1.1	4.8	2.4
3-Methylpentane	2.5	0.9	7.1	1.9	2.5	3.0	2.4	0.1	1.8	0.9	3.4	2.2	1.4	2.4	1.7
Hexane	1.8	1.0	6.7	1.1	1.3	2.5	1.8	0.2	0.4	0.4	0.0	2.9	0.4	1.9	1.5
Methylcyclopentane	1.1	0.7	5.4	1.0	0.0	2.2	0.0	0.0	0.2	0.2	0.0	1.4	0.8	1.8	1.5
Benzene	3.0	1.8	11.6	3.3	0.0	4.6	2.7	2.1	2.2	1.8	0.3	3.9	1.2	4.3	3.2
3-Methylhexane	2.1	0.8	5.8	1.1	2.1	1.9	3.1	0.1	4.4	2.8	2.6	2.8	1.2	4.4	2.4
Heptane	0.8	0.5	3.6	0.7	0.2	1.1	0.5	0.5	0.2	0.2	0.2	1.0	0.5	0.9	0.5
Methylcyclohexane	0.8	0.5	4.2	0.7	1.2	1.0	0.9	0.2	1.0	0.6	0.2	4.6	4.0	0.9	0.5
Toluene	8.0	3.8	30.9	6.3	0.9	13.5	4.7	4.2	2.4	1.4	0.5	8.0	3.3	8.6	5.9
Ethylbenzene	0.9	0.6	4.1	1.0	0.0	1.4	0.6	0.6	0.2	0.2	0.0	1.1	0.4	1.2	0.9
m & p-Xylene	1.9	1.2	7.6	1.3	1.2	2.8	1.7	0.1	0.5	0.2	0.0	1.7	0.9	2.4	1.7
o-Xylene	1.9	0.9	3.9	0.6	2.3	1.3	2.2	1.3	0.2	0.2	0.0	2.1	0.7	1.9	2.1
1,2,4-Trimethylbenzene	0.9	0.4	2.1	1.0	1.2	0.7	0.5	0.1	0.5	0.0	0.9	1.0	0.6	1.2	0.5
Formaldehyde	3.3	2.8	7.7	3.3	1.5	0.0	2.5	0.7	4.1	1.0	2.1	8.0	1.4	3.8	2.0
Acetaldehyde	5.1	2.8	17.0	4.9	2.1	4.4	6.6	1.4	16.2	1.0	4.7	17.6	1.8	6.8	2.4
Acetone	10.4	7.6	26.1	8.8	7.0	0.0	11.4	0.9	21.9	11.0	10.9	22.6	3.0	13.5	3.8
Aromatics	18.6	6.5	67.9	13.9	6.0	26.4	15.1	7.4	7.4	5.3	5.4	19.0	6.9	24.0	14.5
Paraffins	79.0	34.9	270	51.5	48.8	151	73.6	25.4	73.6	9.2	41.2	98.7	20.9	106	78.1
Olefins	13.8	7.6	49.0	22.1	5.6	12.4	15.6	6.8	15.7	5.1	1.6	14.3	1.2	24.3	16.2
Total Carbonyls	70.1	51.0	168	49.8	48.7	11.5	80.7	10.4	154	40.0	60.0	154	5.2	96.9	16.4
Unidentified C2-C9	12.2	3.8	24.4	3.7	0.6	16.0	10.9	4.6	13.3	4.8	10.7	15.3	0.4	19.6	15.5
Unidentified C10+	15.2	6.5	40.0	12.8	17.9	11.9	20.2	7.0	35.5	17.8	11.5	22.7	11.7	45.5	8.9
NMHC	139	52.5	451	72.3	78.9	218	135	51.1	145	42.1	70.4	170	41.1	220	102
NMOC	209	90.9	619	33.7	128	229	216	61.5	299	2.1	130	35.9	317	100	
MPAR23	23.8	12.5	83.7	15.2	3.2	47.7	20.7	13.7	27.2	3.4	5.1	26.1	3.9	28.1	23.7
MPAR45	27.5	12.0	94.5	20.1	20.9	57.0	25.2	5.5	15.2	2.0	18.6	36.5	4.6	36.1	35.3
MPAR6+	27.6	12.8	91.8	21.4	24.7	46.4	27.8	6.2	31.3	10.7	17.5	36.2	12.5	42.1	19.5
MTOLEF	2.4	4.0	7.4	6.8	1.6	3.2	0.9	0.1	1.3	0.9	0.3	2.4	0.1	1.5	0.6
MIOLEF	2.6	2.4	3.2	1.7	0.0	0.2	3.4	2.3	5.5	5.1	0.4	3.3	2.0	4.1	4.0
MONAROM	8.9	4.4	35.7	7.3	0.9	15.2	5.5	5.0	2.6	1.6	0.5	9.1	3.7	10.1	7.1
DIAROM	6.1	1.2	18.9	3.7	5.1	6.3	6.1	0.0	2.0	1.3	2.0	6.1	2.1	8.2	5.0

Table 4-8. Mean Carbon Percent of Abundant Species and Species Groups for Aircraft Samples Collected During the Summer SCAQS 1987 at Various Locations

	Carbon Percent of NMOC														
	AMTRA				DOYLE	GYB	Long Beach				PADDR	Pomona		Riverside	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Mean	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Mean	Standard Deviation	Mean	Standard Deviation
Time	AM	AM	PM	PM	AM	AM	AM	AM	PM	PM	AM	PM	PM	PM	PM
Mean Altitude, m msl:	757	143	693	137	488	762	777	20	762	0	762	777	20	701	133
Ethane	4.08	1.31	5.26	1.95	1.55	5.90	3.62	1.14	3.71	0.31	2.35	2.89	0.13	2.99	1.08
Ethene	2.20	1.62	4.09	3.61	2.85	2.00	3.09	2.36	1.04	0.02	0.34	1.18	0.47	5.41	7.18
Acetylene	1.67	0.66	1.98	0.50	0.32	1.93	1.33	0.60	1.93	0.34	0.41	1.44	0.18	1.30	0.44
Propane	7.34	3.66	8.23	0.69	0.98	14.9	4.81	2.81	5.37	0.89	1.55	5.14	0.18	4.81	2.85
Propene	0.17	0.08	0.33	0.06	0.12	0.42	0.22	0.07	0.19	0.05	0.21	0.20	0.04	0.23	0.12
i-Butane	2.26	1.49	2.54	0.39	0.24	7.24	1.15	0.76	0.60	0.40	0.38	1.51	0.30	1.69	1.36
Butane	3.93	1.60	5.19	1.01	4.94	7.41	2.42	1.58	1.59	0.37	3.22	3.21	0.91	3.40	2.44
i-Pentane	3.40	1.43	5.11	1.12	0.39	7.15	1.83	1.70	2.53	0.50	10.7	2.86	0.98	3.24	1.83
Pentane	4.43	4.39	2.39	0.49	10.8	3.05	6.49	4.90	0.35	0.35	0.00	3.69	2.02	1.21	0.67
2-Methylpentane	0.83	0.41	1.50	0.30	0.47	1.70	0.68	0.55	1.23	0.73	1.23	0.76	0.24	1.54	0.83
3-Methylpentane	1.40	0.71	1.13	0.27	1.96	1.31	1.19	0.36	0.58	0.28	2.61	0.63	0.35	0.68	0.24
Hexane	0.79	0.37	1.08	0.14	1.02	1.09	0.94	0.36	0.12	0.12	0.00	0.92	0.23	0.52	0.25
Methylcyclopentane	0.55	0.27	0.87	0.13	0.00	0.96	0.00	0.00	0.07	0.07	0.00	0.41	0.20	0.47	0.26
Benzene	1.34	0.58	1.86	0.48	0.00	2.01	1.04	0.65	0.71	0.58	0.23	1.17	0.23	1.20	0.54
3-Methylhexane	1.07	0.26	0.93	0.16	1.65	0.83	1.53	0.41	1.45	0.91	1.99	0.82	0.26	1.51	0.94
Heptane	0.35	0.10	0.58	0.09	0.16	0.48	0.16	0.16	0.07	0.07	0.15	0.30	0.12	0.26	0.07
Methylcyclohexane	0.37	0.17	0.67	0.10	0.94	0.44	0.41	0.05	0.34	0.20	0.15	1.30	1.09	0.27	0.06
Toluene	3.68	1.16	4.96	0.83	0.71	5.89	1.77	1.44	0.78	0.45	0.38	2.39	0.76	2.42	0.91
Ethylbenzene	0.38	0.19	0.65	0.13	0.00	0.61	0.22	0.22	0.07	0.07	0.00	0.32	0.07	0.32	0.17
m & p-Xylene	0.82	0.43	1.21	0.15	0.94	1.22	0.84	0.19	0.15	0.05	0.00	0.50	0.22	0.67	0.31
o-Xylene	1.20	0.79	0.62	0.07	1.80	0.57	1.29	0.97	0.05	0.05	0.00	0.68	0.29	0.46	0.42
1,2,4-Trimethylbenzene	0.67	0.67	0.33	0.15	0.94	0.31	0.27	0.12	0.15	0.02	0.69	0.29	0.15	0.37	0.15
Formaldehyde	1.40	0.73	1.24	0.52	1.18	0.00	1.33	0.68	1.35	0.31	1.61	2.54	0.70	1.29	0.91
Acetaldehyde	2.82	1.80	2.78	0.86	1.65	1.92	3.53	1.65	5.41	0.30	3.60	5.57	1.18	2.22	0.86
Acetone	4.54	1.60	4.30	1.66	5.48	0.00	5.87	2.09	7.35	3.73	8.36	7.18	1.72	4.64	2.02
Total Carbonyls	31.4	11.9	27.4	8.77	38.2	5.02	39.1	6.34	51.5	13.7	46.0	48.2	6.96	33.2	8.91
Unidentified C2-C9	6.46	2.06	3.93	0.51	0.47	6.98	4.83	0.76	4.43	1.57	8.20	4.78	0.41	5.41	2.50
Unidentified C10+	7.88	3.66	6.50	2.13	14.0	5.19	9.17	0.63	11.8	5.85	8.82	6.68	2.89	15.8	5.23
Paraffins	38.6	9.53	43.5	7.00	38.3	65.9	33.4	2.23	24.6	2.91	31.6	30.2	3.12	30.1	12.0
Olefins	6.22	1.83	7.80	3.27	4.39	5.39	6.89	1.18	5.23	1.67	1.26	4.43	0.13	8.55	7.41
Aromatics	9.41	1.90	10.9	1.79	4.70	11.5	6.53	1.55	2.44	1.74	4.14	5.69	1.49	6.97	1.96
MPAR23	11.4	4.85	13.5	2.16	2.53	20.8	8.44	3.95	9.08	1.20	3.90	8.03	0.31	7.79	3.93
MPAR45	14.0	4.30	15.2	2.85	16.4	24.9	11.9	0.86	5.06	0.62	14.3	11.3	0.17	9.53	6.28
MPAR6+	13.2	1.84	14.8	2.96	19.4	20.2	13.1	0.86	10.4	3.49	13.4	10.9	2.64	12.8	2.06
MTOLEF	0.87	1.19	1.17	1.04	1.21	1.38	0.46	0.16	0.44	0.30	0.21	0.73	0.05	0.47	0.10
MIOLEF	1.40	1.45	0.53	0.31	0.00	0.09	2.01	1.61	1.83	1.69	0.31	1.09	0.72	1.35	1.26
MONAROM	4.07	1.33	5.73	0.96	0.71	6.63	2.04	1.71	0.85	0.51	0.38	2.71	0.83	2.84	1.13
DIAROM	3.71	1.96	3.04	0.46	4.00	2.75	3.07	0.87	0.65	0.41	1.53	1.82	0.43	2.38	0.65

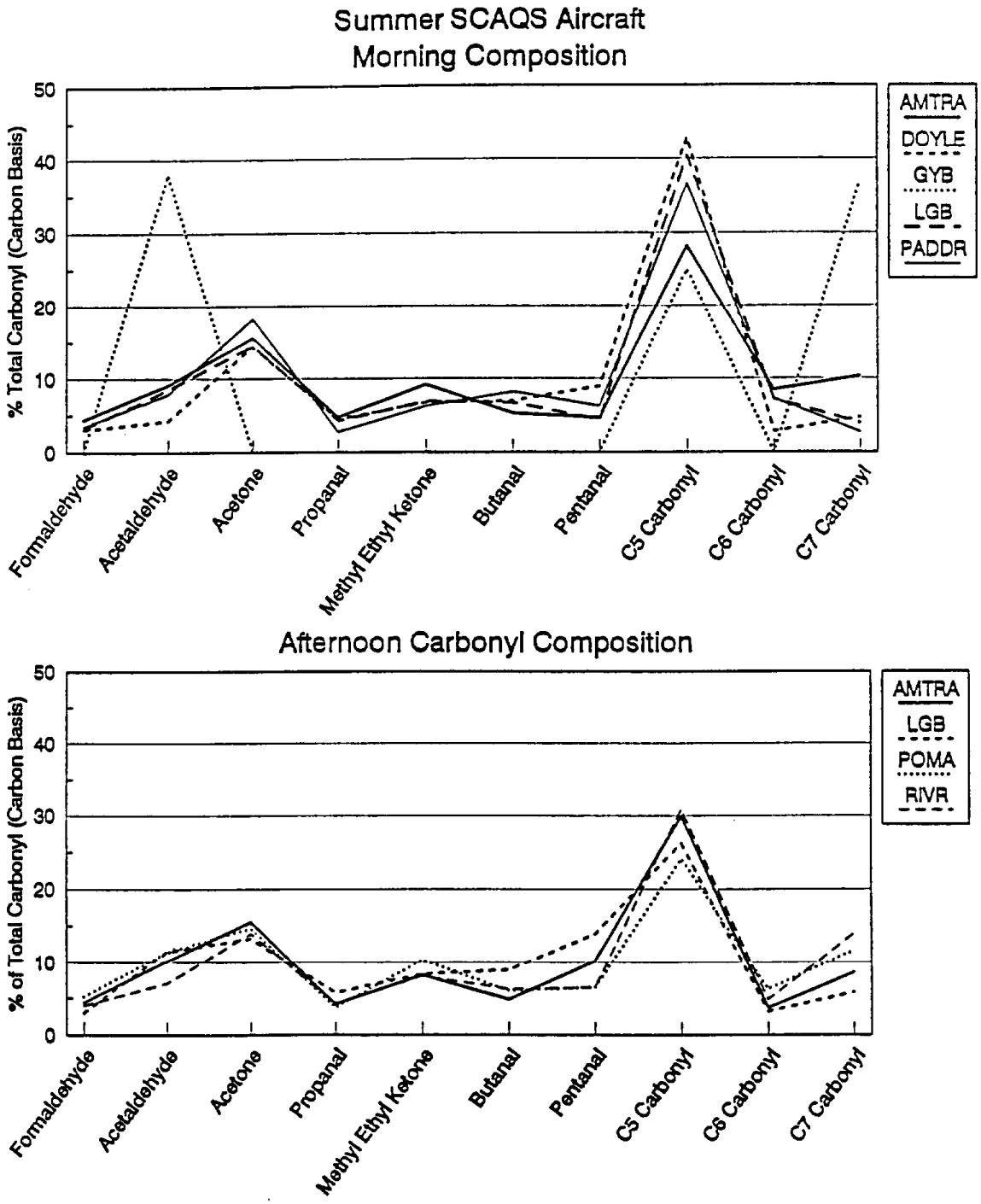


Figure 4-2. Summer SCAQS Aircraft Carbonyl Composition by Site and Time of Day. Composition is in terms of weight percent (carbon basis) of total carbonyl compounds. Locations are shown in Figure 2.2.

4.3 COMPARISON OF SURFACE AND AIRCRAFT DATA

A comparison of surface and aloft NMOC concentrations was made using the ten aloft samples that were collected within about one hour of surface samples at nearby stations. Figure 4-3 shows a plot of the aloft and surface NMOC values. The matched values are identified by time of day. The aloft NMOC concentrations were equal to the surface values in five samples and were lower than the surface values in six other samples. The times of sample collection did not necessarily explain the extent of agreement between surface and aloft NMOC values.

The compositions of the matched samples were compared using the 25 most abundant species. Table 4-9 shows the correlation coefficient (r^2) for the linear regression between samples. The two pairs of samples which do not correlate at all were collected above the inversion height in the early morning. Most of the matched of samples collected in the afternoon show modest or good correlation (r^2 = 0.3 to 0.7).

Table 4-10 shows the side-by-side listing of the abundant species and species groups for the four sites with morning matched samples. In all cases, the concentrations are higher at the surface than aloft. Ratios of the following more reactive to less reactive species are included in the table:

xylenes to benzene,
xylenes to ethane,
toluene to benzene,
toluene to ethane, and
ethene to acetylene.

Most, but not all, of the ratios are lower aloft than at the surface which indicates these aloft mixtures are more aged than the corresponding surface samples.

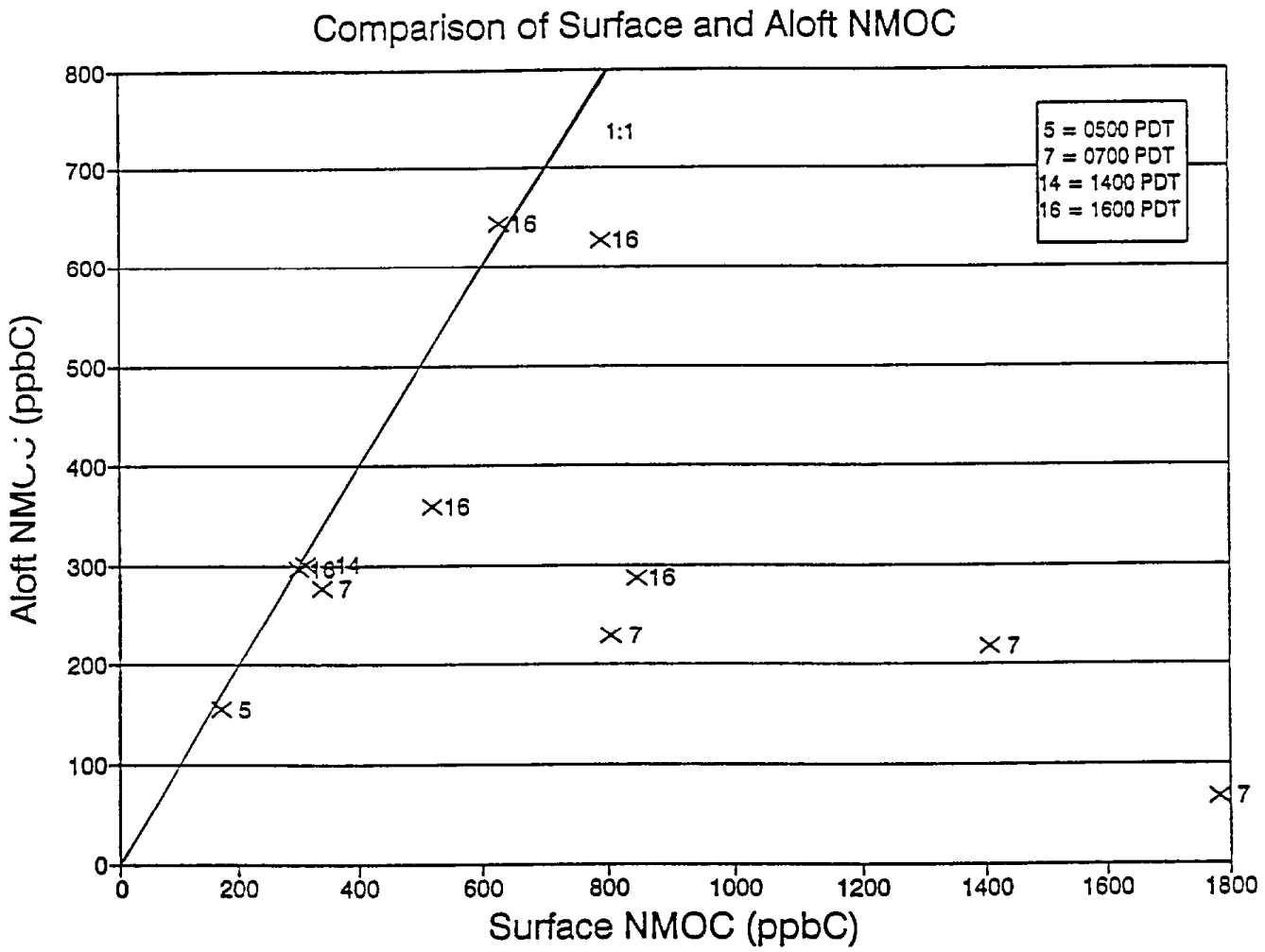


Figure 4-3. Comparison of NMOC Concentrations Measured at the Surface and Aloft During the Summer SCAQS 1987.

Table 4-9. Linear Regression Correlation Coefficients, r^2, for Surface and Aircraft Samples[a]

	Surface			Aircraft		
Date	Site[b]	Time PDT	Site[c]	Time PDT	Altitude m msl	r^2
6/19	Los Angeles	1600	AMTRA	1544	792	0.356
7/15	Los Angeles	1600	AMTRA	1545	762	0.376
9/2	Los Angeles	0700	AMTRA	0610	762	0.0
9/3	Los Angeles	0700	AMTRA	0558	610	0.256
6/25	Claremont	1600	POMA	1519	792	0.732
7/14	Claremont	1600	POMA	1612	762	0.307
6/24	Long Beach	0700	LGB	0556	792	0.587
6/25	Long Beach	1400	LGB	1435	762	0.493
7/15	Long Beach	0500	LGB	0538	762	0.0
7/15	Long Beach	1600	LGB	1507	762	0.304

[a] Comparison based on samples collected within about 1-hour of each other. Note that the surface samples were integrated over one hour, while the aircraft samples were integrated over about 1 to 2 minutes. Only the 25 most abundant species were included in the regression.

[b] See Figure 2-1 for locations.

[c] See Figure 2-2 for locations.

Table 4-10. Comparison of Abundant Species and Species Groups for the Four Sets of Matching Surface and Aircraft Samples Collected in the Morning During the Summer SCAQS

Site	CELA	AMTRA	LBCC	LGB	CELA	AMTRA	LBCC	LGB
Date	870902	870902	870715	870715	870903	870903	870624	870624
Time, PST	600	510	400	438	600	458	600	456
Altitude, m		762		762		610		793
Ethane	20.4	2.4	8.5	3.8	33.0	14.2	17.4	13.2
Ethene	35.0	0.7	4.4	1.1	62.0	3.0	13.6	15.1
Acetylene	24.0	0.8	3.3	1.1	45.6	4.1	9.7	5.4
Propene	15.4	0.2	1.1	0.5	21.3	0.4	4.0	0.4
Propane	6.9	2.1	12.9	3.1	59.7	31.8	32.7	21.2
i-Butane	28.1	0.4	3.3	0.6	22.4	11.4	12.8	5.3
Butane	85.7	1.2	8.2	1.3	84.0	14.8	27.2	11.1
i-Pentane	140	1.2	7.8	0.2	88.6	12.8	29.1	9.8
Pentane	59.7	8.5	3.8	17.6	42.3	6.7	13.3	4.4
2-Methylpentane	47.2	0.4	2.4	0.2	31.9	3.1	8.2	3.4
3-Methylpentane	29.9	1.0	1.9	2.4	21.5	2.3	6.7	2.3
Hexane	31.0	0.2	1.6	2.0	26.7	2.1	5.7	1.6
Methylcyclopentane	28.9	0.6	2.0	0.0	21.9	1.8	6.2	0.0
Benzene	54.2	0.4	2.3	0.6	39.8	4.3	8.4	4.7
2-Methylhexane	19.1	0.4	0.7	0.0	13.3	1.7	2.9	1.1
3-Methylhexane	21.5	0.9	1.7	3.0	15.2	2.5	3.7	3.1
Heptane	23.2	0.2	0.6	0.0	14.9	0.9	2.7	0.9
Methylcyclohexane	22.6	0.3	1.1	0.7	12.3	1.1	3.2	1.0
Toluene	169	1.1	6.5	0.5	106	7.6	21.6	8.9
Ethylbenzene	28.9	0.0	1.3	0.0	18.5	1.0	2.9	1.2
m- & p-Xylene	111	0.0	3.9	1.6	73.5	1.9	11.8	1.8
o-Xylene	39.3	1.5	2.3	3.5	26.4	0.9	4.1	0.9
1,2,4-Trimethylbenzene	37.4	1.4	1.5	0.6	30.2	0.5	2.6	0.4
Formaldehyde	7.4	1.2	4.0	3.1	5.3	2.0	1.5	1.8
Acetaldehyde	8.2	4.4	5.2	8.0	6.2	2.2	0.2	5.2
Acetone	37.2	2.4	1.5	12.3	20.1	4.9	0.0	10.5
Total Carbonyl	89.2	24.3	14.8	70.3	53.8	31.5	22.1	91.0
Aromatics	521	6.3	22.0	7.7	354	19.3	56.6	22.4
Paraffins	776	24.4	69.0	48.2	610	124	199	99.0
Olefins	146	2.1	12.4	8.8	170	10.2	34.4	22.4
NMHC	1693	42.6	156	84.3	1354	186	317	186
NMOC	1782	66.9	171	155	1408	217	339	277
C2-C9 Unidentified	76.9	5.1	11.7	6.3	52.5	11.5	6.1	15.5
C10+ Unidentified	173	4.7	41.0	13.2	168	20.4	20.4	27.2
Xylenes/Benzene	2.8	3.8	2.7	8.5	2.5	0.7	1.9	0.6
Xylenes/Ethane	7.4	0.6	0.7	1.3	3.0	0.2	0.9	0.2
Toluene/Benzene	3.1	2.8	2.8	0.8	2.7	1.8	2.6	1.8
Toluene/Ethane	8.3	0.5	0.8	0.1	3.2	0.5	1.2	0.7
Ethene/Acetylene	1.5	0.9	1.3	1.0	1.4	0.7	1.4	2.8

5. COMPARISON OF AMBIENT AND EMISSIONS INVENTORY NMOC

5.1 THE APPROACH

Emissions inventories of NMOC and of NO_x, CO, PM_{10}, and SO_x need to be evaluated using independent data to establish their validity. The scope of the evaluation should include verification of the absolute amount of emissions, the relative composition of emissions, the spatial pattern of emissions, and the temporal distribution of emissions. Both top-down and bottom-up approaches are needed for a complete inventory evaluation because neither approach can satisfy all of the evaluation objectives.

Comparison of ambient data and emissions inventories is an essential part of any top-down inventory evaluation. Ambient - emissions inventory comparisons are useful for examining the relative composition of emissions inventories; they are not useful for verifying absolute amounts unless they are combined with accurate bottom-up data. In this study, comparisons of CO/NO_x ratios and $NMOC/NO_x$ ratios were made to evaluate the relative amounts of CO, NMOC, and NO_x emissions in the SoCAB. Comparisons of the relative amounts of individual organic species and species groups in ambient data and inventory were made to evaluate the NMOC speciation of the inventory. The scope of our analysis was limited to examining the consistency of the ambient data and inventory. No attempts were made to modify and reevaluate the inventory based on the findings.

