2. Long Beach Summer Episodes

Figure VI-4 provides clear evidence of the generally low pollution conditions encountered throughout the summer episode periods except for episode S-10 on September 2 and, to a lesser extent, the August 27 and 28 daytime periods. With the exception of the peak NO_2 concentration of ~170 ppb, concentrations rarely exceeded 60 ppb during the entire eleven intensive monitoring periods, and NO_2 levels fell below 10 ppb for significant periods of time during the June and July episodes.

Further evidence of the absence of meteorological conditions conducive to elevated pollutant levels is exhibited in Figures VI-5 and VI-6, which show that for a large fraction of the time during the summer episodes at Long Beach, concentrations of HONO and HCHO remained below the DOAS detection limits. Thus, HONO was observed above 0.8 ppb on only four of the episodes, and HCHO concentrations exceeded 15 ppb for only three brief periods. Consistent with the NO_2 results, only on September 2 did HCHO concentrations spike upward to nearly 25 ppb.

3. Long Beach Fall Episodes

In contrast to the summer study, conditions encountered during the fall at Long Beach were highly favorable for prolonged periods of elevated pollutant levels. As seen from Figure VI-7, NO_2 concentrations approached or exceeded 150 ppb on four of the five fall episodes (November 13 being the only "clean" day in the fall study), with levels approaching ~250 ppb on December 3 and 10.

Consistent with these data, and as discussed earlier in Section V, HONO concentrations observed during several of the fall episodes (Figure VI-8) were higher than any previous HONO concentration maxima observed by the DOAS technique, exceeding 15 ppb during the early morning hours of December 3 and 10, and approaching or exceeding 10 ppb during three other episode periods. Figure VI-8 shows clearly the rapid buildup of HONO in the early evening following sunset, and the even more rapid decline in atmospheric concentrations following sunrise. Implications of these data for the sources of observed ambient HONO are discussed below.

As seen in Figure VI-9, HCHO concentrations observed on December 3 and 10 were the highest measured by the DOAS technique during the SCAQS program, reaching almost 40 ppb near mid-day on December 3. Comparisons of these and other DOAS data with results from other measurement methods employed during the SCAQS program, are given in Section VI.C below.

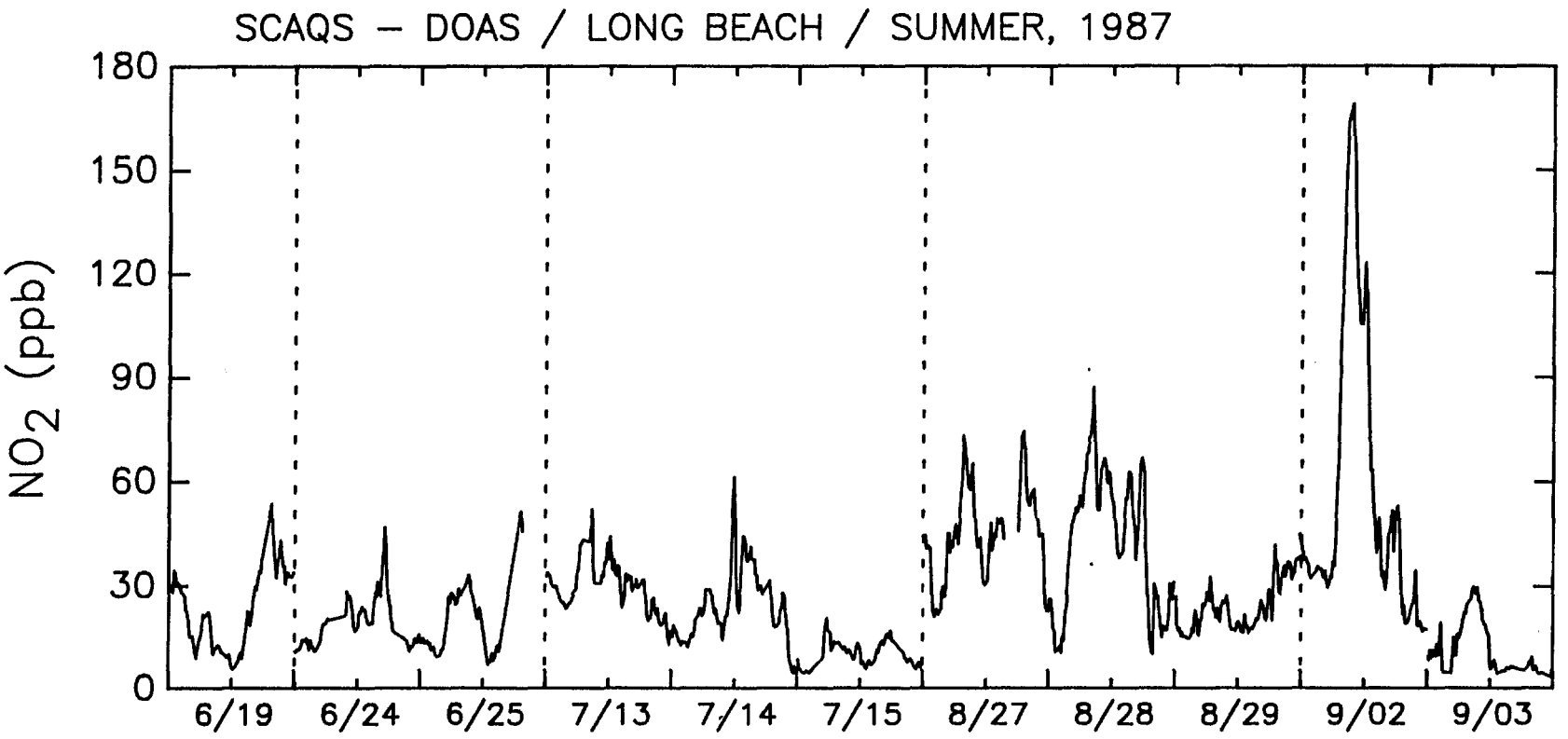

Figure VI-4. Time-concentration profiles for NO_2 measured by DOAS during eleven summer (1987) episodes at Long Beach, CA.

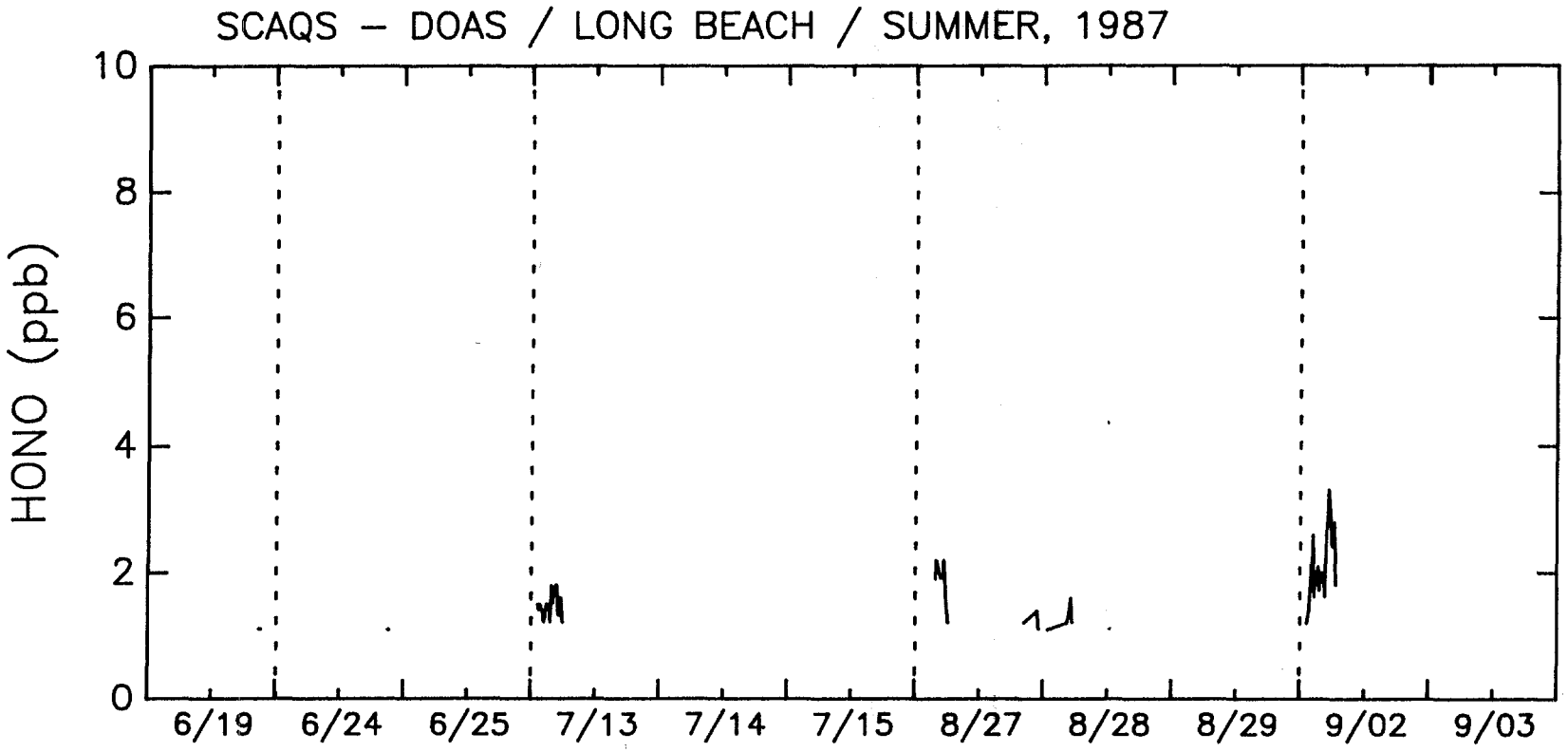

Figure VI-5. Time-concentration profiles for HONO measured by DOAS during eleven summer (1987) episodes at Long Beach, CA.

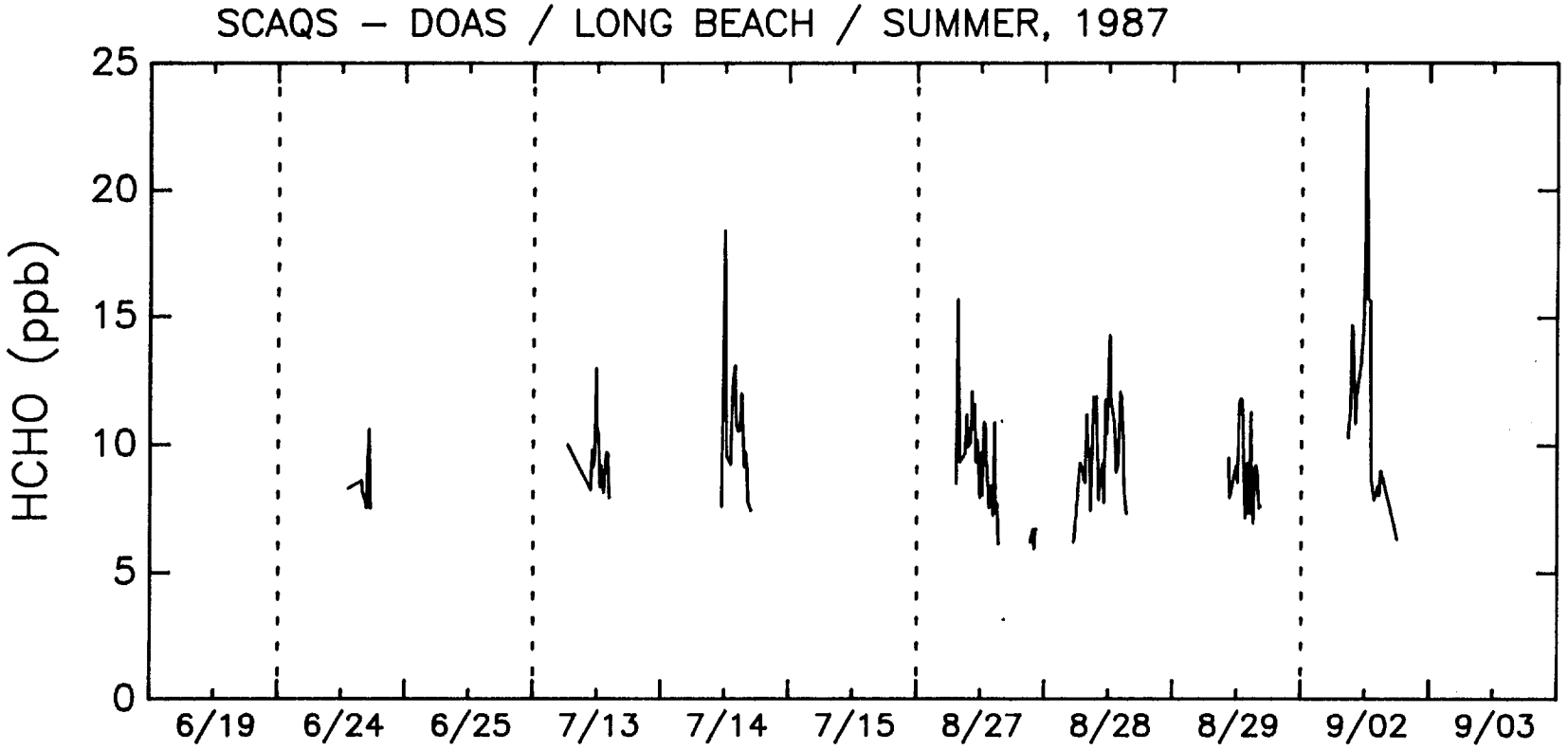

Figure VI-6. Time-concentration profiles for HCHO measured by DOAS during eleven summer (1987) episodes at Long Beach, CA.

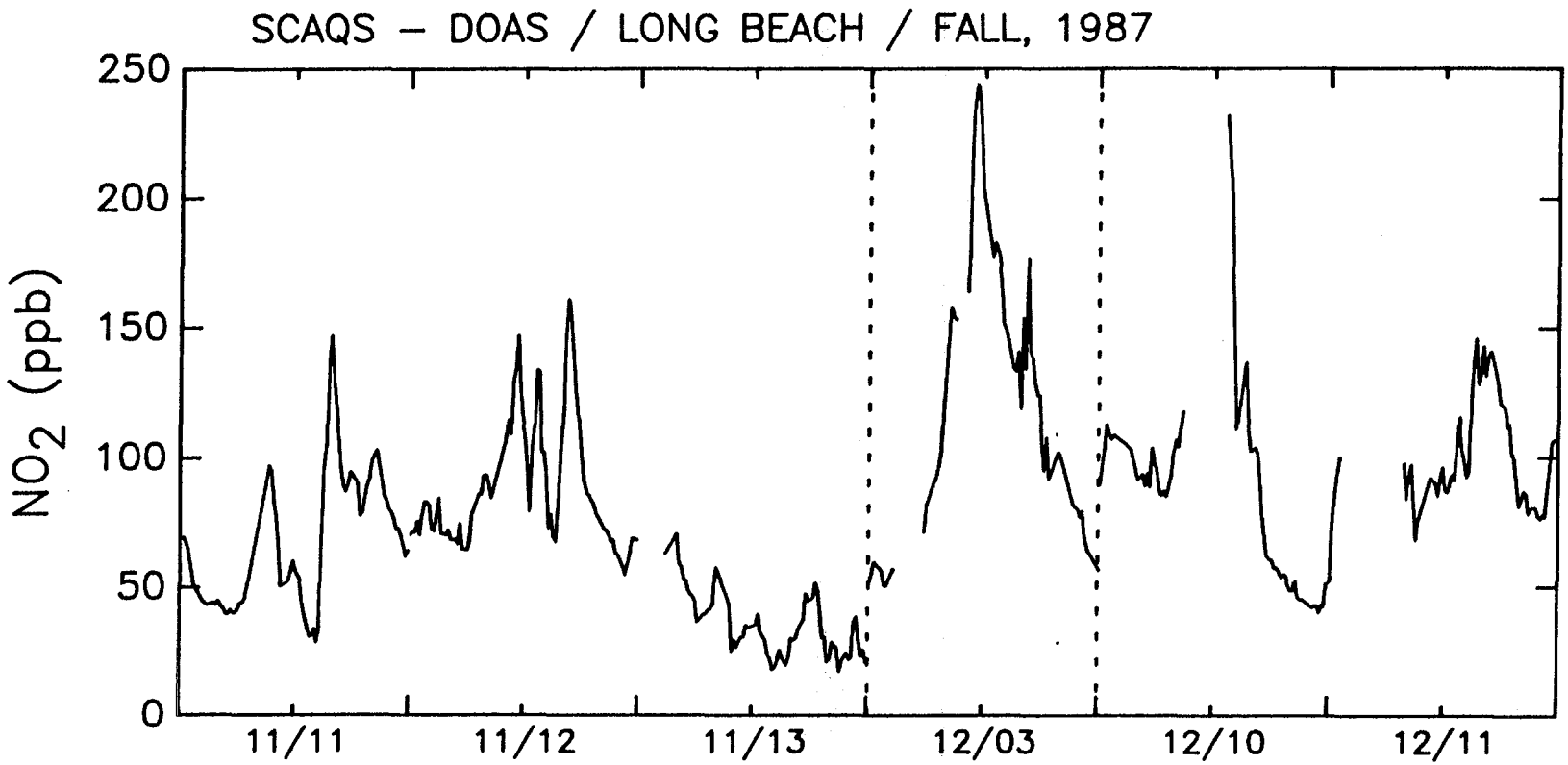

Figure VI-7. Time-concentration profiles for NO_2 measured by DOAS during six fall (1987) episodes at Long Beach, CA.

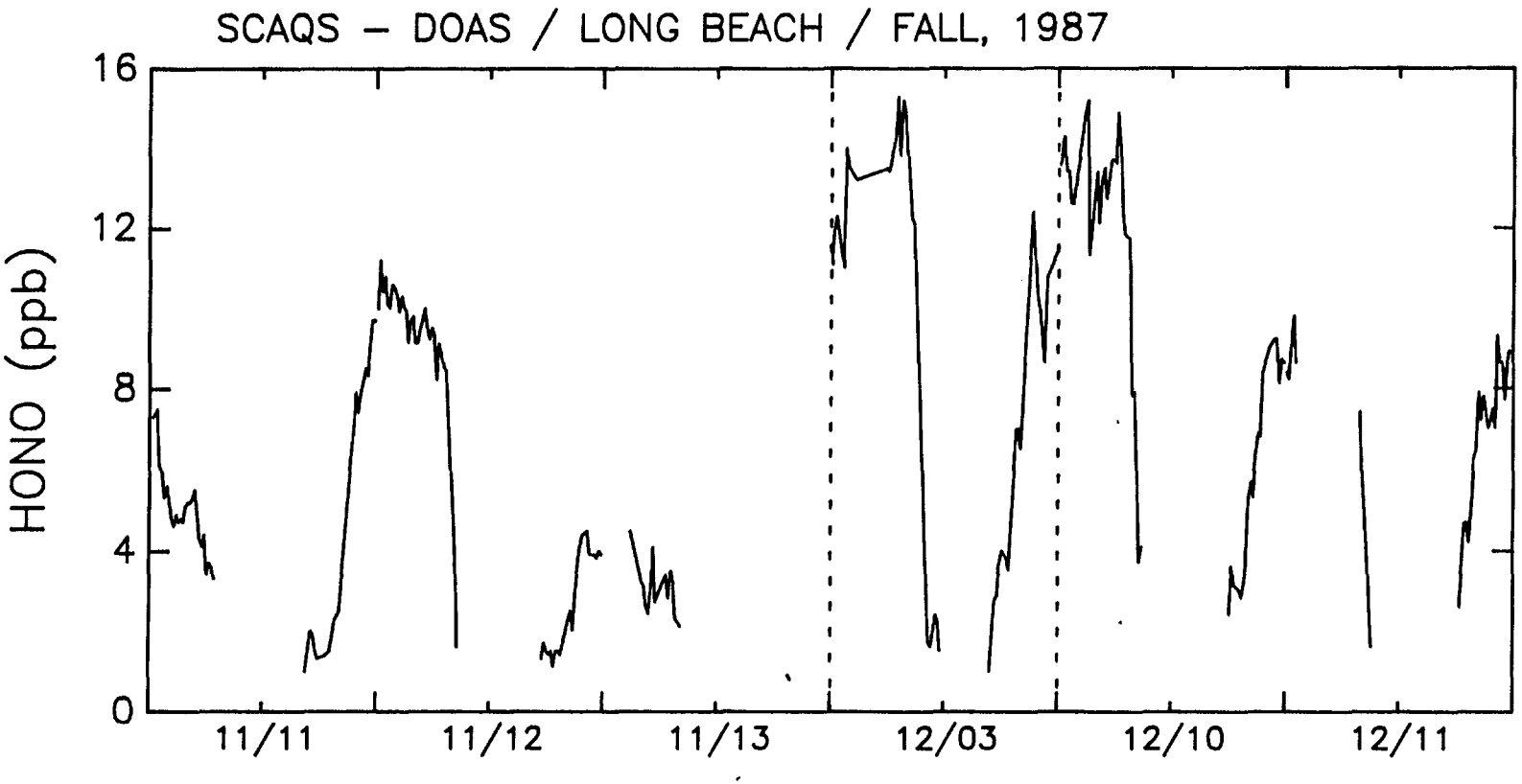

Figure VI-8. Time-concentration profiles for HONO measured by DOAS during six fall (1987) episodes at Long Beach, CA.

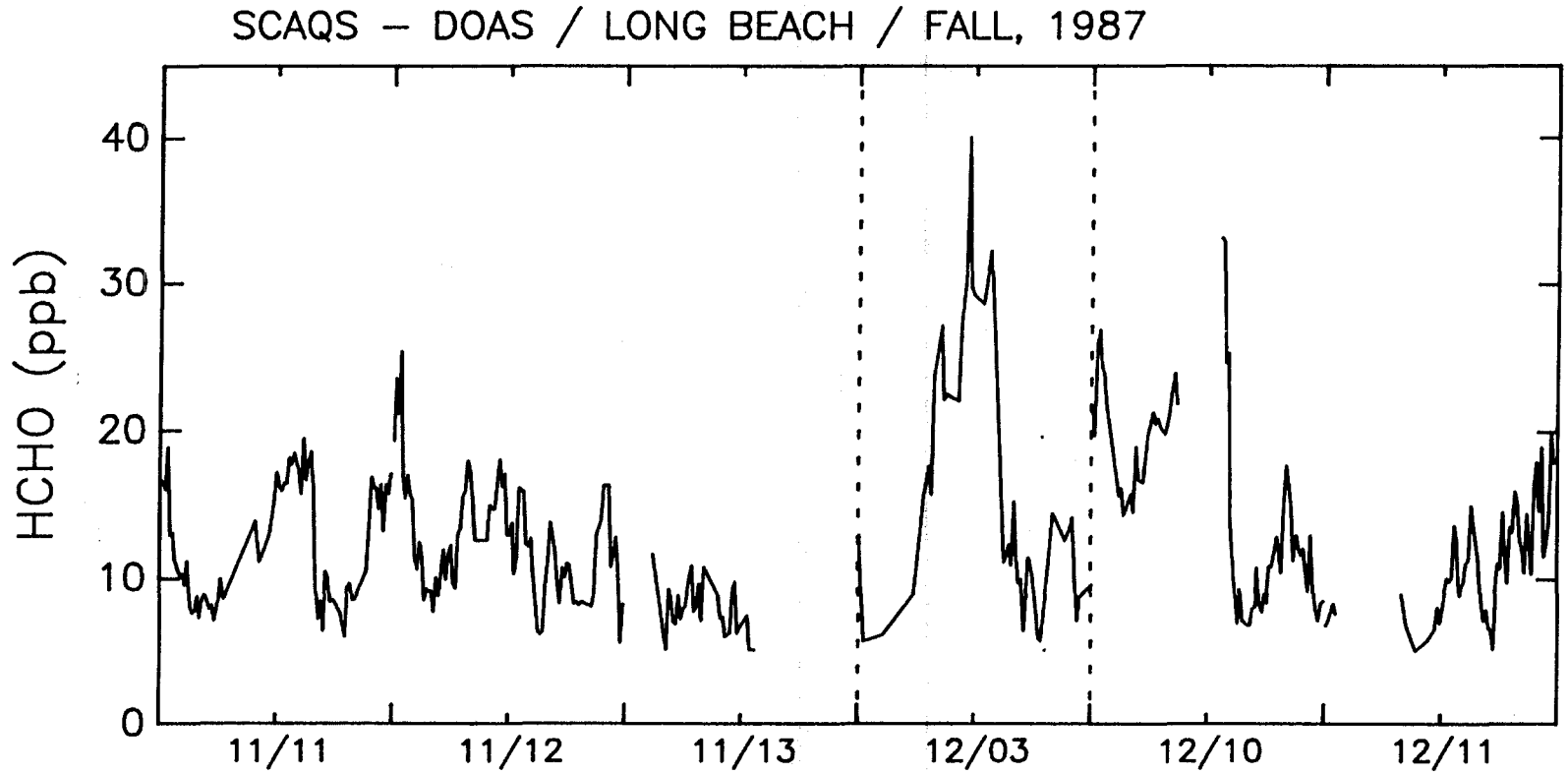

Figure VI-9. Time-concentration profiles for HCHO measured by DOAS during six fall (1987) episodes at Long Beach, CA.

B. Implications for Sources of Atmospheric HONO

Because nitrous acid is an important precursor to hydroxyl (OH) radicals (see Section VI.D below), which in turn initiate the chain photooxidation of organic compounds in the atmosphere (Finlayson-Pitts and Pitts 1986; Seinfeld 1989), considerable attention has been given during the past decade to the reliable measurement of this compound and to analyses of its potential sources, both direct and secondary. Determinations of ambient concentrations of HONO in outdoor and indoor atmospheres is also of interest because of the potential for this nitrosating agent to undergo reactions leading to hazardous compounds, including carcinogens (Fahmy and Fahmy 1976; Pitts et al. 1978, 1980; Pitts 1979; Biermann et al. 1988b). For example, reactions of HONO with secondary or tertiary amines may occur in ambient air, or in-vivo following inhalation, to form nitrosamines.

The first definitive observations of HONO in ambient air were reported by Perner and Platt (1979) for rural atmospheres and by Platt et al. (1980b) for an urban atmosphere (the SoCAB), using long optical path differential absorption spectroscopy. The DOAS technique was subsequently applied to additional measurements of ambient HONO concentrations in the SoCAB (Harris et al. 1982; Pitts et al. 1984a; Biermann et al. 1988a; Winer and Biermann 1989) and in central Europe (Kessler and Platt 1984), as well as to investigations of emissions of HONO from auto exhaust (Pitts et al. 1984c; Kessler and Platt 1984) and its formation in environmental chambers (Pitts et al. 1984b), indoor atmospheres (Pitts et al. 1985; Biermann et al. 1988b; Pitts et al. 1989) and on aerosol surfaces (Lammel and Perner 1988). Because it is a spectroscopic technique, the DOAS method offers high specificity and good time resolution (i.e., minutes).

In recent years, atmospheric concentrations of HONO have also been measured, with longer integrations times (i.e., hours) by collection on alkali-coated, open tubes or annular denuders followed by analysis of HONO as nitrite (Sjodin and Ferm 1985; Allegrini et al. 1987; Sjodin 1988; Appel et al. 1989, 1990). Also, investigations of mechanisms of formation of HONO have been conducted by several groups (Sakamaki et al. 1983; Svensson et al. 1987; Jenkin et al. 1988) in addition to those employing DOAS or denuder techniques.

Despite the substantial effort represented by the studies cited above, the precise mechanisms of formation of HONO in the atmosphere are still not well established, and the partitioning of observed ambient concentrations between primary emissions and secondary formation pathways remains to be determined definitively. During daylight hours, nitrous acid can be formed by the rapid reaction of nitric oxide with hydroxyl radicals as shown in reaction (1)

$$NO + OH \xrightarrow{M} HONO \qquad (1)$$

At the same time, HONO is removed by photolysis from sunlight in the actinic region from 290 to 400 nm

$$HONO + h\nu \ (\lambda < 400 \text{ nm}) \rightarrow OH + NO \qquad (2)$$

The equilibrium concentration of HONO determined between reactions (1) and (2) can be expressed by

$$[HONO]_{eq} = \frac{k_1[OH][NO]}{k_2}$$

where $k_1 = 6 \times 10^{-12}$ cm^3 molecule^{-1} sec^{-1}, $k_2 = 1 \times 10^{-3}$ sec^{-1} under sunlight conditions typical of the Long Beach site in December and the OH radical concentration is assumed to be ~1×10^6 cm^{-3}.

For an NO concentration of ~2.4×10^{12} molecule cm^{-3} (i.e., ~100 ppb), an equilibrium HONO concentration of ~0.5 ppb is then calculated from the equilibrium expression given above. Thus, from the data for NO concentrations shown in Table VI-1, it can be seen that reactions (1) and (2) could have resulted in fractional ppb, to 1 or 2 ppb, concentrations of HONO during the morning hours of several fall episodes in Long Beach. In particular, the observation of measurable HONO concentrations until almost noon on December 3, is consistent with the persistent, elevated NO concentrations reported by the ARB for that period.

However, because OH radicals are present only during daylight hours, the equilibrium cited above cannot account for the rapid accumulation of

Table VI-1. NO Concentrations Measured by the ARB During Fall SCAQS Episodes at Long Beach (ppb)

Hour	Nov 11	Nov 12	Nov 13	Dec 3	Dec 10	Dec 11
0600-0700	188	481	17	572	646	377
0700-0800	246	473	22	710	584	542
0800-0900	257	266	25	651	379	368
0900-1000	133	115	16	292	310	140
1000-1100	46	40	3	179	179	96
1100-1200	30	34		119	55	62
1200-1300	23	21		36	36	43
1300-1400	18	11		34	59	39
1400-1500	16			18	34	32

atmospheric HONO after sunset which is evident in Figure VI-8 and corresponding figures in Section V, for most of the fall episodes.

In previous environmental chamber studies (Sakamaki et al. 1983; Pitts et al. 1984b; Jenkin et al. 1988), the rate of formation of HONO was found to be generally correlated with NO_2 and water vapor concentrations, consistent with the heterogeneous formation of HONO via reaction (3)

$$2\ NO_2 + H_2O \rightarrow HONO + HNO_3 \text{ (Heterogeneous)} \qquad (3)$$

In ambient systems, the ground and other surfaces, as well as the surface of atmospheric aerosol (Lammel and Perner 1988) could be potentially active in this reaction pathway.

Within experimental variability, the rate of HONO formation observed in earlier environmental chamber studies (Sakamaki et al. 1983; Pitts et al. 1984b), was approximately 0.1 ppb HONO formed per minute per ppm of NO_2, or about 5 ppb over an eight-hour period for typical ambient NO_2 levels in the SoCAB between sunset and the hours just after midnight (i.e., ~30-100 ppb). This predicted HONO accumulation concentration fell within the range of maximum HONO concentrations which had been observed up

until that time in urban atmospheres i.e., ca. 2-8 ppb. This agreement led Pitts et al. (1984b), while citing the evidence for direct HONO emissions, to conclude that "heterogeneous processes may be the mechanism predominantly responsible for nighttime HONO formation."

However, as discussed earlier in this report, the maximum HONO concentrations observed by DOAS at Long Beach during the fall episodes of the SCAQS program and in our 1986 winter measurements at Torrance, CA, were factors of two to three higher than both the maximum levels observed in earlier studies and the amount of HONO predicted to be formed in the hours up to midnight by the heterogeneous reaction (3). Note from Figures VI-1 and VI-7, that the ambient NO_2 concentrations in the hours between sunset and midnight were not greatly different at Claremont in the summer vs. Long Beach in the fall, being generally in the range from ~40 to ~90 ppb, but that peak HONO concentrations were as much as a factor of four higher at Long Beach in the fall.

In addition, as seen in Figures VI-10 and VI-11, HONO concentrations measured by DOAS between sunset and midnight during the six fall SCAQS episodes at Long Beach showed no correlation with either the NO_2 ($r = -0.27$) concentration or the square of the NO_2 concentration ($r = -0.17$) measured in the same time period. Thus, even allowing for variability in water vapor concentration and aerosol loading, which could strongly influence (Lammel and Perner 1988) the rate of reaction (3), the levels of HONO observed at Long Beach during the fall episodes suggested the possibility of significant concentrations from primary emissions of HONO.

To explore this further, we employed a principal component model of factor analysis (using the BMDP4I9 statistical package) for the variables HONO, NO_2, carbon monoxide (CO) and NO, and applied this to both the SCAQS Long Beach fall data and the earlier data obtained for winter episodes in 1986 at Torrance, CA. As seen in Table VI-2, HONO concentrations measured during these two studies were strongly related to the concentrations of NO and CO, both of which occur only as primary pollutants emitted from combustion sources. A similar conclusion can be drawn from linear least squares fits of DOAS HONO concentrations between 1800 and midnight and the corresponding NO concentration (Figure VI-12), and of DOAS HONO concentrations and the corresponding CO concentration (see Figure VI-13) measured at Long Beach during the fall SCAQS episodes.

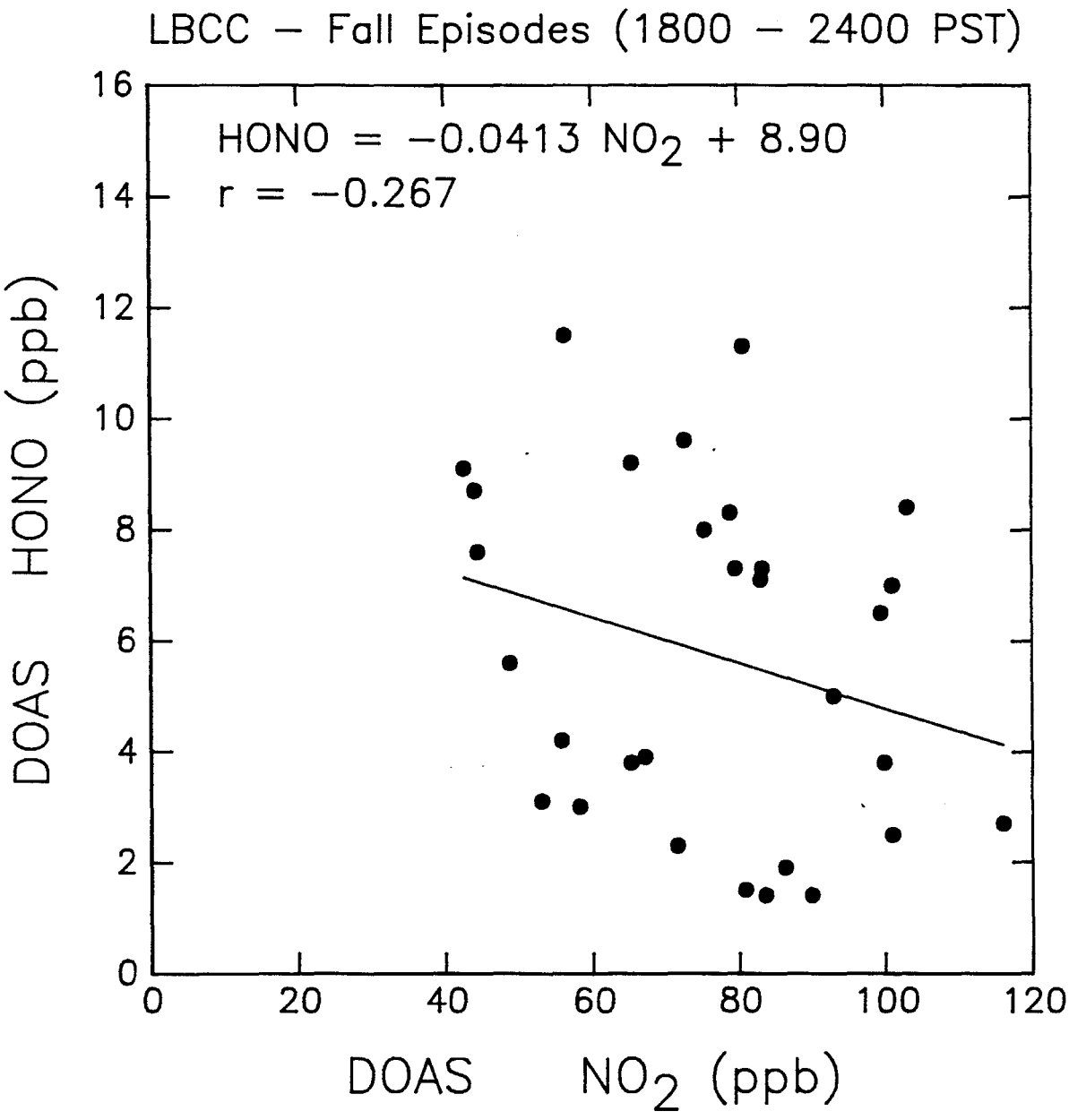

Figure VI-10. Linear least squares fit of DOAS HONO vs. DOAS NO_2 measured from 1800-2400 during six fall episodes at Long Beach.