Comparisons of ambient data and emissions estimates for NMOC and NO_x are confounded by the fact that the ambient concentrations are influenced not only by fresh emissions emitted in the vicinity of the monitor, but also by precursor transport and carry-over effects, and by chemical reactions. The influence of these effects on the comparison can be minimized (but not eliminated) by electing to only use ambient data collected at a time when emission rates are high and when wind speeds and chemical reaction rates are low. Of the SCAQS sampling times, the 0700-0800 sampling period probably had the highest emission rates, lowest wind speeds, and lowest chemical reaction rates, and was therefore selected for use in the comparison. However, it should be recognized that some emissions of NO_x from buoyant point source plumes may be injected above the inversion height in the morning and not influence the ground level observations. Our approach assumes the buoyant source NO_x contributions are small at the SCAQS stations. It is probably a good assumption everywhere except at Hawthorne.

5.2 THE EMISSIONS INVENTORY

Gridded emissions inventories for the SoCAB were employed in the analysis. Day-specific inventories prepared by the ARB's Technical Support Division for August 28th and December 10th were used for all summer and fall days, respectively. The day-specific inventories were prepared using the day-specific emissions-related data collected by Radian (1987) in SCAQS and include all inventory updates through March 1991. The on-road mobile source portion of the inventory was generated using composite emission factors derived from EMFAC7E. The data were gridded with 5 x 5 km resolution and 1-hr

time resolution. The inventories included emissions of total reactive organic gases (ROG), organic species by SAROAD codes, NO_x, and CO.

We chose to aggregate the emissions data for the nine grids closest to each monitoring station and for the 0600-0700 and 0700-0800 periods (local time). Thus, the comparison was between the average emissions within a 15 x 15 km square encompassing the monitor for the 0600-0800 period and the 0700-0800 ambient observations. The rationale for using only two hours worth of emissions estimates is that if the emission rates during this period are much greater than in the earlier hours (i.e., because of the morning traffic emissions), the ambient concentration should be dominated by fresh local emissions. This assumption may be more appropriate for the summer than the fall, because in the fall there are prolonged stagnant periods which may cause significant carry-over of the evening rush hour emissions to the next morning (see Fujita et al., 1992 for the effects of other emissions averaging times).

In order to place the ambient and emissions inventory data on a common basis, the emissions data were converted from a mass basis to a molar basis (46 gm/mole for NO_x and 14.7 gm/carbon for NMHC). Furthermore, only those emissions inventory compounds that were capable of being detected by the SCAQS hydrocarbon and carbonyl measurement systems were included in the adjusted ROG emission rates and profiles. The adjusted VOC emissions include C2-C12 alkanes, alkenes, alkynes, aromatic hydrocarbons, and C1-C7 carbonyl compounds. The emissions of methane, alcohols, ethers, acetates, glycols, esters, formates, organic amines, organic oxides, phenols, organic acids, C8+ carbonyl compounds, and halogenated species were excluded. Because of the small number of stations in the fall, we decided to include the Long Beach data in the comparison. NMOC at Long Beach was estimated using the observed NMHC at Long Beach and the mean NMOC/NMHC ratio observed at the other sites. Also, a significant portion (about 15 percent) of the ambient NMOC were unidentified. For selected analyses, the unidentified NMOC were arbitrarily assigned as follows: 45 percent to paraffins, 45 percent to aromatics, and 10 percent to olefins.

5.3 NMOC/NO_x AND CO/NO_x RATIOS

The relative amounts of CO, NMOC, and NO_x in ambient air and in emissions inventories were examined using the NMOC/NO_x and CO/NO_x ratios. We elected to use NO_x as the common denominator in the analysis because the SCAQS tunnel study suggested the NO_x emissions from on-road motor vehicles may be more accurate than either NMOC or CO mobile emissions (Ingalls et al., 1989), and motor vehicles are the largest source of NO_x in the Basin (about 60 percent of total daily NO_x and a larger percentage of 0600-0800 NO_x). Only NO_x concentrations $\geq$ 40 ppb were used in computing ambient ratios. Because of the potential effects of the confounding factors mentioned above, our expectation was that if ambient and emissions inventory ratios of NMOC/NO_x and CO/NO_x agreed within ±20 percent, the ambient and emissions estimates would be deemed consistent.

Table 5-1 shows the average NMOC/NO_x ratios in the emissions and ambient data at all of the sites in the summer and the fall. The emissions inventory

Table 5-1. $NMOC/NO_x$ Ratios in the 6-8 AM Emissions and 7-8 AM Ambient Data

Location/Season	$NMOC/NO_x$ Ratio		
	Emissions Inventory	Ambient	Bias (%)
Summer:			
Anaheim	4.5	9.3	-52
Azusa	3.3	8.8	-63
Burbank	3.6	9.3	-61
Los Angeles	4.3	8.6	-50
Claremont	3.6	9.6	-63
Hawthorne	5.1	8.4	-39
Long Beach	5.1	8.0	-36
Riverside	3.3	8.6	-62
Average	4.1	8.9	-54
Fall:			
Anaheim	4.7	7.5	-37
Burbank	3.3	9.5	-65
Los Angeles	4.0	5.1	-22
Hawthorne	5.0	5.9	-15
Long Beach	4.9	7.0	-30
Riverside	3.4	5.5	-38
Average	4.2	6.9	-39

has NMOC/NO_x ratios ranging from a low of 3.3 (moles C/mole) at Azusa in the summer and Burbank in the fall to a high of 5.1 at Hawthorne and Long Beach in the summer. The mean NMOC/NO_x ratios are 4.1 and 4.2 in the summer and fall emissions near the SCAQS stations, respectively. As discussed in Section 3.2, the ambient NMOC/NO_x ratios ranged from a low of 5.1 at Los Angeles in the fall to a high of 9.6 at Claremont in the summer. The mean NMOC/NO_x ratios were 8.9 and 6.9 at the SCAQS stations in the summer and fall, respectively. The data indicate the emissions inventory NMOC/NO_x ratios are 36 to 63 percent lower in the summer and 15 to 65 percent lower in the fall than the corresponding ambient ratios. The largest bias is at Burbank in fall and at Azusa and Claremont in summer, while the smallest biases are at Long Beach in the summer and Hawthorne in the fall. The variation in the bias between stations is fairly small in the summer, which suggests the spatial distribution of emissions may be reasonably accurate (in a relative sense). On the average, the emissions inventory ratios are 54 and 39 percent lower than the ambient ratios in the summer and fall respectively. These discrepancies are large and significant. With the exception of data from Hawthorne in the fall, the emissions estimates are not consistent with the ambient data.

Table 5-2 lists the average CO/NO_x ratios in the emissions and ambient data at all of the sites in the summer and the fall. The emissions inventory has CO/NO_x ratios ranging from a low of 6.8 at Long Beach in the summer to a high of 14.5 at Anaheim and Los Angeles in the fall. The average CO/NO_x ratios are 11.2 and 11.5 in the summer and fall inventories near the SCAQS stations, respectively. The ambient CO/NO_x ratios ranged from a low of 14.4 at Long Beach in the summer to a high of 23.9 at Claremont in the summer. The mean ambient CO/NO_x ratios were 19.7 and 18.4 at the SCAQS stations in the summer and fall, respectively. On average, the summer and fall data indicate the emissions inventory CO/NO_x ratios are 43 and 38 percent lower than the corresponding ambient ratios, respectively. The spatial variations in the biases are modest in both seasons, with Azusa (-21 percent) and Los Angeles (-14 percent) showing relatively small biases in the summer and fall, respectively, and with Riverside (-66 percent) and Long Beach (-59 percent) showing relatively large biases in the summer and fall, respectively. The magnitude of the differences in CO/NO_x ratios at most SCAQS stations are significant and suggest there is a problem with the emissions inventory.

The ratio analysis indicates the problem is either that:

(1) NO_x emissions are substantially overestimated, or
(2) NMOC and CO emissions are seriously underestimated, or
(3) some combination of the two.

Because CO and NO_x are primarily emitted by motor vehicles, the CO/NO_x ratio discrepancies indicate the problem is probably with the motor vehicle exhaust emissions. Since the discrepancies in NMOC/NO_x and CO/NO_x ratios are comparable in magnitude, the NMOC/NO_x ratio discrepancies may also be due to inaccuracies in the motor vehicle exhaust emissions estimates. However, biases in emissions estimates for other types of sources may contribute to the discrepancies.

Table 5-2. CO/NO_x Ratios in the 6-8 AM Emissions and 7-8 AM Ambient Data

Location/Season	CO/NO_x Ratio		
	Emissions Inventory	Ambient	Bias (%)
Summer:			
Anaheim	13.3	21.5	-38
Azusa	14.0	17.8	-21
Burbank	11.8	18.2	-35
Los Angeles	12.9	23.4	-45
Claremont	13.7	23.9	-43
Hawthorne	8.9	14.7	-40
Long Beach	7.9	14.4	-45
Riverside	6.8	19.8	-66
Average	11.2	19.7	-43
Fall:			
Anaheim	14.5	19.5	-26
Burbank	12.6	21.6	-42
Los Angeles	14.5	16.9	-14
Hawthorne	9.4	15.8	-41
Long Beach	8.5	20.6	-59
Riverside	9.4	14.9	-37
Average	11.5	18.4	-38

The discrepancies between the ambient and emission inventories are similar to those found in the SCAQS tunnel study. According to the ARB, the CO and ROG emission rates from EMFAC7E are 56 and 52 percent lower than the measured emission rates in the Van Nuys Tunnel (Lovelace, 1991), whereas the NO_x emission estimates and measurements are in close agreement (Ingalls et al., 1989). Based on these results, we believe the problem in the emissions inventory is more likely underestimation of NMOC and CO emissions than overestimation of NO_x emissions.

5.4 NMOC COMPOSITION

5.4.1 Major VOC Groups

The amounts of paraffins, olefins, aromatic hydrocarbons, and carbonyl compounds in the emissions inventory and ambient samples are compared in Tables 5-3 and 5-4. The unidentified NMOC were assigned 45 percent to paraffins, 45 percent to aromatic hydrocarbons, and 10 percent to olefins for this analysis. The summer and fall comparisons indicate the paraffin content of the inventory is consistent with the ambient data at all sites except Long Beach in the summer. On average, the summer and fall emissions inventories contained 54 and 50 percent paraffins which compares well with the observed ambient air content of 53 percent paraffins in both seasons.

Olefins, on the other hand, are overestimated at all sites except Long Beach in the summer. The summer and fall emissions inventories have 22 percent olefins on the average and the ambient data have 12 percent in the summer and 15 percent in the fall. This is a significant discrepancy considering the high reactivity of olefins.

The aromatic content of the emissions inventory is somewhat low compared to the ambient data. On average, the inventories contain 23 percent and 25 percent aromatics in the summer and fall, whereas the ambient data have 27 percent and 29 percent aromatic hydrocarbons in the summer and fall, respectively.

The emissions inventory has a significantly lower carbonyl content than the ambient data. The discrepancy is most apparent in the summer data which show 7.7 percent carbonyl compounds in ambient air on average compared to 2.3 percent in the summer inventory. In the fall, the ambient air and emissions inventory have 3.7 and 2.6 percent, respectively, which is reasonably good agreement.

Tables 5-3 and 5-4 also show the maximum incremental reactivity (MIR - Carter 1991) of one mole carbon of the emissions inventory and ambient NMOC. Despite the underestimation of carbonyl compounds and aromatic hydrocarbons, the reactivity of the emissions inventory mixture is consistently higher than the ambient mixture. The only exception is Long Beach in the summer, which has an unusually large amount of paraffins in the inventory and, therefore, has a reactivity that is lower than the ambient MIR. On average, the inventory mixture is 10 percent and 30 percent higher in reactivity than the ambient mixture in the summer and fall, respectively. While the discrepancies in reactivity are small compared to those in NMOC/NO_x

Table 5-3. The NMOC Fractions of the Major Classes of Organic Compounds and the NMOC Reactivity in the SCAQS Emissions Inventory and in Ambient Air in the Summer

Location	Type	Percent of NMOC Carbon[1]				Reactivity[2]
		Paraffins	Olefins	Aromatic	Carbonyl	MIR
Anaheim	Ambient	52.5	11.7	25.4	10.8	630
	Emissions	47.9	24.5	24.8	2.7	730
Azusa	Ambient	51.9	10.2	29.7	8.5	590
	Emissions	48.7	26.4	22.6	2.2	710
Burbank	Ambient	54.4	12.1	28.9	5.2	580
	Emissions	52.0	21.6	23.4	3.0	670
Los Angeles	Ambient	51.2	13.7	29.8	5.7	620
	Emissions	51.7	21.9	23.8	2.4	680
Claremont	Ambient	51.2	11.6	28.4	8.8	590
	Emissions	52.0	21.4	24.3	2.3	680
Hawthorne	Ambient	56.8	13.0	24.7	5.9	570
	Emissions	53.0	20.4	24.8	1.8	670
Long Beach	Ambient	57.3	12.6	22.7	7.7	580
	Emissions	70.9	13.3	13.8	2.0	480
Riverside	Ambient	51.5	12.2	28.1	8.7	610
	Emissions	52.7	22.3	22.7	2.3	680
Average	Ambient	53.4	12.1	27.2	7.7	600
	Emissions	53.6	21.5	22.6	2.3	660

1 45 percent, 45 percent, and 10 percent of the unidentified NMOC were assigned to paraffins, aromatic hydrocarbons, and olefins. The maximum incremental reactivity of unidentified NMOC was assumed to be 0.50 moles ozone per mole carbon.

2 Based on the Maximum Incremental Reactivity (MIR) scale (Carter 1991).

Table 5-4. The NMOC Fractions of the Major Classes of Organic Compounds and the NMOC Reactivity in the SCAQS Emissions Inventory and in Ambient Air in the Fall

Location	Type	Percent of NMOC Carbon[1]				Reactivity[2]
		Paraffins	Olefins	Aromatic	Carbonyl	MIR
Anaheim	Ambient	51.6	14.0	30.0	4.7	550
	Emissions	51.1	21.6	23.3	3.8	740
Burbank	Ambient	53.6	13.4	29.6	3.5	540
	Emissions	50.8	22.0	24.3	2.7	700
Los Angeles	Ambient	52.9	15.6	29.2	2.4	570
	Emissions	50.3	22.3	24.9	2.4	720
Hawthorne	Ambient	54.9	14.4	27.7	3.2	540
	Emissions	51.6	20.3	26.2	1.8	690
Riverside	Ambient	51.2	15.4	28.7	4.8	560
	Emissions	48.4	24.1	25.1	2.4	740
Average	Ambient	52.9	14.6	29.1	3.7	550
	Emissions	50.5	22.1	24.8	2.6	720

1 45 percent, 45 percent, and 10 percent of the unidentified NMOC were assigned to paraffins, aromatic hydrocarbons, and olefins. The maximum incremental reactivity of unidentified NMOC was assumed to be 0.50 moles ozone per mole carbon.

2 Based on the Maximum Incremental Reactivity (MIR) scale (Carter 1991). Although the MIR scale was developed for summer conditions, it is applied to the fall data to measure the relative reactivities of the two types of mixtures.

ratios, existing inventories may partially compensate for underestimation of NMOC emissions by overestimating the reactivity of the emissions.

5.4.2 Detailed NMOC Composition

The detailed composition of the 0600-0800 NMOC inventories and 0700-0800 ambient data are compared in Tables 5-5 and 5-6. The percentage of NMOC (on a carbon basis) contributed by individual species and detailed species groups are shown. It is difficult to put the detailed compositions on a common basis because the ambient data included 15 percent unidentified species and the inventory includes species that may not have been detected by the ambient measurement systems (about 7 percent of the carbon). We chose to base the percentages of ambient NMOC on the total observed NMOC (i.e., including the unidentified carbon) and the percentages of emitted NMOC on the unadjusted NMOC emissions.

The biases noted above for olefins are reflected in most of the detailed olefinic species' contributions. Ethene and propene are the two most abundant olefins and their fractions in the inventories are a factor of two greater than in the ambient data in both seasons. For example, the fall inventory has 8.4 percent ethene compared to 4.2 percent observed and the summer inventory has 3.3 percent propene compared to 1.4 percent observed. Since these two olefins are quite reactive, these discrepancies are significant. The fractions of most C4+ olefins in the inventory are also high by a factor of two or more. The exceptions are terminal C5 olefins, for which there are comparable fractions in the inventory and ambient, and 1,3-butadiene, for which the fractions are 71 and 98 percent lower in the summer and fall inventory than the ambient, respectively. The underestimation of 1,3-butadiene emissions is important because it is a highly toxic compound.

In contrast, the emissions inventory fractions for the abundant aromatic compounds are fairly close to the ambient air fractions. The benzene fractions (2.4 to 2.8 percent in summer and fall) are in excellent agreement. The emissions inventory's toluene fractions (about 8 percent) are about 20 percent higher than the fractions in ambient data. The inventory's fractions of ethylbenzene and xylenes are 10 to 20 percent lower than in the ambient data. Larger discrepancies occur in the fractions of higher aromatic hydrocarbons. For example, styrene and C9 di-alkylbenzenes are 80 and 40 percent lower, respectively, in the inventory than the ambient. Trimethylbenzenes are 74 and 104 percent higher in the summer and fall inventories than the corresponding ambient data. C10 di-alkylbenzenes are more than 270 percent higher in the inventory than the ambient. Overall, the C6-C8 aromatic fractions compare relatively well and the C9+ aromatic fractions show a mixture of low and high estimates. Comparable discrepancies are evident in the summer and fall comparisons.

The results for carbonyl species are different in summer and fall. In the summer, the formaldehyde content of the inventory is in good agreement with the observed fraction (0.83 percent) and the acetaldehyde fraction of the inventory is 43 percent lower than the ambient (1 percent). The fall inventory has 152 and 53 percent higher formaldehyde and acetaldehyde fractions than the ambient data. The emissions inventory fractions of all C3+ carbonyl compounds are lower than in the ambient observations. As noted

Table 5-5. Comparison of the Summer Ambient and Emissions NMOC Compositions in the SoCAB for 0700 to 0800 PDT

Species	Ambient % NMOC	Emissions %NMOC	%BIAS
Paraffins			
Ethane	3.88	3.03	-22
Propane	6.92	4.37	-37
Acetylene	2.56	4.04	58
Butane	5.28	6.79	29
i-Butane	2.41	2.38	-1
Pentane	3.20	2.10	-34
Branched C5s	6.69	6.33	-5
Cyclopentane	0.37	0.29	-23
Hexane	1.49	2.24	51
Branched C6s	4.47	4.07	-9
Cyclohexane	0.41	1.83	346
Methylcyclopentane	1.47	0.63	-57
Heptane	0.82	0.68	-17
Branched C7s	3.67	3.97	8
Methylcyclohexane	0.97	0.36	-63
Branched C8s	2.48	6.07	145
Branched C9s	0.71	1.80	154
Branched C10s	0.48	1.86	287
Olefins			
Ethene	3.58	7.32	104
Propene	1.44	3.30	128
1,3-Butadiene	0.24	0.07	-71
Terminal C4 olefins	0.62	1.28	106
Internal C4 olefins	0.31	1.06	238
Terminal C5 olefins	0.77	0.76	-1
Internal C5 olefins	0.51	1.03	103
Isoprene	0.24	0.81	237
Terminal C6 olefins	0.00	0.48	380
Aromatics			
Benzene	2.36	2.39	1
Toluene	6.73	8.22	22
Ethylbenzene	1.11	1.00	-10
Xylenes	5.70	4.54	-20
Styrene	0.47	0.09	-81
C9 mono-alkylbenzenes	0.24	0.26	13
C9 di-alkylbenzenes	1.67	1.01	-40
Tri-methylbenzenes	1.94	3.37	74
C10 di-alkylbenzenes	0.30	1.11	270

Table 5-5. Comparison of the Summer Ambient and Emissions NMOC Compositions in the SoCAB for 0700 to 0800 PDT

Species	Ambient % NMOC	Emissions %NMOC	%BIAS
Carbonyls			
Formaldehyde	0.83	0.87	5
Acetaldehyde	1.00	0.58	-43
Propanal	0.44	0.05	-89
Acetone	1.94	0.47	-76
Methyl Ethyl Ketone	0.91	0.34	-63
Butanal	0.26	0.00	-100
Pentanal	1.12	0.00	-100
Hexaldehyde	0.92	0.00	-100
Benzaldehyde	0.24	0.08	-67
Totals			
Paraffins	48.27	52.82	9
Olefins	7.72	16.12	109
Aromatics	20.51	22.00	7
Carbonyls	7.66	2.38	-69
Unidentified	15.84	6.67	-58

Table 5-6. Comparison of the Fall Ambient and Emissions NMOC Compositions in the SoCAB for 0700 to 0800 PST

Species	Ambient % NMOC	Emissions %NMOC	%BIAS
Paraffins			
Ethane	3.28	3.01	-8
Propane	5.19	2.63	-49
Acetylene	3.42	4.69	37
Butane	6.29	5.47	-13
i-Butane	2.32	1.23	-47
Pentane	3.14	1.73	-45
Branched C5s	6.84	5.77	-16
Cyclopentane	0.38	0.26	-33
Hexane	1.59	1.61	1
Branched C6s	5.13	4.38	-15
Cyclohexane	0.39	1.59	312
Methylcyclopentane	1.48	0.69	-53
Heptane	0.93	0.63	-32
Branched C7s	3.95	4.48	13
Methylcyclohexane	0.90	0.41	-55
Branched C8s	3.00	7.08	136
Branched C9s	0.70	1.69	142
Branched C10s	0.24	1.33	451
Olefins			
Ethene	4.20	8.42	100
Propene	1.86	3.72	100
1,3-Butadiene	0.24	0.01	-98
Terminal C4 olefins	0.73	1.52	107
Internal C4 olefins	0.53	1.20	127
Terminal C5 olefins	0.82	0.75	-9
Internal C5 olefins	0.65	1.18	80
Isoprene	0.18	0.09	-50
Terminal C6 olefins	0.00	0.49	399
Aromatics			
Benzene	2.84	2.70	-5
Toluene	7.51	8.84	18
Ethylbenzene	1.14	0.95	-17
Xylenes	6.15	5.14	-16
Styrene	0.70	0.14	-80
C9 mono-alkylbenzenes	0.27	0.34	26
C9 di-alkylbenzenes	2.00	1.26	-37
Tri-methylbenzenes	1.96	4.00	104
C10 di-alkylbenzenes	0.27	1.48	438

Table 5-6. Comparison of the Fall Ambient and Emissions NMOC Compositions in the SoCAB for 0700 to 0800 PST

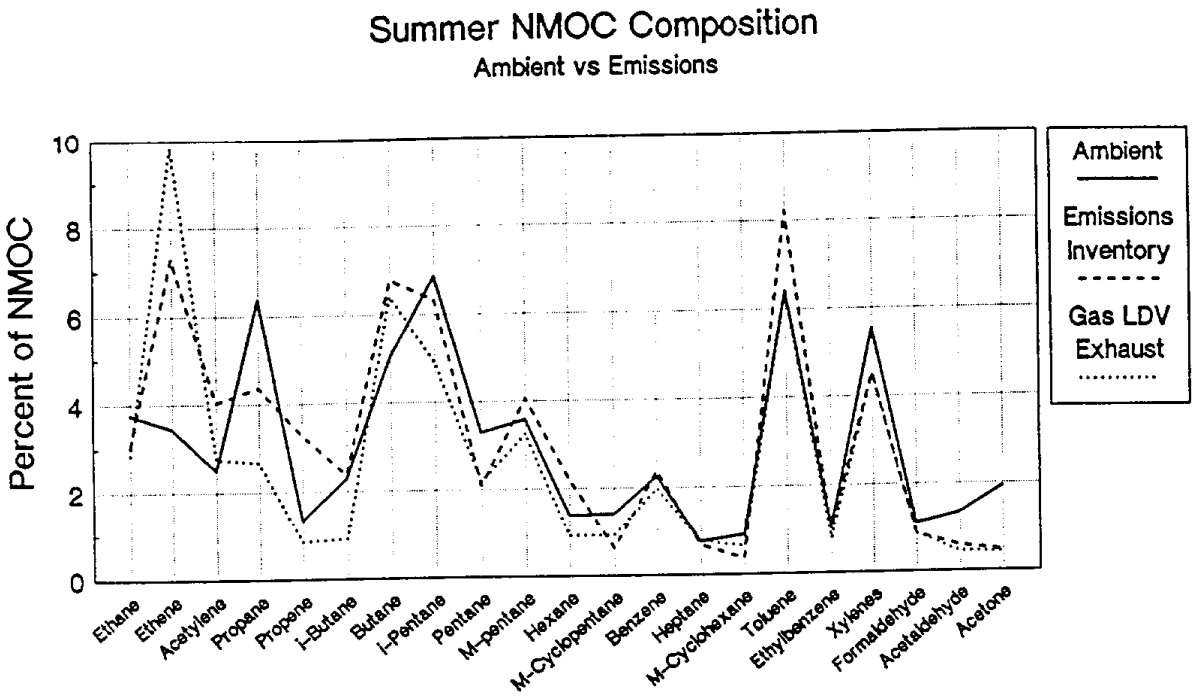
Species	Ambient % NMOC	Emissions %NMOC	%BIAS
Carbonyls			
Formaldehyde	0.47	1.17	152
Acetaldehyde	0.44	0.68	53
Propanal	0.08	0.06	-26
Acetone	1.07	0.33	-69
Methyl Ethyl Ketone	0.97	0.20	-79
Butanal	0.02	0.00	-100
Pentanal	0.20	0.00	-100
Hexaldehyde	0.31	0.00	-99
Benzaldehyde	0.16	0.10	-36
Totals			
Paraffins	49.16	48.68	-1
Olefins	9.22	17.38	89
Aromatics	22.85	24.85	9
Carbonyls	3.73	2.56	-31
Unidentified	15.05	6.54	-57

earlier, the ambient data for the higher carbonyl compounds are not as reliable as those for formaldehyde and acetaldehyde, nevertheless, the almost complete absence of higher carbonyl compounds from the inventory indicates a problem with the inventory composition.

The comparison of the fractions of paraffins are mixed. While the total fraction of paraffins are consistent, the emissions inventory's fractions of ethane, propane, pentane, isopentane, cyclopentane, methylcyclopentane, heptane, and methylcyclohexane are underestimated. The emissions inventory's fractions of acetylene, cyclohexane, and branched C7-C10 paraffins are overestimated. The fractions of n-butane are overestimated in the summer and underestimated in the fall. The fractions of isobutane are similar in the summer but low in the fall. The fractions of hexane are overestimated in the summer but similar in the fall. Overall, the emissions inventory's composition may be biased towards the heavier paraffins and have too few light paraffins. Although some of the unidentified ambient hydrocarbons are probably higher paraffins.

Figure 5-1 shows a comparison NMOC fractions of numerous abundant species in the ambient data, the emissions inventories, and ARB emissions composition profile no. 801, which is for light-duty vehicle (LDV) exhaust emissions. The figure clearly illustrates the discrepancy in the ethene fraction, which is caused by an anomalously high ethene fraction in the LDV exhaust composition profile. The discrepancies in the propane, propene, isobutane, and acetone fractions are also apparent. However, the figure shows the overall emissions inventory composition is quite similar to that for LDV exhaust. For most abundant compounds, the agreement between the ambient and emissions inventory as well as between the ambient and LDV exhaust profile is reasonably good.

In summary, while the discrepancies in the emissions inventory composition are generally small, there appears to be significant bias in the fractions of several important species. Improvements in the emissions inventory speciation profiles are needed to address the overestimation of most olefins and C8+ alkanes, and the underestimation of C2-C6 alkanes, the higher aromatic compounds, and higher carbonyl species.