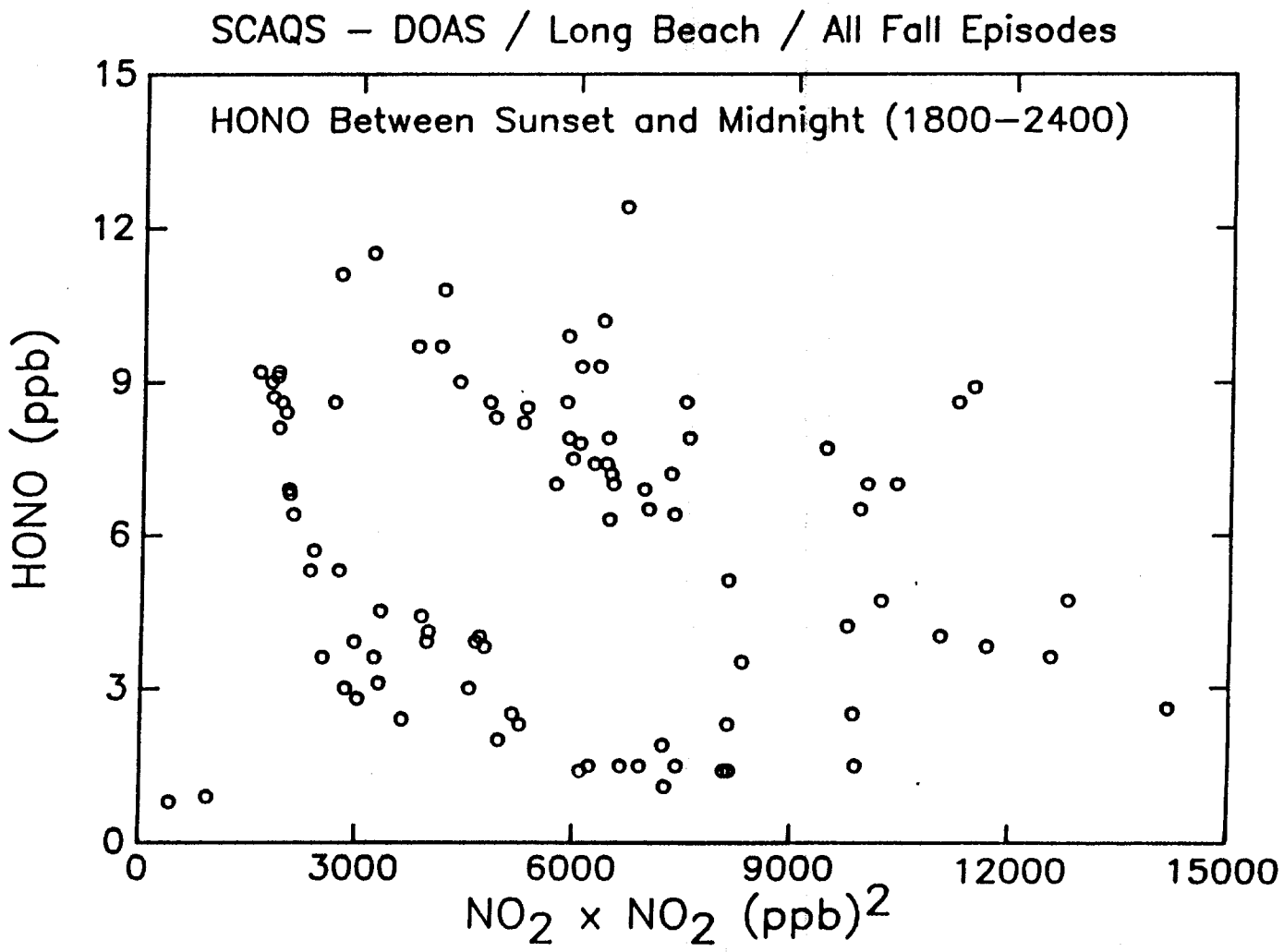

Figure VI-11. Plot of DOAS HONO vs. the square of DOAS NO_2 concentration measured between sunset and midnight during six fall episodes at Long Beach (r = -.17 for linear regression).

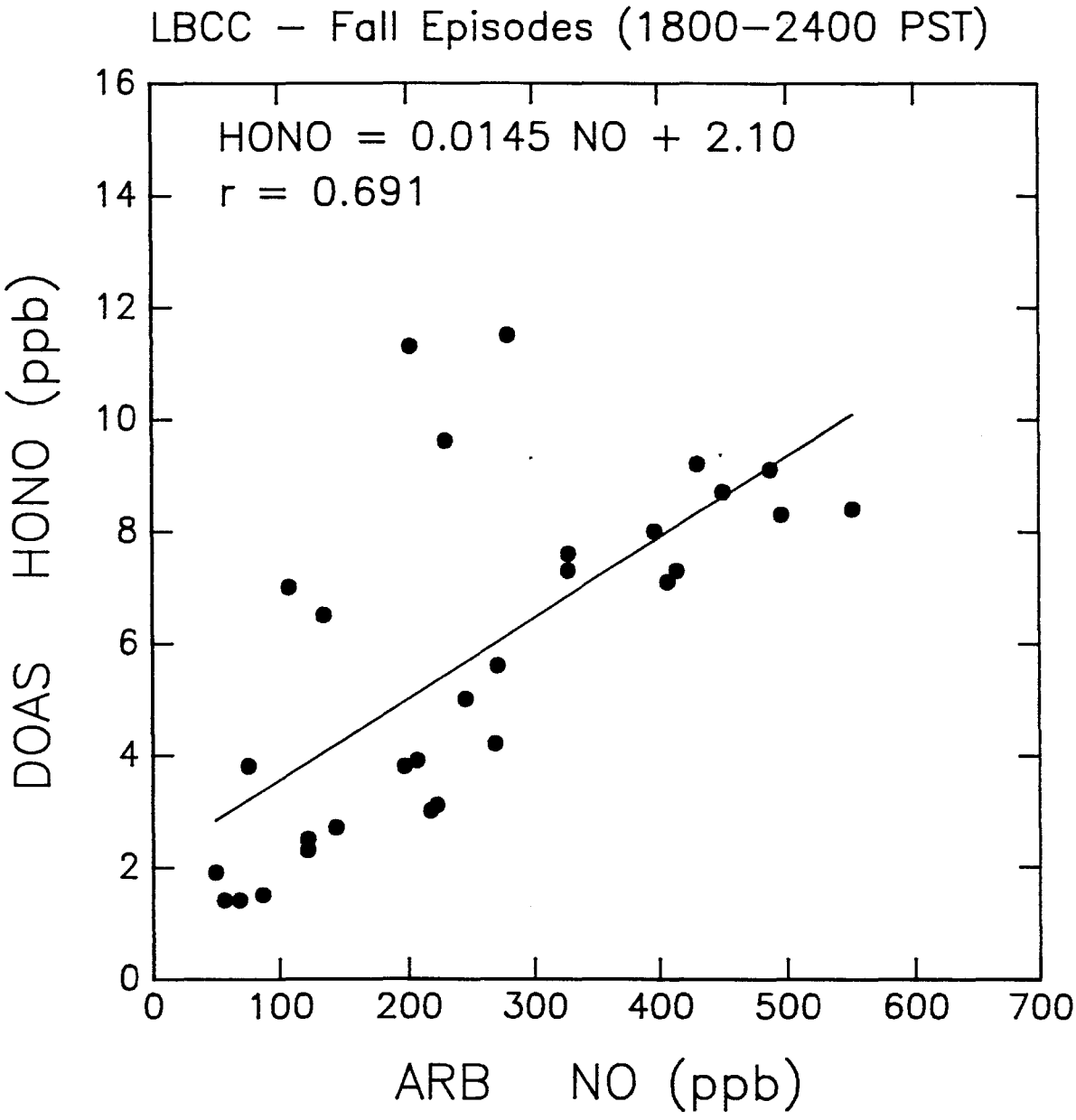

Figure VI-12. Linear least squares fit of DOAS HONO vs ARB NO measured during six fall episodes at Long Beach.

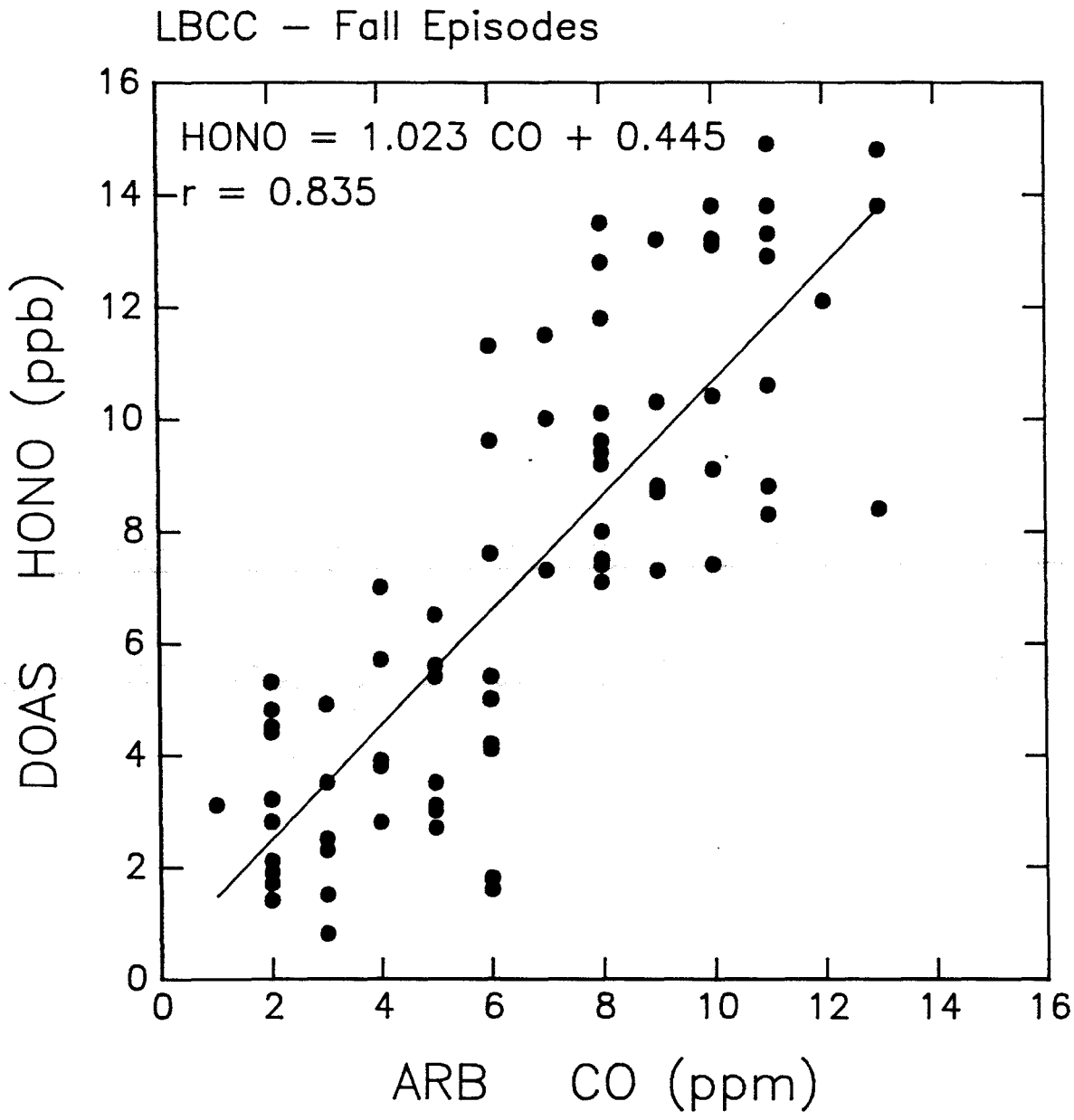

Figure VI-13. Linear least squares fit of DOAS HONO vs. ARB CO measured during six fall episodes at Long Beach.

Table VI-2. Factor Analysis for HONO During Fall SCAQS Long Beach and Winter Torrance Episodes (all data)

Variable	Site/Date	Correlation
NO	Long Beach/1987	0.90
NO	Torrance/1986	0.70
NO_2	Long Beach/1987	0.31
NO_2	Torrance/1986	0.28
CO	Long Beach/1987	0.84

Moreover, if all of the observed HONO formation (see Figures VI-14 to VI-16) was attributed to reaction (3), the heterogeneous formation from NO_2 and water vapor, then the apparent rate constants for formation, k_3, would be approximately a factor of two higher than observed in earlier chamber studies (Sakamaki et al. 1983; Pitts et al. 1984b) and previous field studies (Winer et al. 1987). For these reasons we further explored the origin of the highly elevated HONO concentrations observed during the fall Long Beach episodes by examining a relationship (Sjodin 1988) which includes a factor for direct, primary emissions of HONO

$$[HONO] = \alpha[NO_x] + k_3\,[NO_2] \cdot t \qquad (I)$$

where

$\alpha = \frac{[HONO]}{[NO_x]}$ ratio in combustion emissions, and

k_3 = rate constant for first order reaction of NO_2 to form HONO.

Dividing (I) by the ambient NO_x concentration at time t yields

$$\frac{[HONO]}{[NO_x]} = \alpha + k_3 \frac{[NO_2]}{[NO_x]} \cdot t \qquad (II)$$

where t is the time elapsed from the first measurable HONO concentrations (see, for example, Figures VI-14 to VI-16).

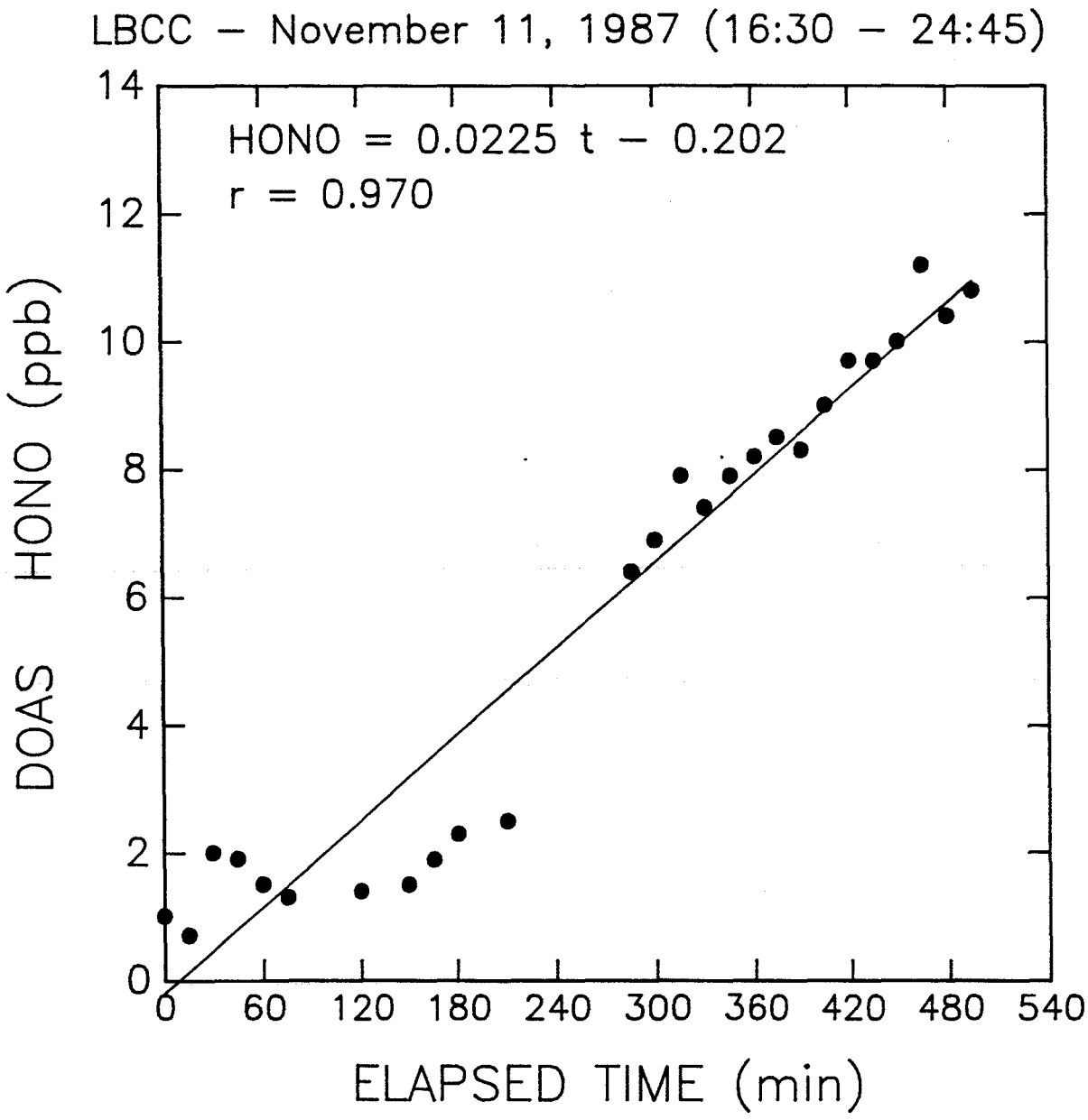

Figure VI-14. Growth in HONO concentration at Long Beach site from 16:30 to 24:45 on November 11, 1987.

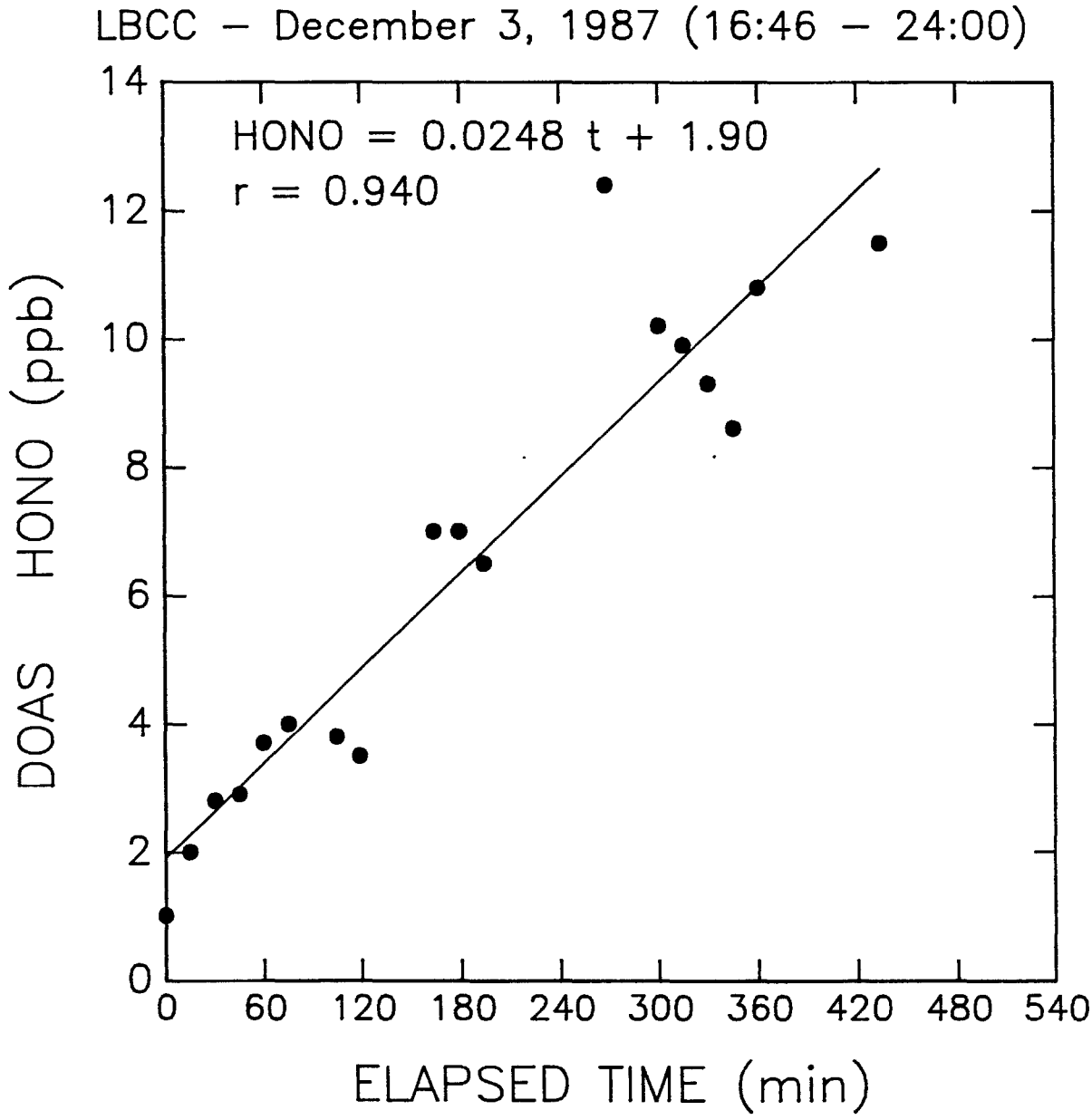

Figure VI-15. Growth in HONO concentration at Long Beach site from 16:46 to 24:00 on December 3, 1987.

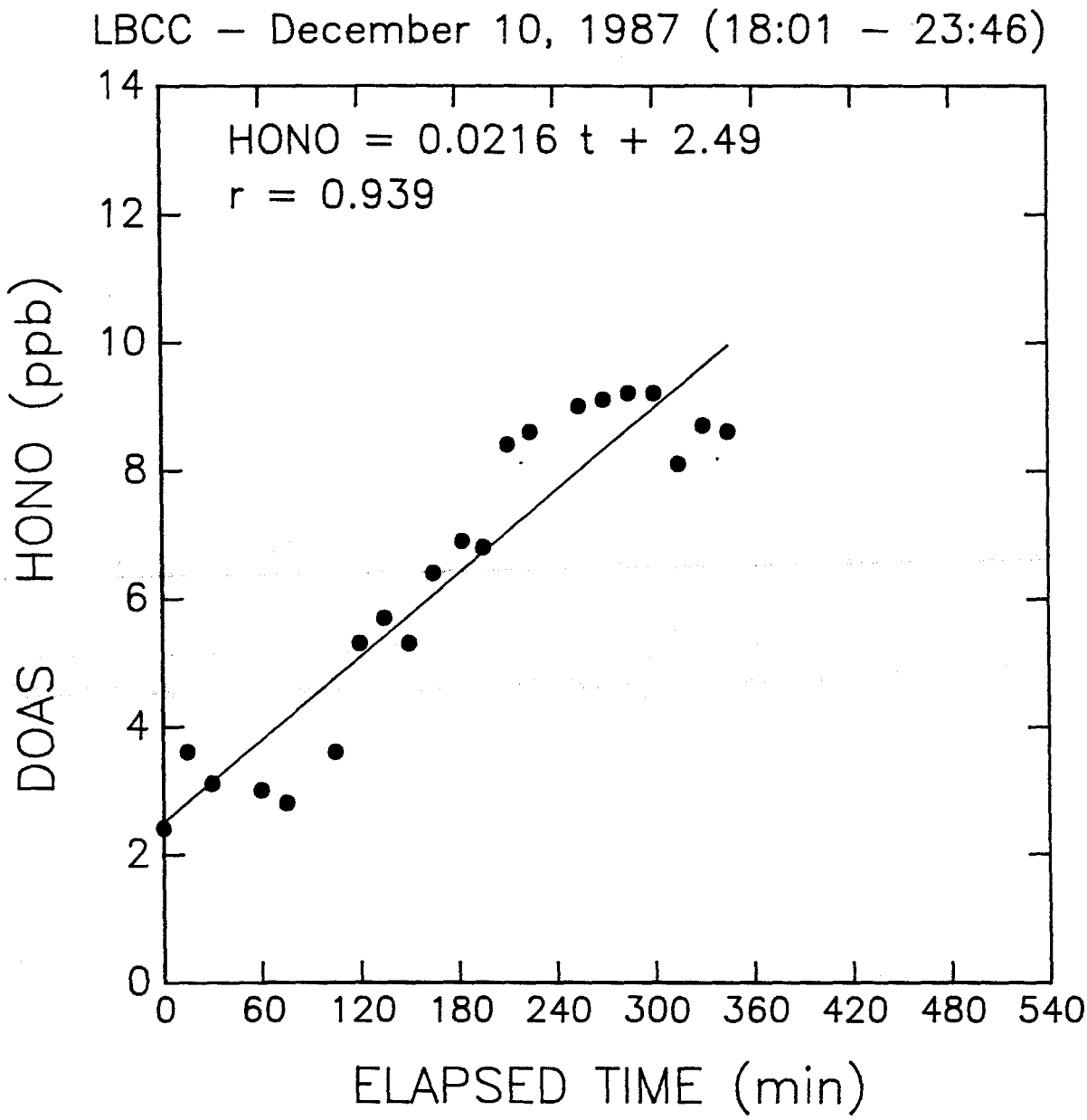

Figure VI-16. Growth in HONO concentration at Long Beach site from 18:01 to 23:46 on December 10, 1987.

Relationship I defines the partitioning of HONO, during the early evening periods of rapidly increasing concentrations, between primary emissions from combustion sources and heterogeneous formation via reaction (3). Relationship II can be used to calculate, for each period of increasing HONO, values of k_3 and α. Thus, by plotting the ratio of $HONO/NO_x$ against the product of $(NO_2/NO_x) \times t$, the slope yields values of k_3 while the intercept yields values of α. Figures VI-17 through VI-19 show such plots for three of the five fall episodes for which HONO was measured during the hours between sunset and midnight, along with the slopes and intercepts resulting from linear least squares fits of the data.

Table VI-3 lists the slopes and intercepts calculated from the DOAS HONO and ARB NO_x measurements for five fall episodes at Long Beach. As seen from Table VI-3, the mean value calculated for k_3 was 1.0% per hour, while the mean value for the HONO to NO_x ratio, α, was 0.8%. These values, derived from ambient air data obtained at Long Beach, are compared to previous determinations of k_3 from environmental chamber and ambient air studies (Table VI-4), and of α from both vehicle and engine emission studies and measurements along a highway (Table VI-5).

As seen from Table VI-4, the value of the heterogeneous formation rate for HONO derived from the Long Beach SCAQS data falls slightly above the upper value from earlier studies, while the value derived for the amount of HONO emitted as a fraction of NOx from combustion sources (Table VI-5) falls within the range of values of α determined in a variety of earlier studies. Clearly, the fact that values derived for k_3 and α by this indirect method are in apparent agreement with those derived from previous studies, does not prove that HONO concentrations observed at Long Beach during the fall SCAQS episodes result partially from secondary formation and partially from direct emissions. In particular, the role of aerosol loadings and water vapor concentrations must be explored more fully with respect to their influence on the effective rate of reaction (3). On the other hand, the above analysis suggests that at least a portion, and perhaps as much as a third to a half, of the highly elevated HONO concentrations measured at Long Beach during the fall episodes are consistent with the influence of primary emissions of HONO from combustion sources known to emit nitrous acid, including motor vehicles. For an

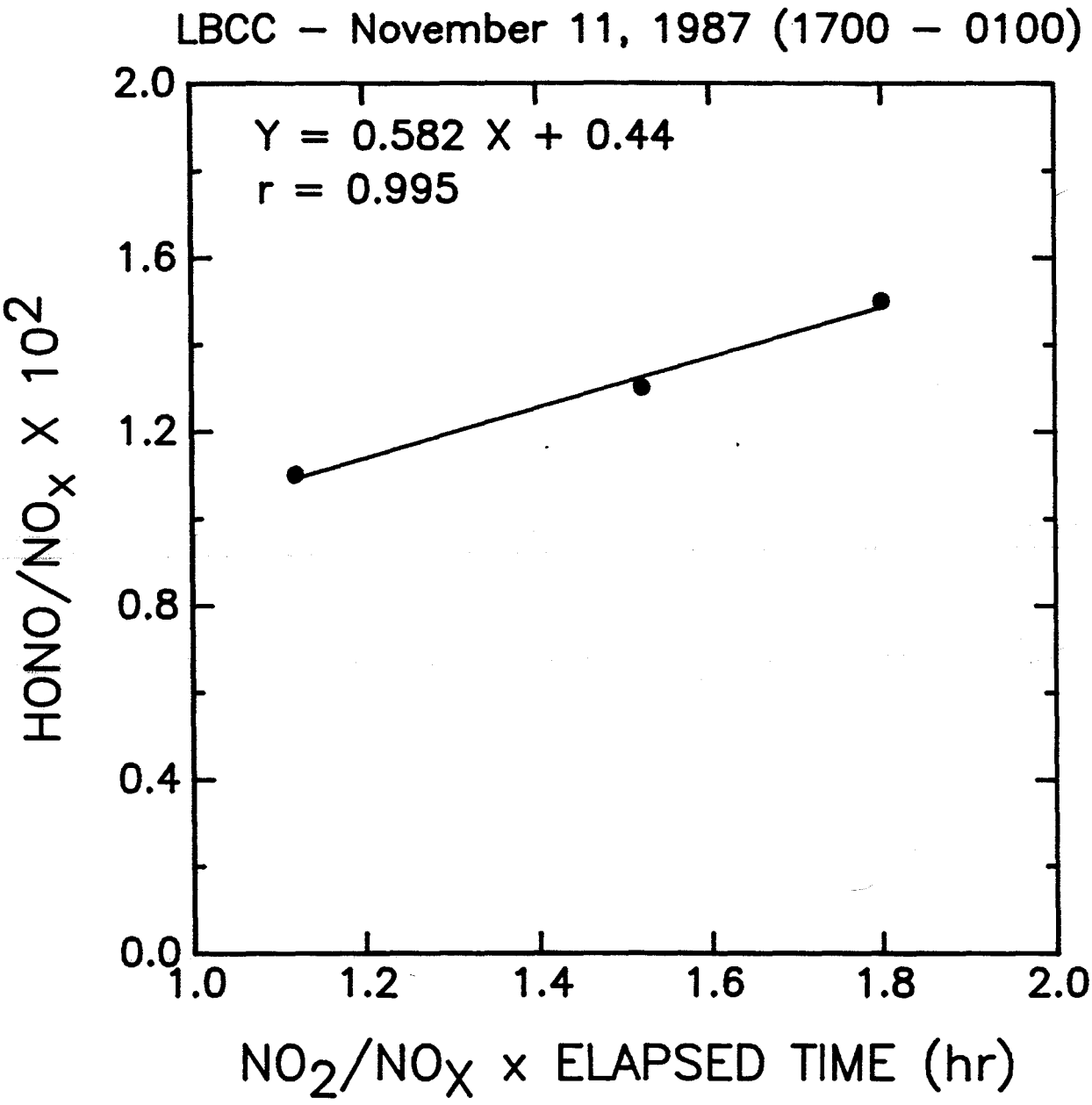

Figure VI-17. Linear least squares fit of $HONO/NO_x$ vs. (NO_2/NO_x) x t for November 11, 1987 at Long Beach.

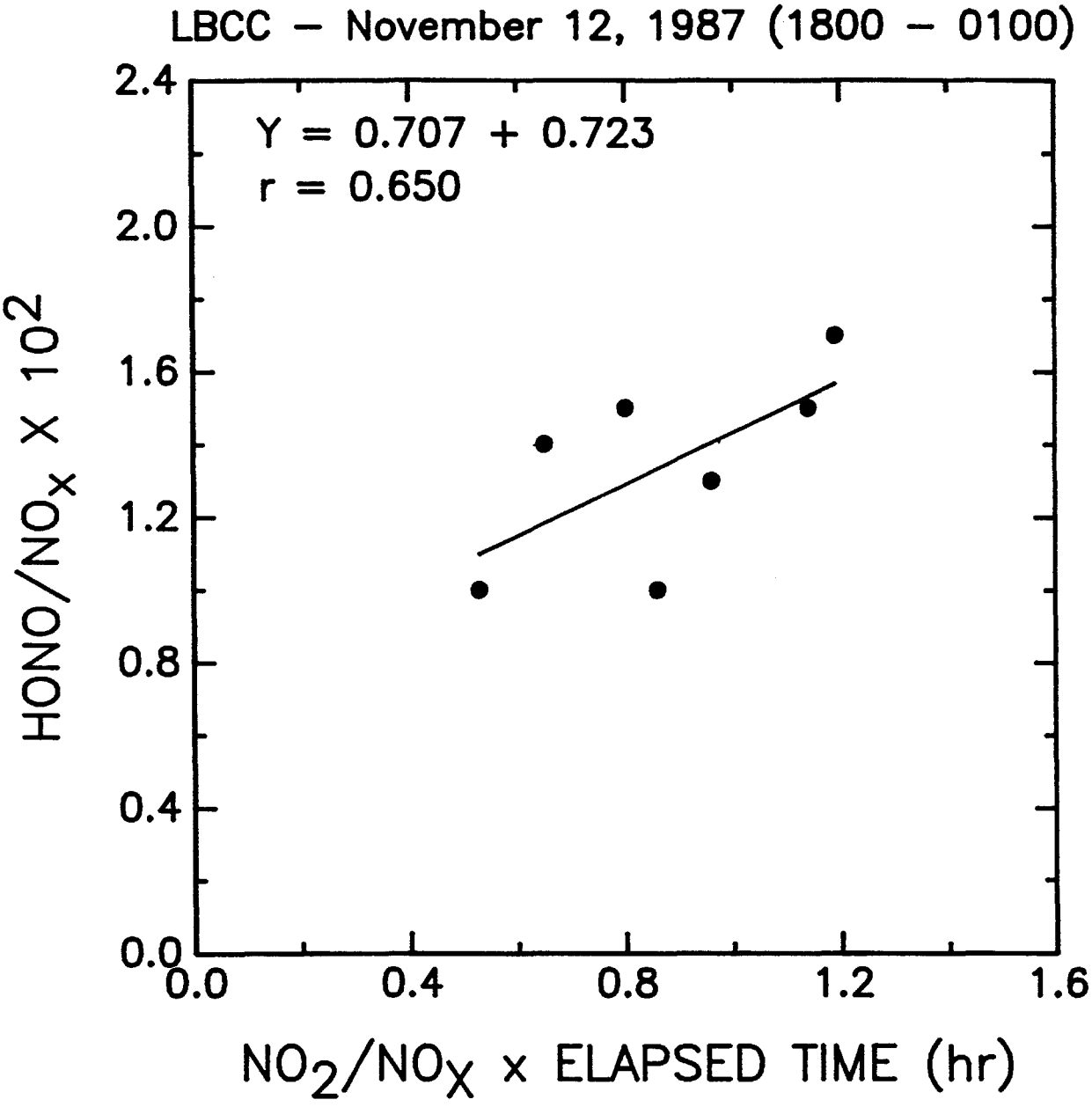

Figure VI-18. Linear least squares fit of $HONO/NO_x$ vs. (NO_2/NO_x) x t for November 12, 1987 at Long Beach.