ARB Emissions Profile No. 801

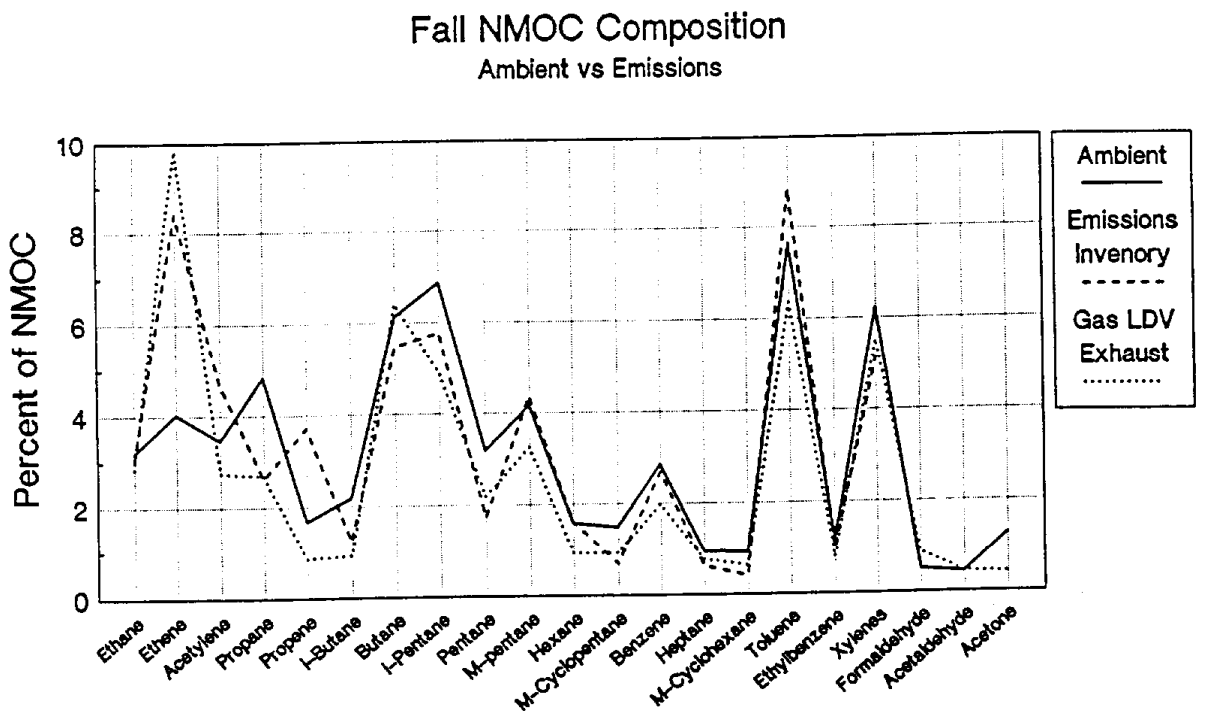


Figure 5-1. Comparison of the SCAQS Ambient NMOC Composition With the Emissions Inventory and Gasoline Light Duty Vehicle Exhaust Profiles.

6. SUMMARY AND CONCLUSIONS

The SCAQS VOC data provided an opportunity to improve the understanding of the spatial and temporal patterns, and the day-to-day and seasonal variability of total NMOC levels, of the major NMOC groups, and of individual organic species concentrations in the SoCAB. They also provided information needed to perform a top-down evaluation of the emissions inventory and refine the conceptual model of emissions in the basin.

6.1 CHARACTERISTICS OF THE AMBIENT DATA

The SCAQS data provide a fairly consistent picture of NMOC during episodic conditions in the SoCAB. The major characteristics are as follows.

Total NMOC:

- Total NMOC concentrations are summarized in Table 6-1. Total NMOC levels ranged from 171 to 2640 ppbC in the summer and from 182 to 4234 ppbC in the fall. The mean NMOC concentrations were 767 and 1595 ppbC in summer and fall, respectively. The mean NMOC concentration on summer mornings was 971 ppbC, which is slightly higher than occurs in most urban areas of the United States.

- The spatial pattern of NMOC had moderate concentrations in the western and southern parts of the basin (at Hawthorne, Long Beach, and Anaheim), high concentrations in the central basin (at Los Angeles and Burbank), and moderate concentrations in the eastern basin during the summer. On average, NMOC concentrations decreased with distance from a high concentration ridge between Los Angeles and Burbank in summer. In fall, there were similar NMOC concentrations (on average) in the western and central areas, and significantly lower concentrations in the eastern basin. The highest NMOC concentrations occurred at Burbank in the fall.

- The diurnal patterns of NMOC were highly variable, probably due to the complexity of meteorology in the basin. On average, NMOC concentrations were highest at 0700-0800 (local time) in summer and fall. In summer, the concentrations generally declined over the course of the day, while in the fall, concentrations declined between 0700 and 1200 and then increased between 1200 and 1600.

- The day-to-day variability of NMOC concentrations during SCAQS episodes was modest. The basinwide mean NMOC concentrations were between 576 and 795 ppbC on eight of the eleven summer days. If data from the one relatively clean summer day (June 19th) is ignored, the basinwide daily mean NMOC explained 50 percent of the variance in basinwide daily ozone maxima. However, in the fall the day-to-day variance in NMOC explained little of the day-to-day variance in basinwide PM_{10} maxima.

- The NMOC levels within the SoCAB were more than eight times higher than the concentrations on San Nicolas Island, which is located 120 km

Table 6-1. Average NMOC Levels in the SoCAB during SCAQS

	NMOC Concentration (ppbC)			
Location/Season	0700-0800	1100-1200	1600-1700	All Times
Summer:				
Hawthorne	602	420	278	447
Long Beach	977	718	400	619
Anaheim	850	546	545	660
Los Angeles	1168	1326	695	1086
Burbank	1480	1138	829	1108
Azusa	971	873	731	858
Claremont	882	669	745	798
Riverside	950	484	470	657
Average:	971	771	607	767
San Nicolas Isl.	116	71	105	94
Winter:				
Hawthorne	3142	1080	582	1772
Long Beach[a]	3111	906	1042	1699
Anaheim	2539	978	1257	1591
Los Angeles	2075	1064	1293	1575
Burbank	3186	1135	1890	2125
Riverside	1719	394	671	912
Average[b]:	2560	937	1179	1595

a NMHC only.
b Excluding Long Beach.

offshore. And only about half of the San Nicolas Island samples had concentrations low enough to be classified as "clean air" samples.

NMOC/NO_x:

- Ambient concentrations of NMOC and NO_x in the morning correlated well, especially in summer (r^2 = 0.78).

- NMOC/NO_x ratios at 0700-0800 ranged from 5 to 15 in the summer and 2 to 11 in the fall at the SCAQS monitoring sites. The majority of morning samples had NMOC/NO_x ratios between 7 and 11 in summer, and 5 and 9 in fall. The mean morning NMOC/NO_x ratios were 8.9 and 6.9 in summer and fall, respectively.

- The spatial variation in morning NMOC/NO_x ratios was small in the summer. All of the mean morning NMOC/NO_x ratios were between 8 and 9.6 in summer. The fall data showed greater spatial variation in morning NMOC/NO_x ratios, with the mean NMOC/NO_x ratios varying from 5.1 at Los Angeles to 9.5 at Burbank.

- Mid-day and afternoon NMOC/NO_x ratios were generally higher (11 to 15) than morning ratios and showed more spatial variation. However, Long Beach and Hawthorne had lower NMOC/NO_x ratios at 1600 than at any other time of the day in summer.

NMOC Composition:

- The composition of NMOC in the SoCAB was similar to many other urban areas and similar to light duty motor vehicle exhaust. As shown below, about 45 percent of the NMOC were paraffins, while 9, 18, and 13 percent were olefins, aromatic hydrocarbons, and carbonyl compounds, respectively. The other 15% of NMOC carbon were unidentified species. The carbonyl content was higher in summer, presumably due to the higher levels of photochemical activity, while the aromatic and olefins contents were higher in the fall.

	Fraction of NMOC		
Compound Class	Summer	Fall	Average
Paraffins	.444	.454	.449
Olefins	.083	.100	.091
Aromatics	.163	.201	.182
Carbonyls	.161	.099	.130
Unidentified	.148	.152	.150

- The spatial, temporal, and day-to-day variations in the relative composition of NMOC were generally small. In fact, with the exception of a large diurnal variation in the carbonyl content, the NMOC composition was amazingly consistent. There was a slight trend towards a higher paraffin content in the western basin and higher aromatic and carbonyl contents in the eastern basin.

- Over 110 individual organic compounds were identified in the SCAQS VOC samples. The 25 most abundant species accounted for more than 62 percent of the NMOC carbon. The 25 most abundant compounds on a carbon basis in summer were:

Compound	% NMOC	Compound	% NMOC
1) propane	7.41	14) 2-methylpentane	1.93
2) isopentane	6.37	15) 3-methylpentane	1.51
3) toluene	5.90	16) formaldehyde	1.37
4) n-butane	5.25	17) hexane	1.31
5) ethane	3.48	18) methylcyclopentane	1.24
6) acetone	3.21	19) o-xylene	1.20
7) m&p-xylene	2.97	20) propene	1.00
8) n-pentane	2.89	21) 124-trimethylbenzene	0.97
9) ethene	2.85	22) 3-methylhexane	0.91
10) isobutane	2.49	23) ethylbenzene	0.90
11) acetylene	2.25	24) methylcyclohexane	0.84
12) acetaldehyde	2.19	25) heptane	0.70
13) benzene	2.07		

In comparison to past hydrocarbon measurements in the SoCAB, the two most notable differences in these species were higher fractions of propane and lower fractions of n-butane in the SCAQS data.

- The abundant species and their contributions to NMOC are similar to those found in EPA's study of 41 non-California-cities in 1984-86. The acetylene, propane, toluene, and xylene content of NMOC was slightly higher in the SoCAB than in the 41 non-California-city average. However, the overall reactivity of NMOC in the SoCAB was slightly lower than the 41 non-California-city average.

- The formaldehyde and acetaldehyde data were generally consistent with previous measurements, except the ratio of acetaldehyde to formaldehyde was slightly higher.

- Acetone was the most abundant carbonyl compound on a carbon basis. C4+ carbonyl species accounted for more than 45% of the total carbonyl compounds on average, which was substantially higher than expected. While the higher carbonyl data are less certain than the formaldehyde and acetaldehyde data, the SCAQS data consistently showed significant quantities of C3-C7 higher carbonyl species. As a result the total carbonyl fraction of NMOC was high (16 percent in summer and 10 percent in fall).

- The formaldehyde, acetaldehyde, acetone, and other carbonyl fractions of NMOC on summer mornings were 0.85, 1.0, 2.0, and 3.65 percent on average, respectively.

- While the diurnal variation in hydrocarbon composition is small, the data clearly show two effects:

(1) preferential oxidation (or disappearance) of the more reactive compounds relative to the less reactive compounds during the morning hours; and

(2) a mid-day peak in the n-butane and isobutane fractions which probably reflects an enhanced mid-day contribution from gasoline evaporation.

The late afternoon hydrocarbon composition was between that observed at 0700 and 1200.

- The xylene to benzene ratio, which is a good indicator of the age of a NMOC mixture and, to a certain extent, the contribution of motor vehicles, showed remarkable consistency in the SCAQS data set. The relative amounts of xylenes and benzene were comparable throughout the measurement network and highly correlated with NMOC and NO_x. The mean ratios in the morning were between 2.2 and 2.5 in summer (except at Azusa) and between 2.0 and 2.3 in the fall. Mid-day and afternoon ratios were lower than the morning ratios in the summer (especially at stations in the eastern basin), but not in the fall. The changes in the xylene to benzene ratios between morning and noon in the summer were much smaller than would occur for a mixture isolated from fresh emissions. Overall, the consistency of the xylene to benzene ratios suggested a fairly continuous and wide-spread contribution from motor vehicle emissions.

- NMOC composition at Hawthorne was distinct from other sites because of high propane levels. The NMOC composition at Long Beach and Los Angeles in the mid-day and afternoon was also somewhat different from the rest of the stations.

- NMOC composition on San Nicolas Island was substantially different than in the onshore data. The mixtures were more aged and contained a greater fraction of carbonyl species than the onshore samples.

- The relative reactivity of NMOC, based on Carter's Maximum Incremental Reactivity (MIR) factors, was high at Los Angeles and Burbank, and low at Hawthorne and Long Beach in the summer. A ranking of species' contributions to reactivity identified mostly the same species as identified by ranking their contributions to NMOC carbon.

- Isoprene was the only biogenic hydrocarbon found in the SCAQS samples. On average, isoprene contributed 0.2 percent of NMOC carbon and 0.7 percent of the NMOC reactivity. Larger isoprene contributions were found at Claremont and Anaheim. Isoprene concentrations at most stations were highest in the morning, rather than in the mid-day or afternoon, which was surprising since laboratory data suggests plant isoprene emissions increase with temperature and solar radiation.

Relationships:

- Many individual hydrocarbons were highly correlated with other species in their compound class and with NMOC, including C5+ paraffins, most aromatic hydrocarbons, and olefins (in fall only).

- CO and acetylene, which are primarily emitted by motor vehicles, were highly correlated with both NMOC and NO_x.

- Morning NMOC correlated reasonably well with most precursor species like NO, NO_x, CO, and abundant hydrocarbons. Afternoon NMOC correlated well with NO_2+ozone, but not with PAN, concurrent ozone, or basinwide daily ozone maxima.

- NMOC levels were not highly correlated with temperature.

Toxic VOCs:

- The 24-hr average concentrations of toxic organic species (halogenated species and benzene) were collected at four sites by two measurement groups. The collocated measurements did not compare well.

VOC Aloft:

- The summer aircraft VOC data, which were collected between 500 and 800 meters during orbits, showed NMOC levels that were mostly lower than surface concentrations and NMOC composition that was more aged than surface data.

- Comparison of concurrent and collocated surface and aircraft samples showed there were cases where concentrations aloft were equal to the surface concentrations and where concentrations aloft were substantially lower than the surface concentrations. The largest differences were for morning samples.

- The morning data, which were collected above the inversion height, had average NMOC levels of 197 ppbC. The afternoon data, which were mostly collected in the mixed layer, had NMOC concentrations of 416 ppbC. The spatial pattern of the afternoon data was consistent with the surface NMOC patterns.

- The distributions of hydrocarbons aloft were usually more aged than the surface mixtures. The species that were abundant aloft were mostly the same as those in the surface data. The carbonyl content (35 percent of NMOC carbon) aloft was more than twice that in the surface data.

6.2 COMPARISON OF EMISSIONS INVENTORY AND AMBIENT DATA

A comparison of emissions inventory and ambient data was carried out using the average emissions within 15 x 15 km grids encompassing each SCAQS monitor for the 0600-0800 period and the 0700-0800 ambient observations. The day-specific emissions inventories created by ARB for August 28 and December

10, 1987 were used to characterize summer and fall emissions. The findings were as follows.

- Average NMOC/NO_x ratios in the emissions inventory were 54 and 39 percent lower than ambient NMOC/NO_x ratios in summer and fall, respectively. The largest discrepancies (more than 60 percent) occurred at Claremont, Azusa, Burbank, and Riverside in the summer. The smallest discrepancies occurred at Hawthorne.

- Average CO/NO_x ratios in the emissions inventory were 43 and 38 percent lower than ambient CO/NO_x ratios in summer and fall, respectively. The largest discrepancies occurred at Riverside in the summer and Long Beach in the fall. The smallest discrepancies occurred at Azusa in the summer and Los Angeles in the fall.

- The ratio analysis indicates the problem is either that:

  (1) NO_x emissions are substantially overestimated, or
  (2) NMOC and CO emissions are seriously underestimated, or
  (3) some combination of the two.

  Because CO and NO_x are primarily emitted by motor vehicles, the CO/NO_x ratio discrepancies indicate the problem is probably with the motor vehicle exhaust emissions. Since the discrepancies in NMOC/NO_x and CO/NO_x ratios are comparable in magnitude, the NMOC/NO_x ratio discrepancies may also be due to inaccuracies in the motor vehicle exhaust emissions estimates. However, biases in emission estimates for other types of sources may contribute to the discrepancies.

- The discrepancies between the ambient and emissions inventories are similar to those found in the SCAQS tunnel study. According to the ARB, the CO and VOC emission rates from EMFAC7E are 56 and 52 percent lower than the measured emission rates in the Van Nuys Tunnel, whereas the NO_x emissions estimates and measurements are in close agreement. Based on these results and the fact that the composition of the NMOC is so similar to motor vehicle exhaust, we believe the problem in the emissions inventory is more likely underestimation of NMOC and CO emissions than overestimation of NO_x emissions.

- The relative composition of the NMOC inventory is biased towards overestimation of olefins and underestimation of aromatic hydrocarbons and carbonyl compounds. Most biases were similar in both seasons and at most stations. In terms of the more detailed species, the problems are as follows.

  (1) The fractions of ethene, propene, and most higher olefins are high by a factor of two or more. The bias in the ethene fraction is larger than that for any other species we examined (8.4 percent versus 4.2 percent). Another problem with the inventory is that the 1,3-butadiene fractions are 71 and 98 percent lower in the summer and fall inventories than the ambient data, respectively, which is a serious omission if the inventory were to be used for modeling toxic exposures.

(2) The fractions of benzene, toluene, and xylenes in the inventory are within ±20 percent of the ambient data, however, the fractions of individual C9+ aromatic species are often over- and underestimated by large amounts.

(3) The summer formaldehyde content of the emissions inventory is in agreement with the ambient data, but there are significant discrepancies between the inventories and ambient data for virtually all other carbonyl species in summer and fall. The largest discrepancy is in the C3-C7 carbonyl species, which are essentially nonexistent in the inventories. The fall inventory also appears to have too much formaldehyde and acetaldehyde.

(4) While the overall paraffin content of the inventory is accurate, there may be a bias towards overestimation of the C7-C10 paraffins and underestimation of the C2-C6 paraffins.

- On average, the reactivities of the emissions inventory composition profiles are about 10 and 30 percent higher than the ambient composition profiles in summer and fall, respectively. The biases in the inventory composition are too small to compensate for the probable deficiencies in mass emissions of NMOC.

6.3 DATA INTERPRETATIONS

Our synthesis of the data leads to the following interpretations concerning emissions and atmospheric processes in the SoCAB.

- The similarity of NMOC composition and NMOC/NO_x ratios throughout the day, and especially in the fall, suggests fresh NMOC emissions are continuously injected into the atmosphere in the SoCAB. While there is evidence of preferential photo-oxidation of the more reactive hydrocarbon species and formation of large amounts of carbonyl compounds, especially on summer mornings, these effects are tempered by the continuous injection of fresh emissions. This finding is not meant to imply that emission rates are constant over the course of the day, because that obviously is not the case; rather, only that the relative composition of many atmospheric constituents between 0700 and 1700 are similar to fresh emissions.

- The NMOC levels have significant day-to-day and seasonal variations, which are undoubtably controlled by meteorology. In addition, the NMOC levels have significant spatial variation within the basin due to the nonuniformity of emission rates and the effects of transport. However, the day-to-day and spatial variations in NMOC composition are relatively small in comparison. This suggests that emissions from one or more common types of sources occur throughout the basin. Since the composition profile strongly resembles that from motor vehicles and since the data show consistent xylene to benzene ratios and high correlation between CO, acetylene, NMOC, and NO_x, the dominant source is probably motor vehicles.

- The combination of the findings from the SCAQS Tunnel Study and the discrepancies between ambient NMOC/NO_x and CO/NO_x ratios and ratios in emissions inventories strongly suggest current inventories underestimate NMOC and CO emissions from motor vehicles. Problems with the emissions from other types of sources may also contribute to the discrepancies, however, there were too few tracer species for organic emissions from specific source types to identify those sources with these data.

- The ambient NMOC/NO_x ratios on summer mornings were mostly between 7 and 11, which is a range where both NMOC and NO_x emission controls are likely to be effective in reducing ozone concentrations.

- Although measurements were not obtained in outlying areas where biogenic emissions may be high, the contribution of isoprene to NMOC in the urban portion of the basin is small compared to anthropogenic source contributions. Because isoprene reacts rapidly, the ambient observations probably underestimate its relative contribution. In addition, the measurement system was not set up to detect the known intermediate products of reaction.

6.4 RECOMMENDATIONS

The findings of the study lead to the following recommendations, which are listed in order of their priority.

- An investigation and correction of the biases in the NMOC, CO, and perhaps NO_x emissions inventories is needed. A series of bottom-up evaluations of the major components of the inventory, with motor vehicles coming first, are needed. These should be followed by top-down evaluations and in-use emissions surveys.

- The NMOC source composition libraries should be updated. Corrections are needed to address the significant overestimation of olefins and underestimation of higher carbonyl compounds, as well as the problem with the C9+ aromatic hydrocarbons.

- The "Level 2 validated" NMOC data base should be distributed to photochemical modeling groups for their use in performance evaluation studies. Comparison of model predictions with the data may help diagnose problems in the emissions inventory.

- Given the importance of NMOC in ozone formation and the resources devoted to the control of NMOC emissions, there is a need for long-term NMOC ambient data to assess trends and assess the effectiveness of NMOC controls. This need could be satisfied with frequent high quality measurements of total NMOC and infrequent analyses of NMOC composition.

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APPENDIX A

INVALID SURFACE AND AIRCRAFT VOC SAMPLES IN THE SCAQS DATA BASE

The following pages list the surface and aircraft VOC samples which have been flagged. The site, date, time, NMOC concentration, valid code, and reason for the flag are provided for each sample. Validation codes were added based on Stockburger's original analytical notes and AeroVironment's field notes. For example, these notes indicated some samples which were contaminated or samples in which the analytical procedure failed after a certain species. The carbonyls were invalid in all the samples collected at Long Beach during the fall because of a sampler timer error.

Internal consistency checks on the data were made using ratios of species such as benzene, total olefins, paraffins or aromatic hydrocarbons ratioed to CO and NMHC. Samples were flagged as having unusually high fractions of selected species if the carbon fraction of a particular species exceeded the median carbon fraction by more than a factor of ten; if the carbon fraction of a species exceeded 10% of the NMOC; if the total unidentified NMOC exceeded 30% on a carbon basis; or if the total carbonyl compounds exceeded 33% of NMOC on a carbon basis. Note that data may be listed with more than three significant figures, however, this is probably the largest degree of accuracy which the data justify.

Table A-1. Surface Samples in SCAQS VOC Data Base Which Have Been Flagged

Site	Date	Time PST	NMOC ppbC	NMOC2[a] ppbC	Valid Code	Problem[b]
ANAH	870624	600	553		0	Invalid
BURK	870619	600	1072		0	Invalid
BURK	870619	1100	1362		0	Invalid
BURK	870619	1500	855		0	Invalid
CELA	870828	600	7451		0	Invalid
CELA	870829	1100	9017		0	Invalid
CELA	870903	1500	1758		0	Invalid
CLAR	870625	800	1596		0	Invalid
CLAR	870829	1300		449	0	Invalid
CLAR	870829	1300		617	0	Invalid
CLAR	870829	1500		1648	0	Invalid
HAWT	870829	1500	906		0	Invalid
RIVR	870902	1500	168		0	Invalid
SNI	870714	1500	68		0	Invalid
CLAR	870827	600	959		1*	"Possible Contamination"
HAWT	870619	1100	286		1*	"Possible Contamination"
ANAH	870624	1500	385		2	Invalid after toluene
CELA	870625	1500	663		2	Invalid after toluene
AZUS	870624	600	599		3	Invalid after p-ethyltoluene
BURK	870624	600	642		3	Invalid after p-ethyltoluene
HAWT	870624	1500	404		3	Invalid after p-ethyltoluene
RIVR	870625	1100	580		3	Invalid after p-ethyltoluene
ANAH	870625	1100	348		4	Invalid after o-xylene
AZUS	870624	1100	795		4	Invalid after o-xylene
BURK	870625	600	781		4	Invalid after o-xylene
CELA	870625	600	1084		4	Invalid after o-xylene
CLAR	870624	800	608		4	Invalid after o-xylene
CLAR	870625	600	1162		4	Invalid after o-xylene
RIVR	870624	600	380		4	Invalid after o-xylene
RIVR	870829	1100	1006		4	Invalid after o-xylene
AZUS	870625	1100	991		5	Invalid after nonane
CLAR	870624	1100	637		5	Invalid after nonane
CLAR	870625	1100	797		5	Invalid after nonane
LBCC	870624	1300	417		5	Invalid after nonane
LBCC	870624	1500		231	5	Invalid after nonane
ANAH	870625	600	321		6*	"Low PSIG"
LBCC	870624	600	339		6*	"Low PSIG"
AZUS	870829	1100	1020		7	Lost n-Butane
CELA	870715	1100		1055	11	High 2,2,4-m-pentane

Table A-1. Surface Samples in SCAQS VOC Data Base Which Have Been Flagged

Site	Date	Time PST	NMOC ppbC	NMOC2[a] ppbC	Valid Code	Problem[b]
CELA	870903	1100	1975		11	High p-ethyltoluene, unidentified
CLAR	870713	400	345		11	High 2-methylheptane
HAWT	870624	600	665		11	High hexane
LBCC	870715	800	347		11	High pentane
LBCC	870903	1300	208		11	High hexane
RIVR	870624	1100	610		11	High 2,2,4-m-pentane
RIVR	871210	700	6989		11	High butane
SNI	870625	1100	156		11	High acetylene
SNI	870625	1500	117		11	High C9 aromatic, unidentified
SNI	870714	1100	41		11	High C4 olefin, c-2-butene
AZUS	870902	1100	677		12	High C2-C3 olefins
AZUS	870903	1500	375		12	High 2-m-1-butene
BURK	870902	1500	882		12	High pentene
CLAR	870902	400	220		12	High pentene
HAWT	870619	1500	252		12	High C8 olefin
HAWT	871112	1200	2222		12	High ethene
HAWT	871210	1600	824		12	High ethene
LBCC	870619	400	236		12	High acetylene, 2-pentenes
LBCC	870619	600	261		12	High c-2-pentene
LBCC	870619	1100	543		12	High c-2-pentene
LBCC	870625	1500	358		12	High olefins, carbonyls
LBCC	870715	600	252		12	High pentane
LBCC	870715	1100	235		12	High pentenes
RIVR	870827	600	685		12	High C2-C3 olefins
SNI	870715	600	53		12	High 3-m-1-butene
SNI	870902	1500	167		12	High c-2-pentene
CELA	870827	1100	1094		14	High 1,3-butadiene
CELA	870827	1500	880		14	High 1,3-butadiene
CELA	870902	1500	703		14	High 1,3-butadiene
RIVR	870827	1100	711		14	High 1,3-butadiene
RIVR	871113	1200	769		14	High 1,3-butadiene
AZUS	870619	1500	1044		15	High unidentified
AZUS	870714	600	888		15	High C8 paraffin
CELA	870829	1500	1455		15	High unidentified
HAWT	870827	600	573		15	High unidentified
HAWT	870828	1100	830		15	High C9 aromatic
HAWT	871111	1600	385		15	High C9 aromatic
LBCC	870827	1100	497		15	High unidentified
LBCC	870829	1300	637		15	High unidentified
RIVR	870619	1500	414		15	High unidentified
SNI	870624	1500	148		15	High unidentified
SNI	870715	1500	50		15	High unidentified

Table A-1. Surface Samples in SCAQS VOC Data Base Which Have Been Flagged

Site	Date	Time PST	NMOC ppbC	NMOC2[a] ppbC	Valid Code	Problem[b]
SNI	870827	1100	237		15	High unidentified
SNI	870902	600	137		15	High unidentified
BURK	870713	600	1027		16	Low benzene
BURK	870903	1100	1118		16	Low i-pentane
BURK	871210	1200	1501		16	Low xylenes, ethylbenzene
HAWT	870903	1500	268		16	Low toluene
ANAH	870713	1500	668		18	High t-2-butene
HAWT	870713	600	418		18	High t-2-butene
SNI	870713	1500	105		18	High c-2-butene
SNI	870714	600	43		18	High c-2-butene
SNI	870827	600	88		18	High t-2-butene
SNI	870902	1100	98		18	High t-2-butene
AZUS	870828	600	1756		19	High i-butane
LBCC	870903	400	173		21*	"Low xylenes"
LBCC	870903	800	356		21*	"Low xylenes"
LBCC	870903	1100	374		21*	"Low xylenes"
LBCC	870903	1500	199		21*	"Low xylenes"
LBCC	871111	500			22	Invalid carbonyls
LBCC	871111	700			22	Invalid carbonyls
LBCC	871111	900			22	Invalid carbonyls
LBCC	871111	1200			22	Invalid carbonyls
LBCC	871111	1400			22	Invalid carbonyls
LBCC	871111	1600			22	Invalid carbonyls
LBCC	871112	500			22	Invalid carbonyls
LBCC	871112	700			22	Invalid carbonyls
LBCC	871112	900			22	Invalid carbonyls
LBCC	871112	1200			22	Invalid carbonyls
LBCC	871112	1400			22	Invalid carbonyls
LBCC	871112	1600			22	Invalid carbonyls
LBCC	871113	500			22	Invalid carbonyls
LBCC	871113	700			22	Invalid carbonyls
LBCC	871113	900			22	Invalid carbonyls
LBCC	871113	1200			22	Invalid carbonyls
LBCC	871113	1400			22	Invalid carbonyls
LBCC	871113	1600			22	Invalid carbonyls
LBCC	871203	500			22	Invalid carbonyls
LBCC	871203	700			22	Invalid carbonyls
LBCC	871203	900			22	Invalid carbonyls
LBCC	871203	1200			22	Invalid carbonyls
LBCC	871203	1400			22	Invalid carbonyls
LBCC	871203	1600			22	Invalid carbonyls
LBCC	871210	500			22	Invalid carbonyls
LBCC	871210	700			22	Invalid carbonyls
LBCC	871210	900			22	Invalid carbonyls

Table A-1. Surface Samples in SCAQS VOC Data Base Which Have Been Flagged

Site	Date	Time PST	NMOC ppbC	NMOC2[a] ppbC	Valid Code	Problem[b]
LBCC	871210	1200			22	Invalid carbonyls
LBCC	871210	1400			22	Invalid carbonyls
LBCC	871210	1600			22	Invalid carbonyls
LBCC	871211	500			22	Invalid carbonyls
LBCC	871211	700			22	Invalid carbonyls
LBCC	871211	900			22	Invalid carbonyls
LBCC	871211	1200			22	Invalid carbonyls
LBCC	871211	1400			22	Invalid carbonyls
ANAH	870829	1500	428		23	High carbonyls
CLAR	870713	1100	421		23	High carbonyls
HAWT	870827	1100	187		23	High carbonyls
LBCC	870624	1100	210		23	High carbonyls
LBCC	870625	1100	249		23	High carbonyls
RIVR	870619	1100	496		23	High carbonyls
RIVR	870624	1500	442		23	High carbonyls
RIVR	870829	1500	271		23	High carbonyls
ANAH	870827	1500		644	24	High or low EPA C2-C3
ANAH	870902	1100		1219	24	High or low EPA C2-C3
CLAR	870902	1300		237	24	High or low EPA C2-C3
CLAR	870903	600		1071	24	High or low EPA C2-C3
HAWT	870625	1500		350	24	High or low EPA C2-C3
HAWT	870713	1500		261	24	High or low EPA C2-C3
LBCC	870624	400			24	High or low EPA C2-C3
LBCC	870714	600		349	24	High or low EPA C2-C3
LBCC	870903	600		224	24	High or low EPA C2-C3
LBCC	871211	1600			24	High or low EPA C2-C3

* We recommend that these samples be retained in the database.

[a] NMOC calculated using EPA sum of C2 species in place of missing OGI C2 data.

[b] Codes 0-7, 21 and 22 were laboratory-defined, while the remaining codes were defined during data analysis.

Table A-2. Aircraft Samples in SCAQS VOC Data Base Which Have Been Flagged

Site	Date	Time	Altitude (ft)	Flight Type	Group	NMOC ppbC	Valid Code	Problem
DOYLE	870714	554	2500	orbit	UW	122.3	11	HIGH C9+ PARAFFINS, AIRCRAFT EXHAUST?[a]
GYB	870902	649	2500	orbit	STI	120	11	HIGH DI-,TRI-METHYLPENTANES
LGB	870713	511	2000	orbit	UW	230.2	11	HIGH HEPTANE
LGB	870714	1350	2100	orbit	UW	108.7	11	HIGH C8,C9 PARAFFINS, AIRCRAFT EXHAUST?[a]
PADDR	870714	644	unknown	orbit	UW	124.8	11	HIGH TRIMETHYLHEXANE
RIVR	870715	1608	2500	orbit	UW	368.9	11	HIGH 13BUTADIENE, 2METHYL1BUTENE
GYB	870828	653	2500	orbit	STI	149.3	12	HIGH C4 OLEFIN
LGB	870714	448	3100	orbit	UW	72.7	14	HIGH 13BUTADIENE
AMTRA	870625	414	2500	orbit	UW	222.7	23	HIGH CARBONYLS
LGB	870625	458	2000	orbit	UW	169.2	23	HIGH CARBONYLS
PADDR	870625	658	2000	orbit	UW	241.5	23	HIGH CARBONYLS
DOYLE	870624	552	2400	orbit	UW	283.1	25	HIGH CARBONYLS
DOYLE	870625	620	2500	orbit	UW	262.7	25	HIGH CARBONYLS
LGB	870619	1529	2500	orbit	UW	164.2	25	HIGH CARBONYLS
PADDR	870624	642	2000	orbit	UW	331.3	25	HIGH CARBONYLS
POMA	870619	1628	2500	orbit	UW	631.8	25	HIGH CARBONYLS

[a] The analytical laboratory's comment.

APPENDIX B

COMPARISON OF THE MORNING NMOC COMPOSITION AT SCAQS STATIONS WITH EPA'S 41-CITY AVERAGE

The following pages provide a detailed, species-by-species comparison of the 0700-0800 PDT summer SCAQS average composition with the EPA's 41-City average. The EPA profile is based on the average of 773 6-9 AM samples analyzed by Jeffries, et al. (1988). The SCAQS average excludes San Nicolas Island data. The carbonyl fractions for the EPA profile are based on EPA's default recommendations for EKMA modeling since the samples were not analyzed for carbonyl compounds.

Table B-1. Comparison of the Morning NMOC Composition[1] at SCAQS Stations With EPA's 41-City Average

Compound	EPA 41-City % NMOC	SCAQS % NMOC
ETHANE	4.184	4.538
ETHYLENE	3.861	4.202
ACETYLENE	2.302	3.007
PROPYLENE	1.491	1.680
PROPANE	4.481	7.888
UNKNOWN	0.000	0.000
PARAFFIN	0.000	0.000
OLEFIN	0.000	0.000
OLEFIN	0.000	0.000
ISOBUTANE	2.788	2.820
UNKNOWN	0.004	0.000
UNKNOWN	0.006	0.000
1-BUTENE	1.005	0.743
1,3-BUTADIENE	0.269	0.282
N-BUTANE	6.619	6.166
TRANS-2-BUTENE	0.412	0.185
CIS-2-BUTENE	0.321	0.181
3-METHYL-1-BUTENE	0.106	0.098
ISOPENTANE	7.118	7.841
C5 OLEFIN	0.057	0.000
1-PENTENE	0.273	0.347
C5 OLEFIN	0.008	0.000
2-METHYL-1-BUTENE	0.414	0.423
N-PENTANE	3.440	3.709
ISOPRENE	0.340	0.279
TRANS-2-PENTENE	0.460	0.324
C5 OLEFIN	0.240	0.000
2-METHYL-2-BUTENE	0.056	0.000
CIS-2-PENTENE	0.545	0.263
C5 OLEFIN	0.057	0.000
C6 PARAFFIN	0.008	0.000
C6 PARAFFIN	0.356	0.000
2,2-DIMETHYLBUTANE	0.234	0.037
C5 OLEFIN	0.013	0.000
C6 OLEFIN	0.118	0.105
C6 PARAFFIN	0.012	0.196
4-METHYL-1-PENTENE	0.064	0.000
CYCLOPENTANE	0.320	0.433
2,3-DIMETHYLBUTANE	0.611	0.686
CIS-4-METHYL-2-PENTEN	0.000	0.000
CIS-4-METHYL-2-PENTEN	0.039	0.000
2-METHYLPENTANE	2.315	2.545
TRANS-4-METHYL-2-PNTE	0.114	0.000
C6 OLEFIN	0.043	0.000
C6 OLEFIN	0.037	0.000
3-METHYLPENTANE	1.659	1.789
1-HEXENE	0.128	0.000
C6 OLEFIN	0.024	0.000
N-HEXANE	1.785	1.750
C7 PARAFFIN	0.096	0.000
C7 OLEFIN	0.129	0.044
2-METHYL-2-PENTENE	0.180	0.093
C7 OLEFIN	0.099	0.004
CIS-2-HEXENE	0.000	0.000
TRANS-2-HEXENE	0.000	0.000
2-HEXENE	0.075	0.000
C7 OLEFIN	0.003	0.000
3-METHYL-TRANS-2-PNTE	0.114	0.017
METHYLCYCLOPENTANE	1.010	1.721
2,4-DIMETHYLPENTANE	0.386	0.451

Table B-1. Comparison of the Morning NMOC Composition[1] at SCAQS Stations With EPA's 41-City Average

Compound	EPA 41-City % NMOC	SCAQS % NMOC
2,2,3-TRIMETHYL-1-BUT	0.379	0.000
C7 OLEFIN	0.013	0.000
C7 OLEFIN	0.005	0.000
C7 PARAFFIN	0.000	0.000
BENZENE	2.078	2.776
3,3-DIMETHYLPENTANE	0.063	0.083
CYCLOHEXANE	0.000	0.493
C7 OLEFIN	0.510	0.000
C7 OLEFIN	0.063	0.000
2-METHYLHEXANE	1.097	0.981
2,3-DIMETHYLPENTANE	0.357	0.662
CYCLOHEXENE	0.044	0.000
C7 OLEFIN	0.038	0.000
3-METHYLHEXANE	0.933	1.167
C7 PARAFFIN	0.233	0.426
C7 PARAFFIN	0.235	0.543
2,2,4-TRIMETHYLPENTAN	0.000	1.414
ISOOCTANE	1.156	0.000
C8 OLEFIN	0.018	0.000
N-HEPTANE	0.792	0.958
T-HEPTENE-2	0.039	0.000
C8 OLEFIN	0.218	0.149
C-HEPTENE-2	0.031	0.000
METHYLCYCLOHEXANE	0.582	1.100
2,5-DIMETHYLHEXANE	0.245	0.000
2,4-DIMETHYLHEXANE	0.289	0.000
C8 PARAFFIN	0.067	0.000
C8 PARAFFIN	0.062	0.000
2,3,4-TRIMETHYLPENTANE	0.438	0.381
TOLUENE	5.793	7.876
C8 PARAFFIN	0.008	0.000
C8 PARAFFIN	0.206	0.343
C8 PARAFFIN	0.030	0.000
2-METHYLHEPTANE	0.384	0.409
C8 PARAFFIN	0.055	0.000
3-METHYLHEPTANE	0.389	0.377
C8 PARAFFIN	0.331	0.000
2,2,5-TRIMETHYLHEXANE	0.195	0.170
1-OCTENE	0.050	0.000
CYCLOHEPTANE	0.011	0.110
C8 PARAFFIN	0.014	0.000
C8 PARAFFIN	0.074	0.000
N-OCTANE	0.480	0.389
C9 PARAFFIN	0.131	0.000
C9 PARAFFIN	0.056	0.000
C-2-OCTENE	0.019	0.000
C9 PARAFFIN	0.017	0.000
C9 OLEFIN	0.128	0.000
2,4-DIMETHYLHEPTANE	0.112	0.000
C9 PARAFFIN	0.016	0.000
C9 PARAFFIN	0.070	0.096
C9 PARAFFIN	0.023	0.000
ETHYLCYCLOHEXANE	0.077	0.000
2,5-DIMETHYLHEPTANE	0.074	0.067
C9 PARAFFIN	0.044	0.013
C9 PARAFFIN	0.004	0.040
C9 PARAFFIN	0.007	0.000
ETHYLBENZENE	0.993	1.292
2,3-DIMETHYLHEPTANE	0.046	0.000

Table B-1. Comparison of the Morning NMOC Composition[1] at SCAQS Stations With EPA's 41-City Average

Compound	EPA 41-City % NMOC	SCAQS % NMOC
M&P-XYLENE	3.118	4.884
4-METHYLOCTANE	0.296	0.209
C9 PARAFFIN	0.055	0.000
3-METHYLOCTANE	0.242	0.209
C9 PARAFFIN	0.006	0.000
C9 OLEFIN	0.440	0.553
C9 PARAFFIN	0.190	0.000
O-XYLENE	1.239	1.805
C9 PARAFFIN	0.002	0.000
1-NONENE	0.060	0.029
C9 PARAFFIN	0.037	0.000
C9 PARAFFIN	0.033	0.000
C9 PARAFFIN	0.026	0.025
NONANE	0.416	0.271
C10 PARAFFIN	0.043	0.000
C10 PARAFFIN	0.029	0.000
C10 PARAFFIN	0.076	0.000
ISOPROPYLBENZENE	0.130	0.000
C10 PARAFFIN	0.043	0.000
C10 PARAFFIN	0.040	0.000
C10 PARAFFIN	0.056	0.000
C10 PARAFFIN	0.044	0.000
C10 PARAFFIN	0.104	0.091
C10 PARAFFIN	0.206	0.270
A-PINENE	0.557	0.000
C10 OLEFIN	0.032	0.000
C10 PARAFFIN	0.028	0.000
N-PROPYLBENZENE	0.259	0.278
C10 PARAFFIN	0.005	0.000
M-ETHYLTOLUENE	0.882	1.008
P-ETHYLTOLUENE	0.484	0.522
C9 AROMATIC	0.526	0.400
4-METHYLNONANE	0.031	0.000
C10 PARAFFIN	0.308	0.208
O-ETHYLTOLUENE	0.484	0.448
C9 AROMATIC	0.018	0.227
C10 PARAFFIN	0.229	0.000
P-,M-,O-METHYLSTYRENE	1.247	0.000
1,2,4-TRIMETHYLBENZENE	1.836	1.656
C9 AROMATIC	0.019	0.000
C10 PARAFFIN	0.139	0.000
N-DECANE	0.637	0.353
C9 AROMATIC	0.016	0.000
SEC-BUTYLBENZENE	0.044	0.000
C9 AROMATIC	0.007	0.000
1,2,3-TRIMETHYLBENZENE	0.786	0.000
1-METHYL-4-ISOPROPBENZ	0.220	0.000
C11 PARAFFIN	0.058	0.000
C11 PARAFFIN	0.142	0.000
C10 AROMATIC	0.534	0.372
C10 AROMATIC	0.255	0.000
1,3-DIETHYLBENZENE	0.126	0.000
C10 AROMATIC	0.312	0.000
1,4-DIETHYLBENZENE	0.403	0.000
C10 AROMATIC	0.027	0.000
1,2-DIETHYLBENZENE	0.020	0.000
C11 PARAFFIN	0.047	0.000
C10 AROMATIC	0.116	0.000
C11 PARAFFIN	0.169	0.000

Table B-1. Comparison of the Morning NMOC Composition[1] at SCAQS Stations With EPA's 41-City Average

Compound	EPA 41-City % NMOC	SCAQS % NMOC
C11 PARAFFIN	0.017	0.000
2,6-DIMETHYLSTYRENE	0.183	0.000
DIMETHYLETHYLBENZENE	0.135	0.000
C10 AROMATIC	0.202	0.000
C10 AROMATIC	0.079	0.000
C11 PARAFFIN	0.181	0.000
C10 AROMATIC	0.012	0.000
C10 AROMATIC	0.022	0.000
1,2-DIMETHYL-3-ETHYLBE	0.407	0.000
C10 AROMATIC	0.016	0.000
1,2,4,5-TETRAMETHYLBEN	0.006	0.000
1,2,3,5-TETRAMETHYLBEN	0.121	0.000
C10 AROMATIC	0.249	0.000
ISOAMYLBENZENE	0.020	0.000
C10 AROMATIC	0.038	0.000
C9 PARAFFIN	0.002	0.000
C11 AROMATIC	0.095	0.000
C11 AROMATIC	0.042	0.000
C11 AROMATIC	0.073	0.000
C11 AROMATIC	0.268	0.000
1,2,3,4-TETRAMETHYLBEN	0.056	0.000
C11 AROMATIC	0.045	0.000
C11 AROMATIC	0.049	0.000
C11 AROMATIC	0.051	0.000
C11 AROMATIC	0.022	0.000
C11 AROMATIC	0.048	0.000
C11 AROMATIC	0.471	0.000
C11 AROMATIC	0.238	0.000
C11 AROMATIC	0.017	0.000
C11 AROMATIC	0.041	0.000
C12 PARAFFIN	0.155	0.000
C11 AROMATIC	0.012	0.000
C11 AROMATIC	0.027	0.000
C11 AROMATIC	0.010	0.000
C11 AROMATIC	0.015	0.000
C11 AROMATIC	0.011	0.000
C11 AROMATIC	0.004	0.000
C11 AROMATIC	0.001	0.000
C12 PARAFFIN	0.000	0.000
C11 AROMATIC	0.003	0.000
C12 AROMATIC	0.006	0.000
C12 AROMATIC	0.003	0.000
N-HEXYLBENZENE	0.002	0.000
C12 AROMATIC	0.004	0.000
C12 AROMATIC	0.006	0.000
C12 AROMATIC	0.004	0.000
C12 AROMATIC	0.012	0.000
C12 AROMATIC	0.002	0.000
C12 AROMATIC	0.001	0.000
C12 AROMATIC	0.055	0.000
C12 AROMATIC	0.019	0.000
C12 AROMATIC	0.003	0.000
C12 AROMATIC	0.034	0.000
C12 AROMATIC	0.001	0.000
C13 PARAFFIN	0.004	0.000
C12 AROMATIC	0.002	0.000
C12 AROMATIC	0.006	0.000
C12 AROMATIC	0.004	0.000
C12 AROMATIC	0.003	0.000

Table B-1. Comparison of the Morning NMOC Composition[1] at SCAQS Stations With EPA's 41-City Average

Compound	EPA 41-City % NMOC	SCAQS % NMOC
C12 AROMATIC	0.004	0.000
C12 AROMATIC	0.010	0.000
C13 PARAFFIN	0.000	0.000
C12 AROMATIC	0.003	0.000
C12 AROMATIC	0.008	0.000
C12 AROMATIC	0.029	0.000
C12 AROMATIC	0.007	0.000
C12 AROMATIC	0.046	0.000
1&2 BUTYNE	0.005	0.000
C4 OLEFIN	0.002	0.000
C4 OLEFIN	0.008	0.000
C6 OLEFIN	0.132	0.000
C7 OLEFIN	0.001	0.000
C7 OLEFIN	0.059	0.000
C7 PARAFFIN	0.086	0.000
C7 OLEFIN	0.008	0.000
C8 OLEFIN	0.030	0.000
C8 OLEFIN	0.004	0.000
2,5-DIMETHYLHEXANE	0.034	0.000
C8 PARAFFIN	0.039	0.000
C8 PARAFFIN	0.017	0.000
C9 OLEFIN	0.017	0.000
C11 OLEFIN	0.449	0.000
C10 AROMATIC	0.487	0.000
C10 AROMATIC	0.023	0.000
C11 AROMATIC	0.047	0.000
C11 AROMATIC	0.006	0.000
C11 AROMATIC	0.004	0.000
C12 AROMATIC	0.013	0.000
C12 AROMATIC	0.028	0.000
C12 AROMATIC	0.074	0.000
C7 OLEFIN	0.003	0.000
C7 PARAFFIN	0.166	0.000
C8 PARAFFIN	0.087	0.000
C9 PARAFFIN	0.046	0.000
C6 PARAFFIN	0.073	0.000
C10 AROMATIC	0.011	0.000
C7 OLEFIN	0.003	0.000
C9 PARAFFIN	0.010	0.000
C10 AROMATIC	0.027	0.000
C10 AROMATIC	0.020	0.000
C4 OLEFIN	0.031	0.000
C6 OLEFIN	0.024	0.000
C11 AROMATIC	0.013	0.000
C12 AROMATIC	0.016	0.000
C11 AROMATIC	0.014	0.000
N-AMYLBENZENE	0.062	0.000
C12 AROMATIC	0.006	0.000
C3 PARAFFIN	0.076	0.000
C3 PARAFFIN	0.057	0.000
C4 PARAFFIN	0.001	0.000
C6 PARAFFIN	0.005	0.000
C7 PARAFFIN	0.004	0.000
C7 OLEFIN	0.003	0.000
C8 PARAFFIN	0.019	0.000
C9 PARAFFIN	0.000	0.000
C12 AROMATIC	0.002	0.000
C4 PARAFFIN	0.000	0.000

Table B-1. Comparison of the Morning NMOC Composition[1] at SCAQS Stations With EPA's 41-City Average

Compound	EPA 41-City % NMOC	SCAQS % NMOC
C4 OLEFIN	0.000	0.000
C5 OLEFIN	0.017	0.000
C5 OLEFIN	0.005	0.000
C5 OLEFIN	0.023	0.000
C8 PARAFFIN	0.008	0.000
C9 PARAFFIN	0.004	0.000
C9 PARAFFIN	0.012	0.000
C10 PARAFFIN	0.016	0.000
C10 AROMATIC	0.013	0.000
C10 AROMATIC	0.017	0.000
C10 AROMATIC	0.022	0.000
C12 AROMATIC	0.004	0.000
C12 AROMATIC	0.001	0.000
C12 AROMATIC	0.024	0.000
C6 PARAFFIN	0.085	0.000
D-3-CARENE	0.055	0.000
C11 AROMATIC	0.001	0.000
C12 AROMATIC	0.002	0.000
C12 AROMATIC	0.007	0.000
C5 OLEFIN	0.013	0.000
C5 OLEFIN	0.006	0.000
C12 AROMATIC	0.001	0.000
C7 OLEFIN	0.004	0.000
C11 AROMATIC	0.006	0.000
P-XYLENE	0.000	0.000
M-XYLENE	0.000	0.000
FORMALDEHYDE	2.000	1.042
ACETALDEHYDE	3.000	1.226
2-METHYL-1,3-BUTADIENE	0.000	0.000
PENTYNE	0.000	0.000
CYCLOPENTENE	0.000	0.000
4-METHYLHEPTANE	0.000	0.000
2,2,3-TRIMETHYLPENTANE	0.000	0.000
2,3,3-TRIMETHYLPENTANE	0.000	0.000
2,3,5-TRIMETHYLHEXANE	0.000	0.000
STYRENE	0.000	0.000
1,3,5-TRIMETHYLBENZENE	0.000	0.000
INDANE	0.000	0.000
BUTYLBENZENE	0.000	0.000
TETRAMETHYLBENZENE	0.000	0.000
UNKNOWNMSB	0.000	0.000
UNKNOWNMSB	0.000	0.000
NAPHTHALENE	0.000	0.000
1-METHYLNAPHTHALENE	0.000	0.000
ACETONE	0.000	2.359
PROPANAL	0.000	0.505
MEK	0.000	1.035
BUTANAL	0.000	0.296
PENTANAL	0.000	1.088
C5 CARBONYL	0.000	0.184
C6 CARBONYL	0.000	1.034
C7 CARBONYL	0.000	0.270

[1] The composition profiles are based only on the identified species. The unidentified hydrocarbons were 1.2% and 15% of NMOC in the 41 City and SCAQS data, respectively. The EPA profile is based on the average of 773 6-9 AM samples analyzed by Jeffries et al. (1988). The SCAQS profile is based on the average of 84 7-8 AM PDT samples collected at SCAQS stations in the summer (excluding San Nicolas Island data). The carbonyl fractions for the EPA profile are based on EPA's default recommendations for EKMA modeling (since the samples were not analyzed for carbonyls).

APPENDIX C

INDIVIDUAL VOC SAMPLE REACTIVITIES USING CARTER'S MAXIMUM INCREMENTAL REACTIVITY SCALE

The following pages list the total reactivity of each sample collected during the summer and fall SCAQS. The samples are sorted by date and in order of descending total reactivity. The maximum incremental reactivity (MIR) scale developed by Carter (1991) was used here to characterize the NMOC reactivity of the SCAQS samples. The MIR scale provides an estimate of moles ozone formed per mole carbon of each organic species measured in the SCAQS, where the ozone formation estimates are intended to be used in a relative rather than absolute basis. The reactivity of each compound is estimated by multiplication of its concentration in ppbC by it's MIR factor, and the reactivity of a sample is estimated by summing the reactivity of its constituents. The MIR scale was developed for summer conditions of temperature and solar radiation, and may not be accurate for conditions in the fall. In the absence of a scale that is appropriate for the fall, we applied the MIR factors to the fall data with the understanding that it would overestimate the absolute NMOC reactivity, but hopefully give the correct relative reactivities. Note that data may be listed with more than three significant figures, however, this is probably the largest degree of accuracy which the data justify.

Table C-1. Total Sample Reactivity Sorted By Date.
For comparison purposes only.

Site	Date	Time PST	Total Reactivity[1]
CELA	870619	1100	727.34
CELA	870619	600	648.25
AZUS	870619	1100	498.48
AZUS	870619	1500	447.31
CELA	870619	1500	445.60
RIVR	870619	1100	409.27
HAWT	870619	600	404.57
CLAR	870619	1500	385.55
CLAR	870619	600	377.82
LBCC	870619	1100	327.93
CLAR	870619	1100	302.55
RIVR	870619	600	267.66
LBCC	870619	1500	260.59
LBCC	870619	600	202.37
HAWT	870619	1100	196.40
HAWT	870619	1500	190.64
CELA	870624	1100	658.30
BURK	870624	1100	622.77
CELA	870624	600	613.49
AZUS	870624	1500	533.08
CELA	870624	1500	513.30
CLAR	870624	1500	453.75
RIVR	870624	1100	416.83
RIVR	870624	1500	373.27
CLAR	870624	600	334.59
ANAH	870624	1100	268.10
HAWT	870624	1100	240.73
LBCC	870624	1100	175.83
LBCC	870624	600	153.20
SNI	870624	1100	78.44
BURK	870625	1100	727.50
CELA	870625	1100	702.06
BURK	870625	1500	516.51
AZUS	870625	600	392.21
CLAR	870625	1500	323.74
ANAH	870625	600	203.01
ANAH	870625	1500	190.44
LBCC	870625	1100	166.34

Table C-1. Total Sample Reactivity Sorted By Date.
For comparison purposes only.