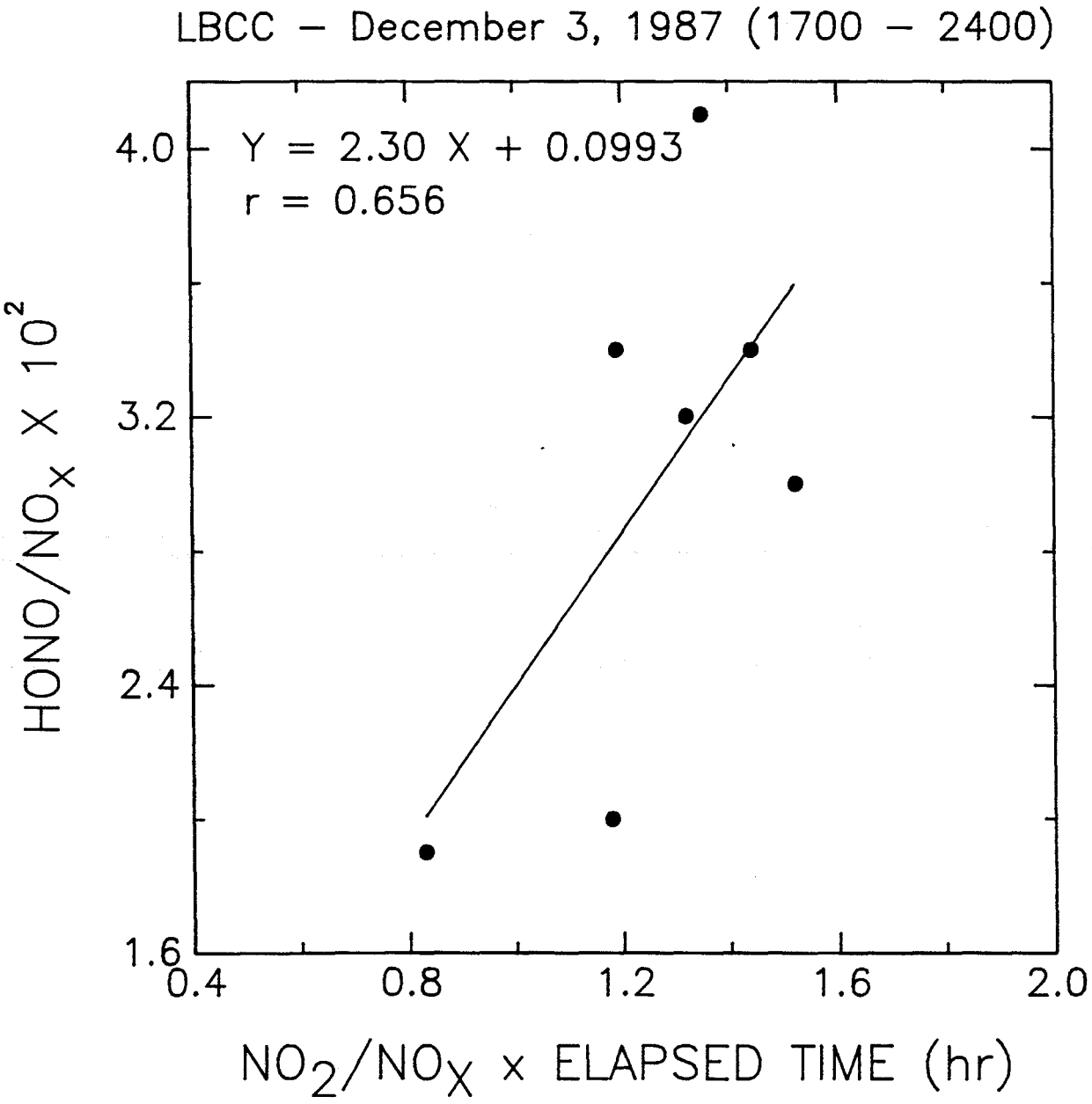

Figure VI-19. Linear least squares fit of $HONO/NO_x$ vs. (NO_2/NO_x) x t for December 3, 1987 at Long Beach.

Table VI-3. Values of Slopes and Intercepts Calculated from Least Squares Fits of Data Plotted According to Relationship II (see text)

Long Beach Fall Episode (1987)	k_3 (% hr^{-1})	$\alpha = \frac{[HONO]}{[NO_x]}$ comb (%)
Nov. 11	0.6	0.4
Nov. 12	0.7	0.7
Dec. 3	2.3	0.1
Dec. 10	1.0	1.2
Dec. 11	0.6	1.5
Mean Values	1.0	0.8

Table VI-4. Heterogeneous Formation Rates for HONO from Previous Research Compared with Present Study

System	k_3 (% hr^{-1})	Reference
Environmental chambers	0.6	Pitts et al. (1984)
Environmental chamber	0.6	Sakamaki et al. (1983)
Ambient air	0.6	Kessler et al. (1984)
Ambient air	0.8	Sjodin (1988)
Ambient air	1.0	SCAQS-DOAS Long Beach (1987)

Table VI-5. HONO Emitted as a Fraction of Vehicle Exhaust NO_x

System	$\alpha = \frac{[HONO]}{[NO_x]}$ (%)	Reference
Variety of vehicles	0.2 - 0.8	Pitts et al. (1984)
Diesel engine	1	Kessler and Platt (1984)
Gasoline engine	0.2	Kessler and Platt (1984)
Highway	0.5	Kessler and Platt (1984)
Ambient air	0.8	SCAQS-DOAS Long Beach (1987)

early evening period in which the average NO_2 and NOx concentrations were 80 and 500 ppb, respectively, approximately 60% of the 10 ppb of HONO accumulated by midnight would have been formed from reaction (3), while approximately 40% could have resulted from direct emissions of HONO:

$$[HONO]^{Accum}_{Midnight} \simeq 1\%\ hr^{-1} \times 80\ ppb\ NO_2 \times 7\ hr + 0.8 \times 500\ ppb\ NO_x$$
$$\simeq 6\ ppb + 4\ ppb$$
$$\simeq 10\ ppb$$

Finally, we emphasize that although Table VI-5 refers only to mobile emission sources, based on our studies of HONO emissions from residential combustion sources (Pitts et al. 1985, 1989), we conclude that stationary NO_x sources may also contribute to direct emissions of HONO into ambient air.

C. Intercomparison with Other Measurement Methods

With the exception of the NO_3 radical, for which only the DOAS technique could provide measurements, the remaining atmospheric compounds accessible to the DOAS technique were measured by one or more other research groups during at least one phase of the SCAQS program. Table VI-6 indicates the analytical methods employed by other investigators for NO_2, HONO and HCHO, and the location and period for these measurements. The only alternative determination of HONO during SCAQS was that of Appel and co-workers who employed an annular denuder technique with a 4- or 6-hr

Table VI-6. Potential Intercomparisons with DOAS Measurements During SCAQS Program

Atmospheric Species	Measurement Method	Research Group	Investigators	Location	Period
HONO	Annular Denuder (4-6 hr averaging time)	Air Industrial Hygiene Laboratory	Appel	Long Beach	Fall
HCHO	Tunable Diode Laser	Unisearch	Mackey and Schiff	Claremont Long Beach	Summer Fall
	Wet Chemical	ENSR	Fung, Collins and Wright	Long Beach Long Beach	Summer Fall
NO_2	Chemiluminescence	ARB	Lawson	Long Beach	Summer
	Chemiluminescence	GMRL	Wolff, Korsog and Kelly	Claremont	Summer
NO_3 Radical	None	-			

averaging time (vs. 15-min for the DOAS technique) at Long Beach during the fall episodes. For the summer episodes at Long Beach and Claremont, only DOAS data are available for nitrous acid.

For HCHO, there was the potential for a three-way intercomparison of data obtained at Long Beach during the fall between ENSR, Unisearch and UCR-SAPRC, while during the summer intercomparisons were possible between the DOAS and TDLAS (Unisearch) data for HCHO at Claremont and between DOAS and a wet chemical method (ENSR) at Long Beach.

For NO_2, intercomparisons were possible between DOAS measurements and data obtained by both the ARB and General Motors Research Laboratories using chemiluminescence instruments. While other intercomparisons may be possible for NO_2, between the DOAS measurements and those made by other groups employing chemiluminescence instruments, we have (with permission from the respective investigators) used the ARB and GM data which were available from the SCAQS archive at the time this report was prepared.

In the following sections we discuss these intercomparisons, based on both linear regressions and comparisons of the time series data.

1. Nitrogen Dioxide

Agreement between measurements of NO_2 by the DOAS technique and the chemiluminescence instruments operated by the Air Resources Board and the the General Motors Research Laboratory were generally excellent for all three measurement periods: summer and fall at Long Beach, and during the summer at Claremont. For example, a linear least squares fit (Figure VI-20) of the GM NO_2 data vs. DOAS data at Claremont for the eleven summer episodes at Claremont yielded a slope of 0.89 and an intercept of +5 ppb, with a correlation coefficient of $r = 0.9$. Agreement to within ~10% is well within the combined estimated uncertainties of ~20% for the two measurement methods and, as seen in Figure VI-21, the 1-hr average time-concentration profiles for the two data sets overlapped well throughout the study, with no significant systematic biases.

This agreement is also satisfactory when it is remembered that at Claremont, during the evening hours, fewer than four 15-min integrated spectral records were recorded in the NO_2, HONO and HCHO spectral region, in order to allow measurement of nitrate radical concentrations at a longer wavelength region. Thus, during those evening periods when NO_2 concentrations were changing very rapidly, the 1-hr average DOAS NO_2

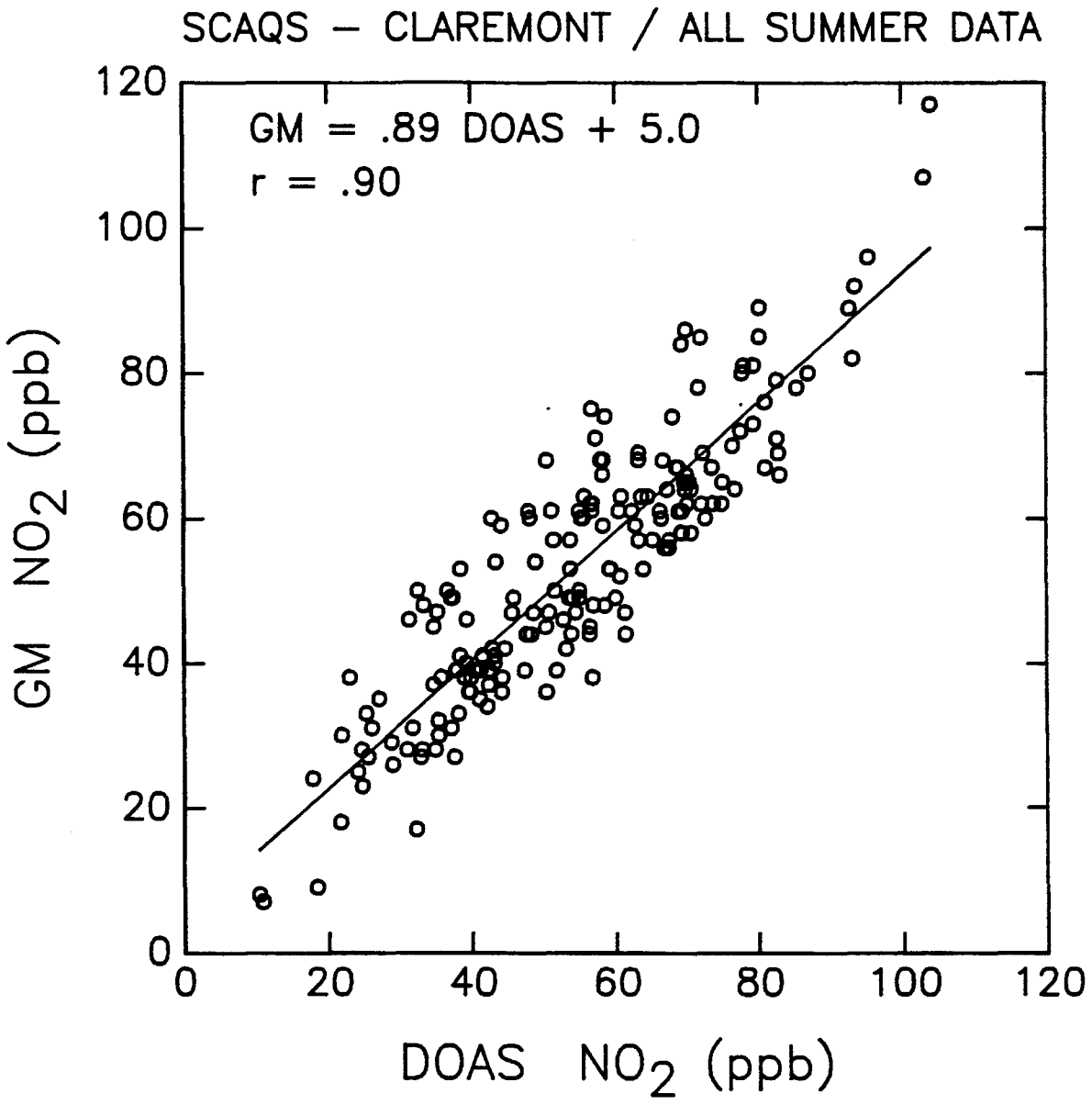

Figure VI-20. Linear least squares fit of GM NO_2 vs. DOAS NO_2 for SCAQS summer episodes at Claremont.

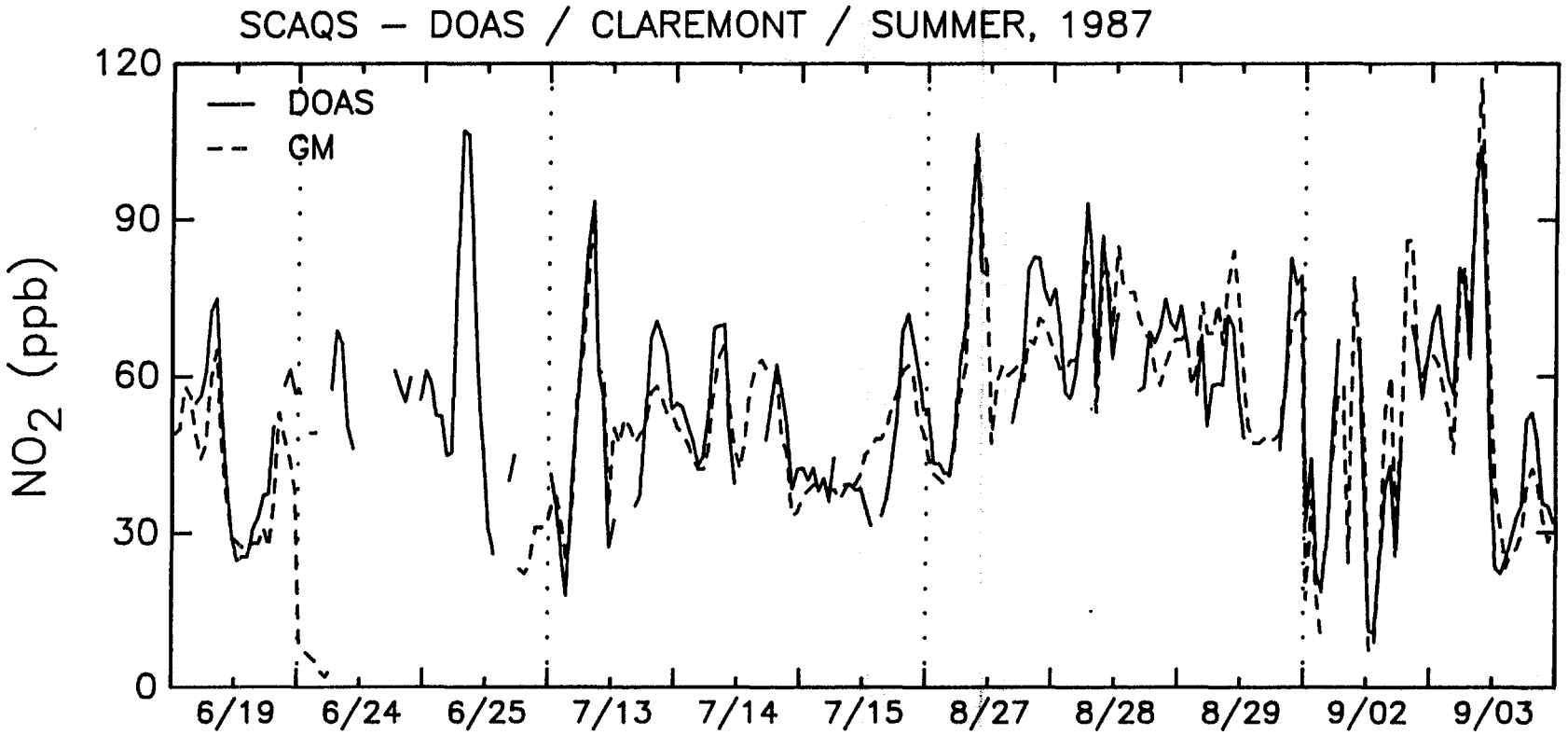

Figure VI-21. Comparison of DOAS and GM NO_2 time-concentration profiles for eleven SCAQS summer episodes at Claremont.

concentrations calculated from as few as one or two 15-min spectra would not necessarily be expected to agree perfectly with 1-hr averages calculated from continuous chemiluminescence measurements.

Due to the low pollution levels experienced during the summer episodes at Long Beach, all but a half dozen hourly average NO_2 concentrations fell below 80 ppb. For that reason, in addition to a linear regression of all ARB NO_2 concentrations against all DOAS NO_2 data (Figure VI-22), individual linear least squares fits are shown in Figures VI-23 through VI-27 for the August and September episodes which included the only significantly elevated pollutant concentrations at Long Beach during the summer study. As can be seen from these figures, and from Figure VI-28, the ARB and DOAS NO_2 data were highly correlated, with all but one correlation coefficient being 0.95 or higher, including the coefficient for the entire data set. Except for September 2, which was influenced by the highest chemiluminescence concentrations being significantly (i.e., ~20%) higher than the corresponding DOAS values, the two methods yielded results within 10% of each other, with a randomly varying intercept of less than 5 ppb.

A linear regression of ARB NO_2 data vs DOAS 1 hr average concentrations obtained at Long Beach during the fall episodes (Figure VI-29) yielded a slope of unity and an intercept of -9.6 ppb. As can be seen from the plot of the time-concentration profiles for these two data sets (Figure VI-30), the larger intercept obtained in this case resulted from the DOAS values being significantly higher than the corresponding chemiluminescence concentrations during three nights (Nov. 11/12 and Dec. 10). Agreement during the remaining periods was excellent between the two methods, leading to an overall correlation coefficient of 0.94.

In summary, the considerable attention paid to calibration, and other quality control measures, for chemiluminescence measurements of the oxides of nitrogen during the SCAQS program yielded NO_2 data which were generally in good agreement, and well correlated with, the absolute, in situ DOAS measurements.

2. Nitrous Acid

As noted earlier, only one method other than the DOAS technique was used to measure HONO during the SCAQS program and that was an annular

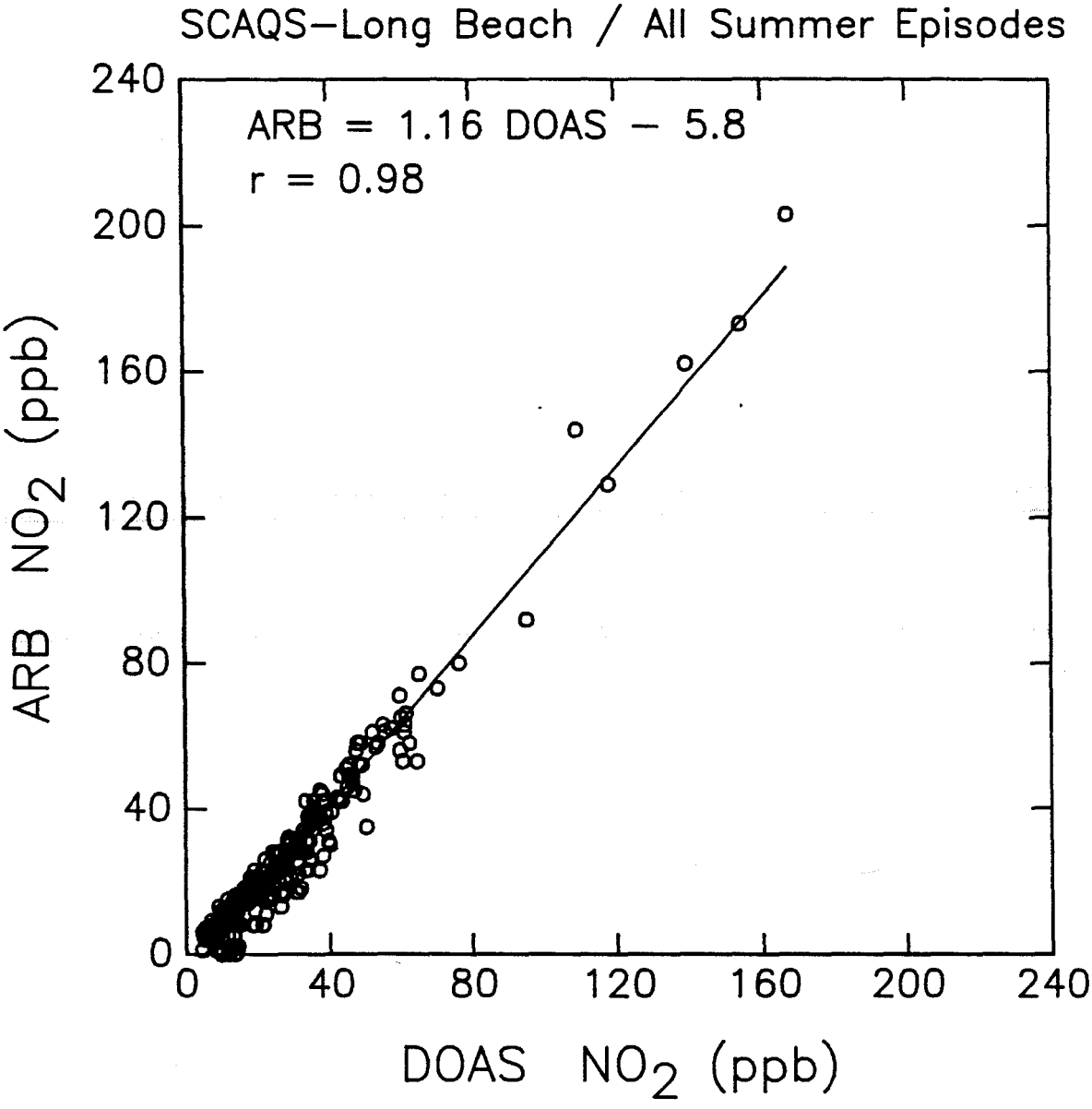

Figure VI-22. Linear least squares fit of ARB NO_2 vs. DOAS NO_2 for eleven SCAQS summer episodes at Long Beach.

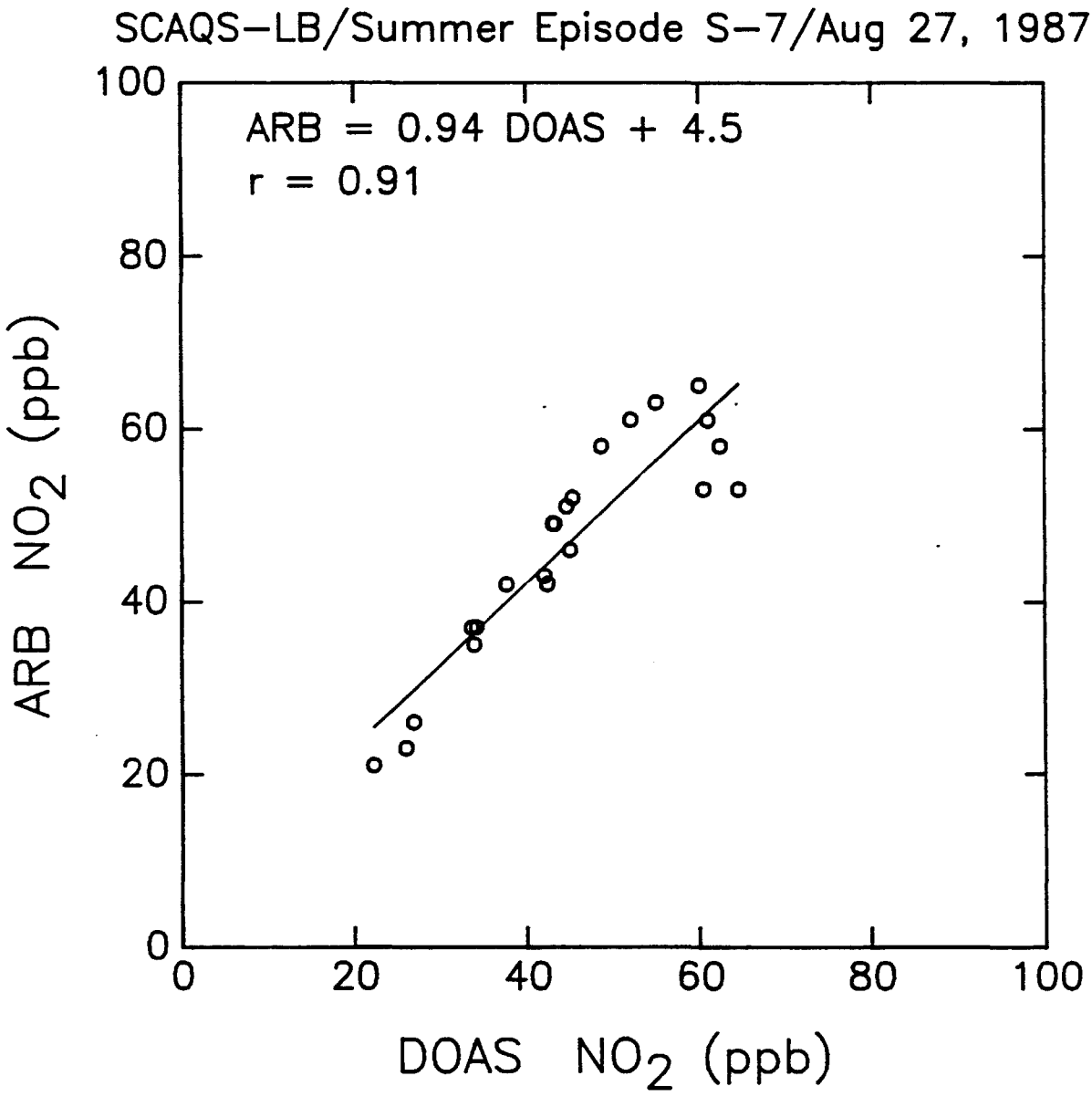

Figure VI-23. Linear least squares fit of ARB NO_2 vs. DOAS NO_2 for SCAQS episode S-7 at Long Beach.

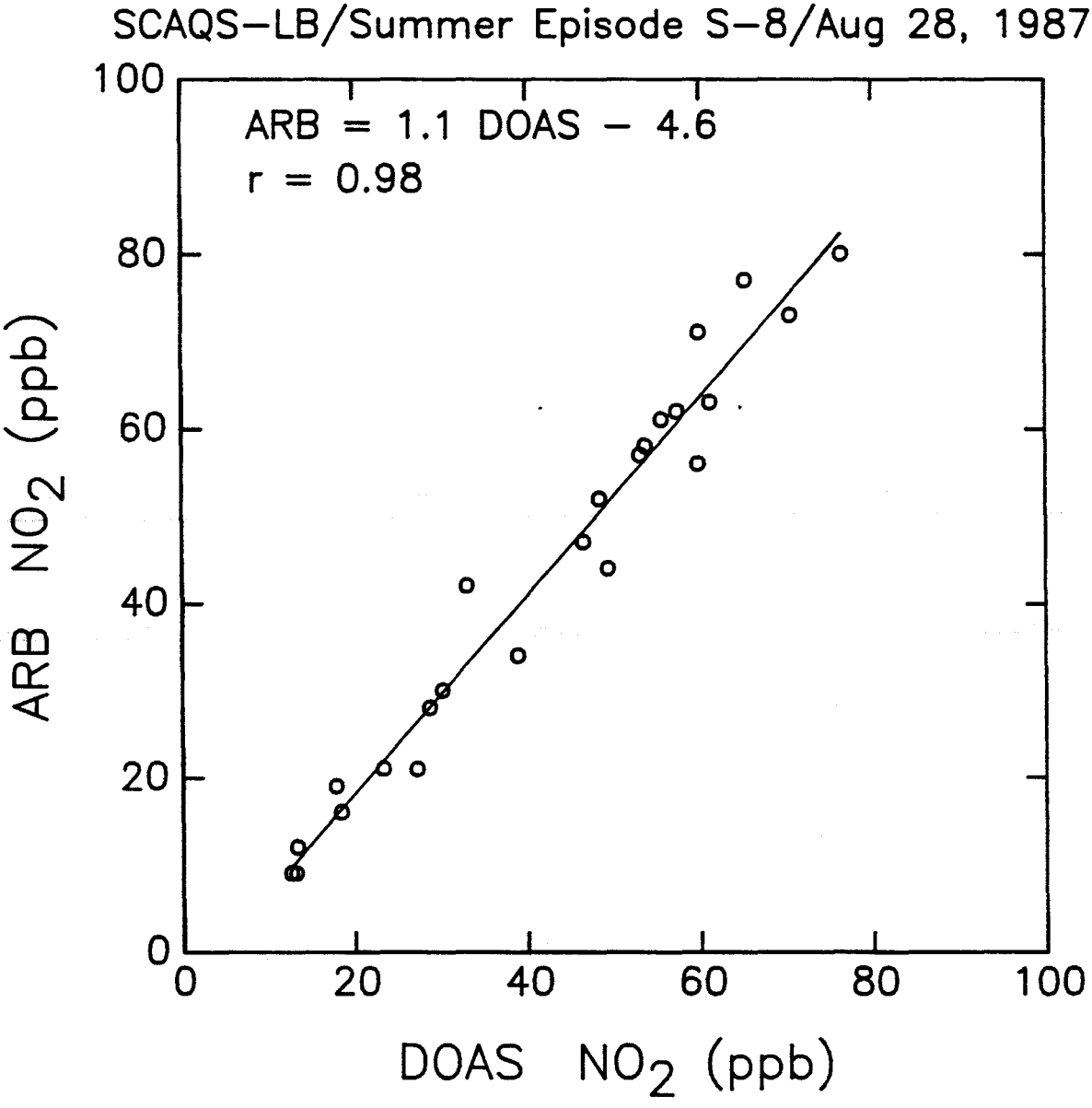

Figure VI-24. Linear least-squares fit of ARB NO_2 vs. DOAS NO_2 for SCAQS episode S-8 at Long Beach.

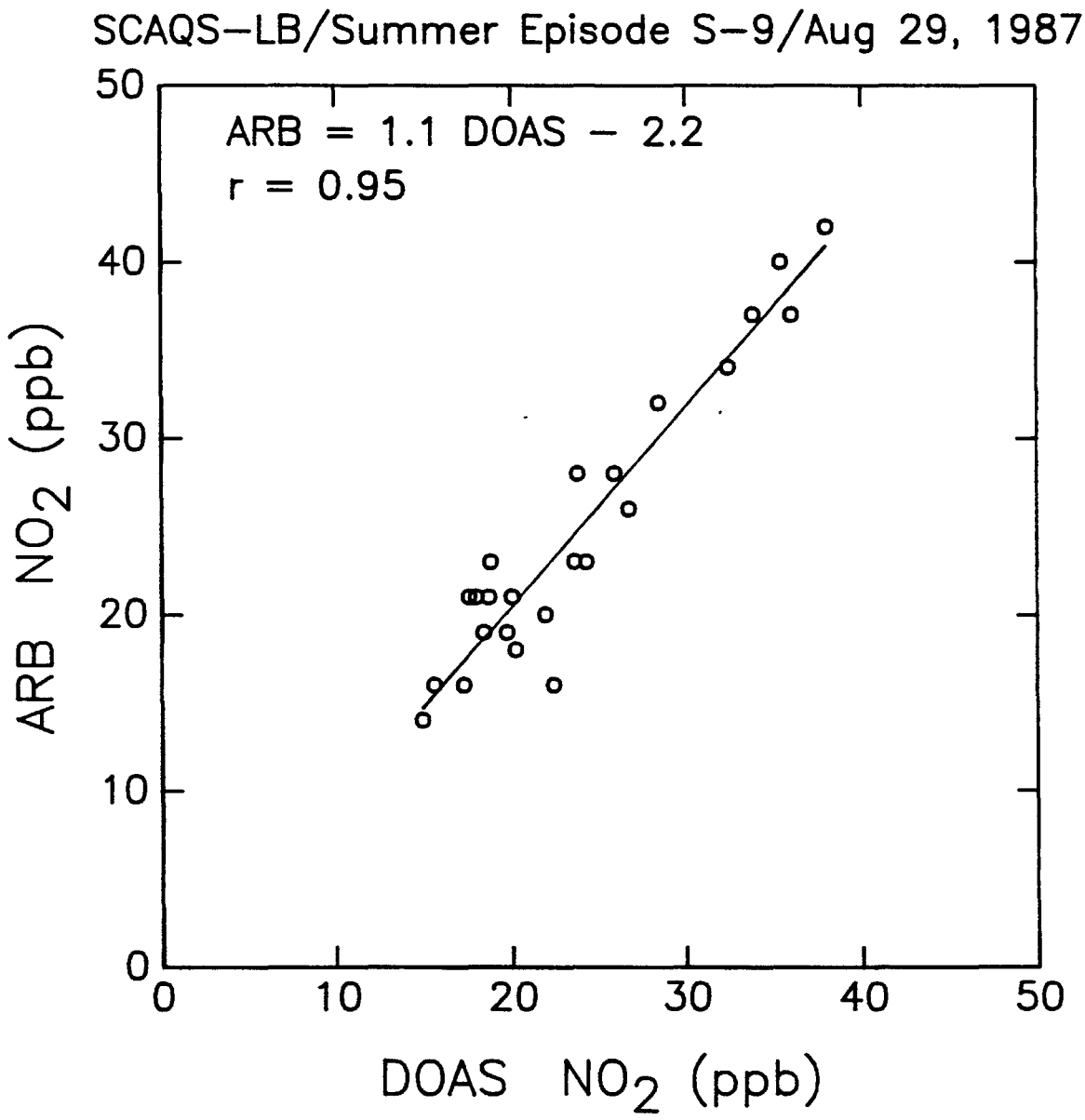

Figure VI-25. Linear least squares fit of ARB NO_2 vs. DOAS NO_2 for SCAQS episode S-9 at Long Beach.