Site	Date	Time PST	Total Reactivity[1]
AZUS	870713	600	547.08
AZUS	870713	1100	531.68
CELA	870713	600	524.42
RIVR	870713	600	502.87
CELA	870713	1100	449.37
BURK	870713	1100	446.03
CLAR	870713	600	445.33
ANAH	870713	600	407.23
CLAR	870713	1500	404.25
BURK	870713	1500	376.45
RIVR	870713	1500	340.71
CELA	870713	1500	335.78
LBCC	870713	600	335.25
LBCC	870713	1100	315.42
AZUS	870713	1500	290.51
CLAR	870713	1100	280.14
RIVR	870713	1100	272.28
ANAH	870713	1100	264.22
LBCC	870713	1500	225.75
SNI	870713	600	58.44
SNI	870713	1100	30.29
BURK	870714	1100	655.35
CELA	870714	1100	653.67
CLAR	870714	1500	490.86
AZUS	870714	1500	475.81
BURK	870714	1500	472.24
CELA	870714	600	437.76
AZUS	870714	1100	420.92
ANAH	870714	1500	409.22
CELA	870714	1500	381.10
ANAH	870714	1100	353.03
CLAR	870714	1100	348.48
CLAR	870714	600	346.24
BURK	870714	600	332.47
RIVR	870714	600	322.01
LBCC	870714	1100	298.83
HAWT	870714	1100	284.73
RIVR	870714	1100	264.01
LBCC	870714	1500	242.25
HAWT	870714	600	183.65
HAWT	870714	1500	127.72

Table C-1. Total Sample Reactivity Sorted By Date.
For comparison purposes only.

Site	Date	Time PST	Total Reactivity[1]
BURK	870715	1500	492.64
CELA	870715	1500	435.36
BURK	870715	600	428.76
BURK	870715	1100	423.57
AZUS	870715	600	378.43
CLAR	870715	1500	372.40
AZUS	870715	1100	346.14
AZUS	870715	1500	344.66
ANAH	870715	1500	281.36
CLAR	870715	600	277.85
ANAH	870715	1100	275.47
RIVR	870715	1100	267.85
ANAH	870715	600	261.11
CLAR	870715	1100	235.01
HAWT	870715	600	217.31
RIVR	870715	600	210.23
HAWT	870715	1100	203.45
HAWT	870715	1500	151.89
LBCC	870715	1500	129.68
RIVR	870715	1500	125.13
ANAH	870827	600	680.86
BURK	870827	1100	664.11
CELA	870827	1500	606.21
ANAH	870827	1100	586.15
CLAR	870827	600	585.03
CLAR	870827	1100	533.66
AZUS	870827	600	528.10
CLAR	870827	1500	452.88
AZUS	870827	1100	450.91
BURK	870827	1500	447.33
LBCC	870827	600	411.72
AZUS	870827	1500	375.98
RIVR	870827	1500	353.40
LBCC	870827	1500	333.21
HAWT	870827	600	262.45
HAWT	870827	1100	145.12
HAWT	870827	1500	136.45
SNI	870827	1500	86.86

Table C-1. Total Sample Reactivity Sorted By Date.
For comparison purposes only.

Site	Date	Time PST	Total Reactivity[1]
BURK	870828	600	1030.77
BURK	870828	1100	771.54
CELA	870828	1100	761.46
CLAR	870828	600	740.79
LBCC	870828	600	740.16
RIVR	870828	600	712.34
CLAR	870828	1500	619.54
ANAH	870828	1100	608.56
BURK	870828	1500	592.39
CELA	870828	1500	528.57
LBCC	870828	1100	523.31
RIVR	870828	1500	509.41
CLAR	870828	1100	499.66
AZUS	870828	1500	499.62
ANAH	870828	1500	459.79
RIVR	870828	1100	391.08
ANAH	870828	600	265.27
LBCC	870828	1500	245.63
HAWT	870828	600	190.73
HAWT	870828	1500	135.52
SNI	870828	600	99.35
SNI	870828	1500	92.11
SNI	870828	1100	69.65
RIVR	870829	600	681.77
BURK	870829	600	638.88
BURK	870829	1100	611.99
CELA	870829	600	531.41
CLAR	870829	600	514.17
AZUS	870829	1500	430.81
BURK	870829	1500	383.36
ANAH	870829	600	355.46
ANAH	870829	1100	337.01
ANAH	870829	1500	331.68
HAWT	870829	1100	306.75
HAWT	870829	600	240.63
LBCC	870829	1100	240.03
LBCC	870829	1500	207.36
LBCC	870829	600	178.17
RIVR	870829	1500	169.68
SNI	870829	1100	147.02
SNI	870829	1500	70.02

Table C-1. Total Sample Reactivity Sorted By Date.
For comparison purposes only.

Site	Date	Time PST	Total Reactivity[1]
ANAH	870902	600	1370.07
BURK	870902	600	1363.12
CELA	870902	1100	1160.45
CELA	870902	600	982.60
LBCC	870902	600	928.37
LBCC	870902	1100	796.54
RIVR	870902	600	752.50
AZUS	870902	600	663.46
BURK	870902	1100	614.58
ANAH	870902	1500	543.59
CLAR	870902	1500	455.28
HAWT	870902	600	438.59
AZUS	870902	1500	421.61
CLAR	870902	1100	421.09
HAWT	870902	1100	285.08
LBCC	870902	1500	242.42
HAWT	870902	1500	168.89
CELA	870903	600	758.81
BURK	870903	600	690.53
RIVR	870903	600	677.38
AZUS	870903	600	589.97
BURK	870903	1100	576.71
ANAH	870903	1100	419.14
BURK	870903	1500	389.90
HAWT	870903	600	385.04
AZUS	870903	1100	321.43
ANAH	870903	600	277.06
RIVR	870903	1100	247.14
CLAR	870903	1500	216.69
ANAH	870903	1500	202.13
LBCC	870903	1100	176.08
RIVR	870903	1500	168.19
HAWT	870903	1100	157.22
LBCC	870903	1500	102.30
SNI	870903	600	80.07
SNI	870903	1500	66.04
SNI	870903	1100	54.84
BURK	871111	700	1328.16
BURK	871111	1600	597.47
RIVR	871111	700	493.70
HAWT	871111	1200	445.00
ANAH	871111	1200	175.67
RIVR	871111	1200	159.90

Table C-1. Total Sample Reactivity Sorted By Date.
For comparison purposes only.

Site	Date	Time PST	Total Reactivity[1]
BURK	871112	700	1824.91
HAWT	871112	700	1811.38
ANAH	871112	700	1301.97
BURK	871112	1600	903.26
RIVR	871112	700	868.47
ANAH	871112	1600	399.76
BURK	871112	1200	386.74
RIVR	871112	1600	366.34
HAWT	871112	1600	317.10
RIVR	871112	1200	171.78
RIVR	871113	700	777.99
BURK	871113	700	721.32
CELA	871113	1200	694.50
HAWT	871113	700	681.79
BURK	871113	1200	665.80
BURK	871113	1600	539.26
ANAH	871113	700	392.24
HAWT	871113	1200	257.80
RIVR	871113	1600	229.35
HAWT	871113	1600	173.25
HAWT	871203	700	2148.94
BURK	871203	700	1772.52
RIVR	871203	700	1178.61
ANAH	871203	1200	632.82
ANAH	871203	1600	607.86
RIVR	871203	1600	596.23
HAWT	871203	1200	592.01
BURK	871203	1200	498.00
RIVR	871203	1200	344.71
HAWT	871203	1600	277.19
BURK	871210	700	1926.84
ANAH	871210	700	1830.28
ANAH	871210	1600	1113.81
BURK	871210	1600	951.00
ANAH	871210	1200	567.02
HAWT	871210	1200	423.77
RIVR	871210	1200	323.69

Table C-1. Total Sample Reactivity Sorted By Date.
For comparison purposes only.

Site	Date	Time PST	Total Reactivity[1]
BURK	871211	700	2004.29
CELA	871211	700	1889.86
BURK	871211	1600	1717.85
HAWT	871211	700	1457.85
RIVR	871211	700	1253.03
BURK	871211	1200	952.44
HAWT	871211	1200	897.27
HAWT	871211	1600	351.84
RIVR	871211	1200	202.72
RIVR	871211	1600	142.14

1 Reactivity determined by multiplying the Maximum Incremental Reactivity (MIR) (Carter 1991) for each species (moles ozone/mole carbon) by the species concentration (ppbC) and summing over all species. Reactivity values were developed for summer conditions.

APPENDIX D

MEAN CONCENTRATIONS AND PERCENTS OF ABUNDANT SPECIES AND SPECIES GROUPS FOR EACH SCAQS SITE

The following pages list the mean concentrations and percents of abundant VOC species and species groups for samples collected at each site during the summer and fall SCAQS. Means and standard deviations are provided for twenty-five abundant species, seven modeling groups, and seven group totals for each site for each sampling time period. Concentrations are in ppbC units. Percents are in weight percent carbon. Samples were collected at three times per day at most sites. However, samples were collected at five times per day at Claremont and Long Beach during the summer and at Los Angeles and Long Beach during the fall. Note that data may be listed with more than three significant figures, however, this is probably the largest degree of accuracy which the data justify.

Table D-1. Mean Concentration of Abundant Species and Species Groups for Anaheim Surface Data From the Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Concentrations, ppbC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	33.8	28.9	16.7	10.5	16.7	15.2
Ethene	29.6	28.0	14.8	5.0	15.4	7.2
Acetylene	19.2	15.7	10.3	3.5	10.8	4.2
Propane	57.9	57.4	41.1	28.9	42.7	37.7
Propene	10.4	11.8	4.1	1.9	4.5	1.4
i-Butane	26.5	26.5	11.8	7.8	12.6	9.2
Butane	54.0	48.9	28.9	18.7	31.6	20.3
i-Pentane	58.6	56.6	30.7	17.3	35.6	21.6
Pentane	32.8	34.0	13.6	8.0	15.3	9.2
2-Methylpentane	18.8	18.6	9.6	4.8	10.1	5.7
3-Methylpentane	12.4	11.7	6.6	3.3	7.2	3.1
Hexane	12.6	12.4	6.0	3.2	6.1	3.4
Methylcyclopentane	13.5	13.3	6.3	2.9	6.4	3.1
Benzene	19.9	19.5	10.0	4.1	10.6	4.9
3-Methylhexane	7.8	7.7	4.6	2.0	4.1	2.2
Heptane	6.8	7.0	2.8	1.4	2.8	1.4
Methylcyclohexane	6.4	6.5	3.3	1.8	2.8	1.6
Toluene	52.2	51.4	26.2	11.0	25.9	11.4
Ethylbenzene	8.8	8.8	4.3	1.5	4.3	1.9
m- & p-Xylenes	34.3	34.3	13.5	4.0	14.6	5.3
o-Xylene	12.5	11.5	5.6	1.7	6.2	1.8
124-Trimethylbenzene	12.0	12.8	4.2	1.0	4.4	2.1
Formaldehyde	11.9	7.1	17.9	9.4	14.2	10.2
Acetaldehyde	11.9	3.6	23.2	10.6	16.4	8.8
Acetone	21.2	12.6	17.1	9.5	24.8	11.2
Olefins	86.2	82.1	38.3	12.0	42.7	17.1
Paraffins	434.0	400.0	221.5	113.3	232.6	147.8
Aromatics	171.0	173.3	76.8	26.1	76.4	29.2
Total Carbonyls	72.9	31.6	136.0	56.5	117.2	50.9
Total Unidentified	114.1	83.0	73.1	30.2	75.9	47.4
NMOC	850.2	724.9	545.6	222.0	544.8	274.7
NMHC	777.4	703.9	409.6	170.6	427.6	235.4
MPAR23	94.4	88.2	57.8	37.8	59.4	52.8
MPAR45	171.9	159.2	85.0	50.3	95.1	59.8
MPAR6	150.1	148.2	78.7	30.9	78.0	37.4
MTOLEF	23.3	25.0	8.2	3.1	10.3	3.5
MIOLEF	9.7	12.3	3.6	0.9	4.8	1.8
MONAROM	62.8	62.4	31.5	12.9	31.1	13.7
DIAROM	80.9	82.1	32.1	9.0	33.8	11.3

Table D-2. Mean Concentration of Abundant Species and Species Groups for Azusa Surface Data From the Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Concentrations, ppbC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	33.3	9.9	24.9	6.7	27.2	12.7
Ethene	30.3	9.6	17.3	4.0	20.3	5.5
Acetylene	20.4	5.6	16.6	3.8	17.5	4.6
Propane	60.3	27.8	56.8	16.7	55.4	26.1
Propene	9.8	4.7	3.8	1.1	3.6	1.7
i-Butane	18.2	5.5	18.0	4.4	17.6	11.3
Butane	42.0	14.0	39.5	11.0	38.2	18.4
i-Pentane	56.0	17.2	55.7	27.0	43.0	14.9
Pentane	33.5	24.4	21.0	7.1	18.9	6.7
2-Methylpentane	19.1	5.7	14.8	5.5	12.4	2.7
3-Methylpentane	13.7	3.5	11.6	4.3	12.2	5.3
Hexane	13.4	3.6	10.4	4.0	8.7	2.0
Methylcyclopentane	12.9	3.4	9.5	4.0	8.0	1.9
Benzene	20.5	5.4	17.0	6.6	15.1	3.4
3-Methylhexane	10.0	3.5	8.4	6.2	6.0	1.9
Heptane	10.6	7.0	9.6	11.1	4.8	1.1
Methylcyclohexane	16.7	11.8	13.9	18.9	5.8	1.2
Toluene	79.9	42.1	57.0	27.1	47.7	14.3
Ethylbenzene	14.1	7.7	8.0	3.7	6.3	1.0
m- & p-Xylenes	44.7	16.8	19.8	9.5	16.4	2.7
o-Xylene	16.3	5.7	9.4	3.4	9.0	2.6
124-Trimethylbenzene	13.8	4.3	5.1	2.2	3.8	1.8
Formaldehyde	5.6	2.6	11.3	4.6	9.6	3.9
Acetaldehyde	7.5	2.5	21.7	7.4	19.1	6.3
Acetone	19.3	8.9	30.6	8.7	28.7	6.7
Olefins	84.3	25.7	51.2	16.4	49.8	11.8
Paraffins	454.9	148.8	320.8	60.9	315.7	104.7
Aromatics	222.5	85.9	135.2	58.6	113.7	23.6
Total Carbonyls	72.6	30.8	154.8	37.6	150.5	36.7
Total Unidentified	166.3	80.9	156.5	90.7	101.1	42.7
NMOC	971.4	332.2	873.3	312.2	731.2	173.4
NMHC	898.8	315.6	718.5	285.7	580.7	149.0
MPAR23	100.0	38.6	80.5	21.1	82.7	38.3
MPAR45	149.6	53.0	134.2	44.3	117.7	50.8
MPAR6	195.0	58.6	160.6	114.5	115.3	21.3
MTOLEF	22.3	7.3	10.4	7.1	7.3	1.7
MIOLEF	9.2	4.7	6.5	6.6	4.1	3.9
MONAROM	96.6	49.5	66.5	31.4	55.4	15.4
DIAROM	101.2	34.0	48.3	20.2	40.1	4.5

Table D-3. Mean Concentration of Abundant Species and Species Groups for Burbank Surface Data From the Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Concentrations, ppbC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	62.7	32.5	37.4	8.2	21.2	5.2
Ethene	48.9	27.1	30.8	6.5	20.2	2.5
Acetylene	34.3	15.6	25.9	5.4	16.5	2.0
Propane	106.3	69.7	87.6	25.4	63.7	25.6
Propene	20.7	9.5	6.6	1.5	4.9	1.3
i-Butane	31.3	16.3	26.2	4.1	17.1	4.2
Butane	79.0	54.8	64.0	20.0	35.4	14.6
i-Pentane	112.7	91.5	77.2	18.5	53.9	7.9
Pentane	52.6	47.9	32.8	7.1	22.9	2.0
2-Methylpentane	35.0	24.5	22.7	5.1	16.7	2.3
3-Methylpentane	24.8	14.7	16.2	4.0	12.5	4.4
Hexane	22.6	15.2	14.5	2.9	10.2	1.3
Methylcyclopentane	21.5	13.5	13.8	2.7	9.2	1.5
Benzene	38.6	25.0	26.0	6.3	17.8	2.5
3-Methylhexane	14.4	7.8	10.3	2.3	8.9	2.4
Heptane	12.8	7.1	8.7	1.7	6.5	2.7
Methylcyclohexane	13.7	4.7	10.6	2.2	8.6	2.8
Toluene	112.5	62.2	79.9	16.6	56.9	10.8
Ethylbenzene	16.7	9.6	10.6	2.9	7.7	1.5
m- & p-Xylenes	66.6	39.0	29.8	7.8	24.5	6.2
o-Xylene	24.3	14.0	13.3	3.9	9.7	2.1
124-Trimethylbenzene	22.7	11.1	7.3	3.2	8.2	4.0
Formaldehyde	6.5	1.8	15.5	6.0	9.7	2.8
Acetaldehyde	8.8	1.5	27.4	5.8	19.5	6.7
Acetone	24.1	9.5	39.8	9.6	28.2	10.0
Olefins	157.7	85.6	77.8	13.5	60.2	9.9
Paraffins	716.4	405.1	510.8	84.0	354.8	39.7
Aromatics	334.2	187.5	189.0	44.6	146.9	34.4
Total Carbonyls	70.0	24.2	191.2	67.4	137.2	45.4
Total Unidentified	201.9	65.9	169.0	76.8	133.4	55.6
NMOC	1480.2	728.2	1137.9	183.9	828.6	120.8
NMHC	1410.2	714.5	946.7	167.7	691.5	122.1
MPAR23	169.0	97.6	125.0	32.0	86.2	30.6
MPAR45	275.6	209.5	200.2	47.1	129.3	20.4
MPAR6	271.8	155.7	185.6	34.1	141.4	25.5
MTOLEF	54.7	34.2	14.1	3.4	12.8	3.6
MIOLEF	18.2	11.6	6.1	1.7	8.6	5.2
MONAROM	132.8	73.8	92.7	19.9	66.5	12.8
DIAROM	155.1	87.7	67.5	20.1	58.6	19.2

Table D-4. Mean Concentration of Abundant Species and Species Groups for Claremont Surface Data From the Summer SCAQS 1987

Time (PST):	400	400	600	600	800	800	1100	1100	1300	1300	1500	1500
	Concentrations, ppbC											
		Mean	Standard	Mean	Standard	Mean	Standard	Mean	Standard	Mean	Standard	Mean	Standard
		Deviation		Deviation		Deviatio		Deviation		Deviation		Deviation	
Ethane	32.1	10.1	30.3	9.4	29.0	9.0	18.1	8.0	21.8	7.5	25.0	8.7
Ethene	27.0	9.0	32.0	9.2	32.0	10.0	14.9	7.4	13.4	4.4	16.0	4.5
Acetylene	18.0	4.5	23.4	9.2	22.2	6.9	12.6	6.1	14.0	5.1	13.8	3.9
Propane	50.4	18.1	45.9	14.5	50.9	15.3	37.6	17.8	67.5	48.1	61.1	26.0
Propene	8.3	2.8	10.8	4.1	8.5	2.9	2.9	1.2	2.2	1.3	2.7	0.6
i-Butane	17.6	9.9	17.2	6.0	18.6	7.5	15.4	7.3	20.0	8.5	20.2	7.8
Butane	39.0	17.7	40.3	13.8	41.4	13.9	34.5	16.7	30.1	22.7	47.2	32.3
i-Pentane	50.5	21.8	60.0	22.1	58.2	19.0	41.6	19.3	32.0	23.9	41.7	15.4
Pentane	21.8	7.7	25.6	8.6	25.1	7.9	18.7	8.7	14.5	11.0	19.2	7.1
2-Methylpentane	16.5	6.3	20.2	7.7	19.3	6.5	13.4	6.2	13.8	5.6	12.5	4.5
3-Methylpentane	12.2	4.5	13.9	4.7	14.0	4.1	9.9	3.0	11.5	7.2	10.5	4.6
Hexane	12.1	6.1	14.7	5.1	11.7	6.4	8.3	3.5	9.1	3.0	8.9	2.5
Methylcyclopentane	10.0	5.2	12.6	4.5	12.1	4.3	8.0	3.4	7.9	2.8	7.0	1.9
Benzene	18.3	7.1	23.1	9.1	21.4	7.2	15.1	6.5	16.1	5.7	13.6	4.1
3-Methylhexane	8.5	4.7	10.4	4.7	13.3	10.6	6.5	3.5	7.0	3.1	6.3	3.3
Heptane	6.4	3.1	7.5	2.9	8.4	6.2	4.1	2.0	4.8	1.7	4.3	1.5
Methylcyclohexane	7.8	3.9	7.6	2.4	9.9	5.8	4.8	2.1	5.0	1.8	5.3	2.4
Toluene	56.0	27.8	65.3	24.4	64.9	28.7	38.5	16.0	39.8	14.5	36.3	12.2
Ethylbenzene	8.2	3.0	10.5	4.1	9.6	2.9	6.3	2.2	5.9	2.1	5.0	1.8
m- & p-Xylenes	30.6	11.6	39.3	16.9	29.9	10.2	15.6	7.6	11.9	3.3	11.2	3.6
o-Xylene	11.7	4.4	14.6	5.7	12.0	4.1	6.9	3.1	6.1	1.5	5.1	1.7
124-Trimethylbenzene	10.1	4.6	13.7	6.2	9.2	2.9	4.4	1.9	5.3	5.0	3.9	3.6
Formaldehyde	7.3	3.0	6.5	2.3	10.5	3.1	10.8	4.9	12.5	2.2	12.7	4.1
Acetaldehyde	8.0	3.3	8.2	3.4	14.5	3.7	18.5	7.2	21.0	6.4	22.9	6.4
Acetone	18.8	6.6	17.7	4.6	23.3	6.7	24.7	10.7	31.9	11.4	32.7	10.3
Olefins	72.6	24.1	86.1	29.5	76.9	24.0	46.4	16.5	39.3	13.5	41.9	11.2
Paraffins	355.7	137.6	378.7	123.5	396.6	139.7	247.4	75.9	315.0	143.1	326.9	129.2
Aromatics	161.5	71.6	198.2	80.7	174.1	61.6	101.8	40.1	94.3	37.2	86.1	27.8
Total Carbonyls	62.5	26.6	65.8	16.6	100.5	15.1	142.0	49.1	188.0	77.7	184.9	52.1
Total Unidentified	161.9	119.6	131.5	71.1	170.4	112.5	104.6	55.9	122.8	75.4	105.4	60.1
NMOC	814.2	346.2	881.8	289.5	918.5	332.3	668.6	208.4	759.5	284.4	745.2	236.8
NMHC	751.7	338.2	816.0	287.0	818.0	331.2	526.6	180.7	571.5	234.5	560.4	207.1
MPAR23	82.5	27.7	77.0	24.4	79.9	24.2	52.9	25.0	92.9	56.5	86.1	34.4
MPAR45	128.9	56.5	143.2	48.7	143.3	47.5	110.2	50.8	116.3	51.0	128.4	55.7
MPAR6	144.4	57.6	170.7	56.1	173.4	70.8	108.5	41.9	105.9	40.3	112.5	55.4
MTOLEF	18.5	7.3	22.5	8.7	15.8	5.9	9.9	8.9	5.7	2.9	5.2	1.2
MIOLEF	8.4	5.4	9.5	5.6	4.5	2.4	4.2	2.4	2.7	1.9	3.2	2.7
MONAROM	66.1	31.3	78.5	29.4	76.8	32.1	46.1	18.6	44.6	18.9	42.2	14.3
DIAROM	73.6	31.5	92.8	41.4	72.3	23.1	37.4	15.6	31.4	11.9	27.9	9.0

Table D-5. Mean Concentration of Abundant Species and Species Groups for Hawthorne Surface Data From the Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Concentrations, ppbC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Propane	64.3	22.6	50.0	30.4	28.2	16.1
Propene	14.1	6.7	6.4	5.3	5.8	3.4
i-Butane	21.8	9.6	17.6	9.2	12.0	10.2
Butane	35.8	13.8	26.0	16.8	8.7	4.9
i-Pentane	38.5	14.0	26.3	20.1	18.3	8.7
Pentane	17.4	6.6	12.1	7.0	8.5	3.0
2-Methylpentane	12.4	4.9	6.5	3.5	5.1	1.9
3-Methylpentane	8.3	2.7	5.3	2.5	3.7	0.8
Hexane	8.6	4.6	4.6	2.1	3.6	0.7
Methylcyclopentane	8.3	3.2	4.4	2.2	3.3	0.6
Benzene	12.8	6.4	4.9	2.3	3.4	1.1
3-Methylhexane	5.3	2.3	3.0	0.8	2.6	0.5
Heptane	4.0	1.8	2.3	1.2	2.0	0.5
Methylcyclohexane	4.6	1.6	3.2	1.3	2.7	0.5
Toluene	32.8	16.6	13.5	5.3	12.4	5.3
Ethylbenzene	5.3	2.7	2.2	0.9	1.5	0.4
m- & p-Xylenes	20.9	11.3	6.5	2.1	5.3	1.6
o-Xylene	8.1	4.1	3.7	1.5	2.2	0.6
124-Trimethylbenzene	7.7	4.0	2.5	1.0	2.3	1.0
Formaldehyde	3.3	1.5	4.6	1.7	2.1	1.1
Acetaldehyde	4.3	1.4	9.3	2.3	4.6	1.6
Acetone	10.7	9.9	13.2	5.3	7.5	3.5
Olefins	67.9	30.8	34.6	17.0	21.5	6.1
Paraffins	303.7	97.6	216.1	98.5	133.3	49.3
Aromatics	102.9	49.9	41.0	13.8	34.3	8.5
Total Carbonyls	33.8	15.3	72.8	18.8	40.0	6.7
Total Unidentified	93.9	44.2	65.4	31.1	48.5	26.8
NMOC	602.2	218.5	420.1	148.3	277.6	84.3
NMHC	568.3	212.7	347.3	142.1	237.6	86.1
MPAR23	90.6	28.5	68.4	36.3	37.8	20.6
MPAR45	113.5	42.2	82.0	51.9	47.6	18.3
MPAR6	99.6	36.8	60.2	20.7	47.9	11.3
MTOLEF	25.7	14.2	13.4	11.5	9.6	4.4
MIOLEF	6.8	3.5	3.8	2.9	3.0	1.0
MONAROM	39.2	19.8	16.2	6.3	14.5	5.3
DIAROM	49.3	24.4	18.4	5.5	15.0	5.6

Table D-6. Mean Concentration of Abundant Species and Species Groups for Long Beach Surface Data From the Summer SCAQS 1987