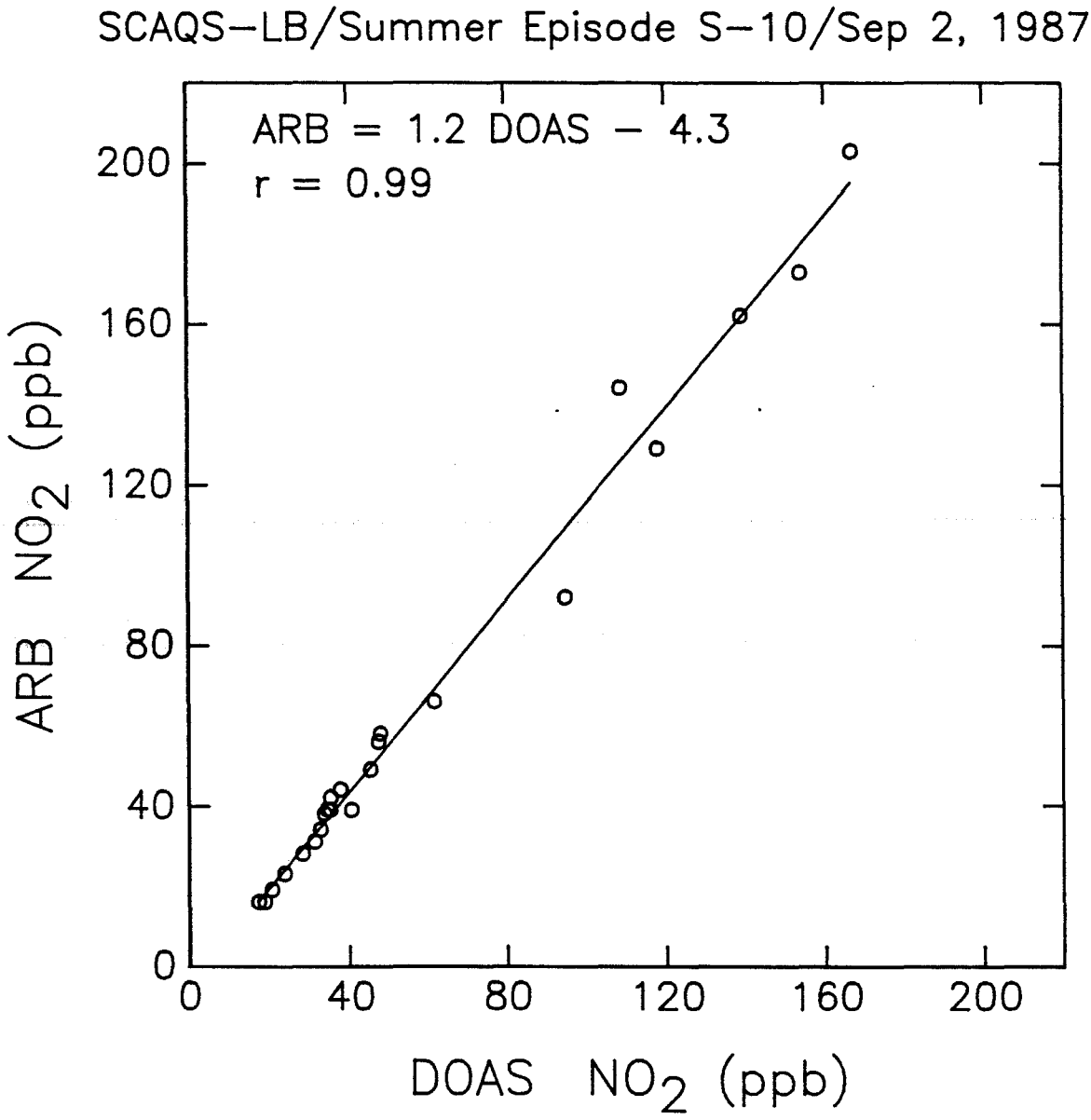

Figure VI-26. Linear least squares fit of ARB NO_2 vs. DOAS NO_2 for SCAQS episode S-10 at Long Beach.

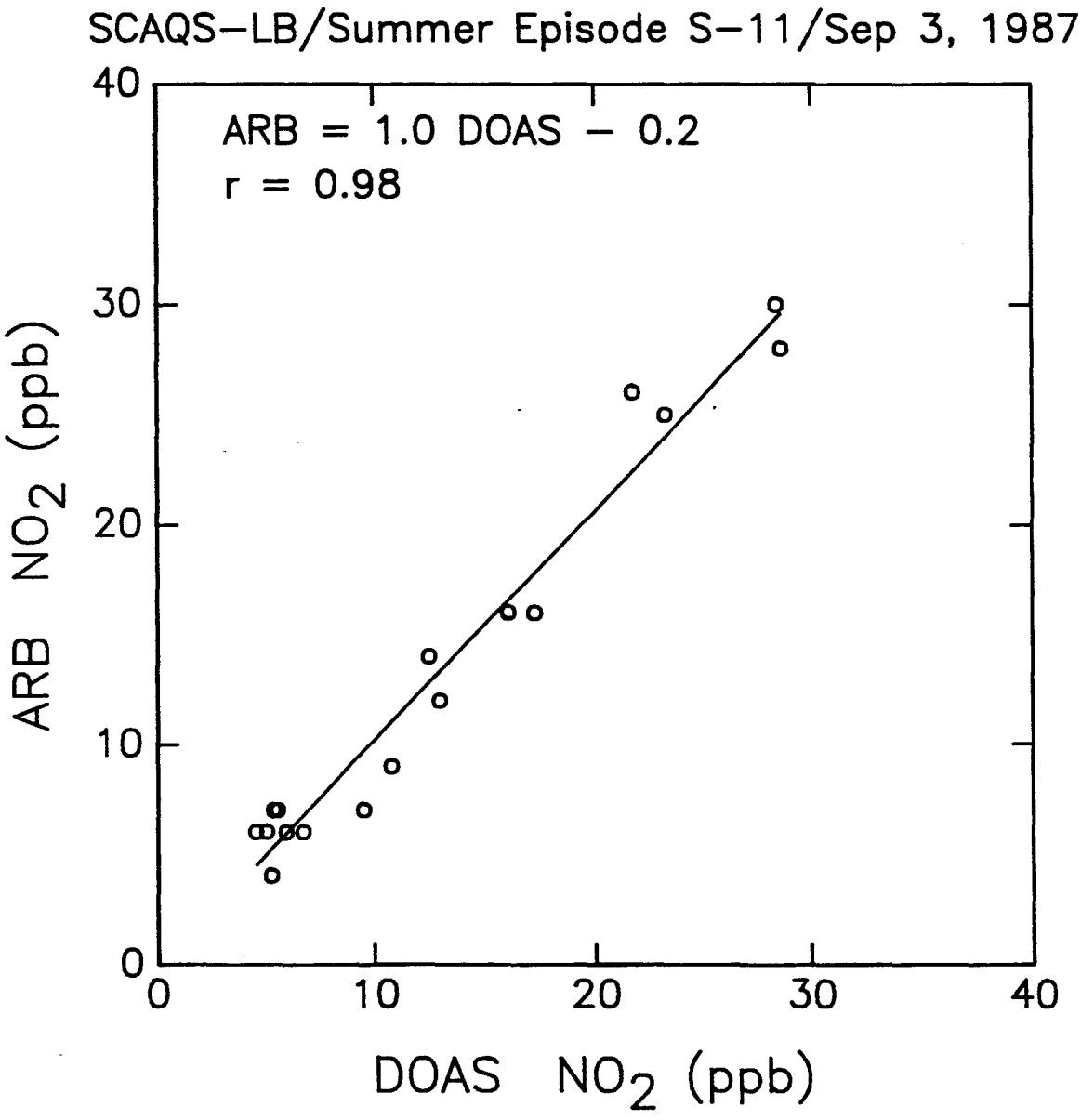

Figure VI-27. Linear least squares fit of ARB NO_2 vs. DOAS NO_2 for SCAQS episode S-11 at Long Beach.

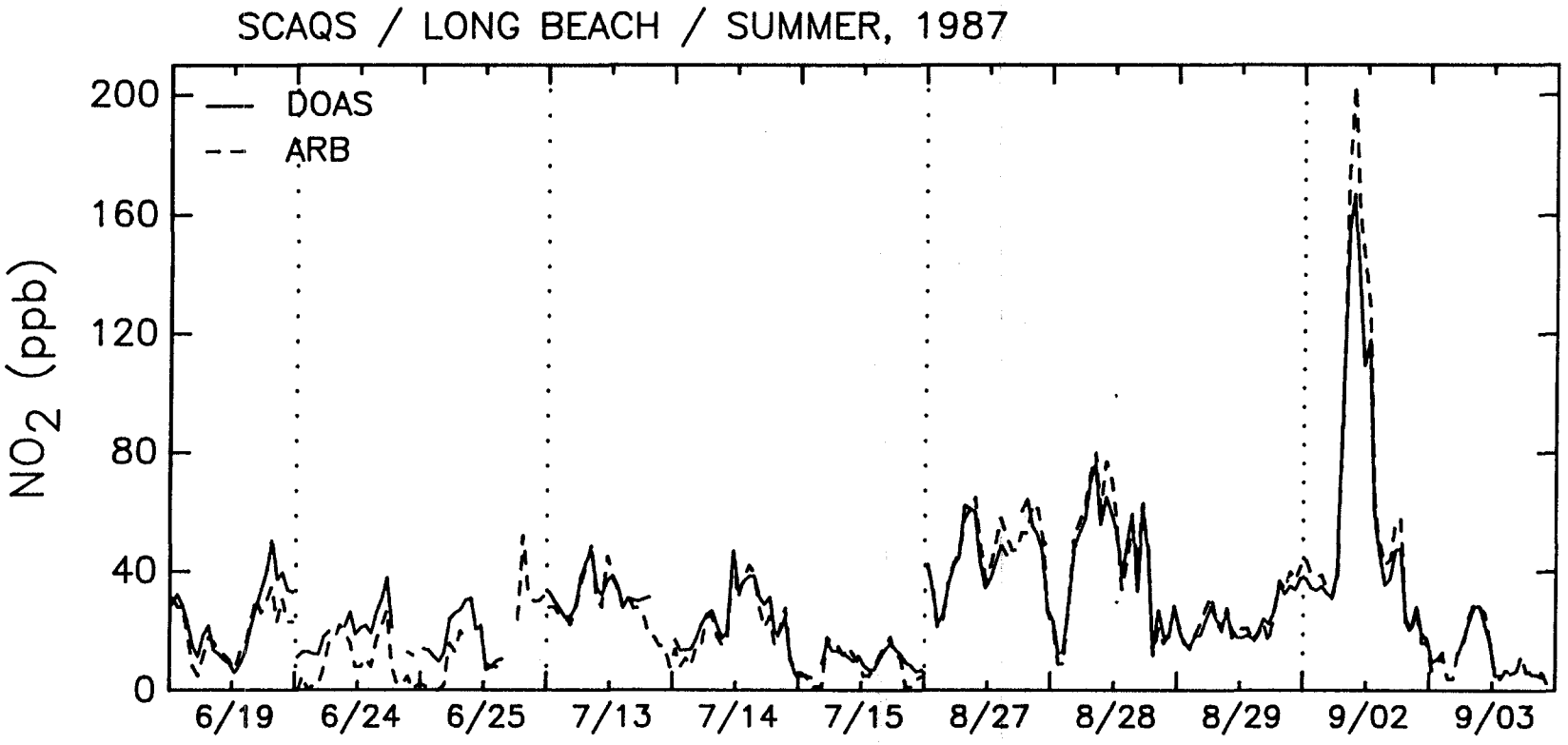

Figure VI-28. Comparison of DOAS and ARB NO_2 time-concentration profiles for eleven SCAQS summer episodes at Long Beach.

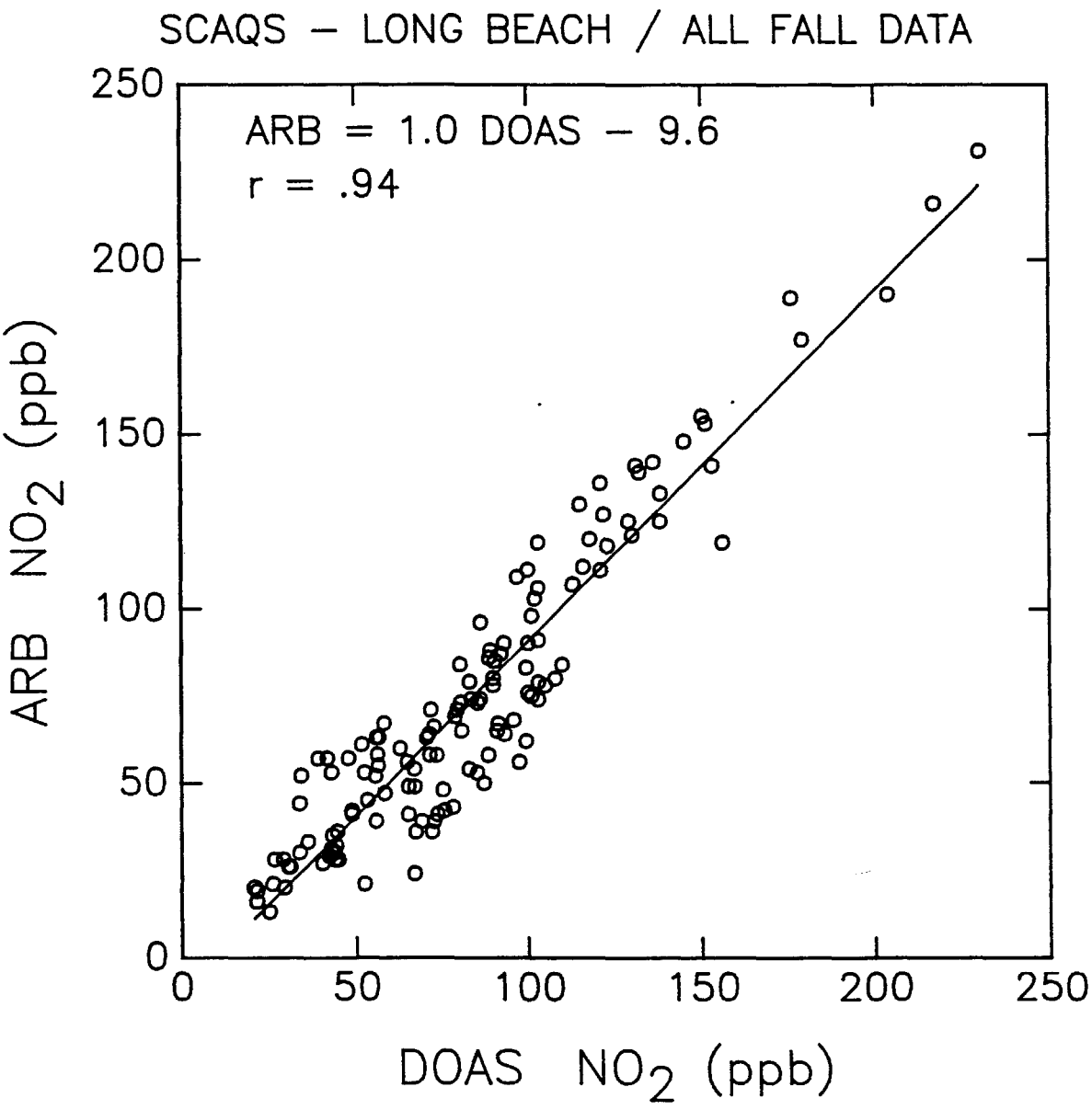

Figure VI-29. Linear least squares fit of ARB NO_2 vs. DOAS NO_2 for SCAQS fall episodes at Long Beach.

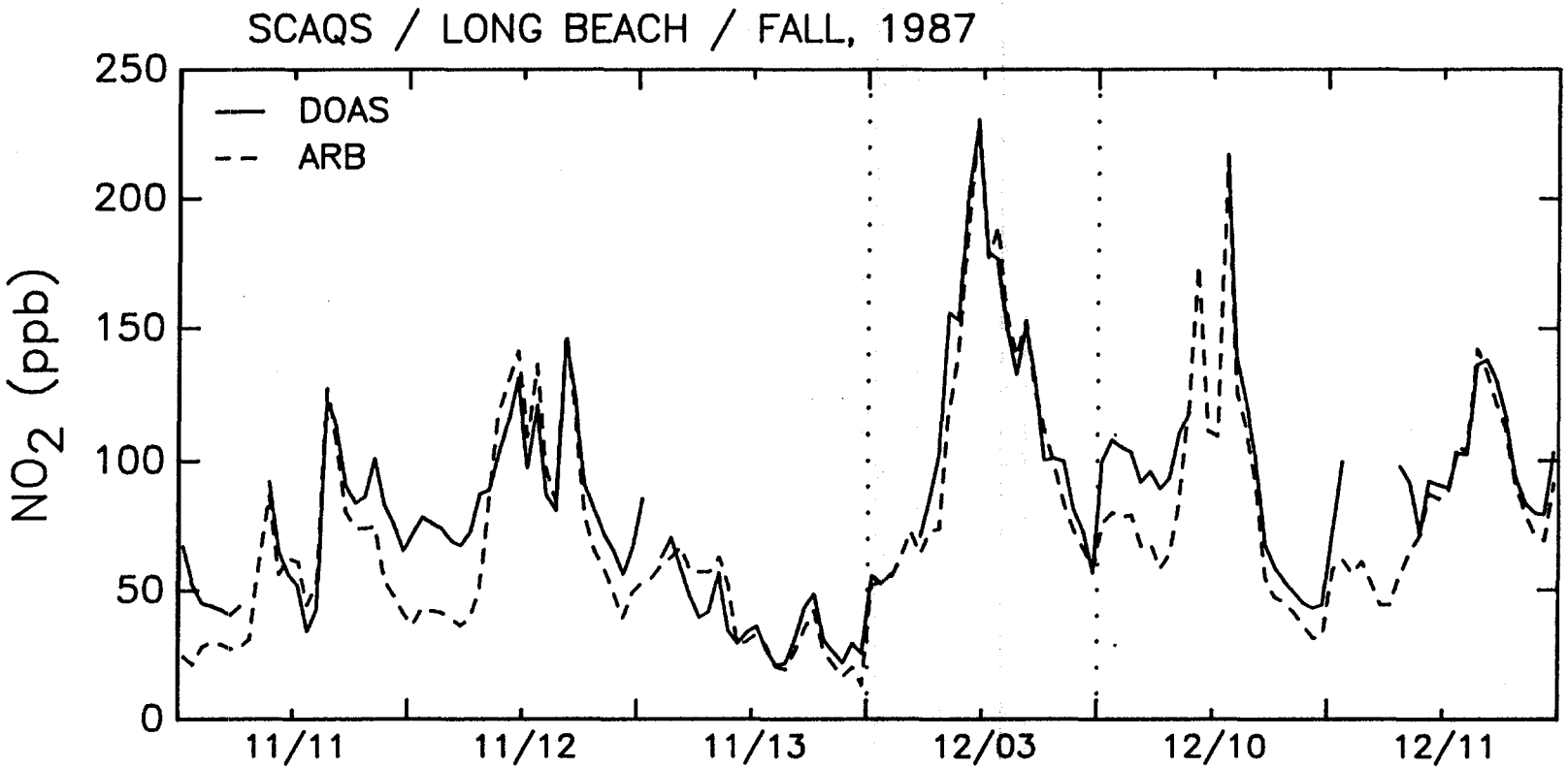

Figure VI-30. Comparison of DOAS and ARB NO_2 time-concentration profiles for six SCAQS fall episodes at Long Beach.

denuder method (ADM) operated by Appel and his co-workers (Appel et al. 1988) during the six fall episodes at Long Beach. Previous comparisons of atmospheric HONO measurements by two different research groups using the ADM yielded differences of a factor of two or more (Lawson 1986). Appel has suggested (Appel et al. 1989) that part or all of this difference might be due to artifactual nitrite formed on the sampler inlet surfaces. In the SCAQS program, Appel and co-workers employed a small Teflon-coated glass cyclone as the sampler inlet in order to exclude coarse particles and minimize possible artifact HONO formation. Thus, it was of considerable interest to compare the results obtained with the enhanced ADM approach with data from the spectroscopic DOAS technique.

At the Long Beach site, the DOAS and ADM instruments were located within about 10 m of each other, with the ADM inlet at a height of 1.5 m and the DOAS optical path at an average height of about 1.9 m. The ADM consisted of two denuders in tandem, coated with an alkaline medium to obtain four- or six-hour integrated samples. Nitrite recovered from the rear denuder was used to correct for sampling artifacts. Detailed descriptions of the experimental methods employed with the ADM, and analysis of the ADM results, are given elsewhere (Appel et al. 1988, 1989, 1990), and therefore are not repeated here.

In order to compare the DOAS HONO results obtained at Long Beach during the fall episodes with data from the ADM, the appropriate four- and six-hour averages were calculated from the 15 min DOAS data and these are given in Table VI-7, along with the corresponding results from the ADM. These values are also plotted in Figure VI-31, and a linear regression of these data showed that the ADM and DOAS HONO measurements were well correlated ($r = 0.94$) at higher concentrations above 4 ppb, with the DOAS results averaging 7% higher than the ADM during the periods of high HONO concentrations. Note that two "outlier" points listed in Table VI-7 (Dec. 10, 000-0600 and Dec. 11, 1800-2400) were not included in Figure VI-31, or the linear regression, since it was believed that the ADM samples were incorrectly processed in these cases. Moreover, as seen from Figure VI-32, for the mid-day periods the ADM exhibited significantly higher values, perhaps reflecting positive interferences in the ADM from species present during the daylight hours, since, as discussed in the preceding section, concentrations of HONO above the DOAS detection limit of 0.8 ppb

Table VI-7. HONO Concentrations Obtained by the ADM and DOAS Methods at LBCC During Fall SCAQS

Date (1987)	Episode	Period	HONO Concentrations (ppb) ADM[a]	DOAS[b]
Nov. 11	F-1	0000-0600	5.1	5.4
		0600-1000	2.5	1.7
		1000-1400	<0.6	<0.8
		1400-1800	1.4	<0.8
		1800-2400	4.9	5.0
Nov. 12	F-2	0000-0600	9.6	9.9
		0600-1000	6.0	5.0
		1000-1400	1.5	<0.8
		1400-1800	<0.6	<0.8
		1800-2400	6.9	2.8
Nov. 13	F-3	0000-0600	5.7	3.8
		0600-1000	4.5	2.0
		1000-1400	<0.6	<0.8
		1400-1800	<0.6	<0.8
		1800-2400	<0.6	<0.8
Dec. 3	F-4	0000-0600	14.3	12.8
		0600-1000	13.0	12.7
		1000-1400	3.6	.8
		1400-1800	2.6	.8
		1800-2400	8.8	8.3
Dec. 10	F-5	0000-0600	<0.4	13.5
		0600-1000	ND[c]	8.4
		1000-1400	1.7	<0.8
		1400-1800	2.9	<0.8
		1800-2400	9.7	6.2
Dec. 11	F-6	0000-0600	8.7	8.7
		0600-1000	7.5	4.4
		1000-1400	3.5	<0.8
		1400-1800	4.3	<0.8
		1800-2400	17.3	6.5

[a]Measured concentrations for corresponding sampling periods.
[b]Averages of concentrations determined for 15-min intervals within sampling period.
[c]No data available.

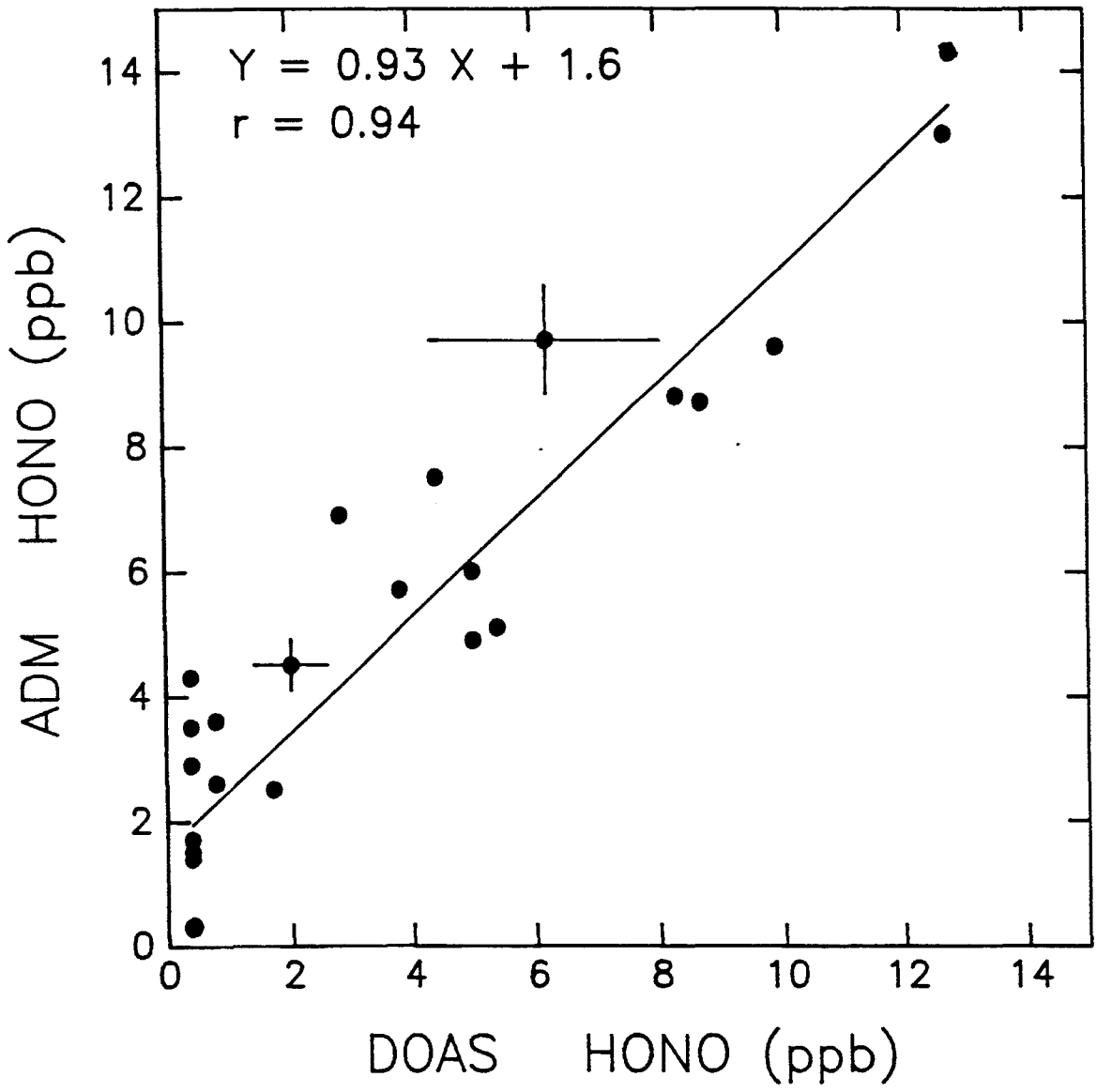

Figure VI-31. Linear least squares fit of ADM HONO vs. DOAS HONO for six SCAQS fall episodes at Long Beach. (Crosses indicate the respective ADM and DOAS uncertainties at two concentrations.)

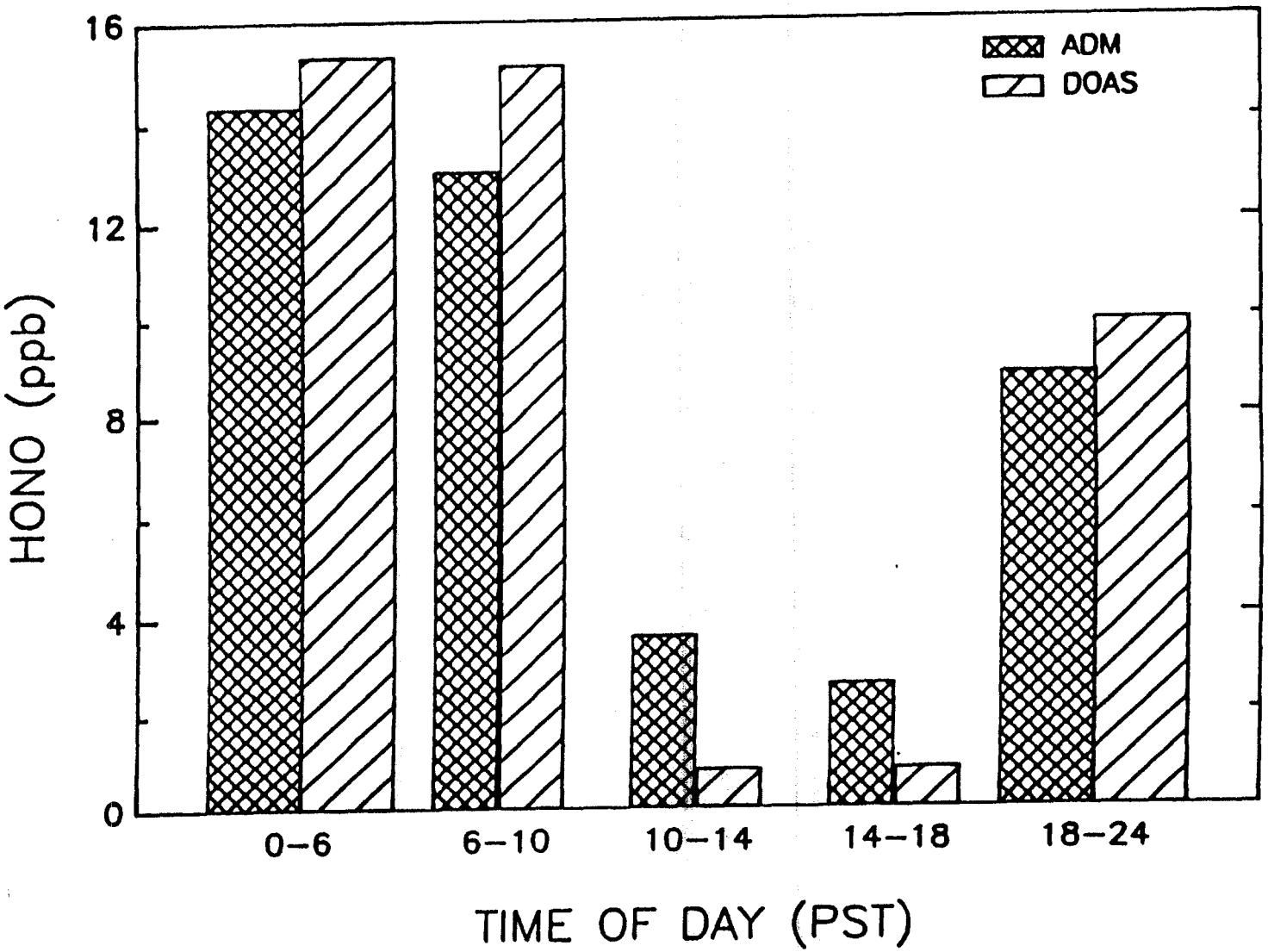

Figure VI-32. Diurnal profile of HONO concentrations measured by the ADM and DOAS for December 3, 1987 at Long Beach site.

were not expected under most of the daytime conditions prevailing during the fall SCAQS episodes. This suggests the need for further research on the ADM for applications at the range of HONO concentrations more typically encountered in ambient air.

3. Formaldehyde

Because HCHO is a relatively weak absorber in the near UV spectral region and exhibits relatively broad absorption bands, concentrations of HCHO determined by the DOAS technique under low pollution conditions are expected to be more scattered and have higher uncertainties, particularly during afternoon periods when signal degradation, due to heating of the DOAS optics and stray light influences, tend to be at a maximum. These factors explain at least part of the lower correlations and larger absolute differences observed for comparisons of DOAS HCHO measurements with those made by Unisearch with the TDLAS method at Claremont in the summer (Figures VI-33 and VI-34) and Long Beach in the fall (Figures VI-35 and VI-36). In the case of intercomparison of DOAS results for the summer episodes at Long Beach with HCHO data obtained by ENSR using a wet chemical technique it is not clear how much of the lack of correlation and larger absolute differences reflected in Table VI-8 and Figures VI-37 and VI-38 should be assigned to the respective methods, since the ENSR results for the fall episodes at Long Beach did not correlate at all with those obtained by DOAS and TDLAS (Fujita 1989).

Examining the comparison between TDLAS and DOAS data for Claremont, linear regression found the TDLAS concentrations overall to be 17 percent lower than the DOAS measurements, within the combined uncertainties of the two methods, and with only a 1 ppb intercept. From Figure VI-34, the DOAS and TDLAS time-concentration profiles appear well correlated during those periods when data were available from both methods, although the linear regression yielded an r value of only 0.76.