Time (PST):	400	400	600	600	800	800	1100	1100	1300	1300	1500	1500
	Concentrations, ppbC											
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviatio	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	33.8	27.3	54.1	46.8	27.8	32.4	38.1	35.0	17.5	9.0	14.1	4.7
Ethene	17.4	14.9	33.6	19.8	22.3	27.6	17.3	14.3	11.9	7.9	15.2	6.8
Acetylene	16.6	10.8	19.7	10.3	15.1	16.2	10.9	7.2	8.3	4.4	9.9	4.2
Propane	57.1	47.4	68.8	72.1	60.2	71.5	100.1	95.6	40.7	22.1	30.9	13.8
Propene	7.4	8.9	16.4	18.2	7.9	10.3	5.9	4.7	6.1	6.0	6.6	4.0
i-Butane	20.9	22.2	38.9	41.7	17.6	19.3	29.0	29.3	14.8	8.7	10.8	5.0
Butane	35.1	30.7	82.4	81.2	36.8	40.4	38.2	32.1	27.9	14.5	21.7	9.2
i-Pentane	34.8	27.0	85.2	76.7	39.5	47.9	49.6	46.7	26.9	14.5	22.5	9.2
Pentane	17.7	13.9	43.0	38.1	19.2	23.2	26.0	25.2	11.4	5.6	9.7	3.2
2-Methylpentane	10.1	7.7	23.5	19.0	12.6	15.0	13.4	12.3	8.4	3.4	6.9	2.7
3-Methylpentane	7.3	5.2	16.0	12.5	9.2	9.6	9.7	8.1	6.0	2.6	7.3	3.4
Hexane	7.1	5.5	16.9	13.7	8.5	11.3	11.1	9.3	5.8	1.2	4.6	1.3
Methylcyclopentane	7.9	6.0	18.3	15.2	14.0	17.7	10.5	9.2	5.3	2.2	4.8	1.3
Benzene	9.8	7.2	21.5	14.1	13.6	16.6	10.8	10.3	7.9	3.0	7.3	2.7
3-Methylhexane	4.5	2.9	9.4	6.9	6.1	7.2	5.0	5.1	4.0	1.4	3.0	1.3
Heptane	3.5	3.0	7.6	6.1	5.3	7.3	4.2	4.0	2.6	1.3	2.3	0.9
Methylcyclohexane	4.6	4.1	9.2	8.0	7.2	9.5	4.2	3.3	3.9	1.5	2.7	0.9
Toluene	25.9	18.5	52.0	30.9	44.0	57.3	32.1	27.7	29.3	16.4	23.1	6.8
Ethylbenzene	4.1	2.9	8.7	5.6	6.1	8.0	4.4	4.5	3.8	2.0	3.6	1.4
m- & p-Xylenes	15.3	11.2	32.7	20.7	20.8	27.0	12.9	11.2	12.0	5.4	12.3	4.8
o-Xylene	5.8	3.7	11.3	6.9	8.7	12.1	5.6	4.5	4.6	2.1	4.7	1.6
124-Trimethylbenzene	5.6	4.7	11.7	8.1	6.1	8.1	3.6	3.4	4.8	2.7	4.3	1.8
Formaldehyde	4.6	1.5	5.2	3.4	7.6	4.4	9.5	3.7	6.8	4.0	5.9	3.5
Acetaldehyde	5.9	2.4	5.2	3.8	9.8	6.9	17.8	8.7	11.3	5.1	8.5	3.2
Acetone	11.5	5.5	9.0	7.5	15.3	14.4	22.5	13.5	19.0	7.9	15.3	9.5
Olefins	55.9	38.7	101.5	71.6	58.6	63.6	40.6	29.1	36.8	19.4	41.6	16.7
Paraffins	286.7	223.1	560.3	464.3	322.1	371.7	390.6	336.1	218.7	103.3	175.2	57.0
Aromatics	80.3	58.0	163.8	103.4	114.9	147.8	80.0	70.2	75.6	36.0	65.2	21.1
Total Carbonyls	40.1	19.0	38.3	20.7	64.8	45.5	106.7	57.0	83.1	23.5	58.3	26.7
Total Unidentified	81.4	42.4	112.6	85.4	107.9	119.2	99.7	65.1	79.7	44.2	60.2	21.8
NMOC	544.5	360.2	976.6	722.5	668.4	740.1	717.6	532.4	493.7	200.5	400.4	102.6
NMHC	504.4	354.4	938.3	708.1	603.6	699.7	610.9	485.6	410.7	181.9	342.1	90.8
MPAR23	90.9	73.7	122.9	99.8	87.9	103.8	138.2	130.6	58.1	31.1	44.9	18.2
MPAR45	108.5	89.2	249.5	236.2	113.2	130.5	142.8	112.0	81.0	42.5	64.7	25.0
MPAR6	87.3	63.8	188.0	148.4	121.0	137.8	109.6	95.7	79.6	33.5	65.5	18.9
MTOLEF	14.7	12.7	33.2	30.3	14.9	15.4	9.6	6.5	10.9	7.7	11.6	5.6
MIOLEF	6.9	8.4	14.1	13.0	4.8	4.9	2.4	1.5	3.1	1.2	4.4	1.6
MONAROM	30.9	22.2	62.7	37.9	51.1	66.3	37.4	33.2	34.0	19.0	27.5	8.4
DIAROM	36.7	26.6	76.3	50.0	47.1	60.6	29.8	25.2	31.7	15.3	29.4	10.3

Table D-7. Mean Concentration of Abundant Species and Species Groups for Los Angeles Surface Data From the Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Concentrations, ppbC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	33.9	10.6	37.0	17.4	15.1	6.0
Ethene	44.3	9.5	32.6	11.2	20.0	4.5
Acetylene	36.0	19.2	28.2	11.4	15.9	2.0
Propane	53.8	25.8	79.9	29.6	29.0	11.8
Propene	16.5	3.1	8.5	5.1	6.1	1.5
i-Butane	20.5	5.9	31.7	9.4	10.6	3.9
Butane	56.5	20.9	77.0	36.2	27.6	6.9
i-Pentane	81.0	27.3	105.1	38.3	43.7	7.4
Pentane	36.2	11.8	45.4	18.0	17.6	3.3
2-Methylpentane	28.0	9.1	30.4	12.4	13.4	2.8
3-Methylpentane	18.9	6.0	20.0	8.2	10.5	2.7
Hexane	19.1	6.6	20.0	8.1	8.6	1.8
Methylcyclopentane	18.1	5.5	15.1	9.7	8.4	1.2
Benzene	32.3	11.2	29.5	12.7	15.1	2.3
3-Methylhexane	13.0	4.4	13.7	5.2	6.1	1.4
Heptane	12.1	5.2	12.5	6.0	4.3	1.0
Methylcyclohexane	11.9	4.8	12.7	5.7	4.8	1.0
Toluene	91.6	36.6	90.7	41.8	41.9	5.9
Ethylbenzene	15.2	6.5	13.5	6.0	7.0	1.0
m- & p-Xylenes	60.2	24.1	42.9	19.1	24.3	3.5
o-Xylene	21.5	8.5	17.0	7.4	9.9	1.5
124-Trimethylbenzene	19.9	11.5	13.2	6.4	9.0	2.0
Formaldehyde	6.4	1.6	13.1	4.1	6.6	2.3
Acetaldehyde	7.9	2.8	24.3	6.5	11.7	2.2
Acetone	17.2	9.5	31.7	11.9	16.7	7.1
Olefins	138.5	31.1	96.3	25.8	59.0	10.1
Paraffins	521.9	153.1	615.7	232.4	256.3	54.0
Aromatics	283.9	114.8	240.4	102.8	128.9	19.1
Total Carbonyls	64.1	20.3	186.7	66.2	133.3	70.9
Total Unidentified	166.4	52.3	186.8	57.4	117.3	57.0
NMOC	1168.4	325.0	1325.9	443.0	694.7	150.7
NMHC	1104.3	315.1	1139.2	400.1	561.5	110.4
MPAR23	90.4	36.0	116.9	46.4	44.0	17.5
MPAR45	194.2	63.2	259.2	100.3	99.4	20.2
MPAR6	238.5	92.5	239.6	93.3	112.9	22.4
MTOLEF	38.6	8.7	22.8	5.7	14.4	3.4
MIOLEF	17.3	7.6	11.6	3.3	8.0	2.4
MONAROM	110.2	44.6	107.7	49.2	50.6	7.1
DIAROM	135.8	59.0	98.3	42.7	60.5	12.0

Table D-8. Mean Concentration of Abundant Species and Species Groups for Riverside Surface Data From the Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Concentrations, ppbC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	30.5	10.6	13.6	3.5	17.9	11.1
Ethene	31.2	13.4	9.4	3.6	8.6	4.8
Acetylene	29.8	19.1	9.0	3.1	9.7	3.3
Propane	51.0	15.9	26.0	7.8	35.9	25.2
Propene	16.2	11.8	1.8	0.6	1.4	0.5
i-Butane	18.0	7.3	10.7	3.1	11.5	8.9
Butane	47.0	22.7	26.9	9.5	25.8	19.1
i-Pentane	70.0	37.1	31.9	13.1	27.5	17.8
Pentane	29.8	14.0	13.3	5.0	12.2	8.8
2-Methylpentane	23.0	12.1	8.7	3.5	7.7	4.9
3-Methylpentane	15.4	7.8	8.7	4.4	7.4	4.9
Hexane	15.2	7.4	5.7	2.1	5.1	3.0
Methylcyclopentane	15.3	7.8	4.8	1.7	4.3	3.2
Benzene	24.5	12.4	9.8	2.8	9.2	4.8
3-Methylhexane	10.0	4.4	3.7	1.5	3.8	1.9
Heptane	7.3	4.0	2.3	0.9	2.6	1.5
Methylcyclohexane	7.2	3.3	2.2	1.1	2.4	1.4
Toluene	64.4	32.0	21.5	7.9	20.3	11.1
Ethylbenzene	11.1	5.8	3.5	1.3	3.0	1.6
m- & p-Xylenes	42.5	22.4	8.3	3.7	6.9	4.2
o-Xylene	15.5	8.0	3.8	1.5	3.0	1.3
124-Trimethylbenzene	14.0	6.9	2.4	1.0	3.3	4.9
Formaldehyde	7.2	4.1	9.7	3.0	8.8	5.2
Acetaldehyde	11.9	8.5	20.2	4.5	17.5	9.2
Acetone	22.3	11.3	27.5	6.6	24.3	10.0
Olefins	104.8	52.5	29.8	8.8	25.8	10.4
Paraffins	424.0	185.2	191.3	60.3	196.1	130.1
Aromatics	207.2	102.3	57.9	21.2	53.4	32.1
Total Carbonyls	78.5	51.9	132.8	46.7	130.4	63.8
Total Unidentified	135.3	49.5	72.4	26.6	64.6	39.8
NMOC	949.8	392.3	484.2	105.4	469.6	247.7
NMHC	871.3	372.0	351.3	97.7	339.2	207.7
MPAR23	81.5	26.2	39.6	11.3	53.8	36.2
MPAR45	164.8	80.5	82.8	30.5	77.0	54.3
MPAR6	177.7	81.5	68.9	23.1	65.3	40.2
MTOLEF	31.5	21.1	5.2	1.7	4.0	2.2
MIOLEF	11.3	6.2	5.2	1.8	2.8	1.7
MONAROM	77.8	38.7	25.7	9.5	24.0	13.1
DIAROM	100.1	51.0	20.5	8.4	19.0	14.7

Table D-9. Mean Concentration of Abundant Surface and Species Groups for San Nicolas Island Surface Data From Summer SCAQS 1987

Time, (PST):	600	600	1100	1100	1500	1500
	Concentration, ppbC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	2.1	0.4	2.2	0.4	1.8	0.4
Ethene	1.0	0.5	0.9	0.6	1.3	0.1
Acetylene	1.4	2.1	0.7	0.1	0.9	0.8
Propane	1.8	0.7	1.7	0.6	1.4	1.0
Propene	0.3	0.2	0.3	0.3	0.5	0.3
i-Butane	1.2	1.6	0.3	0.2	0.2	0.3
Butane	3.0	4.1	1.0	0.8	1.2	1.1
i-Pentane	9.9	9.6	0.9	1.4	1.8	3.4
Pentane	6.1	10.4	1.7	2.0	1.6	3.1
2-Methylpentane	2.3	2.9	0.5	0.8	0.6	0.5
3-Methylpentane	0.8	0.7	0.7	0.6	1.8	1.7
Hexane	0.3	0.6	0.1	0.2	0.0	0.0
Methylcyclopentane	0.9	1.1	0.2	0.2	0.1	0.1
Benzene	1.1	0.6	0.6	0.2	0.5	0.2
3-Methylhexane	1.1	0.7	0.8	0.4	1.1	0.7
Heptane	0.1	0.2	0.4	0.7	0.3	0.3
Methylcyclohexane	0.6	0.4	0.7	0.9	0.5	0.6
Toluene	2.6	2.1	1.4	0.6	1.9	1.8
Ethylbenzene	0.4	0.4	0.1	0.1	0.4	0.3
m- & p-Xylenes	2.7	2.1	1.1	1.4	2.1	2.1
o-Xylene	1.2	1.2	0.7	0.7	1.8	1.4
124-Trimethylbenzene	1.1	0.5	1.0	0.6	2.1	3.0
Formaldehyde	4.3	1.6	2.0	1.8	3.7	2.3
Acetaldehyde	5.2	2.0	4.6	3.2	5.6	3.0
Acetone	1.0	1.4	2.2	1.7	0.9	1.3
Olefins	7.4	6.6	3.2	1.6	3.9	2.3
Paraffins	47.4	16.9	13.7	2.9	18.7	11.0
Aromatics	10.7	5.8	5.6	2.1	18.0	17.7
Total Carbonyls	32.2	15.5	33.9	24.7	39.4	4.6
Total Unidentified	29.3	29.3	14.5	6.5	27.5	26.8
NMOC	116.2	35.0	71.2	20.8	104.9	41.9
NMHC	83.9	49.1	37.3	9.3	65.6	43.5
MPAR23	4.2	1.1	4.1	0.7	3.5	1.4
MPAR45	20.2	13.2	3.9	2.2	4.8	4.5
MPAR6	11.7	9.5	5.4	2.3	8.3	5.8
MTOLEF	1.6	1.1	0.9	0.7	1.3	1.6
MIOLEF	2.0	3.2	1.6	2.5	0.1	0.1
MONAROM	3.3	2.4	1.6	0.7	2.3	2.2
DIAROM	6.3	3.3	3.4	1.6	15.1	17.7

Table D-10. Mean Percent of Abundant Species and Species Groups for Anaheim Surface Data From Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Percent of NMOC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	4.12	1.67	2.86	0.68	2.67	0.98
Ethene	3.75	1.50	2.80	0.53	2.91	0.59
Acetylene	2.58	1.17	1.95	0.29	2.11	0.44
Propane	6.67	3.17	7.16	4.18	6.96	3.06
Propene	1.22	0.42	0.78	0.36	0.91	0.23
i-Butane	2.85	1.90	2.02	0.62	2.13	0.62
Butane	5.92	2.16	5.03	2.16	5.61	1.75
i-Pentane	6.49	0.72	5.39	0.82	6.36	1.12
Pentane	3.52	0.74	2.36	0.39	2.73	0.41
2-Methylpentane	2.08	0.27	1.71	0.28	1.83	0.30
3-Methylpentane	1.40	0.19	1.18	0.13	1.39	0.34
Hexane	1.38	0.25	1.07	0.13	1.10	0.18
Methylcyclopentane	1.48	0.25	1.13	0.09	1.19	0.18
Benzene	2.29	0.37	1.84	0.16	2.00	0.32
3-Methylhexane	0.88	0.13	0.84	0.18	0.75	0.09
Heptane	0.73	0.22	0.50	0.07	0.51	0.08
Methylcyclohexane	0.68	0.16	0.59	0.09	0.52	0.10
Toluene	5.96	1.01	4.79	0.42	4.93	0.82
Ethylbenzene	0.99	0.19	0.80	0.11	0.82	0.17
m- & p-Xylenes	3.85	0.71	2.61	0.57	2.88	0.72
o-Xylene	1.47	0.24	1.07	0.18	1.26	0.36
124-Trimethylbenzene	1.28	0.56	0.83	0.22	0.86	0.42
Formaldehyde	2.00	1.70	3.58	2.40	2.84	2.48
Acetaldehyde	2.00	1.14	4.25	1.18	2.99	0.98
Acetone	3.07	1.76	3.18	1.41	4.73	1.53
Olefins	10.25	2.85	7.31	1.58	8.20	1.46
Paraffins	46.25	7.66	39.37	5.67	41.05	7.39
Aromatics	18.75	4.19	14.48	2.31	14.74	3.41
Total Carbonyls	11.57	6.40	25.14	4.53	22.25	6.28
Total Unidentified	13.96	3.37	13.82	4.39	13.86	2.80
MPAR23	10.74	4.04	10.03	4.60	9.63	3.94
MPAR45	18.72	4.52	14.77	3.31	16.84	3.38
MPAR6	16.48	2.46	14.52	1.19	14.58	2.08
MTOLEF	2.62	0.64	1.58	0.57	2.00	0.37
MIOLEF	0.96	0.40	0.75	0.32	0.95	0.25
MONAROM	7.11	1.22	5.79	0.53	5.92	1.03
DIAROM	8.87	2.35	6.20	1.41	6.78	2.25

Table D-11. Mean Percent of Abundant Species and Species Groups for Azusa Surface Data From Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Percent of NMOC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	3.30	0.49	3.29	0.78	3.61	1.03
Ethene	3.17	1.02	2.28	0.49	2.78	0.30
Acetylene	2.11	0.62	2.20	0.49	2.38	0.16
Propane	6.10	0.96	6.94	2.45	7.29	2.15
Propene	1.08	0.41	0.45	0.10	0.48	0.18
i-Butane	1.99	0.57	2.12	0.33	2.28	1.02
Butane	4.45	1.10	4.64	0.53	5.06	1.49
i-Pentane	5.87	0.95	6.31	1.88	5.81	0.96
Pentane	3.21	1.07	2.43	0.27	2.56	0.47
2-Methylpentane	2.02	0.39	1.71	0.26	1.72	0.17
3-Methylpentane	1.53	0.62	1.34	0.25	1.74	0.90
Hexane	1.43	0.27	1.19	0.18	1.19	0.11
Methylcyclopentane	1.37	0.26	1.09	0.13	1.10	0.14
Benzene	2.17	0.32	1.96	0.34	2.08	0.18
3-Methylhexane	1.04	0.09	0.91	0.31	0.81	0.13
Heptane	1.04	0.30	0.94	0.61	0.66	0.08
Methylcyclohexane	1.65	0.93	1.30	1.11	0.83	0.19
Toluene	8.01	1.38	6.45	1.18	6.64	1.73
Ethylbenzene	1.40	0.38	0.90	0.13	0.89	0.13
m- & p-Xylenes	4.57	0.62	2.21	0.34	2.35	0.56
o-Xylene	1.68	0.15	1.09	0.08	1.24	0.24
124-Trimethylbenzene	1.46	0.32	0.58	0.12	0.56	0.30
Formaldehyde	0.64	0.34	1.31	0.35	1.33	0.44
Acetaldehyde	0.83	0.36	2.52	0.46	2.65	0.70
Acetone	2.00	0.67	3.76	1.30	3.94	0.24
Olefins	8.59	2.38	6.59	1.14	6.85	0.70
Paraffins	44.54	3.24	41.98	3.73	42.67	5.92
Aromatics	22.66	1.92	15.28	1.80	15.96	2.88
Total Carbonyls	7.78	2.77	18.54	3.84	20.89	3.40
Total Unidentified	16.78	3.37	17.56	7.05	13.73	4.07
MPAR23	9.63	1.27	10.68	2.62	10.88	3.09
MPAR45	15.46	2.44	15.47	1.64	15.69	3.83
MPAR6	20.30	1.41	17.18	5.08	16.03	1.65
MTOLEF	2.41	0.64	1.15	0.61	1.02	0.23
MIOLEF	0.91	0.29	0.75	0.74	0.57	0.52
MONAROM	9.64	1.48	7.51	1.33	7.70	1.82
DIAROM	10.44	1.38	5.49	0.91	5.74	1.23

Table D-12. Mean Percent of Abundant Species and Species Groups for Burbank Surface Data From Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Percent of NMOC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	4.27	1.34	3.35	0.75	2.61	0.83
Ethene	3.36	0.86	2.73	0.41	2.45	0.34
Acetylene	2.36	0.33	2.27	0.20	2.01	0.31
Propane	7.85	4.66	7.88	2.33	7.81	3.40
Propene	1.41	0.20	0.60	0.17	0.59	0.16
i-Butane	2.11	0.19	2.33	0.32	2.10	0.59
Butane	5.02	0.94	5.61	1.29	4.29	1.80
i-Pentane	6.95	2.04	6.77	0.89	6.55	0.74
Pentane	3.19	1.20	2.90	0.44	2.79	0.28
2-Methylpentane	2.23	0.44	1.99	0.21	2.02	0.16
3-Methylpentane	1.68	0.47	1.42	0.24	1.51	0.45
Hexane	1.45	0.25	1.28	0.16	1.25	0.13
Methylcyclopentane	1.41	0.18	1.21	0.12	1.12	0.14
Benzene	2.50	0.41	2.27	0.21	2.16	0.18
3-Methylhexane	0.97	0.13	0.90	0.11	1.06	0.12
Heptane	0.86	0.08	0.76	0.09	0.78	0.33
Methylcyclohexane	1.02	0.34	0.95	0.18	1.05	0.36
Toluene	7.56	0.95	7.02	0.65	6.89	0.98
Ethylbenzene	1.11	0.14	0.92	0.14	0.93	0.11
m- & p-Xylenes	4.39	0.54	2.61	0.45	2.94	0.51
o-Xylene	1.60	0.17	1.15	0.19	1.17	0.16
124-Trimethylbenzene	1.55	0.22	0.65	0.27	0.98	0.44
Formaldehyde	0.51	0.27	1.39	0.57	1.18	0.35
Acetaldehyde	0.70	0.28	2.45	0.54	2.40	0.91
Acetone	1.75	0.59	3.53	0.85	3.39	1.06
Olefins	10.45	1.41	6.88	0.86	7.20	0.75
Paraffins	47.71	4.67	45.24	4.60	42.76	2.96
Aromatics	21.84	2.40	16.50	2.15	17.60	2.72
Total Carbonyls	5.22	1.82	16.84	5.88	16.77	6.08
Total Unidentified	14.90	3.73	14.66	5.24	15.82	4.78
MPAR23	12.05	5.89	11.22	2.96	10.50	4.22
MPAR45	17.17	4.13	17.57	2.61	15.69	2.21
MPAR6	18.21	2.49	16.37	1.86	17.07	2.00
MTOLEF	3.51	0.79	1.25	0.30	1.53	0.35
MIOLEF	1.19	0.26	0.56	0.27	1.00	0.46
MONAROM	8.86	1.13	8.13	0.78	8.04	1.12
DIAROM	10.18	1.18	5.90	1.34	7.01	1.91

Table D-13. Mean Percent of Abundant Species and Species Groups for Claremont Surface Data From Summer SCAQS 1987

Time (PST):	400	400	600	600	800	800	1100	1100	1300	1300	1500	1500
	Percent of NMOC											
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	4.20	1.03	3.68	0.74	3.24	0.49	2.94	1.11	3.00	0.76	3.41	0.68
Ethene	3.44	0.45	3.86	0.52	3.54	0.46	2.35	0.78	1.86	0.46	2.19	0.31
Acetylene	2.37	0.49	2.75	0.48	2.46	0.31	1.99	0.65	1.93	0.47	1.90	0.30
Propane	6.48	1.51	5.44	1.37	5.70	0.84	5.79	2.40	8.78	4.33	8.17	2.18
Propene	1.05	0.19	1.24	0.20	0.93	0.10	0.43	0.13	0.32	0.11	0.38	0.12
i-Butane	2.17	0.62	1.99	0.44	2.01	0.16	2.26	0.59	2.31	0.55	2.68	0.49
Butane	4.84	0.94	4.60	0.62	4.55	0.44	5.03	1.22	5.05	0.83	6.13	2.88
i-Pentane	6.23	0.59	6.76	0.59	6.41	0.61	6.05	1.53	5.38	0.76	5.59	0.72
Pentane	2.76	0.34	2.92	0.19	2.77	0.21	2.72	0.60	2.43	0.37	2.58	0.35
2-Methylpentane	2.06	0.19	2.27	0.19	2.12	0.21	1.92	0.43	1.66	0.26	1.67	0.20
3-Methylpentane	1.57	0.49	1.59	0.26	1.57	0.34	1.56	0.57	1.51	0.94	1.50	0.79
Hexane	1.47	0.16	1.66	0.16	1.28	0.46	1.22	0.28	1.15	0.26	1.25	0.29
Methylcyclopentane	1.27	0.40	1.43	0.12	1.32	0.09	1.17	0.27	0.96	0.16	0.97	0.18
Benzene	2.28	0.24	2.60	0.33	2.35	0.23	2.21	0.40	1.97	0.30	1.85	0.25
3-Methylhexane	1.02	0.25	1.15	0.18	1.31	0.48	0.92	0.24	0.91	0.26	0.82	0.28
Heptane	0.78	0.14	0.85	0.12	0.84	0.27	0.59	0.14	0.61	0.08	0.57	0.08
Methylcyclohexane	0.96	0.30	0.89	0.17	1.02	0.21	0.70	0.16	0.65	0.06	0.71	0.19
Toluene	6.79	0.66	7.37	0.92	6.98	0.98	5.66	1.25	4.96	0.67	4.92	0.74
Ethylbenzene	1.04	0.12	1.20	0.23	1.06	0.11	0.95	0.24	0.72	0.09	0.68	0.16
m- & p-Xylenes	3.84	0.44	4.42	0.96	3.27	0.28	2.31	0.88	1.55	0.23	1.56	0.42
o-Xylene	1.46	0.17	1.65	0.31	1.31	0.11	1.02	0.32	0.82	0.17	0.72	0.24
124-Trimethylbenzene	1.24	0.36	1.54	0.41	1.01	0.14	0.67	0.28	0.76	0.48	0.51	0.42
Formaldehyde	1.02	0.61	0.78	0.30	1.25	0.54	1.60	0.46	1.79	0.62	1.77	0.64
Acetaldehyde	1.03	0.46	0.95	0.26	1.69	0.54	2.77	0.53	2.82	0.42	3.15	0.57
Acetone	2.44	0.73	2.12	0.51	2.65	0.71	3.66	1.26	4.04	0.86	4.45	0.92
Olefins	9.25	1.67	10.16	0.96	8.48	0.80	7.39	1.69	5.38	1.09	5.80	1.01
Paraffins	44.67	5.12	44.94	2.22	43.37	1.70	39.36	4.44	40.91	6.22	43.36	4.87
Aromatics	19.52	2.18	21.27	3.48	18.95	1.67	14.32	3.98	12.47	1.34	11.68	1.91
Total Carbonyls	8.47	5.14	8.15	2.95	12.02	3.91	21.79	7.49	25.22	6.22	25.54	5.72
Total Unidentified	18.23	7.05	14.38	4.41	17.28	4.88	15.52	4.68	16.13	5.75	13.71	5.53
MPAR23	10.63	2.45	9.34	1.90	8.93	1.31	8.67	3.67	11.79	4.02	11.56	2.74
MPAR45	15.92	2.30	16.23	1.16	15.74	1.06	16.03	3.58	15.14	2.21	16.98	3.43
MPAR6	17.91	2.19	19.36	0.76	18.67	1.18	16.00	2.51	13.94	0.74	14.79	2.98
MTOLEF	2.35	0.68	2.55	0.31	1.73	0.32	1.47	1.31	0.75	0.18	0.74	0.27
MIOLEF	1.03	0.53	1.01	0.33	0.47	0.17	0.69	0.52	0.35	0.14	0.45	0.36
MONAROM	8.02	0.71	8.84	1.19	8.27	1.02	6.79	1.48	5.84	0.75	5.73	0.89
DIAROM	9.01	1.46	10.34	2.13	7.97	1.02	5.62	1.84	4.25	0.82	3.83	0.95