As noted for the NO_2 intercomparison for the Claremont episodes, some of the reduced correlation observed for HCHO measurements at Claremont may be due to the fact that during the evening periods only one or two 15-min spectra were available for calculating 1-hr average HCHO concentrations, since for the remainder of the time scans were being made in the NO_3

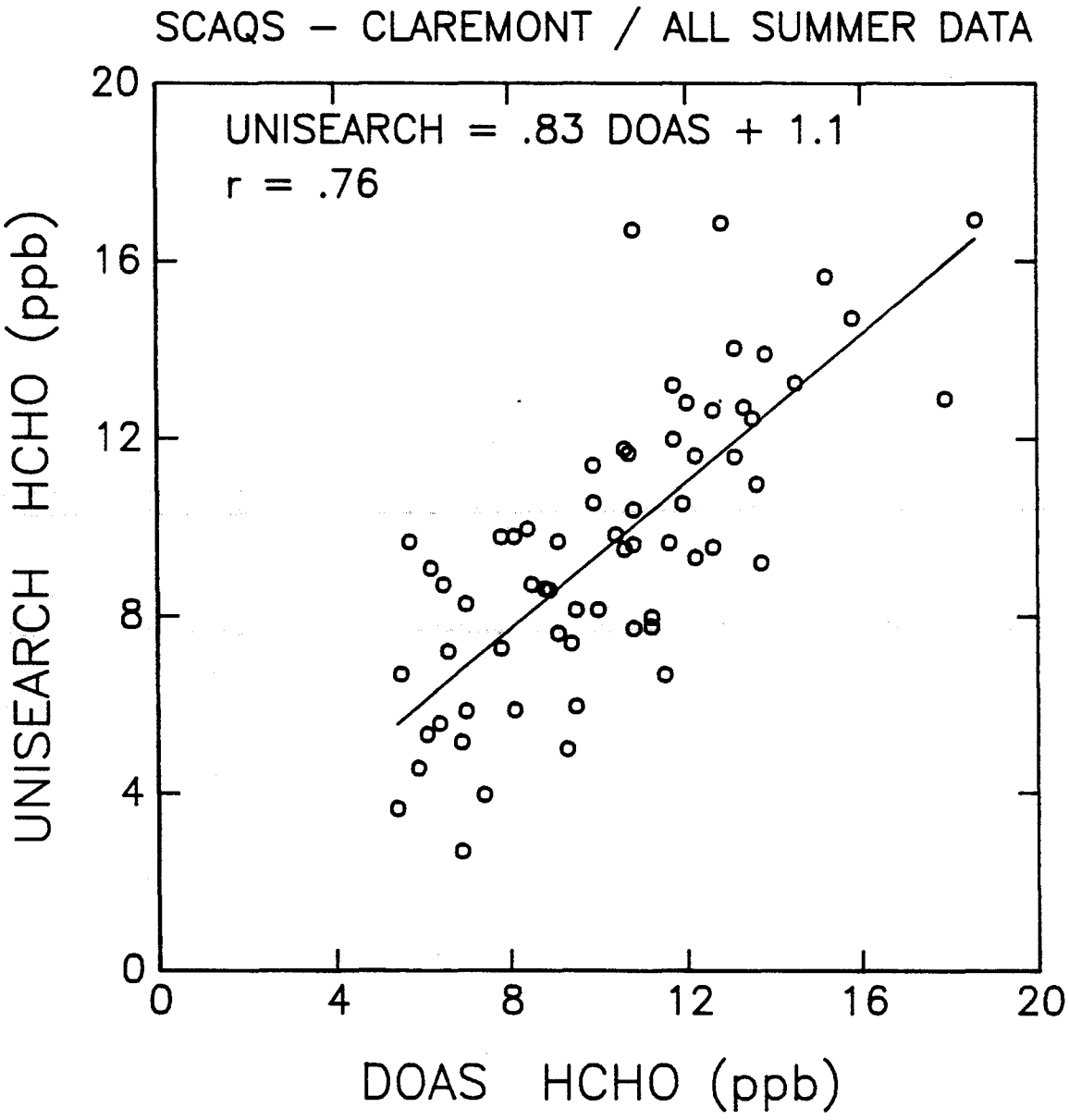

Figure VI-33. Linear least squares fit of Unisearch HCHO vs. DOAS HCHO for SCAQS summer episodes at Claremont.

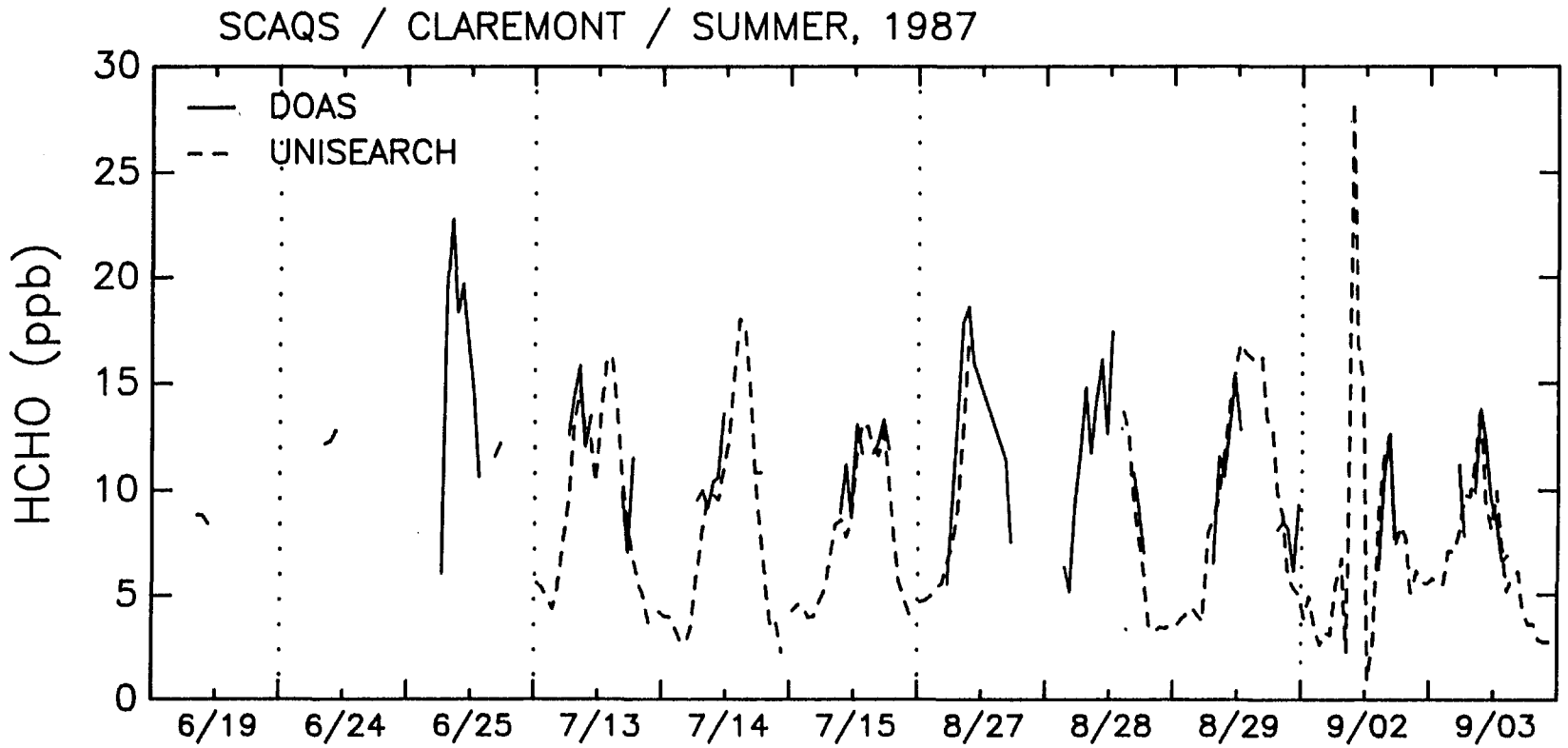

Figure VI-34. Comparison of Unisearch and DOAS HCHO time-concentration profiles for SCAQS summer episodes at Claremont.

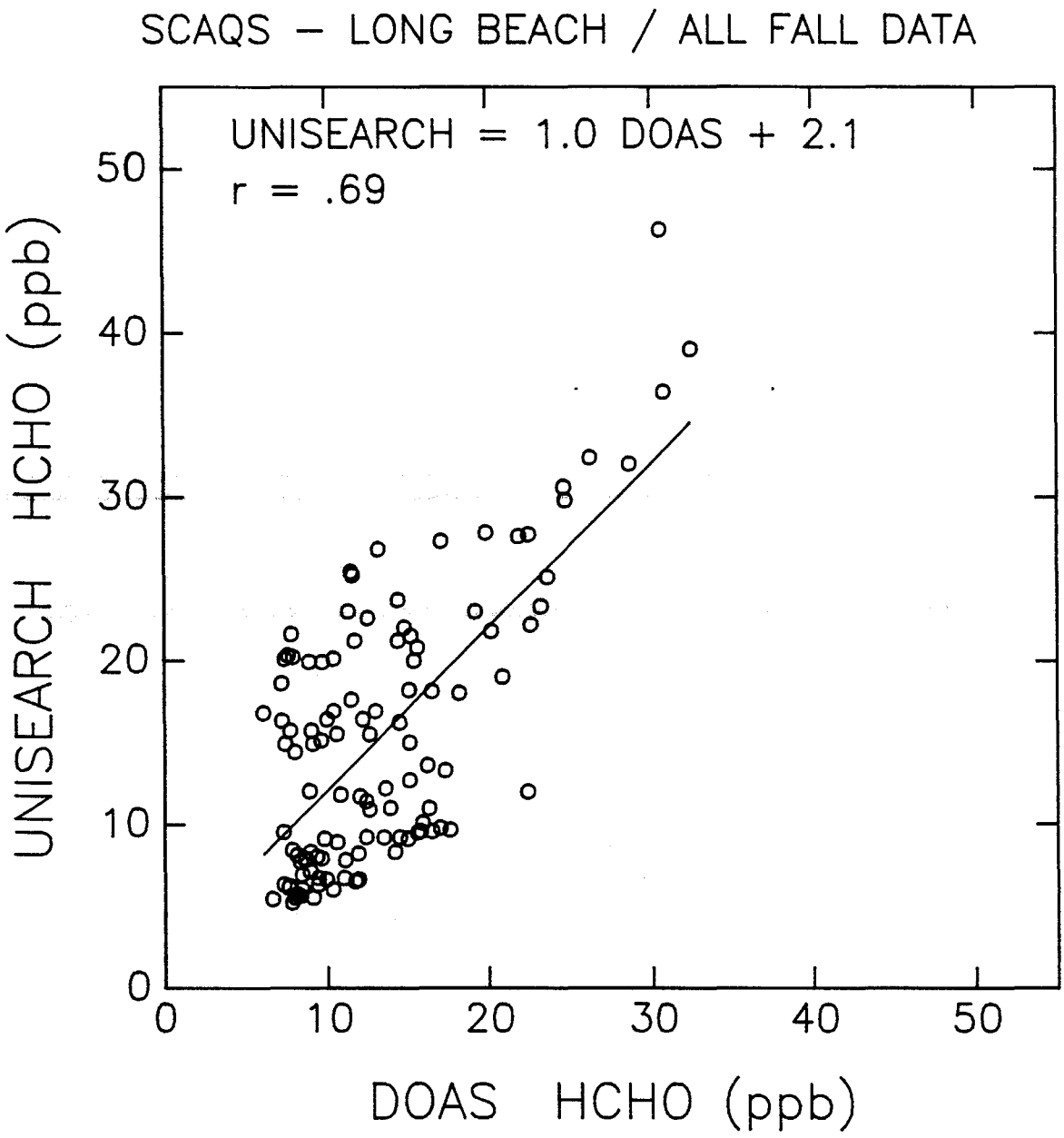

Figure VI-35. Linear least squares fit of Unisearch HCHO vs. DOAS HCHO for SCAQS fall episodes at Long Beach.

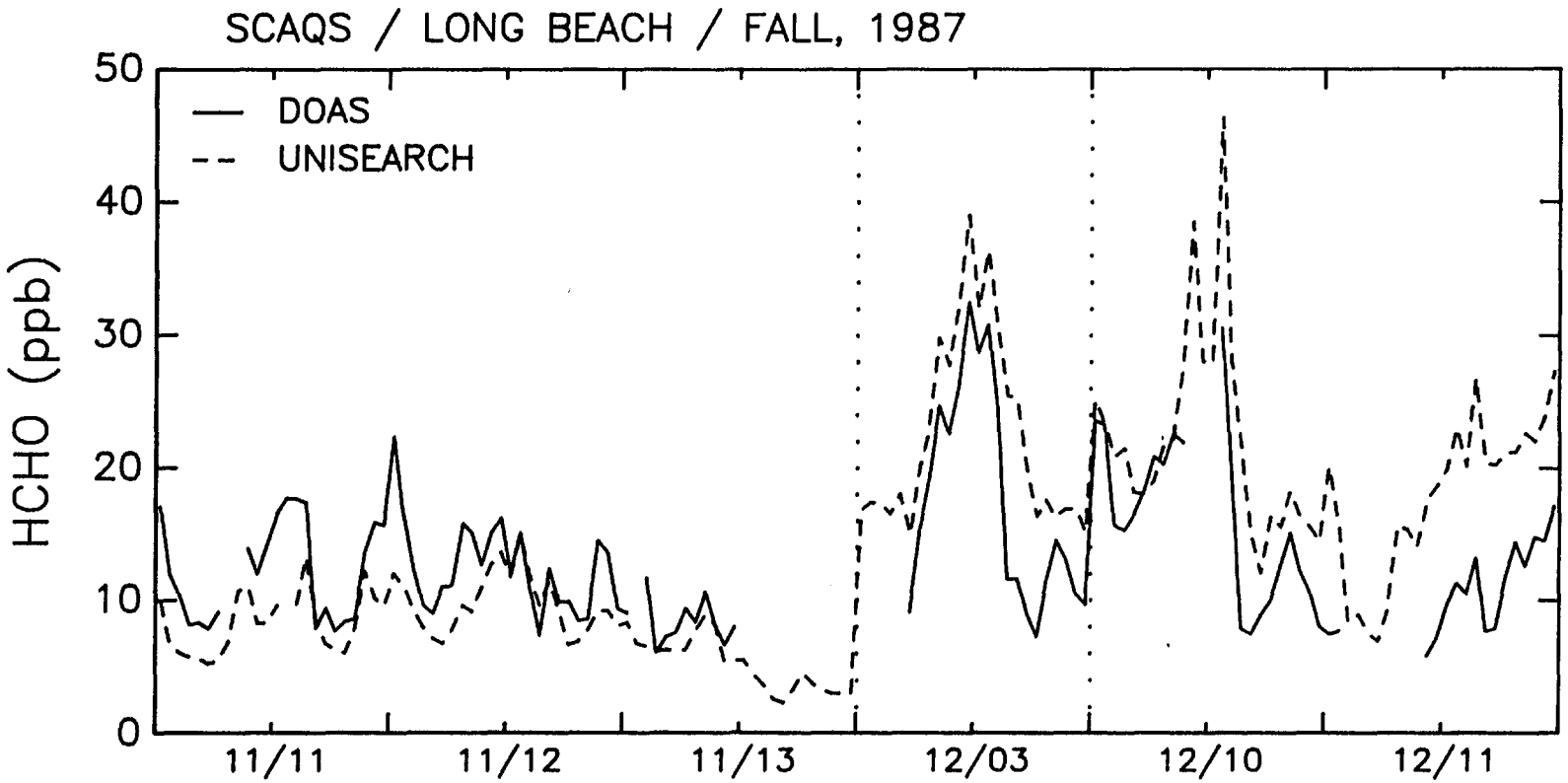

Figure VI-36. Comparison of Unisearch and DOAS HCHO time-concentration profiles for SCAQS fall episodes at Long Beach.

Table VI-8. Formaldehyde DOAS and ENSR Data for Long Beach Summer Episodes

Episode	Date	Time (PST)	Concentration (ppb) DOAS	ENSR
S-4	July 13, 1987	500	BDL[a]	2.6[b]
		700	BDL	0.7
		900	BDL	7.0
		1201	9.4	7.6[b]
		1400	BDL	2.4
		1600	BDL	4.6
S-5	July 14, 1987	500	BDL	2.7
		700	BDL	3.7
		900	BDL	0.3
		1201	6.7	6.7[b]
		1400	10.7	4.6
		1600	6.2	6.3
S-6	July 15, 1987	500	BDL	2.3
		700	BDL	1.7
		900	BDL	ND[c]
		1201	BDL	ND
		1400	BDL	ND
		1600	BDL	ND
S-7	August 27, 1987	500	BDL	8.4
		700	7.9	6.8
		900	10.0	15.3
		1201	9.7	9.0[b]
		1400	8.4	8.7
		1600	ND	8.7
S-8	August 28, 1987	500	BDL	7.5
		700	9.1	12.7
		900	11.6	16.3
		1201	13.0	14.8[b]
		1400	10.9	14.3
		1600	BDL	7.5
S-9	August 29, 1987	500	BDL	5.7
		700	BDL	6.2
		900	BDL	8.9
		1201	10.9	11.0[b]
		1400	8.5	9.4
		1600	BDL	5.7

(continued)

Table VI-8 (continued) - 2

Episode	Date	Time (PST)	Concentration (ppb) DOAS	ENSR
S-10	September 2, 1987	500	BDL	1.7
		700	BDL	4.0
		900	13.5	12.6
		1201	18.5	15.3[b]
		1400	8.5	8.9[b]
		1600	BDL	2.3
S-11	September 3, 1987	500	BDL	0.2
		700	BDL	1.3
		900	BDL	1.7
		1201	BDL	2.8[b]
		1400	BDL	0.3
		1600	BDL	0.3

[a]Average of two values.
[b]Below detection limit.
[c]No data available.

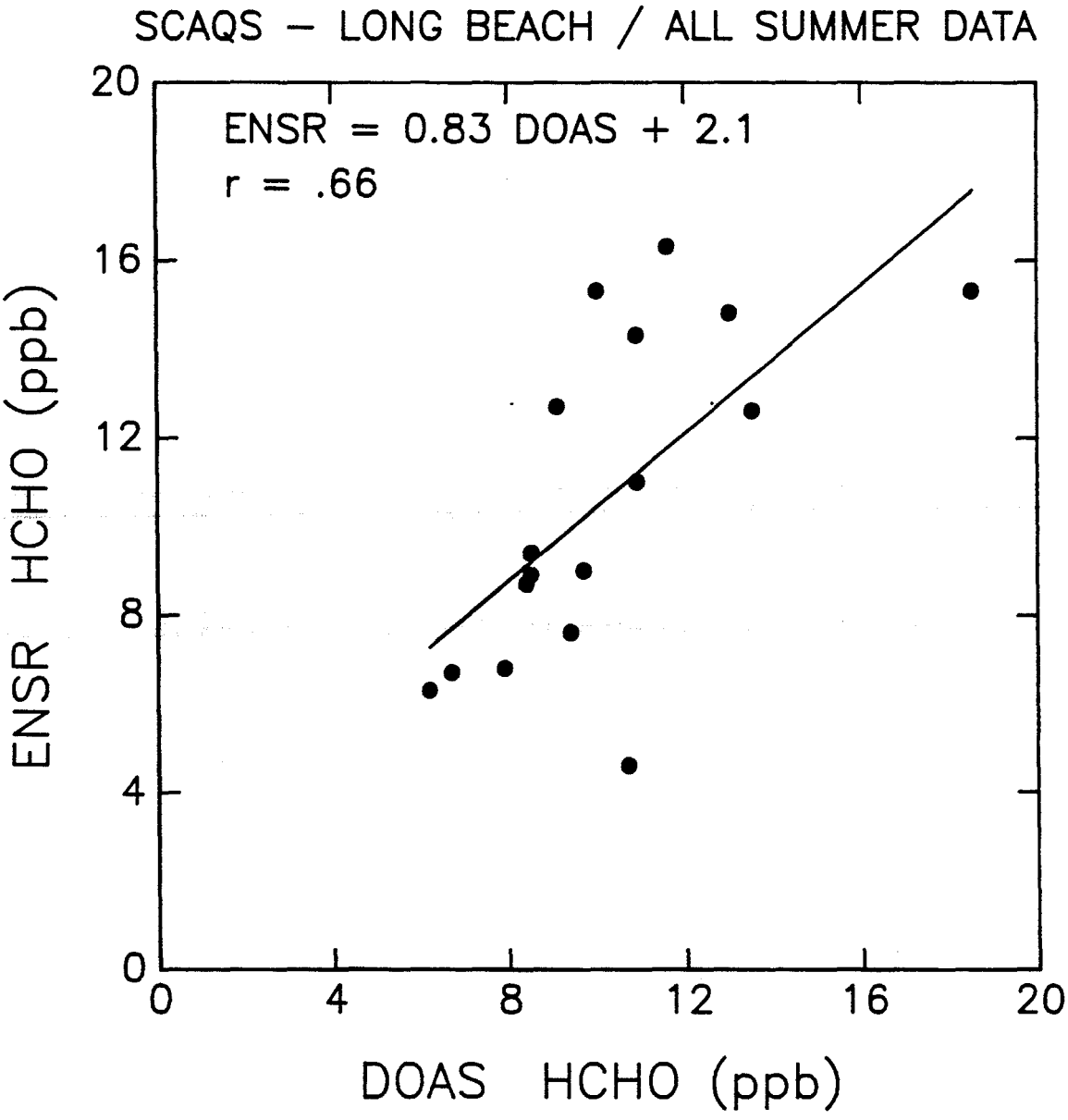

Figure VI-37. Linear least squares fit of ENSR HCHO vs. DOAS HCHO for SCAQS summer episodes at Long Beach.

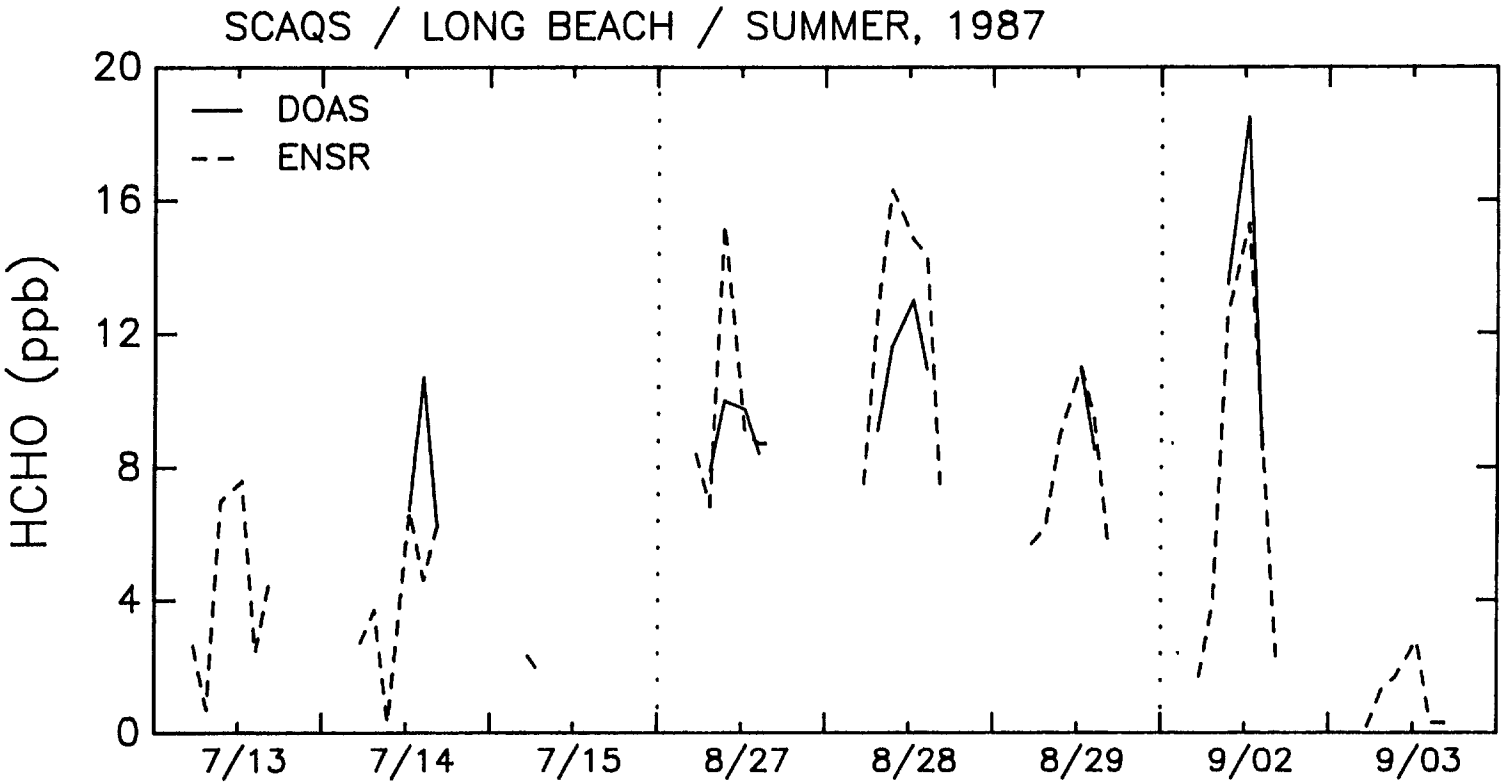

Figure VI-38. Comparison of ENSR and DOAS time-concentration profiles for SCAQS summer episodes at Long Beach.

radical spectral region. While this would not be expected to be important during periods of relatively unvarying HCHO concentrations, during those evening periods when HCHO was changing rapidly, some discrepancy with the TDLAS results could be introduced.

The same intercomparison for the fall episodes at Long Beach yielded a unit slope for the linear regression with a 2 ppb intercept and an r of only 0.69. From Figure VI-36 it is clear that there was a secular change in the relationship between the TDLAS and DOAS measurements, with the DOAS concentrations being somewhat higher during the first two or three fall episodes but the TDLAS concentrations clearly higher for the final three episodes, particularly on December 10. At the present time there is no obvious explanation for this behavior with respect to the DOAS measurements, since no comparable long-term variation was observed in the NO_2 or HONO data.

Considering the low HCHO concentrations encountered during the summer episodes at Long Beach and the relatively few data points for intercomparison between the ENSR and DOAS measurements, the correlation and agreement between the two methods is within their combined estimated uncertainties.

D. Hydroxyl Radical Production

Given the unprecedented levels of nitrous acid observed at Long Beach in the fall, it was of interest to examine the relative importance of HONO as a source of OH radicals under the conditions prevailing during these episodes. In addition to photolysis of HONO at sunrise,

$$HONO + h\nu\ (\lambda < 400\ nm) \rightarrow OH + NO$$

two other important sources of free radical production in polluted atmospheres are the photolysis of ozone at wavelengths less than 320 nm

$$O_3 + h\nu\ (\lambda < 320\ nm) \rightarrow O_2(^1\Delta_g) + O(^1D)$$

$$O(^1D) + H_2O \rightarrow 2\ OH$$

and photolysis of HCHO at wavelengths less than 370 nm

$$HCHO + h\nu\ (\lambda < 370\ nm) \rightarrow H + HCO$$

$$\rightarrow H_2 + CO$$

$$H + O_2 \xrightarrow{M} HO_2$$

$$HCO + O_2 \rightarrow HO_2 + CO$$

$$HO_2 + NO \rightarrow OH + NO_2$$

As seen in Figure VI-39, there were four morning periods in November and December, 1987, when the decay of HONO, due primarily to photolysis, was measured over the whole loss period by the DOAS technique. Using an appropriate model (Peterson 1976; Carter 1990), the relative importance of the OH radical flux due to photolysis of HONO, O_3 and HCHO throughout the daylight periods during the fall episodes at Long Beach was calculated from the following expressions

<u>From HONO</u>

$$\text{Radical flux} = k_t^{phot}\ (HONO \rightarrow OH + NO) \times [HONO]_t$$

<u>From O_3</u>

$$\text{Radical flux} = 2 \times k_t^{phot}\ (O_3 \rightarrow O^1D) \times [O_3]_t \times \frac{k_{H_2O}}{k_{H_2O} + k_M}$$

<u>From HCHO</u>

$$\text{Radical flux} = 2 \times k_t^{phot}\ (HCHO \rightarrow H + HCO) \times [HCHO]_t$$

Where k_t^{phot} is a function of latitude, solar zenith angle, absorption cross-section and quantum yield.

These calculations were made for the latitude at Long Beach and clear sky conditions, using the solar zenith angles appropriate for November 10 and December 3. The resulting OH radical fluxes due to photolysis of HONO, O_3 and HCHO are shown in Figures VI-40 and VI-41. These figures make it clear that the photolysis of HONO shortly after sunrise produces a large pulse of OH radicals at a time of the day when OH production from photolysis of O_3 and HCHO is low. Indeed, for the fall episodes, O_3 photolysis is relatively unimportant as an OH radical source throughout

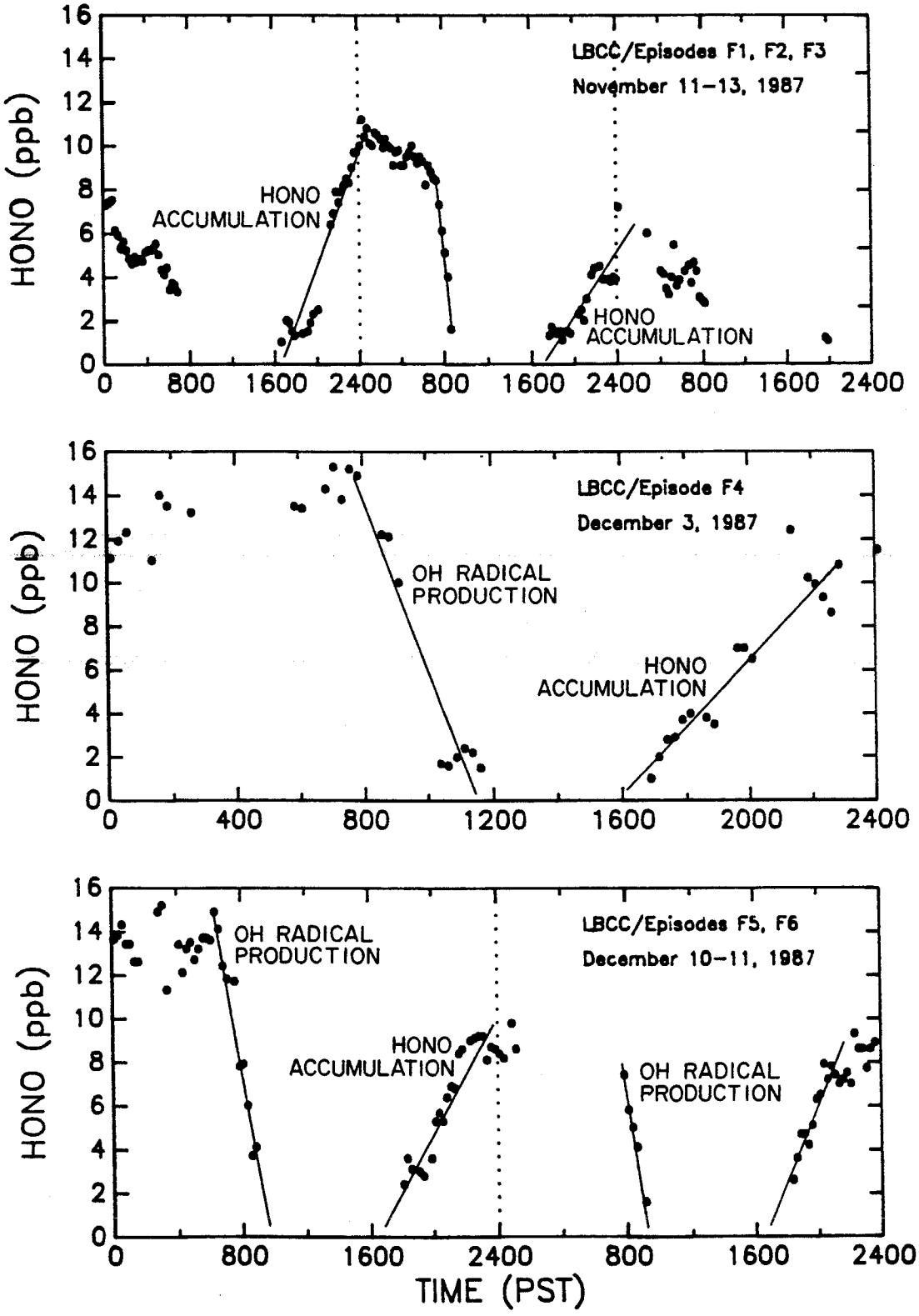

Figure VI-39. Periods of accumulation of HONO and subsequent photolysis to produce OH radicals.

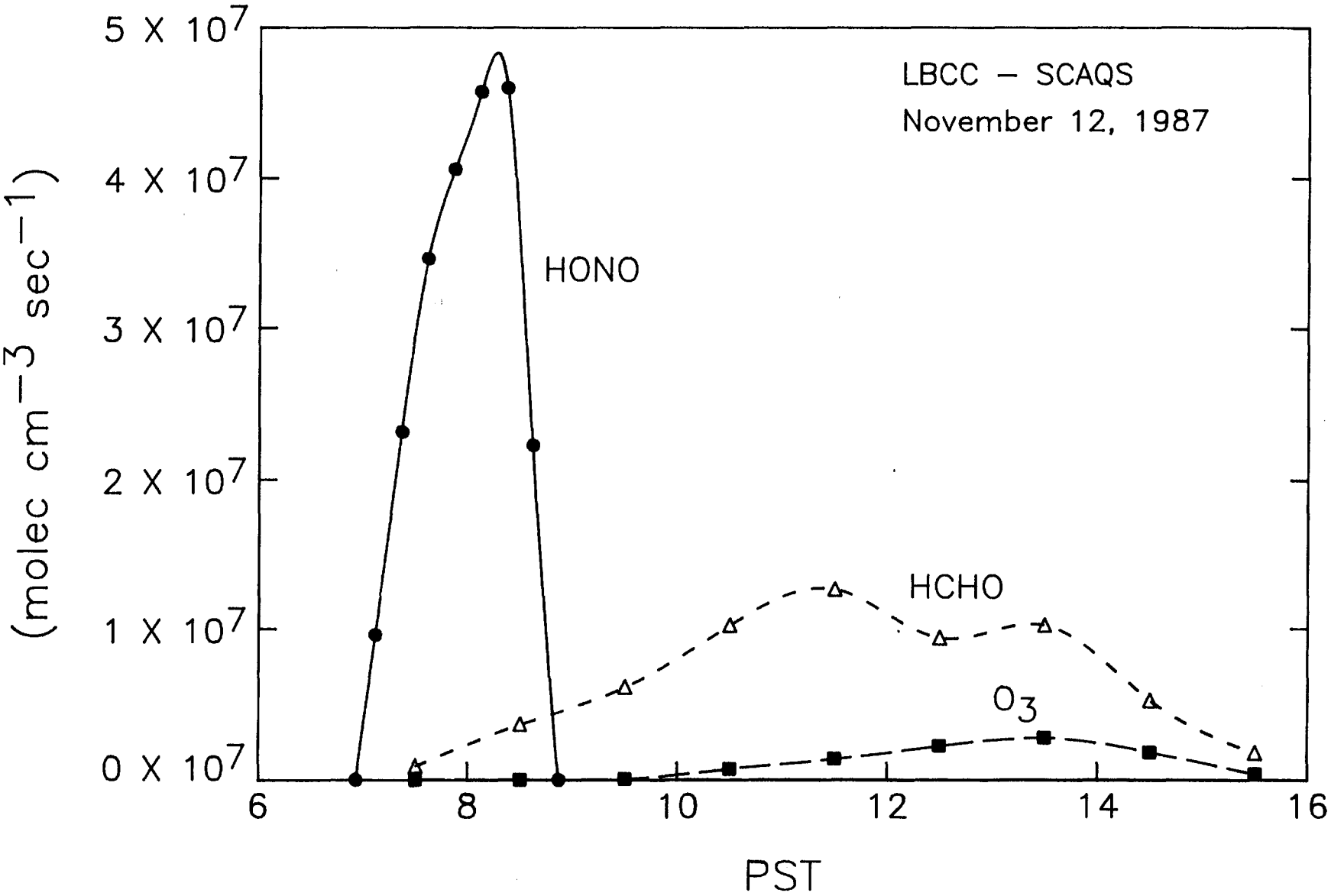

Figure VI-40. Calculated OH radical formation rates from photolysis of HONO, O_3 and HCHO at Long Beach on November 12.