Table D-14. Mean Percent of Abundant Species and Species Groups for Hawthorne Surface Data From Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Percent of NMOC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	4.51	0.60	4.00	1.67	3.26	0.82
Ethene	3.57	0.58	1.93	0.52	1.59	0.12
Acetylene	2.12	0.27	2.13	1.46	1.63	0.85
Propane	11.11	3.03	11.24	4.51	9.73	4.16
Propene	2.33	0.54	1.47	0.96	2.00	1.01
i-Butane	3.79	1.18	3.93	1.20	3.87	2.02
Butane	6.07	1.11	5.82	2.27	3.56	2.01
i-Pentane	6.54	1.21	5.79	2.52	6.39	1.12
Pentane	2.92	0.40	2.75	0.75	3.07	0.29
2-Methylpentane	2.05	0.22	1.49	0.33	1.81	0.22
3-Methylpentane	1.43	0.23	1.28	0.54	1.36	0.17
Hexane	1.39	0.27	1.07	0.22	1.32	0.25
Methylcyclopentane	1.38	0.09	1.00	0.21	1.23	0.17
Benzene	2.04	0.34	1.16	0.18	1.24	0.20
3-Methylhexane	0.88	0.12	0.76	0.26	0.99	0.35
Heptane	0.65	0.07	0.58	0.22	0.74	0.06
Methylcyclohexane	0.78	0.08	0.79	0.29	1.01	0.26
Toluene	5.24	1.02	3.24	0.68	4.84	2.96
Ethylbenzene	0.84	0.16	0.53	0.12	0.57	0.10
m- & p-Xylenes	3.33	0.75	1.59	0.33	1.94	0.37
o-Xylene	1.29	0.24	0.90	0.23	0.81	0.08
124-Trimethylbenzene	1.24	0.32	0.63	0.20	0.83	0.20
Formaldehyde	0.56	0.18	1.21	0.61	0.81	0.54
Acetaldehyde	0.81	0.41	2.46	1.02	1.81	0.87
Acetone	1.74	1.19	3.32	1.39	2.72	0.95
Olefins	10.97	1.16	7.86	1.58	7.77	0.56
Paraffins	51.60	5.12	48.56	9.97	47.39	5.36
Aromatics	16.40	3.02	9.84	1.61	11.87	3.41
Total Carbonyls	5.92	2.42	19.25	7.99	15.53	5.76
Total Unidentified	15.20	2.52	15.39	4.71	16.74	4.17
MPAR23	15.57	3.44	15.39	5.47	12.96	4.26
MPAR45	19.25	3.30	18.24	6.37	16.84	2.12
MPAR6	16.59	1.31	14.45	2.01	17.49	1.00
MTOLEF	4.13	0.91	2.87	1.57	3.35	1.09
MIOLEF	1.11	0.33	0.94	0.66	1.11	0.28
MONAROM	6.25	1.22	3.89	0.76	5.62	2.99
DIAROM	7.94	1.65	4.59	1.12	5.41	1.44

Table D-15. Mean Percent of Abundant Species and Species Groups For Long Beach Surface Data From Summer SCAQS 1987

Time (PST):	400	400	600	600	800	800	1100	1100	1300	1300	1500	1500
	Percent of NMOC											
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	5.74	1.25	5.22	0.88	4.11	0.48	4.73	1.23	3.40	0.82	3.55	1.02
Ethene	2.93	0.57	3.75	1.10	3.10	0.48	2.35	0.42	2.32	0.90	3.73	1.31
Acetylene	3.45	2.48	2.41	0.99	2.33	0.46	1.71	0.48	1.75	0.61	2.43	0.82
Propane	9.86	3.91	7.93	4.07	8.60	1.64	11.92	4.10	7.71	2.15	7.64	3.05
Propene	1.15	0.76	1.38	0.83	1.09	0.20	0.80	0.18	1.11	0.80	1.59	0.86
i-Butane	3.43	1.47	3.40	1.32	2.63	0.64	3.40	1.25	2.79	1.02	2.65	0.97
Butane	5.85	1.39	7.41	2.36	5.66	1.08	6.01	2.63	5.34	1.34	5.33	1.42
i-Pentane	5.89	1.45	7.89	1.90	5.69	0.72	6.23	1.19	5.15	1.09	5.49	0.97
Pentane	3.01	0.85	3.99	0.82	2.76	0.34	3.15	0.84	2.22	0.45	2.45	0.44
2-Methylpentane	1.74	0.40	2.31	0.26	1.82	0.19	1.72	0.35	1.76	0.40	1.69	0.29
3-Methylpentane	1.30	0.29	1.63	0.21	1.43	0.26	1.30	0.16	1.22	0.20	1.83	0.76
Hexane	1.20	0.26	1.67	0.15	1.27	0.42	1.51	0.50	1.33	0.47	1.15	0.12
Methylcyclopentane	1.38	0.31	1.81	0.19	1.97	1.56	1.35	0.29	1.09	0.12	1.20	0.13
Benzene	1.69	0.41	2.33	0.54	1.94	0.31	1.39	0.26	1.65	0.27	1.82	0.38
3-Methylhexane	0.83	0.18	1.00	0.15	0.86	0.12	0.59	0.20	0.83	0.09	0.73	0.16
Heptane	0.56	0.17	0.76	0.08	0.67	0.23	0.51	0.14	0.50	0.10	0.56	0.10
Methylcyclohexane	0.76	0.20	0.91	0.17	0.94	0.35	0.56	0.28	0.81	0.10	0.68	0.09
Toluene	4.62	1.16	5.92	1.47	5.92	1.46	4.33	0.62	6.05	1.98	5.85	0.78
Ethylbenzene	0.73	0.18	0.96	0.25	0.82	0.15	0.50	0.21	0.77	0.16	0.89	0.13
m- & p-Xylenes	2.66	0.80	3.62	1.15	2.86	0.46	1.66	0.29	2.51	0.68	3.04	0.60
o-Xylene	1.12	0.34	1.26	0.39	1.14	0.29	0.74	0.29	0.96	0.25	1.22	0.40
124-Trimethylbenzene	0.92	0.43	1.25	0.52	0.80	0.33	0.39	0.26	0.96	0.32	1.07	0.31
Formaldehyde	1.14	0.61	0.64	0.38	1.54	0.84	1.70	0.78	1.33	0.61	1.43	0.77
Acetaldehyde	1.52	0.90	0.66	0.67	1.81	1.26	3.03	1.28	2.35	0.60	2.07	0.49
Acetone	2.67	2.01	1.10	1.26	2.59	0.92	3.96	2.15	4.41	2.05	4.04	2.10
Olefins	10.02	2.51	10.46	2.55	9.05	1.16	5.87	0.91	7.98	3.61	10.20	2.86
Paraffins	49.02	8.30	54.84	7.95	47.04	5.29	49.26	11.70	42.81	5.82	43.55	7.49
Aromatics	14.21	3.69	17.44	6.11	15.53	2.75	10.23	1.71	14.56	4.14	16.16	2.67
Total Carbonyls	9.67	6.48	5.23	3.71	12.49	6.65	20.40	14.19	18.01	4.82	14.58	5.24
Total Unidentified	17.23	6.46	11.60	2.78	16.09	5.77	14.39	9.68	15.90	4.59	15.67	5.60
MPAR23	15.56	4.58	13.11	4.13	12.67	2.02	16.65	5.28	11.09	2.94	11.14	3.98
MPAR45	18.13	3.28	22.63	6.03	16.69	2.46	18.74	3.86	15.46	3.67	15.86	3.22
MPAR6	15.23	2.88	18.94	1.45	17.54	1.71	13.79	3.54	16.16	1.18	16.38	1.73
MTOLEF	2.57	1.13	3.04	0.93	2.43	0.63	1.39	0.25	2.10	0.91	2.79	0.99
MIOLEF	1.05	0.96	1.21	0.56	0.78	0.64	0.35	0.11	0.66	0.28	1.10	0.34
MONAROM	5.50	1.38	7.09	1.75	6.89	1.58	4.92	0.70	6.97	2.18	6.88	0.87
DIAROM	6.51	1.85	8.29	2.96	6.38	1.41	3.78	1.13	6.45	1.26	7.38	1.58

Table D-16. Mean Percent of Abundant Species and Species Groups for Los Angeles Surface Data From Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Percent of NMOC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	3.14	1.19	2.73	0.68	2.16	0.65
Ethene	4.03	1.06	2.49	0.63	2.90	0.48
Acetylene	3.19	1.48	2.12	0.53	2.35	0.33
Propane	5.06	2.46	6.07	1.54	4.19	1.42
Propene	1.47	0.30	0.61	0.31	0.88	0.16
i-Butane	1.77	0.34	2.45	0.53	1.51	0.39
Butane	4.75	0.78	5.67	0.80	3.98	0.51
i-Pentane	6.90	0.56	7.94	0.76	6.47	1.18
Pentane	3.08	0.20	3.39	0.32	2.58	0.34
2-Methylpentane	2.38	0.16	2.27	0.20	1.96	0.32
3-Methylpentane	1.62	0.26	1.49	0.15	1.56	0.50
Hexane	1.62	0.15	1.50	0.15	1.26	0.20
Methylcyclopentane	1.54	0.06	1.13	0.49	1.24	0.17
Benzene	2.74	0.24	2.19	0.26	2.21	0.26
3-Methylhexane	1.10	0.12	1.03	0.08	0.88	0.12
Heptane	1.01	0.15	0.92	0.28	0.63	0.11
Methylcyclohexane	1.00	0.15	0.93	0.14	0.71	0.11
Toluene	7.69	0.96	6.67	0.91	6.18	0.88
Ethylbenzene	1.26	0.19	1.00	0.15	1.04	0.20
m- & p-Xylenes	5.06	0.59	3.19	0.57	3.63	0.76
o-Xylene	1.81	0.20	1.26	0.20	1.47	0.26
124-Trimethylbenzene	1.68	0.71	0.98	0.30	1.36	0.41
Formaldehyde	0.58	0.17	1.02	0.30	0.96	0.31
Acetaldehyde	0.70	0.26	1.91	0.57	1.74	0.35
Acetone	1.40	0.40	2.40	0.42	2.36	0.63
Olefins	12.21	2.34	7.40	1.37	8.63	1.22
Paraffins	44.84	3.05	46.19	2.82	37.48	5.51
Aromatics	23.69	3.63	17.87	2.38	17.98	5.24
Total Carbonyls	5.68	1.68	14.30	4.56	18.73	6.57
Total Unidentified	14.24	1.63	14.38	3.06	16.35	4.71
MPAR23	8.46	3.59	8.78	2.11	6.33	1.98
MPAR45	16.44	1.32	19.42	1.94	14.47	2.01
MPAR6	20.00	2.13	17.91	1.06	16.53	2.73
MTOLEF	3.36	0.30	1.76	0.31	2.09	0.34
MIOLEF	1.49	0.48	0.98	0.55	1.21	0.44
MONAROM	9.20	1.20	7.92	1.07	7.45	1.15
DIAROM	11.38	2.30	7.34	1.49	9.02	2.35

Table D-17. Mean Percent of Abundant Species and Species Groups for Riverside Surface Data From Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Percent of NMOC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	3.35	0.62	2.85	0.59	3.73	0.50
Ethene	3.47	1.00	1.92	0.43	1.83	0.44
Acetylene	2.93	0.82	1.85	0.34	2.25	0.60
Propane	5.72	1.54	5.42	1.31	7.21	1.92
Propene	1.55	0.59	0.37	0.10	0.32	0.12
i-Butane	1.93	0.31	2.22	0.46	2.26	0.68
Butane	4.91	0.70	5.57	1.38	5.11	1.01
i-Pentane	7.14	1.16	6.59	2.02	5.64	0.75
Pentane	3.10	0.35	2.74	0.70	2.46	0.52
2-Methylpentane	2.33	0.36	1.77	0.45	1.61	0.31
3-Methylpentane	1.58	0.28	1.77	0.80	1.56	0.59
Hexane	1.56	0.21	1.16	0.22	1.08	0.18
Methylcyclopentane	1.57	0.24	0.98	0.19	0.84	0.40
Benzene	2.49	0.36	2.02	0.25	2.00	0.37
3-Methylhexane	1.07	0.13	0.77	0.21	0.85	0.22
Heptane	0.75	0.13	0.47	0.09	0.54	0.09
Methylcyclohexane	0.76	0.09	0.44	0.14	0.53	0.17
Toluene	6.59	0.85	4.37	0.75	4.40	1.09
Ethylbenzene	1.13	0.19	0.70	0.14	0.67	0.19
m- & p-Xylenes	4.30	0.75	1.66	0.39	1.47	0.37
o-Xylene	1.57	0.24	0.76	0.15	0.68	0.15
124-Trimethylbenzene	1.45	0.24	0.49	0.10	0.56	0.45
Formaldehyde	0.79	0.35	2.01	0.61	1.79	0.59
Acetaldehyde	1.32	0.80	4.22	0.77	3.71	1.05
Acetone	2.40	0.98	5.76	1.24	5.47	1.44
Olefins	10.66	1.50	6.11	0.99	5.79	1.07
Paraffins	44.66	4.14	39.54	7.45	40.14	7.06
Aromatics	20.11	2.74	11.68	2.10	11.39	2.72
Total Carbonyls	8.70	4.50	27.78	8.77	28.59	10.73
Total Unidentified	15.13	4.53	15.01	5.42	14.20	4.70
MPAR23	9.03	2.13	8.25	1.88	10.92	2.31
MPAR45	17.00	2.19	17.10	4.47	15.45	2.70
MPAR6	18.41	1.55	14.11	2.67	13.70	2.81
MTOLEF	3.05	0.99	1.07	0.32	0.93	0.47
MIOLEF	1.15	0.31	1.09	0.38	0.61	0.28
MONAROM	7.92	1.05	5.22	0.89	5.21	1.32
DIAROM	10.13	1.52	4.14	0.90	3.89	1.14

Table D-18. Mean Percent of Abundant Species and Species Groups for San Nicolas Island Surface Data From Summer SCAQS 1987

Time (PST):	600	600	1100	1100	1500	1500
	Percent of NMOC					
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	1.55	0.46	3.38	1.19	2.06	0.51
Ethene	0.79	0.48	1.15	0.54	1.52	0.65
Acetylene	1.11	1.73	1.00	0.36	0.91	0.38
Propane	1.61	0.59	2.56	1.23	1.40	0.68
Propene	0.29	0.21	0.44	0.28	0.62	0.44
i-Butane	1.05	1.31	0.43	0.31	0.28	0.42
Butane	2.23	2.33	1.53	1.06	1.63	2.26
i-Pentane	8.72	7.78	1.53	2.62	1.68	3.18
Pentane	4.92	8.52	2.53	2.89	1.18	2.06
2-Methylpentane	1.60	1.62	0.90	1.43	0.68	0.70
3-Methylpentane	0.69	0.56	1.01	0.85	1.64	1.24
Hexane	0.23	0.51	0.11	0.19	0.00	0.00
Methylcyclopentane	0.59	0.72	0.22	0.28	0.08	0.18
Benzene	0.93	0.39	0.82	0.30	0.61	0.40
3-Methylhexane	0.86	0.34	1.25	0.80	1.07	0.87
Heptane	0.08	0.18	0.80	1.39	0.30	0.39
Methylcyclohexane	0.44	0.27	1.02	1.34	0.38	0.40
Toluene	2.22	1.61	2.02	0.99	1.79	1.63
Ethylbenzene	0.34	0.29	0.14	0.24	0.32	0.28
m- & p-Xylenes	2.39	1.74	1.77	2.17	2.12	2.05
o-Xylene	1.09	1.00	0.91	0.92	1.63	1.24
124-Trimethylbenzene	0.91	0.25	1.40	0.93	1.86	2.84
Formaldehyde	3.92	1.73	2.70	2.43	4.86	4.61
Acetaldehyde	5.07	2.76	5.86	3.16	7.37	6.70
Acetone	0.94	1.43	2.82	2.04	0.85	1.16
Olefins	5.74	5.64	4.63	1.71	4.05	1.04
Paraffins	33.95	6.86	21.80	9.30	18.60	5.08
Aromatics	9.01	4.22	8.53	4.31	15.23	12.09
Total Carbonyls	32.46	20.32	42.86	26.40	44.26	21.92
Total Unidentified	21.31	16.29	22.58	14.90	21.17	16.30
MPAR23	3.15	1.18	6.21	2.18	3.74	0.52
MPAR45	16.92	8.48	6.02	3.79	4.76	3.93
MPAR6	8.90	5.73	8.61	5.61	7.75	4.81
MTOLEF	1.31	0.79	1.48	1.35	1.20	0.99
MIOLEF	2.34	4.26	2.03	3.24	0.11	0.25
MONAROM	2.73	1.77	2.35	1.29	2.18	2.03
DIAROM	5.31	2.66	5.20	3.12	12.37	12.12

Table D-19. Mean Concentration of Abundant Species And Species Groups for Anaheim Surface Data From the Fall SCAQS 1987

	Concentration, ppbC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	52.1	24.4	24.5	16.4	38.7	16.2
Ethene	90.5	61.7	25.4	18.7	53.5	29.3
Acetylene	79.2	57.4	22.0	17.0	42.2	23.9
Propane	134.2	72.1	48.6	29.3	83.9	50.1
Propene	37.8	18.9	7.2	4.9	15.8	7.2
i-Butane	56.3	22.7	24.4	20.7	31.8	21.4
Butane	148.4	68.9	73.3	57.6	88.5	58.3
i-Pentane	171.5	74.2	74.2	46.3	89.5	43.0
Pentane	83.4	33.2	31.4	19.3	38.8	17.7
2-Methylpentane	59.6	25.1	20.9	13.1	30.5	15.6
3-Methylpentane	46.4	17.4	16.3	12.0	21.7	10.8
Hexane	39.1	13.5	13.3	8.1	19.2	9.3
Methylcyclopentane	37.8	16.6	12.0	7.9	18.0	9.1
Benzene	67.9	28.4	22.4	14.3	35.1	15.1
3-Methylhexane	26.0	11.2	8.4	5.1	12.2	6.4
Heptane	22.6	8.6	6.3	3.9	9.6	5.0
Methylcyclohexane	20.4	5.8	6.8	4.3	9.1	5.6
Toluene	185.3	70.9	56.9	35.0	82.8	38.5
Ethylbenzene	28.9	12.4	8.9	5.3	13.4	6.2
m- & p-Xylenes	116.0	48.8	27.0	16.4	47.3	21.6
o-Xylene	40.2	17.0	10.9	6.1	18.1	7.9
124-Trimethylbenzene	43.9	18.8	9.5	4.4	18.9	7.9
Formaldehyde	8.7	2.1	10.6	5.2	9.2	3.2
Acetaldehyde	7.7	2.6	15.5	6.8	13.6	5.7
Acetone	47.6	40.1	55.1	65.4	32.5	47.0
Olefins	292.4	197.3	74.0	51.6	147.9	87.6
Paraffins	986.0	576.2	424.3	299.2	657.5	406.0
Aromatics	624.6	248.5	160.8	92.8	251.5	109.6
Total Carbonyls	107.9	35.0	161.4	91.8	101.2	76.0
Total Unidentified	355.3	151.1	144.8	60.6	183.1	56.2
NMOC	2538.6	976.8	978.2	524.8	1256.8	597.0
NMHC	2430.6	959.2	816.8	460.9	1155.6	529.4
MPAR23	145.1	61.6	71.2	49.8	120.3	63.6
MPAR45	459.6	192.6	203.2	140.5	248.5	139.2
MPAR6	495.6	191.6	167.3	99.5	234.6	114.0
MTOLEF	81.6	34.0	16.8	10.0	31.4	16.5
MIOLEF	39.9	19.7	8.0	4.5	15.2	7.6
MONAROM	221.1	86.1	67.9	41.4	99.5	45.9
DIAROM	269.3	111.9	66.8	36.8	113.0	47.6

Table D-20. Mean Concentration of Abundant Species and Species Groups for Burbank Surface Data From the Fall SCAQS 1987

	Concentration, ppbC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	110.9	35.1	33.3	16.4	49.1	38.1
Ethene	105.6	33.7	45.7	19.7	67.2	38.2
Acetylene	117.0	65.1	36.2	14.0	46.4	26.3
Propane	126.5	32.2	48.0	30.0	99.5	69.7
Propene	45.6	15.7	9.7	5.8	19.2	9.5
i-Butane	75.9	31.4	29.7	18.2	50.9	37.9
Butane	236.1	104.6	90.0	55.3	143.9	102.8
i-Pentane	230.4	81.2	80.6	39.2	129.2	73.8
Pentane	107.3	38.4	33.3	15.6	55.7	32.2
2-Methylpentane	76.7	26.4	24.9	12.5	44.1	25.0
3-Methylpentane	61.7	20.1	19.4	10.6	34.4	17.0
Hexane	48.5	15.6	15.7	8.8	30.7	17.7
Methylcyclopentane	43.1	14.2	14.0	7.7	25.2	14.5
Benzene	89.3	31.2	29.6	14.9	48.8	24.7
3-Methylhexane	32.5	10.8	10.5	6.2	19.2	10.7
Heptane	30.9	9.1	10.3	6.9	18.9	12.3
Methylcyclohexane	31.8	11.4	12.8	9.0	21.4	14.6
Toluene	259.6	85.5	88.8	47.0	150.1	80.9
Ethylbenzene	36.7	12.4	12.8	6.9	21.5	10.9
m- & p-Xylenes	149.6	51.0	38.4	20.4	74.1	35.7
o-Xylene	52.8	17.6	15.4	7.6	27.9	13.8
124-Trimethylbenzene	59.8	21.4	13.7	6.3	27.3	12.4
Formaldehyde	10.0	2.1	12.0	6.0	15.4	8.1
Acetaldehyde	8.7	2.0	17.1	7.2	19.1	12.6
Acetone	39.6	19.5	38.7	13.3	43.6	15.1
Olefins	387.0	137.1	114.8	50.0	178.3	92.5
Paraffins	1519.7	506.9	596.0	271.4	922.7	619.6
Aromatics	756.7	251.4	228.4	116.0	400.8	199.6
Total Carbonyls	99.7	36.0	123.6	21.6	151.3	43.1
Total Unidentified	423.2	158.7	158.5	62.0	246.6	81.3
NMOC	3186.1	1033.5	1135.0	533.1	1890.0	937.2
NMHC	3086.5	1027.1	1011.4	514.6	1738.7	907.0
MPAR23	237.4	65.7	89.9	42.6	151.9	115.0
MPAR45	649.7	248.7	233.7	127.7	379.6	245.9
MPAR6	632.6	199.5	214.7	115.9	389.5	209.9
MTOLEF	102.2	33.9	19.7	11.7	41.5	19.7
MIOLEF	58.0	23.8	9.1	6.0	19.0	7.7
MONAROM	306.1	100.2	104.7	55.4	177.0	94.3
DIAROM	350.2	121.0	91.5	45.1	170.7	79.3

Table D-21. Mean Concentration of Abundant Species and Species Groups for Hawthorne Surface Data From the Fall SCAQS 1987

	Concentration, ppbC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	120.9	46.4	47.9	22.0	27.0	12.3
Ethene	123.7	45.4	42.8	33.0	14.1	5.4
Acetylene	105.0	57.9	21.5	6.9	11.2	3.5
Propane	171.7	72.6	86.2	53.1	51.2	32.7
Propene	56.9	20.8	14.0	16.5	4.6	1.9
i-Butane	77.4	30.6	45.7	46.7	18.2	10.6
Butane	206.5	103.9	92.3	56.7	39.7	20.4
i-Pentane	228.9	89.3	81.8	51.2	33.1	14.5
Pentane	99.6	32.5	35.0	20.9	16.0	5.9
2-Methylpentane	78.8	32.0	22.9	10.6	10.2	3.8
3-Methylpentane	55.4	22.0	17.2	8.0	6.7	1.2
Hexane	47.7	17.9	15.0	7.5	6.7	2.1
Methylcyclopentane	50.0	19.8	14.0	7.0	7.6	3.9
Benzene	101.8	43.8	21.5	6.3	11.1	3.6
3-Methylhexane	30.5	14.4	9.1	3.9	4.1	1.0
Heptane	27.2	10.8	7.6	3.2	4.2	1.4
Methylcyclohexane	25.9	9.3	9.7	4.3	4.3	1.6
Toluene	247.9	100.9	60.8	16.6	30.6	8.1
Ethylbenzene	37.6	14.5	9.1	2.9	4.6	1.6
m- & p-Xylenes	146.6	57.8	28.0	8.2	14.9	4.5
o-Xylene	50.7	19.1	11.1	3.3	5.8	2.1
124-Trimethylbenzene	53.0	19.4	10.1	2.5	7.5	3.8
Formaldehyde	12.9	7.2	12.8	6.5	6.5	4.6
Acetaldehyde	11.7	6.0	16.6	9.2	9.3	2.7
Acetone	22.0	15.8	14.8	12.5	10.1	7.2
Olefins	396.2	163.1	96.6	65.2	41.0	14.6
Paraffins	1444.6	521.2	577.9	317.2	274.4	114.5
Aromatics	744.5	293.9	162.1	43.7	90.3	29.6
Total Carbonyls	83.3	45.6	100.7	63.4	68.7	23.8
Total Unidentified	419.9	134.7	143.0	34.5	108.0	48.8
NMOC	3142.0	1059.8	1080.4	478.7	582.3	209.1
NMHC	3058.7	1026.7	979.7	440.8	513.6	191.0
MPAR23	319.7	101.9	134.1	73.6	78.1	44.9
MPAR45	612.4	240.9	254.8	174.4	107.1	49.8
MPAR6	608.2	247.2	189.0	75.9	89.2	31.6
MTOLEF	110.6	34.1	23.6	24.4	9.5	4.0
MIOLEF	56.3	25.9	8.2	6.3	5.9	2.6
MONAROM	293.9	118.4	72.3	20.3	36.7	10.1
DIAROM	338.1	131.7	66.6	17.6	41.6	17.7

Table D-22. Mean Concentrations of Abundant Species and Species Groups for Long Beach Surface Data From Fall SCAQS 1987

Time, PST	500	500	700	700	900	900	1200	1200	1400	1400	1600	1600
	Concentration, ppbC											
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	165.9	62.4	49.1	43.5	44.1	22.7	12.0	33.3	19.1			
Ethene	186.2	56.3	60.0	55.2	35.4	18.3	8.8	35.8	21.1			
Acetylene	137.0	52.6	45.6	42.4	29.4	16.9	7.0	27.6	16.1			
Propane	146.4	76.6	130.2	70.8	78.2	29.5	62.5	32.6	81.5	46.1	58.3	26.0
Propene	37.5	23.6	49.5	31.6	18.3	10.1	8.1	4.2	8.0	5.7	13.4	6.3
i-Butane	78.5	43.9	87.2	50.5	43.9	21.8	31.3	15.8	42.0	27.0	36.6	16.6
Butane	241.6	147.7	265.4	166.6	122.3	64.3	87.1	45.8	80.3	50.0	84.3	42.0
i-Pentane	220.8	118.9	238.9	131.7	115.2	50.4	72.6	32.2	78.5	41.8	78.1	33.6
Pentane	103.1	55.0	108.5	55.8	53.6	21.9	33.8	14.7	36.1	19.6	34.7	14.5
2-Methylpentane	71.9	37.3	78.9	42.6	37.1	17.7	22.8	10.5	22.4	12.3	25.7	11.7
3-Methylpentane	47.4	25.6	51.9	27.5	31.2	13.9	18.9	11.2	21.3	14.8	20.5	11.8
Hexane	47.9	26.0	52.5	28.1	24.7	11.1	15.9	7.4	16.5	8.2	17.0	7.5
Methylcyclopentane	45.3	24.2	49.5	27.4	24.2	11.2	14.4	6.9	14.9	8.3	15.5	7.0
Benzene	92.6	69.6	90.2	49.9	42.5	20.8	22.2	11.5	22.0	12.1	30.1	13.8
3-Methylhexane	27.6	14.4	32.9	18.7	14.9	7.8	9.0	4.2	8.5	5.0	10.5	4.6
Heptane	25.6	13.9	28.5	15.8	12.5	7.0	7.4	3.6	8.0	4.5	8.4	3.7
Methylcyclohexane	25.2	12.7	26.8	14.4	12.6	6.4	9.1	4.3	9.6	5.6	9.1	4.1
Toluene	203.5	115.7	227.9	127.1	105.2	50.6	60.8	30.6	65.4	35.2	75.5	33.4
Ethylbenzene	30.1	16.3	36.5	20.8	16.9	8.8	9.3	4.7	9.9	5.6	12.2	6.4
m- & p-Xylenes	120.0	67.8	144.4	80.9	61.2	30.2	30.0	15.3	26.9	14.5	38.4	19.4
o-Xylene	43.7	23.3	52.8	30.2	22.8	11.2	12.2	6.1	10.5	5.9	14.6	7.2
124-Trimethylbenzene	45.5	23.1	55.1	30.6	22.9	10.6	10.2	4.2	9.2	5.7	12.1	8.5
Formaldehyde[a]												
Acetaldehyde[a]												
Acetone[a]												
Olefins	578.7	166.9	161.1	153.5	95.2	38.3	24.2	101.5	59.5			
Paraffins	2127.9	561.9	646.0	624.0	588.7	228.0	109.1	450.5	269.7			
Aromatics	626.1	353.7	711.1	394.4	319.0	152.6	167.2	81.1	166.1	87.1	208.0	101.6
Total Carbonyls[a]												
Total Unidentified	432.7	271.8	488.0	334.6	242.1	162.5	161.6	61.6	160.0	89.7	140.8	52.7
NMOC[a]												
NMHC	2744.5	1497.7	3111.0	1729.6	1443.9	655.8	906.2	406.5	948.4	505.2	1041.8	485.6
MPAR23	341.3	106.3	117.9	96.3	117.4	55.1	31.8	84.4	51.2			
MPAR45	644.1	360.9	700.0	400.6	335.0	156.6	224.7	107.4	236.9	135.0	233.8	105.3
MPAR6	566.9	300.1	629.4	346.7	303.5	144.2	190.3	88.8	206.5	116.0	209.6	94.9
MTOLEF	81.7	49.0	103.9	62.3	36.3	19.5	17.4	6.9	16.6	9.4	26.3	10.8
MIOLEF	64.3	35.5	73.8	42.9	21.3	11.6	8.6	3.9	6.6	2.4	12.8	4.9
MONAROM	240.9	135.2	273.6	152.7	126.4	61.3	72.4	36.4	77.3	42.0	90.1	41.0
DIAROM	279.1	149.7	333.4	184.6	143.6	67.6	70.6	33.4	64.8	32.8	84.9	46.7

[a] Carbonyls were invalid.

Table D-23. Mean Concentration of Abundant Species and Species Groups for Los Angeles Surface Data From the Fall SCAQS 1987

	Concentration, ppbC											
Time, PST	500	500	700	700	900	900	1200	1200	1400	1400	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	75.7	29.8	136.2		42.4	13.8	46.2		45.8	22.2		
Ethene	63.1	23.9	173.4		68.9	21.4	48.0		41.5	19.1		
Acetylene	41.7	14.2	116.4		49.8	15.8	32.4		36.8	27.4		
Propane	83.2	31.1	75.7	45.6	72.2	32.0	51.7	41.0	96.8	53.3	62.6	23.8
Propene	22.3	8.3	32.6	21.9	22.2	8.1	8.6	4.6	11.1	5.6	13.2	7.8
i-Butane	37.5	17.5	41.7	22.8	38.1	9.4	29.2	16.4	56.6	45.4	33.2	18.9
Butane	111.8	53.8	129.1	73.8	113.9	30.4	86.6	49.0	167.2	145.6	88.9	62.4
i-Pentane	102.2	37.6	130.1	60.5	111.7	26.0	73.3	32.8	136.0	114.8	86.6	36.8
Pentane	44.8	14.7	63.6	35.9	49.1	10.9	32.6	14.3	64.6	58.9	37.4	15.2
2-Methylpentane	33.1	12.1	46.7	22.6	40.8	9.9	23.0	9.8	38.7	27.1	28.8	11.1
3-Methylpentane	26.2	8.5	37.1	20.0	30.7	8.0	15.5	5.9	28.6	17.1	22.6	12.7
Hexane	22.2	7.5	32.2	15.0	26.9	6.6	15.9	6.9	25.0	17.7	18.8	7.4
Methylcyclopentane	21.0	7.2	30.3	14.5	24.9	6.0	13.8	6.1	21.2	14.0	17.4	7.4
Benzene	37.7	12.8	59.5	27.9	49.5	12.8	24.6	9.3	37.1	22.8	36.0	14.8
3-Methylhexane	15.9	4.8	22.4	10.6	19.5	5.1	10.4	3.5	14.5	9.5	12.4	5.3
Heptane	16.1	3.8	22.5	10.1	18.7	6.1	9.8	3.5	12.0	7.7	10.0	3.7
Methylcyclohexane	20.5	2.8	23.1	8.8	22.0	8.5	11.7	4.5	14.2	9.6	10.6	3.8
Toluene	119.3	33.6	167.5	83.8	137.2	37.5	71.5	26.0	95.2	58.4	92.6	37.7
Ethylbenzene	19.9	8.2	25.3	11.3	20.9	3.7	11.1	4.0	14.5	9.3	14.5	6.1
m- & p-Xylenes	66.0	23.0	100.1	48.8	74.3	22.6	35.3	14.1	46.2	28.8	51.8	23.8
o-Xylene	24.2	8.0	35.7	17.4	26.0	7.2	14.1	5.9	18.7	11.6	20.4	9.5
124-Trimethylbenzene	26.6	11.2	39.7	20.2	24.4	15.2	10.8	6.3	17.9	11.5	21.2	10.8
Formaldehyde	7.8	1.3	11.8	1.7	11.7	2.0	12.4	4.4	13.5	5.5	12.5	4.6
Acetaldehyde	9.8	4.4	11.7	4.1	15.4	5.1	18.9	6.0	22.8	11.1	15.9	7.4
Acetone	12.1	7.3	19.7	6.0	21.5	12.9	23.3	15.2	36.1	25.4	22.7	8.8
Olefins	183.3	65.5	507.0		198.4	53.2	112.0		125.9	66.7		
Paraffins	786.3	269.4	1659.4		792.5	141.6	660.4		870.5	608.5		
Aromatics	347.0	113.3	500.9	240.8	382.1	100.4	191.9	74.7	266.9	166.5	277.6	121.3
Total Carbonyls	60.1	8.9	81.8	12.8	105.3	35.8	123.9	41.1	158.2	83.6	106.4	33.9
Total Unidentified	274.7	80.2	321.8	125.2	251.0	68.4	153.1	52.7	242.9	122.6	222.0	56.2
NMOC	1651.3	518.3	2075.2	964.8	1729.3	238.1	1063.6	399.8	1664.4	1005.2	1293.4	476.2
NMHC	1591.2	512.7	1993.3	961.2	1624.0	249.2	939.7	362.9	1506.2	929.3	1187.0	462.3
MPAR23	158.9	56.1	294.6		114.6	44.5	171.0		142.6	74.3		
MPAR45	296.3	122.3	364.5	187.7	312.7	70.8	221.7	111.0	424.5	361.1	246.1	131.8
MPAR6	331.1	94.1	434.5	201.9	365.2	78.7	207.8	73.0	303.5	194.8	247.2	99.0
MTOLEF	48.4	16.3	73.7	46.0	51.3	14.7	19.2	8.9	29.9	20.6	30.4	17.7
MIOLEF	26.5	12.0	38.4	22.0	26.2	11.7	7.1	3.8	16.8	18.3	14.6	7.7
MONAROM	144.2	42.5	199.3	97.8	162.4	41.1	85.3	30.9	113.6	70.4	111.3	46.0
DIAROM	158.2	59.2	234.7	112.9	164.3	63.1	79.1	34.7	113.4	72.7	126.9	59.3

Table D-24. Mean Concentration of Abundant Species and Species Groups for Riverside Surface Data From the Fall SCAQS 1987

	Concentration, ppbC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	40.2	14.5	7.3	2.8	14.9	9.4
Ethene	76.5	24.7	10.4	5.9	17.2	12.0
Acetylene	64.2	23.0	8.3	4.8	13.7	10.1
Propane	86.9	41.6	16.2	8.8	29.8	22.0
Propene	42.2	25.9	3.5	2.1	5.6	2.7
i-Butane	35.2	23.8	8.4	4.9	13.6	9.4
Butane	94.9	50.1	28.2	20.7	40.6	28.3
i-Pentane	125.2	48.3	25.7	14.4	42.4	24.9
Pentane	53.4	15.8	10.1	5.4	19.2	11.0
2-Methylpentane	41.6	11.3	7.8	4.1	15.1	8.8
3-Methylpentane	29.1	8.4	5.9	2.7	11.1	6.1
Hexane	28.5	5.8	4.9	2.7	10.3	5.8
Methylcyclopentane	28.3	8.2	4.5	2.6	8.6	5.0
Benzene	50.7	16.3	7.6	4.0	15.5	8.1
3-Methylhexane	16.8	5.7	3.1	1.7	6.0	3.2
Heptane	13.7	4.7	2.2	1.2	4.7	2.4
Methylcyclohexane	12.2	4.0	2.1	1.2	4.8	3.1
Toluene	120.1	49.3	18.5	9.3	41.1	23.5
Ethylbenzene	19.9	7.0	3.4	1.4	7.1	4.3
m- & p-Xylenes	77.1	24.4	11.3	5.1	22.3	13.3
o-Xylene	27.3	10.0	4.4	2.3	9.0	5.1
124-Trimethylbenzene	27.9	12.7	4.5	2.1	9.1	6.2
Formaldehyde	12.3	4.8	7.2	4.1	11.4	6.2
Acetaldehyde	9.4	3.6	12.0	5.8	15.2	6.9
Acetone	21.7	11.5	7.5	3.7	26.7	19.5
Olefins	239.9	82.6	32.0	15.7	43.1	26.5
Paraffins	768.9	267.7	158.6	85.1	252.1	188.0
Aromatics	378.7	138.4	60.2	27.6	126.7	73.5
Total Carbonyls	79.1	19.7	81.5	10.1	114.5	50.0
Total Unidentified	252.3	82.1	62.2	33.5	91.9	49.6
NMOC	1718.9	556.2	394.4	158.8	671.4	347.0
NMHC	1639.8	543.5	312.9	155.8	556.8	312.4
MPAR23	127.1	55.8	23.5	11.5	48.3	36.3
MPAR45	308.6	136.7	72.5	45.1	115.8	72.8
MPAR6	333.2	100.2	62.6	30.8	122.4	68.5
MTOLEF	67.7	34.1	8.7	3.5	12.4	7.2
MIOLEF	29.2	9.6	4.1	2.1	7.2	6.8
MONAROM	144.3	57.6	22.8	11.1	49.7	28.8
DIAROM	175.9	64.4	28.7	12.8	58.0	37.3

Table D-25. Mean Percent of Abundant Species and Species Groups for Anaheim Surface Data From Fall SCAQS 1987

	Percent of NMOC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	2.57	0.53	2.33	0.35	2.87	0.40
Ethene	3.87	0.68	2.25	0.77	3.80	0.08
Acetylene	3.30	0.81	1.93	0.78	2.96	0.08
Propane	5.32	1.36	4.65	1.05	6.53	3.32
Propene	1.41	0.31	0.68	0.15	1.27	0.08
i-Butane	2.20	0.19	2.14	1.02	2.32	0.79
Butane	5.72	1.02	6.63	2.57	6.57	2.14
i-Pentane	6.56	0.73	6.99	1.73	7.12	0.32
Pentane	3.32	0.24	2.99	0.68	3.12	0.19
2-Methylpentane	2.31	0.15	1.99	0.50	2.41	0.16
3-Methylpentane	1.94	0.52	1.53	0.59	1.70	0.27
Hexane	1.60	0.23	1.29	0.22	1.53	0.11
Methylcyclopentane	1.45	0.14	1.13	0.28	1.43	0.11
Benzene	2.61	0.31	2.13	0.53	2.85	0.18
3-Methylhexane	1.00	0.09	0.85	0.11	0.96	0.07
Heptane	0.92	0.12	0.60	0.12	0.75	0.06
Methylcyclohexane	0.90	0.35	0.65	0.12	0.68	0.13
Toluene	7.34	0.36	5.56	0.98	6.65	0.26
Ethylbenzene	1.11	0.15	0.89	0.11	1.08	0.06
m- & p-Xylenes	4.45	0.68	2.72	0.32	3.83	0.39
o-Xylene	1.54	0.27	1.14	0.15	1.48	0.14
124-Trimethylbenzene	1.68	0.29	1.06	0.24	1.56	0.23
Formaldehyde	0.40	0.20	1.11	0.27	0.76	0.18
Acetaldehyde	0.35	0.18	1.75	0.50	1.12	0.26
Acetone	2.04	1.71	5.37	4.41	1.95	1.81
Olefins	12.43	2.02	6.81	1.57	10.24	0.28
Paraffins	45.29	1.45	38.76	10.05	45.08	4.49
Aromatics	24.16	3.31	16.36	1.60	20.45	1.60
Total Carbonyls	4.73	1.82	17.81	5.52	7.55	2.97
Total Unidentified	14.32	2.44	17.27	7.34	15.83	4.11
MPAR23	7.27	1.73	6.55	1.55	8.53	0.53
MPAR45	17.75	1.41	18.72	5.28	19.13	3.15
MPAR6	19.72	1.35	16.41	2.29	18.62	0.73
MTOLEF	3.23	0.35	1.69	0.15	2.49	0.39
MIOLEF	1.50	0.26	0.78	0.21	1.22	0.25
MONAROM	8.69	0.48	6.69	1.02	7.99	0.32
DIAROM	10.30	1.44	7.01	0.87	9.27	1.15

Table D-26. Mean Percent of Abundant Species and Species Groups for Burbank Surface Data From Fall SCAQS 1987

	Percent of NMOC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	3.51	0.27	2.61	0.79	2.39	0.63
Ethene	3.44	0.73	3.58	0.43	3.54	0.29
Acetylene	3.53	1.31	2.88	0.46	2.44	0.17
Propane	4.20	1.07	3.98	1.31	4.94	1.72
Propene	1.43	0.09	0.81	0.16	1.04	0.18
i-Butane	2.34	0.37	2.49	0.39	2.49	0.67
Butane	7.19	1.46	7.56	1.12	7.03	1.61
i-Pentane	7.15	0.52	7.09	0.46	6.66	0.54
Pentane	3.34	0.34	2.94	0.16	2.88	0.20
2-Methylpentane	2.39	0.16	2.19	0.16	2.27	0.24
3-Methylpentane	1.99	0.34	1.70	0.48	1.80	0.40
Hexane	1.53	0.06	1.34	0.14	1.58	0.34
Methylcyclopentane	1.35	0.03	1.19	0.12	1.30	0.14
Benzene	2.78	0.19	2.57	0.20	2.57	0.19
3-Methylhexane	1.02	0.05	0.91	0.18	0.99	0.12
Heptane	0.99	0.14	0.87	0.25	0.95	0.22
Methylcyclohexane	1.02	0.35	1.06	0.37	1.06	0.28
Toluene	8.15	0.73	7.67	0.97	7.83	0.62
Ethylbenzene	1.15	0.07	1.09	0.12	1.13	0.10
m- & p-Xylenes	4.67	0.39	3.33	0.26	3.97	0.38
o-Xylene	1.65	0.12	1.36	0.15	1.49	0.16
124-Trimethylbenzene	1.85	0.15	1.25	0.29	1.48	0.16
Formaldehyde	0.37	0.22	1.05	0.24	0.80	0.10
Acetaldehyde	0.32	0.21	1.54	0.23	0.96	0.33
Acetone	1.28	0.47	4.08	2.48	2.44	0.42
Olefins	12.00	1.20	8.97	0.68	9.56	0.93
Paraffins	47.65	1.50	46.69	2.15	46.57	6.78
Aromatics	23.68	1.29	19.94	1.07	21.23	1.53
Total Carbonyls	3.55	1.94	12.24	3.93	9.00	3.57
Total Unidentified	13.24	1.94	14.46	2.07	13.98	2.87
MPAR23	7.71	1.18	7.04	1.74	7.44	2.49
MPAR45	19.98	2.19	20.04	1.56	19.06	2.78
MPAR6	19.88	0.77	18.60	1.82	20.19	2.17
MTOLEF	3.20	0.09	1.69	0.19	2.26	0.34
MIOLEF	1.77	0.28	0.80	0.24	1.09	0.40
MONAROM	9.60	0.71	9.02	1.01	9.25	0.72
DIAROM	10.92	0.81	8.11	0.94	9.16	0.85

Table D-27. Mean Percent of Abundant Species and Species Groups for Hawthorne Surface Data From Fall SCAQS 1987

	Percent of NMOC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	4.08	0.63	4.46	0.74	4.63	1.25
Ethene	4.21	0.78	3.67	1.00	2.51	0.62
Acetylene	3.29	0.77	2.11	0.52	1.97	0.26
Propane	6.19	3.76	8.05	3.39	8.52	4.09
Propene	1.88	0.46	1.11	0.73	0.81	0.22
i-Butane	2.58	0.90	3.75	1.95	2.92	0.83
Butane	6.45	1.47	8.23	1.20	6.49	1.65
i-Pentane	7.17	0.51	7.29	1.34	5.57	0.68
Pentane	3.19	0.10	3.18	0.63	2.73	0.20
2-Methylpentane	2.46	0.39	2.13	0.25	1.76	0.12
3-Methylpentane	1.72	0.23	1.63	0.55	1.26	0.41
Hexane	1.51	0.19	1.38	0.14	1.17	0.09
Methylcyclopentane	1.56	0.13	1.29	0.12	1.25	0.24
Benzene	3.13	0.53	2.10	0.41	1.94	0.19
3-Methylhexane	0.95	0.25	0.84	0.08	0.74	0.13
Heptane	0.86	0.16	0.72	0.06	0.72	0.06
Methylcyclohexane	0.82	0.09	0.90	0.09	0.74	0.08
Toluene	7.67	1.37	5.93	1.14	5.45	0.72
Ethylbenzene	1.17	0.20	0.87	0.12	0.81	0.12
m- & p-Xylenes	4.58	0.83	2.75	0.64	2.72	0.80
o-Xylene	1.59	0.24	1.08	0.18	1.02	0.25
124-Trimethylbenzene	1.70	0.36	0.99	0.20	1.29	0.38
Formaldehyde	0.39	0.11	1.16	0.37	1.07	0.75
Acetaldehyde	0.39	0.17	1.48	0.46	1.67	0.42
Acetone	0.71	0.44	1.25	0.86	1.70	1.18
Olefins	12.98	0.59	8.47	1.70	7.31	1.83
Paraffins	49.02	3.32	52.70	6.70	46.28	6.30
Aromatics	23.22	3.84	15.84	2.93	15.95	2.51
Total Carbonyls	2.68	1.16	9.05	4.54	12.00	2.22
Total Unidentified	13.48	1.00	14.12	2.89	18.63	3.78
MPAR23	11.67	4.32	12.49	3.93	13.12	5.32
MPAR45	19.34	2.10	22.39	4.76	17.69	2.68
MPAR6	19.04	3.01	17.71	1.27	15.38	0.68
MTOLEF	3.62	0.53	1.94	1.00	1.72	0.59
MIOLEF	1.75	0.44	0.72	0.28	1.08	0.48
MONAROM	9.09	1.62	7.03	1.32	6.50	0.72
DIAROM	10.60	1.89	6.50	1.22	7.36	1.99

Table D-28. Mean Percent of Abundant Species and Species Groups for Los Angeles Surface Data From Fall SCAQS 1987

	Percent of NMOC											
Time, PST	500	500	700	700	900	900	1200	1200	1400	1400	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviatio	Mean	Standard Deviation	Mean	Standard Deviation
Ethane	4.52	0.52	3.85		2.51	0.85	3.28		2.93	0.56		
Ethene	3.78	0.33	4.90		4.02	1.10	3.41		2.67	0.51		
Acetylene	2.53	0.41	3.29		2.90	0.79	2.30		2.37	1.50		
Propane	5.07	1.54	3.56	1.03	4.35	2.25	4.41	2.41	6.07	2.06	4.89	1.23
Propene	1.34	0.14	1.47	0.30	1.30	0.42	0.76	0.18	0.72	0.18	0.98	0.22
i-Butane	2.20	0.58	1.95	0.33	2.22	0.51	2.62	0.72	3.07	0.79	2.46	0.43
Butane	6.49	1.34	5.99	1.01	6.57	1.16	7.91	2.28	8.98	2.90	6.15	3.12
i-Pentane	6.13	0.50	6.30	0.23	6.42	0.69	6.89	1.29	7.49	2.13	6.60	0.41
Pentane	2.72	0.31	3.00	0.62	2.83	0.37	3.04	0.52	3.46	1.24	2.87	0.17
2-Methylpentane	2.00	0.15	2.23	0.12	2.34	0.27	2.15	0.30	2.22	0.26	2.21	0.12
3-Methylpentane	1.63	0.37	1.74	0.34	1.76	0.27	1.47	0.15	1.70	0.33	1.67	0.50
Hexane	1.35	0.11	1.56	0.10	1.54	0.20	1.48	0.23	1.43	0.17	1.44	0.09
Methylcyclopentane	1.27	0.10	1.46	0.05	1.43	0.17	1.27	0.17	1.25	0.13	1.33	0.10
Benzene	2.27	0.14	2.87	0.18	2.83	0.38	2.35	0.27	2.22	0.21	2.75	0.16
3-Methylhexane	0.97	0.05	1.08	0.06	1.11	0.15	0.99	0.10	0.85	0.12	0.95	0.07
Heptane	1.01	0.19	1.09	0.08	1.06	0.21	0.93	0.15	0.73	0.10	0.77	0.05
Methylcyclohexane	1.32	0.33	1.15	0.14	1.25	0.35	1.12	0.31	0.85	0.16	0.82	0.08
Toluene	7.34	0.76	8.02	0.89	7.84	1.15	6.80	0.77	5.81	0.90	7.07	0.61
Ethylbenzene	1.19	0.28	1.23	0.07	1.21	0.14	1.05	0.11	0.87	0.14	1.11	0.09
m- & p-Xylenes	3.99	0.28	4.81	0.31	4.29	1.03	3.36	0.47	2.89	0.69	3.93	0.47
o-Xylene	1.47	0.11	1.72	0.14	1.51	0.35	1.33	0.16	1.16	0.27	1.54	0.16
124-Trimethylbenzene	1.58	0.22	1.90	0.23	1.43	0.80	1.05	0.39	1.13	0.28	1.59	0.24
Formaldehyde	0.50	0.11	0.67	0.29	0.69	0.14	1.20	0.26	0.93	0.26	1.02	0.37
Acetaldehyde	0.58	0.16	0.59	0.07	0.90	0.28	1.90	0.54	1.51	0.44	1.23	0.42
Acetone	0.79	0.49	1.16	0.65	1.29	0.90	2.04	0.86	2.04	0.90	1.88	0.84
Olefins	10.94	0.93	14.19		11.38	2.25	7.95		7.85	1.39		
Paraffins	47.40	3.77	46.89		45.91	4.21	46.85		49.99	6.17		
Aromatics	21.05	1.21	24.08	1.77	22.02	3.96	18.23	2.15	16.35	2.89	21.09	1.77
Total Carbonyls	3.88	1.01	4.63	1.85	6.26	2.53	12.04	1.68	10.04	2.51	8.80	3.14
Total Unidentified	16.94	2.34	16.06	2.08	14.62	3.49	15.16	3.58	15.93	3.35	18.12	4.31
MPAR23	9.57	1.59	8.32		6.86	3.05	12.13		9.00	2.51		
MPAR45	17.49	2.38	17.18	1.50	17.99	2.28	20.40	4.49	23.00	6.72	18.05	3.73
MPAR6	20.20	0.81	20.90	0.60	20.95	1.78	19.70	1.55	17.95	1.40	18.95	0.83
MTOLEF	2.93	0.23	3.37	0.64	2.95	0.60	1.77	0.29	1.77	0.40	2.26	0.48
MIOLEF	1.58	0.36	1.75	0.34	1.47	0.49	0.69	0.29	0.99	0.56	1.12	0.31
MONAROM	8.80	0.80	9.55	0.93	9.29	1.21	8.09	0.83	6.92	1.08	8.49	0.75
DIAROM	9.48	0.87	11.24	0.89	9.52	3.18	7.54	1.46	7.04	1.61	9.60	1.08

Table D-29. Mean Percent of Abundant Species and Species Groups for Riverside Surface Data From Fall SCAQS 1987

	Percent of NMOC					
Time, PST	700	700	1200	1200	1600	1600
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviatio
Ethane	2.37	0.55	1.92	0.53	2.63	0.31
Ethene	4.60	1.02	2.56	0.54	2.93	0.30
Acetylene	3.70	0.22	2.03	0.45	2.28	0.31
Propane	4.92	1.24	4.00	0.96	4.29	1.61
Propene	2.34	0.75	0.86	0.26	0.92	0.30
i-Butane	1.88	0.81	2.01	0.57	1.88	0.45
Butane	5.17	1.60	6.50	3.11	5.65	1.26
i-Pentane	7.20	0.70	6.22	1.20	6.06	0.74
Pentane	3.13	0.19	2.47	0.38	2.71	0.48
2-Methylpentane	2.47	0.24	1.89	0.29	2.13	0.33
3-Methylpentane	1.72	0.15	1.49	0.36	1.59	0.21
Hexane	1.74	0.32	1.20	0.20	1.48	0.19
Methylcyclopentane	1.67	0.10	1.07	0.22	1.23	0.18
Benzene	2.95	0.24	1.87	0.33	2.29	0.16
3-Methylhexane	1.00	0.22	0.76	0.18	0.92	0.10
Heptane	0.82	0.19	0.54	0.10	0.69	0.09
Methylcyclohexane	0.72	0.11	0.50	0.09	0.67	0.18
Toluene	6.95	1.33	4.59	0.65	5.82	1.17
Ethylbenzene	1.15	0.09	0.87	0.09	0.99	0.18
m- & p-Xylenes	4.54	0.51	2.86	0.48	3.22	0.60
o-Xylene	1.59	0.20	1.10	0.24	1.30	0.25
124-Trimethylbenzene	1.59	0.45	1.16	0.26	1.32	0.41
Formaldehyde	0.71	0.11	1.75	0.52	1.80	0.51
Acetaldehyde	0.55	0.10	3.07	0.70	2.57	1.06
Acetone	1.23	0.62	2.04	0.97	3.59	2.43
Olefins	13.84	0.77	7.95	1.16	7.73	1.32
Paraffins	44.40	3.17	38.56	6.98	40.52	4.67
Aromatics	21.90	2.57	15.18	1.91	18.09	2.80
Total Carbonyls	4.80	1.05	23.04	7.60	19.25	6.34
Total Unidentified	15.14	3.68	15.38	4.78	13.83	2.24
MPAR23	7.29	1.70	5.92	1.35	7.70	1.12
MPAR45	17.36	2.92	17.18	5.19	16.27	2.46
MPAR6	19.69	2.57	15.41	1.68	17.67	1.79
MTOLEF	3.76	0.77	2.24	0.48	1.97	0.67
MIOLEF	1.71	0.27	1.00	0.29	1.07	0.62
MONAROM	8.34	1.44	5.67	0.71	7.00	1.41
DIAROM	10.18	1.34	7.31	1.46	8.30	2.01

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