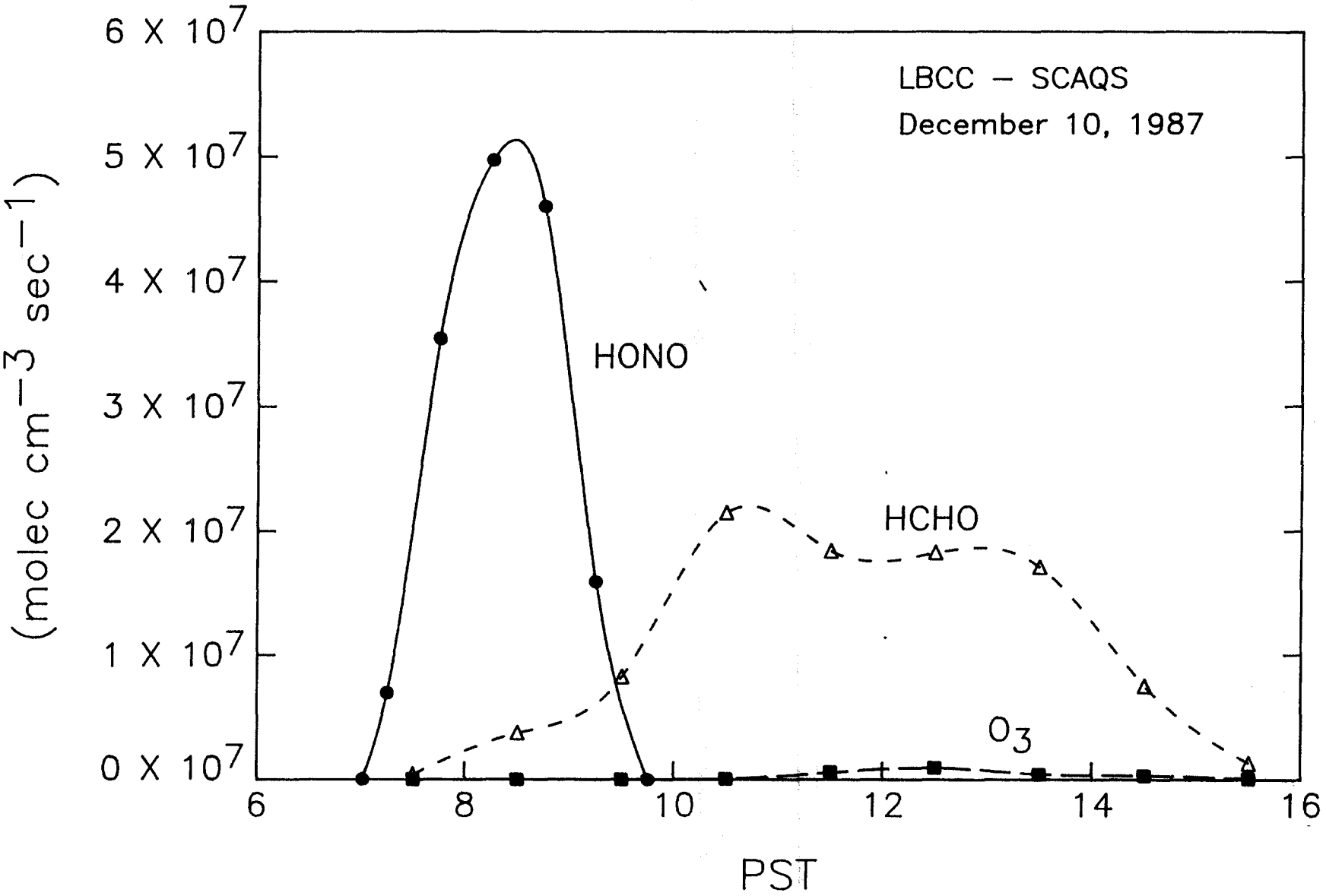

Figure VI-41. Calculated OH radical formation rates from photolysis of HONO, O_3 and HCHO at Long Beach on December 10.

the day and, in terms of integrated production of OH radicals, HONO is of comparable importance to HCHO. (For December 10, the integrated OH radical fluxes due to photolysis of HONO, HCHO and O_3 were 7.6 x 10^7, 9.6 x 10^7 and 2.4 x 10^6, respectively.) Clearly, there is the potential for the elevated HONO concentrations which were observed to accumulate during the fall evenings at Long Beach to play a significant role in photooxidation reactions on the following mornings. Additional details of these calculations is provided elsewhere (Winer and Biermann 1990).

E. Conclusions

An extensive set of measurements of HONO, NO_2 and HCHO concentrations, as well as NO_3 radical concentrations, were obtained during the SCAQS program by the DOAS technique under a wide range of pollutant and meteorological conditions, thereby achieving the specific objectives of this project. In addition, the principal findings from the DOAS measurements were the following:

- Maximum HONO levels observed at Long Beach during the fall episodes were approximately 50% to a factor of two higher than maximum DOAS HONO concentrations previously reported anywhere.

- Calculations showed that OH radical production at Long Beach from photolysis of these elevated HONO concentrations after sunrise produced a large pulse of OH radicals at a time when there was little or no contribution from photolysis of HCHO and O_3. For the fall episodes at Long Beach the total integrated OH radical production during morning hours from HONO photolysis under these conditions was comparable to total OH radical production from HCHO photolysis through the rest of the day and, as expected, approximately an order of magnitude greater than radical production from O_3 photolysis.

- Although as much as half, to all, of the ambient nighttime levels of HONO observed at Long Beach could result from heterogeneous atmospheric formation pathways involving NO_2, factor analyses for the SCAQS data (and data obtained in the

winter of 1986 at Torrance, California), as well as partitioning calculations, suggest that HONO levels in the western end of the SoCAB during the fall/winter period may contain a significant contribution from HONO emissions from combustion sources.

- Under conditions prevailing at Claremont during the summer SCAQS episodes, only limited periods of elevated NO_3 concentrations occurred. This was due to both declining NO_2 and O_3 precursor concentrations and to increasing NO levels in the early evening hours of most episode days.

- Pronounced diurnal profiles in the atmospheric concentrations of NO_2, HONO, HCHO and NO_3 radicals were observed for most of the episodes studied, with clear evidence for the influence of mobile emission sources on ambient levels of NO_2 and HCHO at both Claremont and Long Beach.

- Generally good correlation and absolute agreement with other analytical or instrumental methods was obtained for the DOAS measurements of HONO, NO_2 and HCHO at Long Beach during the fall episodes and NO_2 and HCHO during the summer episodes. This offers the potential for obtaining statistically robust model inputs from the SCAQS gaseous pollutant data base.

- With further analysis and correlation with other SCAQS data, the DOAS results for HCHO should be useful in exploring the partitioning of ambient concentrations of HCHO between direct emissions and formations from secondary reactions in the atmosphere.

F. Recommendations for Future Research

The present DOAS study provided a set of data which, along with the entire SCAQS data base, will be useful over at least the next five years in the development and testing of chemical mechanisms and airshed models. However, several suggestions for future research employing the DOAS technique result from the experience of the SCAQS program.

- For future ambient air studies, a third generation DOAS instrument should be developed based on the availability of commercial photodiode array detectors and the dramatic advances in microcomputer capabilities since the present DOAS instruments were initially developed over a decade ago.

- Additional atmospheric measurements should be conducted of HONO concentrations occurring at the western edge of the SoCAB during fall and winter periods. In each of the previous two DOAS studies (at Torrance and Long Beach) conducted under these conditions, assumptions concerning the maximum HONO concentrations occurring in the SoCAB were shown to underestimate the actual measured HONO levels. With respect to both accurately modeling HONO's role in the formation of photochemical air pollution, and establishing a data base for health effects researchers, it is important to better characterize the maximum levels of HONO which may occur along the coastal region of the SoCAB, from West Los Angeles to Orange County.

- The DOAS technique should be used to investigate further the production of HONO from a range of combustion sources, including stationary, as well as mobile, sources.

- Additional ambient air and/or laboratory studies should be conducted to further test and validate the utility of the denuder difference method for obtaining time-averaged HONO data, particularly in the presence of potentially interfering species.

VII. REFERENCES

Allegrini, I., De Santis, F., Di Palo, V., Febo, A., Perrino, C., Possanzini, M. and Leberti, A. (1987): Annual denuder method for sampling reactive gases and aerosols in the atmosphere. Sci. of the Total Environ., 67, 1.

Appel, B., Tokiwa, Y. and Povard, V. (1988): South Coast Air Quality Study - Fall Study. Final Report to Contract No. A732-089, California Air Resources Board, July 1988.

Appel, B., Winer, A. M., Tokiwa, Y. and Biermann, H. W. (1989): Comparison of atmospheric nitrous acid measurements by annual denuder and differential optical absorption systems. Paper No. 89-152.1, Proceedings of the 82nd Annual AWMA Meeting, Anaheim, CA, June 25-30.

Appel, B., Winer, A. M., Tokiwa, Y. and Biermann, H. W. (1990): Comparison of atmospheric nitrous acid measurements by annual denuder and differential optical absorption systems. Atmos. Environ., in press.

Atkinson, R. and Carter, W. P. L. (1984): Kinetics and mechanisms of the gas-phase reactions of ozone with organic compounds under atmospheric conditions. Chem. Rev., 84, 437.

Atkinson, R., Plum, C. N., Carter, W. P. L., Winer, A. M. and Pitts, J. N., Jr. (1984): Rate constants for the gas-phase reactions of NO_3 radicals with a series of organics in air at 298 ± 1 K. J. Phys. Chem., 88, 1210.

Atkinson, R., Aschmann, S. M., Winer, A. M. and Pitts, J. N., Jr. (1985): Kinetics and atmospheric implications of the gas phase reactions of NO_3 radicals with a series of monoterpenes and related organics. Environ. Sci. Technol., 19, 159.

Atkinson, R. (1986): Kinetics and mechanisms of the gas-phase reactions of the hydroxyl radical with organic compounds under atmospheric conditions. Chem. Rev., 86, 69.

Atkinson, R., Winer, A. M. and Pitts, J. N., Jr. (1986): Estimation of nighttime N_2O_5 concentrations from ambient NO_2 and NO_3 radical concentrations and the role of N_2O_5 in nighttime chemistry. Atmos. Environ., 20, 331.

Atkinson, R., Aschmann, S. M. and Pitts, J. N., Jr. (1988): Rate constants for the gas-phase reactions of the NO_3 radical with a series of organic compounds at 296 ± 2 K. J. Phys. Chem., 92, 3454.

Atkinson, R. (1989): Kinetics and mechanisms of the gas-phase reactions of the hydroxyl radical with organic compounds. J. Phys. Chem. Ref. Data, in press.

Bass, A. M., Ledford, A. E., Jr. and Laufer, A. H. (1976): Extinction coefficient of NO_2 and N_2O_4. J. Res. NBS, 80A, 143.

Biermann, H. W., Tuazon, E. C., Winer, A. M., Wallington, T. J. and Pitts, J. N., Jr. (1988a): Simultaneous absolute measurements of gaseous nitrogen species in urban ambient air by long pathlength infrared and ultraviolet-visible spectroscopy. Atmos. Environ., 22, 1545.

Biermann, H. W., Pitts, J. N., Jr. and Winer, A. M. (1988b): Simultaneous spectroscopic determination of gaseous nitrous acid and nitrogen dioxide in polluted indoor and outdoor air environments. Advances in Air Sampling, Chapter 19, p. 265, Lewis Publishers.

Blumenthal, D. L., Watson, J. G. and Roberts, P. T. (1987): Southern California Air Quality Study (SCAQS) Program Plan. Prepared for California Air Resources Board, June 1987.

Carter, W. P. L. (1990): A detailed mechanism for the gas-phase atmospheric reactions of organic compounds. Atmos. Environ., in press.

Chan, W. J., Nordstrom, R. J., Calvert, J. G. and Shaw, J. H. (1976): Kinetic study of HONO formation and decay reactions in gaseous mixtures of HONO, NO, NO_2, H_2O and N_2. Environ. Sci. Technol., 10, 674.

DeMore, W. B., Molina, M. J., Sander, S. P., Golden, D. M., Hampson, R. F., Kurylo, M. J., Howard, C. J. and Ravishankara, A. R. (1987): Chemical kinetics and photochemical data for use in stratospheric modeling. Evaluation Number 8, NASA, Jet Propulsion Laboratory, Pasadena, CA, JPL Publication 87-41, September 15.

Drummond, J. W., Schiff, H. I., Karecki, D. R. and Mackay, G. I. (1989): Measurements of NO_2, NO_x, O_3, PAN, HNO_3, H_2O_2, and HCHO during the Southern California Air Quality Study, Paper No. 138.4, Proceedings of the 82nd Annual AWMA Meeting, Anaheim, CA, June 25-30.

Fahmy, O. G. and Fahmy, M. J. (1976): Cancer Research, 36, 4504.

Finlayson-Pitts, B. J. and Pitts, J. N., Jr. (1986) Atmospheric Chemistry, John Wiley & Sons, New York.

Fujita, E. (1989): Private communication.

Graham, R. A. and Johnston, H. S. (1978): The photochemistry of NO_3 and the kinetics of the N_2O_5-O_3 system. J. Phys. Chem., 82, 254.

Green, M. and Biermann, H. W. (1987): unpublished data.

Harris, G. W., Carter, W. P. L., Winer, A. M., Pitts, J. N., Jr., Platt, U. and Perner, D. (1982): Observation of nitrous acid in the Los Angeles atmosphere and implications for predictions of ozone-precursor relationships. Environ. Sci. Technol., 16, 414.

Jenkin, M. E., Cox, R. A. and Williams, D. J. (1988): Laboratory studies of the kinetics of formation of nitrous acid from the thermal reaction of nitrogen dioxide and water vapor. Atmos. Environ., 22, 487.

Kessler, C. and Platt, U. (1984): Nitrous acid in polluted air masses--sources and formation pathways. Proc. Env. Symp. Physic. Chem. Behav. Atmos. Pollut., 3rd, p. 412.

Lammel, G. and Perner, D. (1988): The atmospheric aerosol as a source of nitrous acid in the polluted atmosphere. J. Aerosol. Sci., 19, 1199.

Lawson, D. (1986): Nitrogen species method comparison studies at Claremont, California, September 1985 - Overview. Presented at the 1986 EPA/APCA Symposium on Measurement of Toxic Air Pollutants, April.

Mackay, G. I., Karecki, D. R. and Schiff, H. I. (1988): The Southern California air quality study: tunable diode laser absorption spectrometer measurements of H_2O_2 and H_2CO at the Claremont and Long Beach A sites. Report submitted to California Air Resources Board, November 9, 1988.

Mac Leod, H., Aschmann, S. M., Atkinson, R., Tuazon, E. C., Sweetman, J. A., Winer, A. M. and Pitts, J. N., Jr. (1986): Kinetics and mechanisms of the gas-phase reactions of the NO_3 radical with a series of reduced sulfur compounds. J. Geophys. Res., 91, 5338.

Perner, W. and Platt, U. (1979): Detection of nitrous acid in the atmosphere by differential optical absorption. Geophys. Res. Lett., 6, 917.

Peterson, J. T. (1976): Calculated actinic fluxes (290-700 nm) for air pollution photochemistry application. EPA 600/4-76-025.

Pitts, J. N., Jr., Grosjean, D., van Cauwenberghe, K. A., Schmid, J. P. and Fitz, D. R. (1978): Photooxidation of aliphatic amines under atmospheric conditions: Formation of nitrosamines, nitramines, amides and photochemical oxidants. Environ. Sci. Technol., 12, 1296.

Pitts, J. N., Jr., Biermann, H. W., Atkinson, R. and Winer, A. M. (1984a): Atmospheric implications of simultaneous nighttime measurements of NO_3 radicals and HONO. Geophys. Res. Lett., 11, 557.

Pitts, J. N., Jr., Sanhueza, E., Atkinson, R., Carter, W. P. L., Winer, A. M., Harris, G. W. and Plum, C. (1984b): An investigation of the dark formation of nitrous acid in environmental chambers. Int. J. Chem. Kinet., 16, 919.

Pitts, J. N., Jr., Biermann, H. W., Winer, A. M. and Tuazon, E. C. (1984c): Spectroscopic identification and measurement of gaseous nitrous acid in dilute auto exhaust. Atmos. Environ., 18, 847.

Pitts, J. N., Jr., Wallington, T. J., Biermann, H. W. and Winer, A. M. (1985): Identification and measurement of nitrous acid in an indoor environment. Atmos. Environ., 19, 763.

Pitts, J. N., Jr., Biermann, H. W., Tuazon, E. C., Green, M., Long, W. D. and Winer, A. M. (1989): Time-resolved identification and measurement of indoor air pollutants by spectroscopic techniques: gaseous nitrous acid, methanol, formaldehyde and formic acid. J. Air Pollut. Control Assoc., 39, 1344.

Platt, U., Perner, D., Winer, A. M., Harris, G. W. and Pitts, J. N., Jr. (1980a): Detection of NO_3 in the polluted troposphere by differential optical absorption. Geophys. Res. Lett., 7, 89.

Platt, U., Perner, D., Harris, G. W., Winer, A. M. and Pitts, J. N., Jr. (1980b): Observations of nitrous acid in an urban atmosphere by differential optical absorption. Nature, 285, 312.

Platt, U., Winer, A. M., Biermann, H. W. and Pitts, J. N., Jr. (1984): Measurement of nitrate radical concentrations in continental air. Environ. Sci. Technol., 18, 365.

Richards, L. W. (1983): Comments on the oxidation of NO_2 to nitrate-day and night. Atmos. Environ., 17, 397.

Russell, A. G., McRae, G. J. and Cass, G. R. (1985): The dynamics of nitric acid production and the fate of nitrogen oxides. Atmos. Environ., 19, 893.

Sakamaki, F., Hatakeyama, S. and Akimoto, H. (1983): Formation of nitrous acid and nitric oxide in the heterogeneous dark reaction of nitrogen dioxide and water vapor in a smog chamber. Int. J. Chem. Kinet., 15, 1013.

Seinfeld, J. (1989): Urban air pollution: state of the science. Science, 243, 745.

Sjodin, A. and Ferm, M. (1985): Measurements of nitrous acid in an urban area. Atmos. Environ., 19, 985.

Sjodin, A. (1988): Studies of the diurnal variation of nitrous acid in urban air. Environ. Sci. Technol., 22, 1086.

Stockwell, W. R. and Calvert, J. G. (1978): The near ultraviolet absorption spectrum of gaseous HONO and N_2O_5. J. Photochem., 8, 193.

Stockwell, W. R. and Calvert, J. G. (1983): The mechanism of NO_3 and HONO formation in the nighttime chemistry of the urban atmosphere. J. Geophys. Res., 88, 6673.

Svensson, R., Ljungstrom, E. and Lindqvist, O. (1987): Kinetics of the reaction between nitrogen dioxide and water vapor. Atmos. Environ., 21, 1529.

Tuazon, E. C., Atkinson, R., Plum, C. N., Winer, A. M. and Pitts, J. N., Jr. (1983): The reaction of gas phase N_2O_5 with water vapor. Geophys. Res. Lett., 10, 953.

U. S. Environmental Protection Agency (1977): Uses, limitations and technical basis of procedures for quantifying relationships between photochemical oxidants and precursors. EPA 450/2-77-021a, Research Triangle Park, NC, November.

U. S. Environmental Protection Agency (1978): Air quality criteria for ozone and other photochemical oxidants. EPA 600/8-78-004, Washington, DC, April.

U. S. Environmental Protection Agency (1980): Federal Register, 45, 64856, September 30.

White, J. U. (1942): Long optical paths of large aperature. J. Opt. Soc. Am., 32, 285.

Winer, A. M., Peters, J. W., Smith, J. P. and Pitts, J. N., Jr. (1974): Response of commercial chemiluminescent NO-NO_2 analyzers to other nitrogen containing compounds. Environ. Sci. Technol., 8, 1118.

Winer, A. M., Atkinson, R. and Pitts, J. N., Jr. (1984): Gaseous nitrate radical: Possible nighttime atmospheric sink for biogenic organic compounds. Science, 224, 156.

Winer, A. M., Atkinson, R., Arey, J., Biermann, H. W., Harger, W. P., Tuazon, E. C. and Zielinska, B. (1987): The role of nitrogenous pollutants in the formation of atmospheric mutagens and acid deposition. Final Report to the California Air Resources Board, Contract No. A4-081-32, March.

Winer, A. M. and Biermann, H. W. (1989): In-situ long pathlength differential optical absorption spectroscopy (DOAS) measurements of gaseous species during the 1987 SCAQS program. Paper No. 89-139.3, Proceedings of the 82nd Annual AWMA Meeting, Anaheim, CA, June 25-30.

Winer, A. M. and Biermann, H. W. (1990): In-situ long pathlength differential optical absorption spectroscopy (DOAS) measurements of gaseous species during the 1987 SCAQS program. Atmos. Environ., in preparation.

VIII. APPENDICES

Appendix A

Time-Resolved Concentration Data for
Claremont Summer Episodes

Appendix B

Time-Resolved Concentration Data for
Long Beach Summer Episodes

Appendix C

Time-Resolved Concentration Data for
Long Beach Fall Episodes

APPENDIX A

TIME-RESOLVED CONCENTRATION DATA FOR CLAREMONT SUMMER EPISODES

Table A-1. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-1, June 19, 1987

File No.	Measurement Period	Concentrations (ppb)			
		NO_2	HONO	HCHO	NO_3
10218	00:04:34 - 00:14:54	72.1	BDL	BDL	
10219	00:15:04 - 00:27:13	61.6	BDL	BDL	
10220	00:27:20 - 00:33:25	ND	ND	ND	
10221	00:37:37 - 00:37:41	ND	ND	ND	
10222	00:37:49 - 00:37:54	ND	ND	ND	
10223	00:37:54 - 00:44:53				ND
10224	00:45:02 - 01:01:42	59.9	BDL	BDL	
10225	01:01:50 - 01:14:08	ND	BDL	BDL	
10226	01:18:41 - 01:30:54				BDL
10227	01:31:04 - 01:47:46	ND	BDL	BDL	
10228	01:47:46 - 02:00:06	ND	BDL	BDL	
10229	02:04:41 - 02:16:52				BDL
10230	02:16:52 - 02:33:42	ND	BDL	BDL	
10231	02:33:52 - 02:46:06	ND	ND	ND	
10232	02:46:09 - 03:02:56				ND
10233	03:03:04 - 03:19:50	ND	ND	ND	
10234	03:20:00 - 03:32:20	ND	ND	ND	
10235	03:32:20 - 03:49:08	ND	ND	ND	
10236	03:49:16 - 04:06:04	ND	ND	ND	
10237	04:06:04 - 04:18:28	ND	ND	ND	
10238	04:23:02 - 04:35:20				ND
10239	04:35:20 - 04:52:22	ND	ND	ND	
10240	04:52:22 - 05:04:38	ND	ND	ND	
10241	05:04:46 - 05:21:26				BDL
10242	05:26:06 - 05:38:12	ND	BDL	BDL	
10243	05:38:20 - 05:50:33	54.8	BDL	BDL	
10244	05:55:08 - 06:07:09				BDL
10245	06:07:18 - 06:23:52	56.3	BDL	6.8	
10246	06:23:52 - 06:36:05	55.8	BDL	BDL	
10247	06:46:44 - 07:01:49	56.7	BDL	6.7	
10248	07:01:49 - 07:17:01	59.6	BDL	BDL	
10249	07:17:01 - 07:32:10	58.8	BDL	BDL	
10250	07:32:10 - 07:47:24	60.9	BDL	7.2	
10251	07:47:24 - 08:02:33	66.7	BDL	6.6	
10252	08:02:33 - 08:17:48	70.9	BDL	BDL	
10253	08:17:48 - 08:33:02	67.9	BDL	ND	
10254	08:33:02 - 08:48:16	73.4	BDL	ND	
10255	08:48:16 - 09:03:34	80.5	BDL	BDL	
10256	09:03:34 - 09:18:48	80.2	BDL	6.2	
10257	09:18:48 - 09:34:00	80.6	BDL	10.3	
10258	09:34:04 - 09:49:17	70.2	BDL	10.2	
10259	09:49:24 - 10:04:34	64.5	BDL	11.5	
10260	10:04:34 - 10:19:54	59.7	BDL	9.3	
10261	10:19:54 - 10:35:10	54.5	BDL	ND	
10262	10:35:10 - 10:50:28	51.2	BDL	7.8	

Table A-1 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10263	10:50:28 - 11:05:42	45.5	BDL	8.4	
10264	11:05:50 - 11:21:01	41.1	BDL	7.7	
10265	11:21:01 - 11:36:22	38.4	BDL	11.7	
10266	11:36:22 - 11:51:38	39.4	BDL	6.0	
10267	11:51:38 - 12:06:58	34.1	BDL	8.4	
10268	12:06:58 - 12:22:13	33.9	BDL	7.2	
10269	12:22:13 - 12:37:33	32.2	BDL	ND	
10270	12:37:33 - 12:52:49	21.6	BDL	BDL	
10271	12:52:52 - 13:08:09	19.3	BDL	6.7	
10272	13:08:09 - 13:23:26	23.1	BDL	7.8	
10273	13:23:26 - 13:38:41	26.4	BDL	ND	
10274	13:38:41 - 13:54:00	25.6	BDL	8.4	
10275	13:54:00 - 14:09:14	26.8	BDL	ND	
10276	14:09:21 - 14:24:30	26.1	BDL	5.5	
10277	14:24:30 - 14:39:49	25.2	BDL	BDL	
10278	14:39:49 - 14:55:02	24.1	BDL	BDL	
10279	14:55:02 - 15:10:18	25.4	BDL	BDL	
10280	15:10:18 - 15:25:72	ND	ND	ND	
10281	16:47:08 - 16:59:32	30.9	BDL	BDL	
10282	16:59:58 - 17:15:04	31.6	BDL	BDL	
10283	17:15:04 - 17:30:18	32.6	BDL	BDL	
10284	17:30:18 - 17:45:34	33.0	BDL	6.6	
10285	17:54:34 - 18:00:44	38.0	BDL	ND	
10286	18:00:44 - 18:15:58	38.2	BDL	BDL	
10287	18:15:58 - 18:31:10	37.5	BDL	ND	
10288	18:31:14 - 18:46:24	36.8	BDL	BDL	
10289	18:46:24 - 19:01:34	35.8	BDL	ND	
10290	19:01:34 - 19:16:42	36.0	BDL	ND	
10291	19:16:42 - 19:29:32	33.8	BDL	ND	
10292	19:32:48 - 19:42:40	44.9	BDL	BDL	
10293	19:42:40 - 19:59:01				BDL
10294	19:59:12 - 20:11:14				BDL
10295	20:11:14 - 20:27:44	50.3	BDL	BDL	
10296	20:32:20 - 20:44:08				BDL
10297	20:44:08 - 20:56:04				BDL
10298	20:56:14 - 21:12:14	ND	ND	ND	
10299	21:12:45 - 21:14:36	ND	ND	ND	
10300	21:14:36 - 21:31:00				BDL
10301	21:31:10 - 21:31:10	ND	ND	ND	ND
10302	21:31:14 - 21:43:32	ND	ND	ND	
10303	21:44:17 - 21:44:22	ND	ND	ND	ND
10304	21:48:57 - 21:56:41				BDL
10305	21:56:52 - 21:56:52	ND	ND	ND	ND
10306	21:57:01 - 22:08:26	ND	ND	ND	
10307	22:08:58 - 22:09:17	ND	ND	ND	
10308	22:09:17 - 22:19:44				BDL
10309	22:19:44 - 22:21:33				ND

Table A-1 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10310	22:21:44 - 22:38:21	58.4	BDL	BDL	
10311	22:41:00 - 22:41:50	ND	ND	ND	
10312	22:46:25 - 22:58:13				BDL
10313	22:58:24 - 23:10:14				BDL
10314	23:10:14 - 23:26:42	61.3	BDL	BDL	
10315	23:31:17 - 23:43:08				BDL
10316	23:43:08 - 23:55:09				BDL
10317	23:55:18 - 00:00:14	ND	ND	ND	
10318	00:01:38 - 00:13:34	61.6	BDL	BDL	
10319	00:13:34 - 00:25:37	57.0	BDL	BDL	
10320	00:25:37 - 00:42:01				BDL
10321	00:42:10 - 00:58:32	52.9	BDL	BDL	
10322	00:58:32 - 01:10:30	56.9	BDL	BDL	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period
NS = No scans

Table A-2. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-2, June 24, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10437	19:50:08 - 19:59:34				BDL
10438	19:59:44 - 20:11:49				BDL
10440	20:33:02 - 20:45:02				BDL
10441	20:45:06 - 20:57:18				BDL
10443	21:14:06 - 21:30:34				BDL
10444	21:30:34 - 21:42:44				BDL
10446	21:59:24 - 22:16:00				BDL
10447	22:16:08 - 22:28:10				BDL
10449	22:44:56 - 23:01:33				BDL
10450	23:01:42 - 23:13:50				BDL
10452	23:35:01 - 23:47:06				BDL
10453	23:47:06 - 23:59:20				BDL
10454	23:59:29 - 00:15:58	57.4	1.6	BDL	
10455	00:16:01 - 00:28:13	62.7	2.1	10.1	
10456	00:28:13 - 00:44:50				BDL
10457	00:45:00 - 01:01:36	58.1	BDL	7.8	
10458	01:01:36 - 01:13:49	61.2	1.0	BDL	
10459	01:18:22 - 01:30:28				BDL
10460	01:30:32 - 01:47:13	55.2	1.3	8.5	
10461	01:47:13 - 01:59:28	54.5	1.2	5.7	
10462	02:04:01 - 02:16:09				ND
10463	02:16:09 - 02:33:00	ND	ND	ND	
10464	02:33:00 - 02:45:09	ND	ND	ND	
10465	02:45:09 - 03:01:45				ND
10466	03:01:54 - 03:18:26	ND	ND	ND	
10467	03:18:30 - 03:30:44	ND	ND	ND	
10468	03:30:44 - 03:47:21				ND
10469	03:47:30 - 04:04:08	49.1	ND	ND	
10470	04:04:08 - 04:16:21	ND	ND	ND	
10471	04:20:54 - 04:32:58				ND
10472	04:33:02 - 04:49:44	ND	ND	ND	
10473	04:49:44 - 05:01:58	ND	ND	ND	
10474	05:06:32 - 05:18:36				ND
10475	05:18:36 - 05:35:22	ND	ND	ND	
10476	05:35:22 - 05:47:25	ND	ND	ND	
10477	05:47:25 - 06:04:01				BDL
10478	06:04:10 - 06:20:32	ND	ND	ND	
10479	06:20:34 - 06:32:30	ND	ND	ND	
10480	06:32:38 - 06:49:12				BDL
10481	06:49:21 - 07:08:57	ND	ND	ND	
10482	07:08:57 - 07:24:10	47.5	ND	ND	
10483	07:24:10 - 07:39:16	50.3	BDL	BDL	
10484	07:39:18 - 07:54:30	68.2	BDL	ND	
10485	07:54:30 - 08:09:46	75.8	BDL	ND	
10486	08:09:46 - 08:25:04	64.2	BDL	ND	

Table A-2 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10487	08:25:04 - 08:40:16	67.9	BDL	ND	
10488	08:40:16 - 08:55:30	68.8	BDL	ND	
10489	08:55:30 - 09:10:46	71.1	BDL	ND	
10490	09:10:46 - 09:26:00	69.2	BDL	ND	
10491	09:26:00 - 09:41:16	67.3	BDL	ND	
10492	09:41:16 - 09:56:34	59.4	BDL	12.5	
10493	09:56:34 - 10:11:48	57.3	BDL	10.7	
10494	10:11:48 - 10:27:04	50.6	BDL	13.0	
10495	10:27:04 - 10:42:21	47.2	BDL	12.8	
10496	10:42:21 - 10:57:34	46.7	BDL	ND	
10497	10:57:34 - 11:12:50	50.0	BDL	ND	
10498	11:12:50 - 11:28:05	46.7	BDL	12.8	
10499	11:28:05 - 11:43:17	42.7	BDL	ND	
10500	11:43:17 - 11:58:34	45.2	BDL	ND	
10501	11:58:34 - 12:13:38	ND	ND	ND	
10502	12:13:38 - 12:28:28	ND	ND	ND	
10503	12:28:28 -	ND	ND	ND	
10504	-	ND	ND	ND	
10505	-	ND	ND	ND	
10506	-	ND	ND	ND	
10507	-	ND	ND	ND	
10508	-	ND	ND	ND	
10509	-	ND	ND	ND	
10510	-	ND	ND	ND	
10511	-	ND	ND	ND	
10512	-	ND	ND	ND	
10513	-	ND	ND	ND	
10514	-	ND	ND	ND	
10515	-	ND	ND	ND	
10516	-	ND	ND	ND	
10517	-	ND	ND	ND	
10518	-	ND	ND	ND	
10519	-	ND	ND	ND	
10520	-	ND	ND	ND	
10521	-	ND	ND	ND	
10522	- 19:26:56	ND	ND	ND	
10523	19:26:56 - 19:41:58	61.0	BDL	ND	
10524	19:46:32 - 19:58:34				0.056
10525	19:58:34 - 20:10:42				0.044
10526	20:10:52 - 20:27:21	57.1	BDL	10.0	
10527	20:27:21 - 20:43:53				BDL
10528	20:43:53 - 20:56:08				BDL
10529	20:56:17 - 21:12:58	60.2	ND	ND	
10530	21:12:58 - 21:29:33				BDL
10531	21:29:44 - 21:41:49				BDL
10532	21:41:49 - 21:58:29	49.9	ND	ND	
10533	22:03:02 - 22:15:05				BDL

Table A-2 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10534	22:15:14 - 22:27:21				BDL
10535	22:27:21 - 22:48:37	59.7	ND	ND	
10536	22:48:37 - 23:00:42				BDL
10537	23:00:56 - 23:12:56				BDL
10538	23:13:05 - 23:29:41	ND	ND	ND	
10539	23:29:41 - 23:46:20				BDL
10540	23:46:20 - 23:58:36				BDL
10541	24:05:33 - 00:14:46	49.9	BDL	6.5	
10542	00:14:46 - 00:27:01	53.2	BDL	BDL	
10543	00:27:01 - 00:43:40				BDL
10544	00:43:49 - 01:00:25	60.2	BDL	BDL	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-3. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-3, June 25, 1987

File No.	Measurement Period	Concentrations (ppb)			
		NO_2	HONO	HCHO	NO_3
10545	01:00:25 - 01:12:40	58.4	ND	ND	
10546	01:17:14 - 01:29:41				BDL
10547	01:29:41 - 01:46:05	60.0	ND	ND	
10548	01:46:14 - 01:58:21	65.1	1.3	BDL	
10549	01:58:29 - 02:15:02				BDL
10550	02:15:02 - 02:31:46	57.0	1.4	BDL	
10551	02:31:56 - 02:44:06	60.1	1.2	BDL	
10552	02:44:06 - 03:00:46				BDL
10553	03:00:56 - 03:17:34	52.8	2.2	BDL	
10554	03:17:34 - 03:29:50	54.6	4.5	BDL	
10555	03:29:50 - 03:46:50				BDL
10556	03:46:41 - 04:03:18	49.9	ND	ND	
10557	04:03:18 - 04:15:34	56.2	3.6	BDL	
10558	04:20:09 - 04:32:17				BDL
10559	04:32:17 - 04:49:02	51.4	ND	BDL	
10560	04:49:10 - 05:01:17	49.5	4.4	BDL	
10561	05:01:26 - 05:18:01				BDL
10562	05:18:01 - 05:34:15	45.2	4.9	BDL	
10563	05:34:54 - 05:47:04	43.5	4.5	BDL	
10564	05:47:04 - 06:03:42				BDL
10565	06:03:52 - 06:20:33	43.8	ND	ND	
10566	06:20:33 - 06:32:45	47.6	ND	ND	
10567	06:32:45 - 06:49:21				BDL
10568	07:02:57 - 07:15:48	65.6	ND	ND	
10569	07:15:57 - 07:31:02	78.9	1.7	BDL	
10570	07:31:02 - 07:46:17	87.1	1.2	BDL	
10571	07:46:17 - 08:01:29	92.3	BDL	18.9	
10572	08:01:32 - 08:14:57	97.6	BDL	19.4	
10573	08:14:57 - 08:30:10	104.6	BDL	17.3	
10574	08:30:10 - 08:45:10	112.6	BDL	20.8	
10575	08:45:10 - 09:00:30	113.0	BDL	20.3	
10576	09:02:41 - 09:16:38	111.3	BDL	22.9	
10577	09:16:38 - 09:30:32	105.3	BDL	23.4	
10578	09:30:32 - 09:45:34	106.2	BDL	21.9	
10579	09:45:34 - 10:00:34	102.2	BDL	23.3	
10580	10:00:34 - 10:15:01	97.2	BDL	20.2	
10581	10:15:01 - 10:30:01	88.7	BDL	17.4	
10582	10:30:01 - 10:45:05	77.0	BDL	16.1	
10583	10:45:05 - 11:00:10	70.6	BDL	19.1	
10584	11:00:10 - 11:15:14	63.7	BDL	20.2	
10585	11:15:14 - 11:30:16	67.8	BDL	22.9	
10586	11:30:16 - 11:45:21	60.0	BDL	ND	
10587	11:45:21 - 12:00:28	46.3	BDL	16.1	
10588	12:00:28 - 12:15:34	45.3	BDL	17.3	
10589	12:15:34 - 12:30:37	47.1	BDL	17.7	

Table A-3 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10590	12:30:46 - 12:45:44	47.1	BDL	16.4	
10591	12:45:44 - 13:00:52	44.8	BDL	16.5	
10592	13:00:52 - 13:16:01	37.6	BDL	19.1	
10593	13:16:01 - 13:31:09	26.4	BDL	12.6	
10594	13:31:09 - 13:46:14	28.0	BDL	ND	
10595	13:46:14 - 14:01:22	28.1	BDL	12.0	
10596	14:01:22 - 14:16:32	26.5	BDL	10.5	
10597	14:16:32 - 14:31:41	24.8	BDL	ND	
10598	17:40:26 - 17:40:40	ND	ND	ND	
10599	17:40:57 - 17:48:20	40.8	BDL	9.2	
10600	17:48:20 - 18:00:49	39.3	BDL	13.0	
10601	18:00:49 - 18:14:48	40.0	BDL	12.0	
10602	18:29:56 - 18:44:58	49.6	BDL	12.3	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-4. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-4, July 13, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10721	00:31:05 - 00:42:58				BDL
10723	00:59:72 - 01:11:20	40.4	ND	ND	
10724	01:11:26 - 01:27:42				BDL
10725	01:27:42 - 01:44:08	37.1	1.5	6.4	
10726	01:44:16 - 01:56:06	46.2	ND	ND	
10727	01:56:06 - 02:12:28				BDL
10728	02:12:36 - 02:28:54	39.7	BDL	BDL	
10729	02:28:54 - 02:40:52	30.7	1.7	BDL	
10730	02:40:52 - 02:57:12				BDL
10731	02:57:21 - 03:13:40	22.5	BDL	5.9	
10732	03:13:40 - 03:25:36	32.4	1.1	8.3	
10733	03:30:09 - 03:42:00				BDL
10734	03:42:00 - 03:58:26	24.3	BDL	BDL	
10735	04:15:46 - 04:27:37	21.8	ND	ND	
10736	04:27:37 - 04:43:58				BDL
10737	04:44:24 - 05:00:45	14.6	ND	ND	
10738	05:00:45 - 05:12:41	20.9	ND	ND	
10739	05:17:14 - 05:29:05				BDL
10740	05:29:05 - 05:45:29	46.5	ND	ND	
10741	05:45:37 - 05:57:29	52.5	ND	ND	
10742	05:57:29 - 06:13:52				BDL
10743	06:14:01 - 06:30:40	52.5	ND	ND	
10744	06:30:42 - 06:43:00	55.1	BDL	ND	
10746	07:14:36 - 07:29:38	66.5	BDL	10.7	
10747	07:29:38 - 07:44:42	69.1	BDL	14.5	
10748	07:44:42 - 07:59:46	72.8	BDL	ND	
10749	07:59:46 - 08:14:52	81.1	BDL	15.7	
10750	08:14:52 - 08:29:54	84.6	BDL	19.7	
10751	08:30:01 - 08:45:00	90.3	BDL	8.0	
10752	08:45:00 - 09:00:06	ND	ND	ND	
10753	09:00:06 - 09:15:12	94.1	BDL	10.5	
10754	09:15:12 - 09:30:14	105.1	BDL	17.8	
10755	09:30:17 - 09:45:21	100.9	BDL	18.4	
10756	09:45:21 - 10:00:26	73.6	BDL	16.4	
10757	10:00:26 - 10:15:33	68.3	BDL	12.6	
10758	10:15:33 - 10:30:38	51.4	BDL	10.2	
10759	10:30:38 - 10:45:41	53.8	BDL	11.5	
10760	10:45:48 - 11:00:46	68.2	BDL	13.6	
10761	11:00:46 - 11:15:53	65.2	BDL	11.8	
10762	11:15:53 - 11:31:00	52.9	BDL	12.3	
10763	11:31:00 - 11:46:04	46.4	BDL	16.3	
10764	11:46:08 - 12:01:12	ND	ND	ND	
10765	12:01:12 - 12:16:17	ND	ND	ND	
10766	12:16:17 - 12:31:22	ND	ND	MD	
10767	12:31:22 - 12:46:28	22.0	BDL	ND	
10768	12:46:28 - 13:01:32	32.4	BDL	ND	

Table A-4 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10769	13:01:32 - 13:16:37	ND	BDL	ND	
10770	13:16:37 - 13:31:44	ND	BDL	ND	
10771	13:31:44 - 13:46:52	ND	BDL	ND	
10772	13:46:52 - 14:01:56	ND	BDL	ND	
10773	14:02:02 - 14:17:04	ND	BDL	ND	
10774	14:17:04 - 14:32:12	ND	BDL	ND	
10775	14:32:12 - 14:47:22	ND	BDL	ND	
10776	14:47:22 - 15:02:26	ND	BDL	ND	
10777	15:02:30 - 15:17:36	ND	BDL	ND	
10778	15:17:36 - 15:32:44	ND	BDL	ND	
10779	15:32:44 - 15:47:53	ND	BDL	ND	
10780	15:47:53 - 16:03:02	ND	BDL	ND	
10781	16:03:02 - 16:18:08	ND	BDL	ND	
10782	16:18:16 - 16:33:17	ND	BDL	ND	
10783	16:33:17 - 16:48:25	ND	BDL	ND	
10784	17:37:56 - 17:45:00	35.1	BDL	9.9	
10785	17:45:04 - 18:00:08	ND	ND	ND	
10786	18:00:08 - 18:15:14	34.5	BDL	6.4	
10787	18:15:14 - 18:30:28	39.0	BDL	5.9	
10788	18:30:28 - 18:45:34	37.6	BDL	7.5	
10789	18:45:34 - 18:53:13	39.0	BDL	9.6	
10790	19:08:17 - 19:13:52	RS	RS	RS	
10791	19:15:02 - 19:20:34	RS	RS	RS	
10792	19:29:52 - 19:42:00	51.4	BDL	11.5	
10793	19:42:00 - 19:58:34				BDL
10794	19:58:44 - 20:10:49				BDL
10795	20:10:49 - 20:27:28	66.2	BDL	5.3	
10796	20:27:28 - 20:44:09				BDL
10797	20:44:09 - 20:56;17				BDL
10798	20:56:17 - 21:13:13	72.0	BDL	BDL	
10799	21:17:48 - 21:29:58				BDL
10800	21:29:58 - 21:42:43				BDL
10801	21:42:22 - 21:58:57	69.3	2.1	BDL	
10802	21:58:57 - 22:15:34				BDL
10803	22:15:34 - 22:27:49				BDL
10804	22:27:58 - 22:44:33	67.4	2.9	BDL	
10805	22:44:33 - 23:01:13				BDL
10806	23:01:24 - 23:13:16				BDL
10807	23:13:16 - 23:29:41	63.8	4.0	6.0	
10808	23:34:16 - 23:46:02				BDL
10809	23:46:12 - 23:58:06				BDL
10810	00:04:28 - 00:16:18	53.0	3.3	BDL	
10812	00:32:21 - 00:44:13				BDL
10813	00:44:13 - 01:00:38	54.0	3.7	BDL	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-5. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-5, July 14, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10814	01:00:48 - 01:12:36	54.2	4.1	9.3	
18015	01:12:40 - 01:29:01				BDL
10816	01:29:01 - 01:45:26	55.3	4.5	7.1	
10817	01:45:36 - 01:57:26	54.9	3.4	5.8	
10818	01:57:26 - 02:14:06				BDL
10819	02:14:16 - 02:30:41	53.9	ND	BDL	
10820	02:30:41 - 02:42:38	54.1	3.6	5.5	
10821	02:42:38 - 02:59:00				BDL
10822	02:59:09 - 03:15:28	52.5	3.0	7.3	
10823	03:15:28 - 03:27:25	50.1	3.7	BDL	
10824	03:32:00 - 03:43:50				BDL
10825	03:43:50 - 04:00:16	49.2	ND	BDL	
10826	04:00:24 - 04:12:13	50.0	3.3	BDL	
10827	04:12:17 - 04:28:38				BDL
10828	04:25:37 - 04:45:14	46.9	3.2	6.1	
10829	04:45:14 - 04:57:05	45.9	3.6	6.5	
10830	04:57:05 - 05:13:26				BDL
10831	05:13:36 - 05:30:14	42.5	3.7	ND	
10832	05:30:14 - 05:42:34	43.0	3.2	ND	
10833	05:42:34 - 05:59:18				BDL
10834	05:59:28 - 06:16:10	43.0	2.3	6.9	
10835	06:16:10 - 06:28:29	46.7	1.9	BDL	
10836	06:59:18 - 07:14:28	42.3	2.0	ND	
10837	07:14:28 - 07:29:40	52.2	2.1	8.7	
10838	07:31:06 - 07:46:13	54.7	1.0	10.0	
10839	07:46:13 - 08:01:21	61.1	0.9	10.0	
10840	08:01:32 - 08:16:33	ND	ND	ND	
10841	08:16:33 - 08:31:44	ND	ND	ND	
10842	08:31:44 - 08:42:29	ND	ND	ND	
10843	08:42:34 - 08:57:41	ND	ND	ND	
10844	08:57:41 - 09:12:53	73.3	BDL	ND	
10845	09:12:53 - 09:28:05	70.0	BDL	ND	
10846	09:28:05 - 09:43:18	67.2	BDL	ND	
10847	09:43:18 - 09:58:25	67.5	BDL	8.7	
10848	09:58:25 - 10:13:36	75.8	BDL	12.3	
10849	10:13:36 - 10:28:50	72.4	BDL	8.4	
10850	10:28:50 - 10:44:02	68.2	BDL	ND	
10851	10:44:02 - 10:59:12	64.0	BDL	ND	
10852	10:59:22 - 11:14:22	55.5	BDL	12.4	
10853	11:14:22 - 11:29:34	48.0	BDL	BDL	
10854	11:29:34 - 11:44:48	49.9	BDL	16.8	
10855	11:44:48 - 12:00:01	42.2	BDL	14.2	
10856	12:00:01 - 12:15:12	42.8	BDL	13.6	
10857	12:15:12 - 12:30:25	40.8	BDL	13.0	
10858	12:30:25 - 12:45:40	34.2	BDL	14.2	

Table A-5 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10859	12:45:40 - 13:00:56	ND	ND	ND	
10860	13:00:56 - 13:16:08	ND	ND	ND	
10861	13:16:18 - 13:31:22	ND	ND	ND	
10862	13:31:22 - 13:46:38	ND	ND	ND	
10863	13:46:38 - 14:01:53	ND	ND	ND	
10864	14:01:53 - 14:17:04	ND	ND	ND	
10865	14:17:08 - 14:32:18	ND	ND	ND	
10866	14:32:18 - 14:47:33	ND	ND	ND	
10867	14:47:33 - 15:02:49	ND	ND	ND	
10868	15:02:49 - 00:00:00	ND	ND	ND	
10869	15:02:49 - 00:00:00	ND	ND	ND	
10870	15:02:49 - 00:00:00	ND	ND	ND	
10871	15:02:49 - 00:00:00	ND	ND	ND	
10872	15:02:49 - 00:00:00	ND	ND	ND	
10873	15:02:49 - 00:00:00	ND	ND	ND	
10874	15:02:49 - 00:00:00	ND	ND	ND	
10875	15:02:49 - 15:18:48	ND	ND	ND	
10876	15:18:48 - 15:34:02	ND	ND	ND	
10877	15:34:02 - 15:49:14	ND	ND	ND	
10878	15:49:14 - 16:04:29	ND	ND	ND	
10879	16:04:29 - 16:19:44	ND	ND	ND	
10880	16:19:44 - 16:34:58	ND	ND	ND	
10881	16:34:58 - 16:50:09	ND	ND	ND	
10882	16:50:22 - 17:05:21	ND	ND	ND	
10883	17:05:24 - 17:20:38	ND	ND	ND	
10884	17:20:38 - 17:35:53	ND	ND	ND	
10885	17:35:53 - 17:51:38	ND	ND	ND	
10886	17:51:41 - 18:06:53	ND	ND	ND	
10887	18:06:53 - 18:22:14	ND	ND	ND	
10888	18:22:14 - 18:37:28	45.5	BDL	10.5	
10889	18:37:28 - 18:52:57	49.0	BDL	10.5	
10890	18:52:57 - 19:08:01	49.8	BDL	12.1	
10891	19:13:34 - 19:19:04	RS	RS	RS	
10892	19:21:44 - 19:27:18	RS	RS	RS	
10893	19:29:54 - 19:36:17	58.8	BDL	8.6	
10894	19:40:57 - 19:44:13	60.3	BDL	11.9	
10895	19:48:46 - 19:59:56				BDL
10896	19:59:56 - 20:10:17				BDL
10897	20:10:25 - 20:26:50	63.2	BDL	ND	
10898	20:26:53 - 20:43:12				0.053
10899	20:43:12 - 20:55:06				0.058
10900	20:55:14 - 21:11:32	59.0	BDL	3.4	
10901	21:11:32 - 21;27:52				0.059
10902	21:28:00 - 21:39:45				BDL
10903	21:39:49 - 21:56:16	55.2	BDL	BDL	
10904	22:00:49 - 22:12:34				BDL
10905	22:12:42 - 22:24:32				BDL

Table A-5 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10906	22:24:32 - 22:40:56	50.2	1.3	BDL	
10907	22:45:29 - 22:57:18				BDL
10908	22:57:18 - 23:09:13				BDL
10909	23:09:21 - 23:25:48	38.1	ND	ND	
10910	23:25:48 - 23:42:08				BDL
10911	23:42:08 - 23:54:02				BDL
10912	23:59:54 - 00:11:53	37.1	BDL	8.5	
10913	00:11:53 - 00:23:53	40.9	1.2	BDL	
10914	00:28:25 - 00:40:16				BDL
10915	00:40:16 - 00:56:41	45.5	2.2	7.4	
10916	00:56:49 - 01:08:38	48.0	2.6	BDL	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-6. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-6, July 15, 1987

File No.	Measurement Period	Concentrations (ppb)			
		NO_2	HONO	HCHO	NO_3
10916	00:56:49 - 01:08:38	47.0	2.1	BDL	
10917	01:08:38 - 01:24:58				BDL
10918	01:25:06 - 01:41:21	40.8	1.8	BDL	
10919	01:41:25 - 01:53:20	40.7	1.4	BDL	
10920	01:53:20 - 02:09:40				BDL
10921	02:09:48 - 02:26:12	ND	ND	ND	
10922	02:26:12 - 02:38:06	39.6	2.2	5.8	
10923	02:42:40 - 02:54:26				BDL
10924	02:54:34 - 03:10:53	40.3	2.0	6.2	
10925	03:10:53 - 03:23:02	43.2	ND	BDL	
10926	03:27:36 - 03:39:48				BDL
10927	03:39:48 - 03:56:33	43.1	ND	ND	
10928	03:56:41 - 04:08:53	41.1	2.3	BDL	
10929	04:08:53 - 04:25:34				BDL
10930	04:25:42 - 04:42:20	37.8	ND	ND	
10931	04:42:24 - 04:54:40	35.1	2.3	BDL	
10932	04:54;40 - 05:11:22				BDL
10933	05:11:30 - 05:28:12	40.0	2.1	BDL	
10934	05:28:12 - 05:40:29	41.7	2.7	BDL	
10935	05:45:02 - 05:57:09				BDL
10936	05:57:17 - 06:13:58	35.9	ND	ND	
10937	06:13:58 - 06:26:16	36.7	1.7	ND	
10938	06:44:48 - 06:59:48	34.7	2.0	ND	
10939	06:59:48 - 07:14:50	41.8	2.3	ND	
10940	07:14:50 - 07:29:53	46.5	BDL	ND	
10941	07:29:53 - 07:44:53	43.7	BDL	ND	
10942	07:44:56 - 07:59:54	44.6	BDL	ND	
10943	07:59:54 - 08:14:56	ND	ND	ND	
10944	08:14:56 - 08:29:58	ND	ND	ND	
10945	08:29:58 - 08:45:00	ND	ND	ND	
10946	08:45:00 - 09:00:00	ND	ND	ND	
10947	09:00:00 - 09:15:04	38.5	BDL	ND	
10948	09:15:04 - 09:30:08	39.4	BDL	ND	
10949	09:30:08 - 09:45:12	39.9	BDL	ND	
10950	09:45:12 - 10:00:13	37.7	BDL	ND	
10951	10:00:20 - 10:15:17	40.9	BDL	ND	
10952	10:15:17 - 10:30:21	39.6	BDL	8.9	
10953	10:30:21 - 10:45:25	39.4	BDL	ND	
10954	10:45:25 - 11:00:29	36.5	BDL	ND	
10955	11:00:29 - 11:15:29	39.1	BDL	11.2	
10956	11:15:29 - 11:30:33	37.2	BDL	ND	
10957	11:30:33 - 11:45:38	36.3	BDL	ND	
10958	11:45:38 - 12:00:42	39.0	BDL	ND	
10959	12:00:42 - 12:15:44	36.8	BDL	7.2	
10960	12:15:50 - 12:30:48	39.1	BDL	ND	

Table A-6 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
10961	12:30:48 - 12:45:53	40.6	BDL	ND	
10962	12:45:53 - 13:00:57	36.7	BDL	10.6	
10963	13:00:57 - 13:16:00	38.0	BDL	13.6	
10964	13:16:02 - 13:31:05	37.1	BDL	11.8	
10965	13:31:05 - 13:46:10	29.7	BDL	14.5	
10966	13:46:10 - 14:01:16	33.5	BDL	12.5	
10967	14:01:16 - 14:16:21	31.1	BDL	11.7	
10968	14:16:21 - 14:31:24	ND	ND	ND	
10969	14:31:24 - 14:46:30	ND	ND	ND	
10970	14:46:30 - 15:01:36	ND	ND	ND	
10971	15:01:36 - 15:16:42	ND	ND	ND	
10972	15:16:42 - 15:31:46	ND	ND	ND	
10973	15:31:54 - 15:46:54	ND	ND	ND	
10974	15:46:54 - 16:02:04	ND	ND	ND	
10975	16:02:04 - 16:17:10	31.4	BDL	10.9	
10976	16:17:10 - 16:32:18	ND	ND	ND	
10977	16:32:18 - 16:47:20	32.3	BDL	12.2	
10978	16:47:20 - 17:02:22	36.2	BDL	11.9	
10979	17:02:22 - 17:17:26	35.4	BDL	13.2	
10980	17:17:26 - 17:32:30	35.4	BDL	14.1	
10981	17:32:30 - 17:47:30	37.1	BDL	12.3	
10982	17:47:38 - 18:02:34	38.5	BDL	8.5	
10983	18:02:34 - 18:17:37	41.3	BDL	12.5	
10984	18:17:37 - 18:32:40	43.3	BDL	14.5	
10985	18:32:40 - 18:47:40	44.7	BDL	13.7	
10986	18:47:44 - 19:02:42	45.1	BDL	13.3	
10987	19:05:41 - 19:11:14	RS	RS	RS	
10988	19:21:54 - 19:27:28	RS	RS	RS	
10989	19:30:02 - 19:42:16	52.8	BDL	11.5	
10990	19:42:16 - 19:58:40				BDL
10991	19:58:48 - 20:10:34				0.072
10992	20:10:37 - 20:27:04	68.1	BDL	6.3	
10993	20:31:38 - 20:43:24				BDL
10994	20:43:32 - 20:55:22				BDL
10995	20:55:22 - 21:11:45	70.7	1.0	BDL	
10996	21:16:20 - 21:28:08				BDL
10997	21:28:08 - 21:40:02				BDL
10998	21:40:13 - 21:56:30	72.7	1.5	BDL	
10999	21:56:30 - 22:12:50				BDL
11000	22:12:50 - 22:24:46				BDL
11001	22:24:54 - 22:41:30	66.3	2.6	ND	
11002	22:41:30 - 22:57:50				BDL
11003	22:58:01 - 23:09:50				BDL
11004	23:09:50 - 23:26:18	60.6	ND	ND	
11005	23:30:53 - 23:42:40				BDL
11006	23:42:48 - 23:54:38				BDL
11007	00:00:04 - 00:12:09	56.1	ND	ND	

Table A-6 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11009	00:24:20 - 00:40:01				BDL
11010	00:40:50 - 00:57:18	51.4	3.4	6.7	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-7. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-7, August 27, 1987

File No.	Measurement Period	Concentrations (ppb)			
		NO_2	HONO	HCHO	NO_3
11102	19:40:05 - 19:56:20				BDL
11103	19:56:20 - 20:08:16				BDL
11105	20:24:42 - 20:41:02				BDL
11106	20:41:12 - 20:52:58				BDL
11110	21:58:29 - 22:14:49				BDL
11111	22:14:49 - 22:25:54				BDL
11113	22:44:58 - 22:56:49				BDL
11114	22:56:49 - 23:08:44				BDL
11116	23:25:16 - 23:41:36				BDL
11117	23:41:36 - 23:53:32				BDL
11118	00:01:05 - 00:10:00	55.1	BDL	6.9	
11119	00:10:08 - 00:21:56	55.5	1.7	BDL	
11120	00:21:58 - 00:38:18				BDL
11121	00:42:56 - 00:54:42	58.3	BDL	BDL	
11122	00:54:50 - 01:06:41	56.5	1.4	7.6	
11123	01:06:41 - 01:23:02				BDL
11124	01:23:10 - 01:39:29	53.5	BDL	BDL	
11125	01:39:29 - 01:51:25	52.4	BDL	BDL	
11126	01:51:25 - 02:07:45				BDL
11127	02:07:53 - 02:24:12	46.8	BDL	BDL	
11128	02:24:12 - 02:36:08	42.1	BDL	BDL	
11129	02:40:41 - 02:52:30				BDL
11130	02:52:30 - 03:08:56	36.5	BDL	BDL	
11131	03:09:04 - 03:20:52	43.9	BDL	BDL	
11132	03:20:54 - 03:37:14				BDL
11133	03:41:52 - 03:53:38	47.4	BDL	BDL	
11134	03:53:46 - 04:05:37	42.5	BDL	BDL	
11135	04:05:37 - 04:21:57				BDL
11136	04:22:05 - 04:38:25	37.3	1.9	BDL	
11137	04:38:25 - 04:50:21	45.6	BDL	BDL	
11138	04:50:21 - 05:06:41				BDL
11139	05:06:49 - 05:23:33	41.0	1.8	BDL	
11140	05:23:33 - 05:35:53	36.6	2.1	7.6	
11141	05:40:26 - 05:52:41				BDL
11142	05:52:41 - 06:09:30	50.7	2.5	10.4	
11143	06:09:30 - 06:21:54	38.0	ND	BDL	
11144	06:21:54 - 06:38:41				BDL
11145	06:44:56 - 07:00:04	55.5	2.0	6.7	
11146	07:00:04 - 07:15:12	61.4	2.0	11.5	
11147	07:15:12 - 07:30:22	65.0	ND	ND	
11148	07:30:22 - 07:45:30	63.6	1.9	7.5	
11149	07:45:38 - 08:00:42	62.7	ND	ND	
11150	08:00:42 - 08:15:52	64.7	BDL	12.5	
11151	08:15:52 - 08:31:02	63.3	BDL	13.3	
11152	08:31:02 - 08:46:09	70.3	BDL	12.0	

Table A-7 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11153	08:46:13 - 09:01:18	82.7	BDL	17.3	
11154	09:01:18 - 09:16:28	90.8	BDL	18.6	
11155	09:16:28 - 09:31:37	91.4	BDL	16.1	
11156	09:31:37 - 09:46:46	93.8	BDL	18.0	
11157	09:46:46 - 10:01:52	95.6	BDL	19.3	
11158	10:01:52 - 10:17:01	103.9	BDL	15.6	
11159	10:17:01 - 10:32:10	111.4	BDL	19.2	
11160	10:32:10 - 10:47:20	108.8	BDL	ND	
11161	10:47:20 - 11:02:26	87.8	BDL	21.3	
11162	11:02:33 - 11:17:54	60.5	BDL	19.4	
11163	11:34:25 - 11:44:58	89.5	BDL	13.4	
11164	11:44:58 - 12:00:04	91.8	BDL	13.1	
11165	12:00:08 - 12:15:13	94.3	BDL	ND	
11166	12:15:13 - 12:30:24	78.4	BDL	ND	
11167	12:30:24 - 12:45:36	66.2	BDL	ND	
11168	12:45:36 - 13:00:48	ND	ND	ND	
11169	13:00:48 - 13:15:58	ND	ND	ND	
11170	13:15:58 - 13:31:12	ND	ND	ND	
11171	13:31:12 - 13:46:26	ND	ND	ND	
11172	13:46:26 - 14:01:40	ND	ND	ND	
11173	14:01:40 - 14:16:33	ND	ND	ND	
11174	14:16:41 - 14:31:22	ND	ND	ND	
11175	14:31:22 - 14:46:28	ND	ND	ND	
11176	14:46:28 - 15:01:33	ND	ND	ND	
11177	15:01:33 - 15:16:41	ND	ND	ND	
11178	15:16:41 - 15:31:56	ND	ND	ND	
11179	15:31:56 - 15:47:30	ND	ND	ND	
11180	15:47:30 - 16:02:36	ND	ND	ND	
11181	16:02:36 - 16:17:41	ND	ND	ND	
11182	16:17:41 - 16:32:41	ND	ND	ND	
11183	16:32:41 - 16:47:46	ND	ND	ND	
11184	16:47:46 - 17:02:52	ND	ND	ND	
11185	17:02:52 - 17:17:57	ND	ND	ND	
11186	17:17:57 - 17:33:29	48.3	BDL	11.4	
11187	17:33:32 - 17:48:33	52.8	BDL	13.2	
11188	17:48:33 - 18:03:36	52.4	BDL	8.4	
11189	18:03:36 - 18:18:40	54.8	BDL	6.4	
11190	18:32:32 - 18:37:30	RS	RS	RS	
11191	18:38:46 - 18:43:10	RS	RS	RS	
11192	18:45:29 - 18:57:38	60.3	BDL	8.6	
11193	19:01:37 - 19:06:46	66.7	BDL	BDL	
11194	19:06:46 - 19:18:44				0.039
11195	19:18:44 - 19:25:30				0.049
11196	19:25:30 - 19:41:56	61.4	BDL	5.5	
11197	19:46:30 - 19:58:20				BDL
11198	19:58:20 - 20:10:17				BDL
11199	20:10:25 - 20:26:45	79.9	BDL	5.4	

Table A-7 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11200	20:26:45 - 20:43:06				BDL
11201	20:43:06 - 20:55:02				BDL
11202	20:55:12 - 21:11:37	84.3	1.2	BDL	
11203	21:11:37 - 21:27:58				BDL
11204	21:28:08 - 21:39:54				BDL
11205	21:39:58 - 21:56:24	81.9	BDL	5.2	
11206	22:00:58 - 22:12:46				BDL
11207	22:12:56 - 22:24:46				BDL
11208	22:24:46 - 22:41:21	82.5	1.7	BDL	
11209	22:45:56 - 22:57:46				BDL
11210	22:57:46 - 23:09:42				BDL
11211	-	76.3	1.4	BDL	
11212	23:26:38 - 23:42:49				BDL
11213	23:42:49 - 23:54:46				BDL
11214	00:02:28 - 00:14:24	73.6	ND	ND	
11215	00:14:33 - 00:25:00	73.5	BDL	BDL	
11216	00:25:00 - 00:41:21				BDL
11217	00:41:30 - 00:57:50	73.1	ND	ND	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-8. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-8, August 28, 1987

File No.	Measurement Period	Concentrations (ppb)			
		NO_2	HONO	HCHO	NO_3
11218	00:57:50 - 01:09:48	77.5	3.0	BDL	
11219	01:09:48 - 01:26:09				BDL
11220	01:26:18 - 01:42:38	79.7	2.1	10.2	
11221	01:42:38 - 01:54:36	71.9	3.5	BDL	
11222	01:59:10 - 02:11:00				BDL
11223	02:11:00 - 02:27:26	74.6	2.9	ND	
11224	02:27:36 - 02:39:24	66.4	3.1	ND	
11225	02:39:33 - 02:55:49				BDL
11226	02:55:49 - 03:12:18	55.0	ND	BDL	
11227	03:12:26 - 03:24:18	56.4	4.7	6.4	
11228	03:24:18 - 03:40:40				BDL
11229	03:40:49 - 03:57:09	57.7	3.4	ND	
11230	03:57:09 - 04:09:06	57.3	ND	5.9	
11231	04:09:06 - 04:25:28				BDL
11232	04:25:37 - 04:41:57	52.1	2.9	ND	
11233	04:41:57 - 04:53:54	58.8	2.6	6.6	
11234	04:58:29 - 05:10:20				BDL
11235	05:10:20 - 05:26:45	59.8	ND	ND	
11236	05:26:54 - 05:38:42	60.1	2.8	5.1	
11237	05:38:50 - 05:55:06				BDL
11238	05:55:06 - 06:11:32	65.3	3.2	ND	
11239	06:11:41 - 06:23:52	65.6	2.6	ND	
11240	06:28:26 - 06:40:42				BDL
11241	06:41:14 - 07:00:48	80.6	3.0	9.2	
11242	07:00:48 - 07:15:53	89.3	4.2	11.7	
11243	07:16:02 - 07:31:01	89.1	3.4	10.7	
11244	07:31:01 - 07:46:08	95.2	3.3	ND	
11245	07:46:08 - 08:01:14	100	1.7	12.9	
11246	08:01:14 - 08:16:17	101	0.9	17.6	
11247	08:16:21 - 08:31:26	100	BDL	16.5	
11248	08:31:26 - 08:46:37	80.1	BDL	16.2	
11249	08:46:37 - 09:01:44	41.4	BDL	8.2	
11250	09:01:44 - 09:16:52	54.3	BDL	12.0	
11251	09:16:52 - 09:31:56	57.6	BDL	7.8	
11252	09:32:05 - 09:47:04	64.3	BDL	13.9	
11253	09:47:04 - 10:02:12	63.5	BDL	14.0	
11254	10:02:12 - 10:17:22	79.2	BDL	10.8	
11255	10:17:22 - 10:32:39	91.5	BDL	16.4	
11256	10:32:32 - 10:47:38	93.2	BDL	15.5	
11257	10:47:38 - 11:02:49	86.4	BDL	14.5	
11258	11:02:49 - 11:18:01	82.1	BDL	21.6	
11259	11:18:01 - 11:32:12	82.3	BDL	16.5	
11260	11:37:12 - 11:48:20	74.1	BDL	11.3	
11261	11:48:20 - 12:03:30	68.0	BDL	13.7	
11262	12:03:30 - 12:18:42	59.5	BDL	11.0	

Table A-8 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11263	12:18:42 - 12:33:53	61.5	BDL	14.9	
11264	12:33:53 - 12:49:00	60.4	BDL	12.6	
11265	12:49:09 - 13:04:12	72.2	BDL	11.3	
11266	13:04:12 - 13:19:22	77.8	BDL	13.7	
11267	13:19:22 - 13:34:34	73.9	BDL	19.9	
11268	13:34:34 - 13:49:45	63.4	BDL	20.0	
11269	13:49:45 - 14:04:54	ND	ND	ND	
11270	14:05:54 - 14:20:05	ND	ND	ND	
11271	14:20:05 - 14:35:16	ND	ND	ND	
11272	14:35:16 - 14:50:28	ND	ND	ND	
11273	14:50:28 - 15:05:34	ND	ND	ND	
11274	15:05:44 - 15:20:46	ND	ND	ND	
11275	15:20:46 - 15:35:57	ND	ND	ND	
11276	15:35:57 - 15:51:08	ND	ND	ND	
11277	15:51:08 - 16:06:14	ND	ND	ND	
11278	16:06:18 - 16:21:25	ND	ND	ND	
11279	16:21:25 - 16:36:36	ND	ND	ND	
11280	16:36:36 - 16:51:48	ND	ND	ND	
11281	16:51:48 - 17:06:58	ND	ND	ND	
11282	17:06:58 - 17:22:05	ND	ND	ND	
11283	17:22:05 - 17:37:14	ND	ND	ND	
11284	17:37:14 - 17:52:20	57.2	BDL	10.6	
11285	17:52:20 - 18:07:24	56.9	BDL	11.1	
11286	18:07:24 - 18:22:25	58.4	BDL	ND	
11287	18:22:25 -	RS	RS	RS	
11288	18:38:34	RS	RS	RS	
11289	18:38:34 - 18:44:09	59.1	BDL	7.5	
11290	18:45:01 - 18:57:10	57.1	BDL	8.6	
11291	18:57:10 - 19:13:30				0.059
11292	19:13:30 - 19:25:26				0.049
11293	19:25:34 - 19:42:17	68.4	BDL	7.0	
11294	19:42:17 - 19:58:36				0.080
11295	19:58:36 - 20:10:34				0.062
11296	20:10:34 - 20:26:57	65.6	BDL	BDL	
11297	20:31:30 - 20:43:16				0.014
11298	20:43:24 - 20:55:14				0.023
11299	20:55:14 - 21:12:00	67.5	1.2	7.5	
11300	21:16:32 - 21:28:21				BDL
11301	21:28:21 - 21:40:16				BDL
11302	21:40:25 - 21:57:04	70.2	1.5	BDL	
11303	21:57:04 - 22:13:22				BDL
11304	22:13:22 - 22:25:17				BDL
11305	22:25:26 - 22:42:05	74.8	3.4	BDL	
11306	22:42:05 - 22:58:24				BDL
11307	22:58:32 - 23:10:21				BDL
11308	23:10:21 - 23:27:01	70.2	3.6	BDL	
11309	23:31:33 - 23:43:20				BDL

Table A-8 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11310	23:43:26 - 23:55:17				BDL
11311	00:00:50 - 00:13:02	56.8	BDL	BDL	
11312	00:13:10 - 00:24:58	71.0	3.5	5.2	
11313	00:29:32 - 00:41:18				BDL
11314	00:41:21 - 00:57:44	75.3	6.2	9.3	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-9. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-9, August 29, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11315	00:57:53 - 01:09:38	74.6	4.8	6.4	
11316	01:09:46 - 01:26:01				BDL
11317	01:26:01 - 01:42:24	70.3	4.9	BDL	
11318	01:42:32 - 01:54:21	76.9	6.1	BDL	
11319	01:54:21 - 02:10:40				BDL
11320	02:10:48 - 02:27:06	64.5	ND	BDL	
11321	02:27:06 - 02:39:01	69.1	ND	BDL	
11322	02:39:01 - 02:55:20				BDL
11323	02:55:29 - 03:11:50	ND	ND	ND	
11324	03:11:50 - 03:23:45	ND	ND	ND	
11325	03:28:18 - 03:40:04				BDL
11326	03:40:08 - 03:56:30	ND	ND	ND	
11327	03:56:40 - 04:08:25	ND	ND	ND	
11328	04:08:33 - 04:24:48				BDL
11329	04:24:48 - 04:41:12	ND	ND	ND	
11330	04:41:20 - 04:53:10	56.4	6.7	BDL	
11331	04:53:10 - 05:09:29				BDL
11332	05:09:37 - 05:25:58	69.5	6.2	BDL	
11333	05:25:58 - 05:38:09	65.8	7.2	BDL	
11334	05:38:09 - 05:54:30				BDL
11335	05:54:38 - 06:11:08	ND	ND	ND	
11336	06:11:08 - 06:23:22	ND	ND	ND	
11337	06:27:56 - 06:40:06				BDL
11338	06:41:30 - 07:01:04	50.3	6.6	ND	
11339	07:01:04 - 07:16:09	61.9	6.4	5.1	
11340	07:16:09 - 07:31:13	66.2	4.5	BDL	
11341	07:31:13 - 07:46:13	47.1	3.0	ND	
11342	07:46:20 - 08:00:22	ND	ND	ND	
11343	08:00:22 - 08:15:24	56.3	BDL	BDL	
11344	08:15:24 - 08:30:25	60.1	BDL	9.7	
11345	08:30:25 - 08:45:26	59.2	BDL	9.9	
11346	08:45:26 - 09:00:52	58.5	BDL	6.6	
11347	09:00:52 - 09:15:57	59.2	BDL	7.5	
11348	09:15:57 - 09:31:13	57.2	BDL	12.0	
11349	09:31:13 - 09:46:17	54.2	BDL	13.5	
11350	09:46:17 - 10:01:14	62.2	BDL	14.0	
11351	10:01:21 - 10:16:16	68.7	BDL	6.6	
11352	10:16:16 - 10:31:18	71.0	BDL	10.4	
11353	10:31:18 - 10:46:21	72.9	BDL	10.1	
11354	10:46:21 - 11:01:24	74.4	BDL	15.5	
11355	11:01:24 - 11:16:24	69.8	BDL	11.9	
11356	11:16:24 - 11:31:28	70.3	BDL	10.2	
11357	11:31:28 - 11:46:32	67.8	BDL	12.9	
11358	11:46:32 - 12:01:40	68.3	BDL	17.8	
11359	12:01:40 - 12:16:41	69.3	BDL	ND	

Table A-9 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11360	12:16:49 - 12:31:45	54.7	BDL	12.0	
11361	12:31:45 - 12:46:50	51.7	BDL	20.1	
11362	12:46:50 - 13:01:57	48.0	BDL	12.8	
11363	13:01:57 - 13:16:58	ND	ND	ND	
11364	13:17:02 - 13:32:06	ND	ND	ND	
11365	13:32:06 - 13:47:13	ND	ND	ND	
11366	13:47:13 - 14:02:21	ND	ND	ND	
11367	14:02:21 - 14:17:30	ND	ND	ND	
11368	14:17:30 - 14:32:34	ND	ND	ND	
11369	14:32:34 - 14:47:42	ND	ND	ND	
11370	14:47:42 - 15:02:50	ND	ND	ND	
11371	15:02:50 - 15:17:58	ND	ND	ND	
11372	15:17:58 - 15:33:02	ND	ND	ND	
11373	15:33:10 - 15:48:10	ND	ND	ND	
11374	15:48:10 - 16:03:17	ND	ND	ND	
11375	16:03:17 - 16:18:25	ND	ND	ND	
11376	16:18:25 - 16:33:32	ND	ND	ND	
11381	17:34:00 - 17:49:04	ND	ND	ND	
11382	17:49:12 - 18:04:12	ND	ND	ND	
11383	18:04:12 - 18:15:34	ND	ND	ND	
11386	18:33:12 - 18:42:48	ND	ND	ND	
11388	18:59:58 - 19:11:44				0.060
11389	19:11:53 - 19:23:42				0.067
11390	19:23:42 - 19:40:26	ND	ND	ND	
11391	19:45:00 - 19:56:49				0.129
11392	19:56:49 - 20:08:46				0.150
11393	20:08:56 - 20:25:29	41.4	0.9	8.0	
11394	20:25:29 - 20:41;50				0.097
11395	20:41;50 - 20:53:45				0.063
11396	20:53:54 - 21:10:32	57.0	1.8	8.5	
11397	21:10:32 - 21:26:52				0.097
11398	21:27:01 - 21:38:50				0.074
11399	21:38:50 - 21:55:30	58.9	ND	ND	
11400	22:00:05 - 22:11:50				0.062
11401	22:12:00 - 22:23:49				BDL
11402	22:23:49 - 22:40:25	82.7	2.8	8.1	
11403	22:44:58 - 22:56:48				BDL
11404	22:56:48 - 23:08:44				ND
11405	23:08:53 - 23:25:20	77.5	2.9	6.1	
11406	23:25:20 - 23:41:38				ND
11407	23:41:38 - 23:53:34				ND
11408	23:59:58 - 00:11:44	85.1	4.3	9.8	
11409	00:11:48 - 00:23:42	72.1	ND	ND	
11410	00:23:42 - 00:40:02				BDL

Table A-9 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11411	00:40:12 - 00:56:29	81.1	4.3	9.1	
11412	00:56:29 - 01:08:25	75.9	5.6	8.3	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-10. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-10, September 2, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11485	21:20:52 - 21:32:42				BDL
11486	21:52:52 - 22:04:42				BDL
11488	22:25:02 - 22:36:52				BDL
11490	00:45:16 - 00:57:10	41.0	BDL	BDL	
11491	00:57:10 - 01:09:06	29.4	BDL	7.6	
11492	01:13:38 - 01:25:29				BDL
11493	01:25:29 - 01:41:53	32.6	1.6	BDL	
11494	01:42:00 - 01:53:52	33.8	1.6	BDL	
11495	01:53:52 - 02:10:12				BDL
11496	02:10:20 - 02:26:34	50.5	BDL	7.4	
11497	02:26:38 - 02:38:33	42.7	BDL	BDL	
11498	02:38:33 - 02:54:54				BDL
11499	02:55:02 - 03:11:21	25.4	BDL	BDL	
11500	03:11:21 - 03:23:17	27.7	BDL	BDL	
11501	03:27:50 - 03:39:37				BDL
11502	03:39:40 - 03:56:04	15.8	0.9	BDL	
11503	03:56:04 - 04:08:00	16.5	BDL	BDL	
11504	04:12:33 - 04:24:22				BDL
11505	04:24:22 - 04:40:54	16.3	ND	ND	
11506	04:40:54 - 04:52:46	22.2	ND	ND	
11507	04:52:46 - 05:09:06				BDL
11508	05:09:14 - 05:25:36	28.1	ND	ND	
11509	05:25:40 - 05:37:36	31.7	BDL	BDL	
11510	05:37:36 - 05:53:56				BDL
11511	05:54:04 - 06:10:33	29.2	1.2	BDL	
11512	06:10:33 - 06:22:50	38.0	BDL	BDL	
11513	06:27:24 - 06:39:29				BDL
11514	06:44:24 - 06:59:28	68.8	2.4	BDL	
11515	06:59:28 - 07:14:32	69.1	BDL	6.6	
11516	07:14:32 - 07:29:38	63.4	BDL	7.7	
11517	07:29:38 - 07:44:41	67.9	1.5	BDL	
11518	11:37:16 - 11:41:37	RS	RS	RS	
11519	11:43:20 - 11:47:41	RS	RS	RS	
11520	11:53:32 - 12:04:13	67.1	BDL	10.8	
11521	12:04:13 - 12:14:48	55.7	BDL	ND	
11522	12:14:38 - 12:29:56	44.0	BDL	ND	
11523	12:29:56 - 12:45:01	30.9	BDL	ND	
11524	12:45:01 - 13:00:05	14.4	BDL	BDL	
11525	13:00:05 - 13:15:06	12.0	BDL	BDL	
11526	13:15:06 - 13:30:12	10.4	BDL	BDL	
11527	13:30:12 - 13:45:18	11.6	BDL	BDL	
11528	13:45:18 - 14:00:25	9.3	BDL	BDL	
11529	14:00:25 - 14:15:29	7.6	BDL	BDL	
11530	14:15:36 - 14:30:34	12.6	BDL	BDL	
11531	14:30:34 - 14:45:42	12.9	BDL	BDL	

Table A-10 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11532	14:45:42 - 15:00:50	8.1	BDL	BDL	
11533	15:00:50 - 15:15:54	9.4	BDL	BDL	
11534	15:15:57 - 15:31:01	18.4	BDL	5.1	
11535	15:31:01 - 15:46:08	33.1	BDL	10.0	
11536	15:46:08 - 16:01:13	36.9	BDL	10.2	
11537	16:01:13 - 16:16:18	36.6	BDL	8.8	
11538	16:16:18 - 16:31:21	37.3	BDL	11.8	
11539	16:31:29 - 16:46:28	43.1	BDL	11.6	
11540	16:46:28 - 17:01:34	36.5	BDL	ND	
11541	17:01:34 - 17:16:38	48.1	BDL	13.3	
11542	17:16:38 - 17:31:41	49.0	BDL	13.9	
11543	17:31:44 - 17:46:45	40.7	BDL	14.2	
11544	17:46:45 - 18:01:49	32.6	BDL	8.6	
11545	18:01:49 - 18:16:52	18.4	BDL	5.2	
11546	18:16:52 - 18:27:29	25.5	BDL	7.2	
11547	18:29:52 - 18:35:16	RS	RS	RS	
11548	18:37:01 - 18:42:25	RS	RS	RS	
11549	18:44:49 - 18:56:50	32.1	BDL	11.3	
11550	18:56:50 - 19:13:10				0.114
11551	19:13:18 - 19:25:09				0.126
11552	19:25:09 - 19:41:58	45.5	BDL	ND	
11553	19:46:33 - 19:58:20				0.174
11554	19:58:24 - 20:10:20				0.135
11555	20:14:57 - 20:26:44	ND	ND	ND	
11556	20:31:18 - 20:43:08				0.057
11557	20:43:08 - 20:55:05				0.061
11558	20:55:13 - 21:11:50	ND	ND	ND	
11559	21:11:50 - 21:28:12				BDL
11560	21:28:21 - 21:40:08				BDL
11561	21:40:17 - 21:56:50	69.7	BDL	BDL	
11562	21:56:50 - 22:13:17				BDL
11563	22:13:26 - 22:25:17				BDL
11564	22:25:17 - 22:41:41	64.4	BDL	BDL	
11565	22:47:12 - 22:59:02				BDL
11566	23:01:38 - 23:14:36				BDL
11567	23:15:36 - 23:28:29	55.4	ND	ND	
11568	23:29:52 - 23:42:45				BDL
11569	23:42:46 - 23:57:17				BDL
11570	00:02:21 - 00:11:02	74.3	ND	ND	
11572	00:25:33 - 00:37:24				BDL
11573	00:44:52 - 00:56:42	55.4	ND	ND	

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table A-11. Fifteen Minute Average NO_2, HONO, HCHO and NO_3 Radical Concentrations (ppb) at Claremont.
SCAQS Episode S-11, September 3, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11574	00:56:42 - 01:08:38	59.2	ND	ND	
11575	01:13:18 - 01:25:05				BDL
11576	01:25:08 - 01:41:36	70.1	1.3	BDL	
11577	01:41:36 - 01:53:32	79.7	2.3	7.4	
11578	01:58:05 - 02:09:56				BDL
11579	02:09:56 - 02:26:21	76.4	2.8	BDL	
11580	02:26:29 - 02:38:21	72.2	3.3	BDL	
11581	02:38:21 - 02:54:41				BDL
11582	02:54:50 - 03:11:06	68.1	3.9	7.9	
11583	03:11:09 - 03:23:06	67.0	4.3	BDL	
11584	03:23:06 - 03:39:28				BDL
11585	03:39:36 - 03:55:56	61.4	4.8	BDL	
11586	03:55:56 - 04:07:52	65.7	5.3	BDL	
11587	04:12:25 - 04:24:13				BDL
11588	04:26:16 - 04:40:41	53.3	4.0	7.4	
11589	04:40:41 - 04:52:38	61.9	ND	BDL	
11590	04:57:12 - 05:09:02				0.059
11591	05:09:02 - 05:25:28	51.9	ND	ND	
11592	05:25:36 - 05:37:28	50.3	ND	BDL	
11593	05:37:28 - 05:53:49				BDL
11594	05:53:58 - 06:10:30	79.3	4.0	13.2	
11595	06:10:34 - 06:22:53	79.5	4.6	8.9	
11596	06:22:53 - 06:39:36				BDL
11597	06:44:36 - 06:59:34	83.3	3.9	11.6	
11598	06:59:44 - 07:14:40	75.9	3.3	10.9	
11599	07:14:40 - 07:29:45	74.0	3.6	8.1	
11600	07:29:45 - 07:44:52	78.4	2.7	12.0	
11601	07:44:52 - 07:59:53	83.3	0.9	BDL	
11602	07:59:56 - 08:14:57	74.0	BDL	6.1	
11603	08:14:57 - 08:30:02	71.1	BDL	4.0	
11604	08:30:02 - 08:45:09	61.5	BDL	6.4	
11605	08:45:09 - 09:00:14	45.9	BDL	6.1	
11606	09:00:14 - 09:15:17	82.5	BDL	8.4	
11607	09:15:26 - 09:30:24	108	BDL	11.3	
11608	09:30:24 - 09:45:32	ND	ND	ND	
11609	09:45:32 - 10:00:38	ND	ND	ND	
11610	10:00:38 - 10:15:42	123	BDL	11.4	
11611	10:15:46 - 10:30:50	107	BDL	16.9	
11612	10:30:50 - 10:45:57	107	BDL	17.0	
11613	10:45:57 - 11:01:05	75.9	BDL	9.6	
11614	11:01:05 - 11:16:12	91.4	BDL	ND	
11615	11:16:12 - 11:31:16	98.9	BDL	ND	
11616	11:31:16 - 11:46:21	85.1	BDL	12.4	
11617	11:46:21 - 12:01:30	42.8	BDL	12.2	
11618	12:01:30 - 12:16:38	61.4	BDL	11.1	

Table A-11 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11619	12:16:38 - 12:31:44	51.0	BDL	9.6	
11620	12:31:52 - 12:46:53	33.6	BDL	8.5	
11621	12:46:53 - 13:02:02	28.1	BDL	8.2	
11622	13:02:02 - 13:17:12	23.6	BDL	6.6	
11623	13:17:12 - 13:32:20	20.9	BDL	5.8	
11624	13:32:20 - 13:47:25	21.6	BDL	7.1	
11625	13:47:25 - 14:02:36	24.9	BDL	14.9	
11626	14:02:36 - 14:17:48	20.5	BDL	9.9	
11627	14:17:48 - 14:32:58	23.2	BDL	5.6	
11628	14:32:58 - 14:48:06	19.1	BDL	BDL	
11629	14:48:16 - 15:03:14	24.2	BDL	9.9	
11630	15:03:14 - 15:18:22	24.7	BDL	6.7	
11631	15:18:22 - 15:33:29	25.6	BDL	9.8	
11632	15:33:29 - 15:48:37	21.5	BDL	8.6	
11633	15:48:41 - 16:03:44	27.9	BDL	BDL	
11634	16:03:44 - 16:18:48	28.0	BDL	7.3	
11635	16:18:48 - 16:33:53	29.9	BDL	BDL	
11636	16:33:53 - 16:49:00	28.4	BDL	6.1	
11637	16:49:00 - 17:04:00	30.0	BDL	7.0	
11638	17:04:00 - 17:19:02	33.0	BDL	BDL	
11639	17:19:02 - 17:34:06	32.1	BDL	BDL	
11640	17:34:06 - 17:49:16	31.7	BDL	BDL	
11641	17:49:16 - 18:04:17	36.1	BDL	BDL	
11642	18:04:26 - 18:19:20	35.7	BDL	BDL	
11643	18:19:20 - 18:29:52	38.4	BDL	BDL	
11644	18:32:00 - 18:37:22	RS	RS	RS	
11645	18:38:38 - 18:43:58	RS	RS	RS	
11646	18:45:30 - 18:57:06	31.5	BDL	BDL	
11647	18:57:06 - 19:13:25				BDL
11648	19:13:33 - 19:25:22				BDL
11649	19:25:22 - 19:41:46	51.7	BDL	BDL	
11650	19:46:20 - 19:58:05				BDL
11651	19:58:09 - 20:10:04				BDL
11652	20:14:40 - 20:26:26	51.1	2.1	BDL	
11653	20:31:02 - 20:42:52				BDL
11654	20:42:52 - 20:54:46				BDL
11655	20:54:54 - 21:11:12	57.3	BDL	BDL	
11656	21:11:12 - 21:27:30				BDL
11657	21:27:40 - 21:39:45				BDL
11658	21:39:33 - 21:55:52	40.4	1.3	BDL	
11659	21:55:52 - 22:12:12				BDL
11660	22:12:20 - 22:24:09				BDL
11661	22:24:09 - 22:40:52	35.3	ND	BDL	
11662	22:45:24 - 22:57:10				BDL
11663	22:57:13 - 23:09:08				BDL
11664	23:13:46 - 23:25:33	34.8	ND	BDL	
11665	23:25:41 - 23:41:54				BDL

Table A-11 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO	NO_3
11666	23:41:54 - 23:53:49				BDL
11667	23:59:52 - 00:11:41	31.1	ND	ND	
11668	00:11:41 - 00:23:36	34.0	2.0	BDL	
11669	00:28:09 - 00:39:58				BDL
11670	00:39:58 - 00:56:22	28.9	ND	BDL	
11671	00:56:30 - 01:08:21	39.2	2.3	BDL	
11672	01:08:21 - 01:24:10				BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

APPENDIX B

TIME-RESOLVED CONCENTRATION DATA FOR LONG BEACH SUMMER EPISODES

Table B-1. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-1, June 19, 1987

File No.	Measurement Period	Concentrations (ppb)		
		NO_2	HONO	HCHO
15207	01:00:30 - 01:15:28	30.5	BDL	BDL
15208	01:15:28 - 01:30:22	29.2	BDL	BDL
15209	01:30:22 - 01:45:30	28.2	BDL	BDL
15210	01:45:30 - 02:00:33	27.9	BDL	BDL
15211	02:00:33 - 02:15:37	34.6	BDL	BDL
15212	02:15:37 - 02:30:41	33.6	BDL	BDL
15213	02:30:41 - 02:45:40	30.7	BDL	BDL
15214	02:45:40 - 03:00:42	30.9	BDL	BDL
15215	03:00:42 - 03:15:46	30.1	BDL	BDL
15216	03:15:46 - 03:30:49	28.7	BDL	BDL
15217	03:30:49 - 03:45:48	27.7	BDL	BDL
15218	03:45:54 - 04:00:52	27.4	BDL	BDL
15219	04:00:52 - 04:15:54	26.4	BDL	BDL
15220	04:15:54 - 04:30:58	22.8	BDL	BDL
15221	04:30:58 - 04:45:57	21.6	BDL	BDL
15222	04:45:57 - 05:01:01	19.3	BDL	BDL
15223	05:01:01 - 05:16:04	14.9	BDL	BDL
15224	05:16:04 - 05:31:08	15.4	BDL	BDL
15225	05:31:08 - 05:46:06	15.4	BDL	BDL
15226	05:46:06 - 06:01:09	12.9	BDL	BDL
15227	06:01:09 - 06:16:13	10.6	BDL	BDL
15228	06:16:13 - 06:31:17	8.8	BDL	BDL
15229	06:31:17 - 06:46:16	11.8	BDL	BDL
15230	06:46:21 - 07:01:18	14.0	BDL	BDL
15231	07:01:18 - 07:16:22	15.3	BDL	BDL
15232	07:16:22 - 07:31:25	17.7	BDL	BDL
15233	07:31:25 - 07:46:24	21.8	BDL	BDL
15234	07:46:24 - 08:01:28	20.8	BDL	BDL
15235	08:01:28 - 08:16:32	ND	ND	ND
15236	08:16:32 - 08:31:34	22.0	BDL	BDL
15237	08:31:34 - 08:46:33	22.5	BDL	BDL
15238	08:46:33 - 09:01:37	20.9	BDL	BDL
15239	09:01:37 - 09:16:41	18.0	BDL	BDL
15240	09:16:41 - 09:31:40	12.9	BDL	BDL
15241	09:31:45 - 09:46:44	10.0	BDL	BDL
15242	09:46:44 - 10:01:48	11.9	BDL	BDL
15243	10:01:48 - 10:16:50	11.8	BDL	BDL
15244	10:16:50 - 10:31:50	12.7	BDL	BDL
15245	10:31:54 - 10:46:53	12.6	BDL	BDL
15246	10:46:53 - 11:01:57	11.7	BDL	BDL
15247	11:01:57 - 11:17:01	10.7	BDL	BDL
15248	11:17:01 - 11:32:05	10.3	BDL	BDL
15249	11:32:05 - 11:47:04	10.0	BDL	BDL
15250	11:47:04 - 12:02:06	9.7	BDL	BDL
15251	12:02:06 - 12:17:12	9.0	BDL	BDL

Table B-1 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15252	12:17:12 - 12:32:10	9.4	BDL	BDL
15253	12:32:10 - 12:47:14	10.0	BDL	BDL
15254	12:47:14 - 13:02:17	7.2	BDL	BDL
15255	13:02:17 - 13:17:21	5.8	BDL	BDL
15256	13:17:21 - 13:32:20	5.3	BDL	BDL
15257	13:32:20 - 13:47:24	6.1	BDL	BDL
15258	13:47:24 - 14:02:28	6.5	BDL	BDL
15259	14:02:28 - 14:17:32	7.8	BDL	BDL
15260	14:17:32 - 14:32:30	8.1	BDL	BDL
15261	14:32:30 - 14:47:36	9.9	BDL	BDL
15262	14:47:36 - 15:02:40	10.7	BDL	BDL
15263	15:02:40 - 15:17:44	8.7	BDL	BDL
15264	15:17:44 - 15:32:44	11.7	BDL	BDL
15265	15:32:44 - 15:47:48	15.1	BDL	BDL
15266	15:47:48 - 16:02:52	17.9	BDL	BDL
15267	16:02:52 - 16:17:57	22.8	BDL	BDL
15268	16:17:57 - 16:32:56	22.2	BDL	BDL
15269	16:32:56 - 16:48:01	18.3	BDL	BDL
15270	16:48:01 - 17:03:05	21.6	BDL	BDL
15271	17:03:05 - 17:18:09	26.6	BDL	BDL
15272	17:18:09 - 17:33:09	28.0	BDL	BDL
15273	17:33:09 - 17:48:13	30.0	BDL	BDL
15274	17:48:13 - 18:03:17	28.7	BDL	BDL
15275	18:03:17 - 18:18:17	32.0	BDL	7.7
15276	18:18:17 - 18:33:21	34.5	BDL	BDL
15277	18:33:21 - 18:48:25	33.7	BDL	BDL
15278	18:48:25 - 19:03:30	38.1	BDL	BDL
15279	19:03:30 - 19:18:30	40.5	ND	ND
15280	19:18:30 - 19:33:34	ND	ND	ND
15281	19:33:34 - 19:48:38	ND	ND	ND
15282	19:48:38 - 20:03:44	ND	ND	ND
15283	20:03:44 - 20:18:50	ND	ND	ND
15284	20:18:50 - 20:33:48	ND	ND	ND
15285	20:33:48 - 20:48:52	53.6	BDL	BDL
15286	20:48:52 - 21:03:57	45.7	BDL	BDL
15287	21:03:57 - 21:18:57	41.0	BDL	BDL
15288	21:19:04 - 21:34:01	35.5	BDL	BDL
15289	21:34:01 - 21:49:05	32.2	BDL	BDL
15290	21:49:05 - 22:04:10	37.2	1.1	BDL
15291	22:04:10 - 22:19:10	39.6	1.1	BDL
15292	22:19:17 - 22:34:14	43.2	BDL	BDL
15293	22:34:14 - 22:49:20	ND	ND	ND
15294	22:49:20 - 23:04:24	35.5	BDL	BDL
15295	23:04:24 - 23:19:24	35.7	BDL	BDL
15296	23:19:24 - 23:34:28	30.4	BDL	BDL
15297	23:34:28 - 23:49:33	34.0	BDL	BDL
15298	23:49:33 - 00:04:38	33.6	BDL	BDL

Table B-1 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15299	00:04:38 - 00:19:38	32.4	BDL	BDL
15300	00:19:38 - 00:34:44	32.8	BDL	BDL
15301	00:34:44 - 00:49:48	32.6	BDL	BDL
15302	00:49:48 - 01:04:53	33.9	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-2. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-2, June 24, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15343	00:56:44 - 01:11:52	11.2	BDL	BDL
15344	01:11:57 - 01:27:04	10.7	BDL	BDL
15345	01:27:04 - 01:42:17	11.7	BDL	BDL
15346	01:42:17 - 01:57:32	11.2	BDL	BDL
15347	01:57:32 - 02:12:42	11.6	BDL	BDL
15348	02:12:42 - 02:28:00	12.4	BDL	BDL
15349	02:28:00 - 02:43:18	14.3	BDL	BDL
15350	02:43:18 - 02:58:36	13.7	BDL	BDL
15351	02:58:36 - 03:13:49	14.1	BDL	BDL
15352	03:13:54 - 03:29:08	14.7	BDL	BDL
15353	03:29:08 - 03:44:28	13.0	BDL	BDL
15354	03:44:28 - 03:59:46	11.1	BDL	BDL
15355	03:59:56 - 04:15:00	14.2	BDL	BDL
15356	04:15:06 - 04:30:16	11.9	BDL	BDL
15357	04:30:16 - 04:45:30	12.2	BDL	BDL
15358	04:45:30 - 05:00:41	10.7	BDL	BDL
15359	05:00:41 - 05:15:48	11.1	BDL	BDL
15360	05:48:24 - 06:03:38	13.5	BDL	BDL
15361	06:03:38 - 06:13:08	ND	ND	ND
15362	06:13:08 - 06:28:29	17.9	BDL	BDL
15363	06:28:29 - 06:43:40	19.1	BDL	BDL
15364	06:43:40 - 06:58:56	18.8	BDL	BDL
15365	06:58:56 - 07:14:08	19.3	BDL	BDL
15366	07:14:08 - 07:29:18	20.5	BDL	BDL
15367	07:29:18 - 07:44:25	19.9	BDL	BDL
15368	07:44:25 - 07:59:36	ND	ND	ND
15369	07:59:36 - 08:14:48	ND	ND	ND
15370	08:14:48 - 08:30:00	ND	ND	ND
15371	08:30:00 - 08:45:04	ND	ND	ND
15372	08:45:04 - 09:00:10	ND	ND	ND
15373	09:00:10 - 09:15:21	ND	ND	ND
15374	09:15:21 - 09:30:32	ND	ND	ND
15375	09:30:32 - 09:45:40	ND	ND	ND
15376	09:45:40 - 10:00:57	ND	ND	ND
15377	10:00:57 - 10:16:13	ND	ND	ND
15378	10:16:13 - 10:31:26	ND	ND	ND
15379	10:31:26 - 10:46:30	21.4	BDL	BDL
15380	10:46:30 - 11:01:50	21.9	BDL	BDL
15381	11:01:50 - 11:17:09	28.5	BDL	BDL
15382	11:17:09 - 11:32:25	26.8	BDL	BDL
15383	11:32:25 - 11:47:37	26.6	BDL	BDL
15384	11:47:37 - 12:02:52	24.2	BDL	BDL
15385	12:02:52 - 12:18:09	21.4	BDL	BDL
15386	12:18:09 - 12:33:24	17.7	BDL	BDL
15387	12:33:29 - 12:48:41	16.5	BDL	BDL

Table B-2 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15388	12:48:41 - 13:03:58	17.4	BDL	BDL
15389	13:03:58 - 13:19:14	18.2	BDL	BDL
15390	13:19:14 - 13:34:26	22.6	BDL	BDL
15391	13:34:26 - 13:49:41	22.0	BDL	BDL
15392	13:49:41 - 14:04:58	24.0	BDL	BDL
15393	14:04:58 - 14:20:14	22.8	BDL	8.3
15394	14:20:14 - 14:35:24	23.2	BDL	BDL
15395	14:35:24 - 14:50:40	20.9	BDL	BDL
15396	14:50:40 - 15:05:54	19.1	BDL	BDL
15397	15:05:54 - 15:21:10	18.6	BDL	BDL
15398	15:21:10 - 15:36:21	19.3	BDL	BDL
15399	15:36:28 - 15:51:37	18.9	BDL	BDL
15400	15:51:37 - 16:06:52	19.2	BDL	BDL
15401	16:06:52 - 16:22:06	25.2	BDL	BDL
15402	16:22:06 - 16:37:16	27.9	BDL	BDL
15403	16:37:16 - 16:52:32	26.7	BDL	8.6
15404	16:52:32 - 17:07:46	31.2	BDL	8.1
15405	17:07:46 - 17:23:02	30.1	BDL	BDL
15406	17:23:02 - 17:38:13	26.7	BDL	BDL
15407	17:38:13 - 17:53:33	32.9	BDL	7.5
15408	17:53:33 - 18:08:48	38.7	BDL	9.3
15409	18:08:48 - 18:24:05	46.9	BDL	10.6
15410	18:24:05 - 18:39:17	40.8	BDL	7.5
15411	18:39:17 - 18:54:33	30.6	BDL	BDL
15412	18:54:33 - 19:09:49	25.4	BDL	BDL
15413	19:09:49 - 19:25:08	23.9	BDL	BDL
15414	19:25:08 - 19:40:22	19.8	BDL	BDL
15415	19:40:22 - 19:55:41	16.7	BDL	BDL
15416	19:55:41 - 20:10:57	ND	ND	ND
15417	20:10:57 - 20:26:16	ND	ND	ND
15418	20:26:16 - 20:41:25	ND	ND	ND
15419	20:41:25 - 20:56:38	ND	ND	ND
15420	20:56:38 - 21:11:50	ND	ND	ND
15421	21:11:50 - 21:27:01	ND	ND	ND
15422	21:27:01 - 21:42:17	ND	ND	ND
15423	21:42:17 - 21:57:32	ND	ND	ND
15424	21:57;32 - 22:12:42	ND	ND	ND
15425	22:12:42 - 22:27:49	ND	ND	ND
15426	22:27:49 - 22:43:00	13.8	BDL	BDL
15427	22:43:00 - 22:58:10	12.3	BDL	BDL
15428	22:58:10 - 23:13:24	10.7	BDL	BDL
15429	23:13:24 - 23:28:30	12.5	BDL	BDL
15430	23:28:20 - 23:43:41	12.0	BDL	BDL
15431	23:43:41 - 23:58:52	13.0	BDL	BDL
15432	23:58:52 - 00:14:06	14.9	BDL	BDL
15433	00:14:06 - 00:29:12	13.4	BDL	BDL

Table B-2 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15434	00:29:20 - 00:44:22	13.4	BDL	BDL
15435	00:44:22 - 00:59:33	15.8	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-3. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-3, June 25, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15436	00:59:33 - 01:14:48	13.5	BDL	BDL
15437	01:14:48 - 01:29:57	14.9	BDL	BDL
15438	01:30:05 - 01:45:14	14.7	BDL	BDL
15439	01:45:14 - 02:00:30	13.1	BDL	BDL
15440	02:00:30 - 02:15:42	13.7	BDL	BDL
15441	02:15:42 - 02:31:01	14.1	BDL	BDL
15442	02:31:01 - 02:46:21	12.8	BDL	BDL
15443	02:46;21 - 03:01:40	13.4	BDL	BDL
15444	03:01:40 - 03:16:52	11.1	BDL	BDL
15445	03:16:52 - 03:32:08	11.7	BDL	BDL
15446	03:32:08 - 03:47:26	12.3	BDL	BDL
15447	03:47:26 - 04:02:41	10.1	BDL	BDL
15448	04:02:41 - 04:17:57	9.4	BDL	BDL
15449	04:17:57 - 04:33:05	9.4	BDL	BDL
15450	04:33:05 - 04:48:20	9.6	BDL	BDL
15451	04:48:20 - 05:03:33	10.0	BDL	BDL
15452	05:03:33 - 05:18:53	11.5	BDL	BDL
15453	05:18:53 - 05:34:10	11.6	BDL	BDL
15454	05:34:10 - 05:49:28	14.1	BDL	BDL
15455	05:49:28 - 06:04:44	16.9	BDL	BDL
15456	06:04:44 - 06:19:54	20.2	BDL	BDL
15457	06:19:54 - 06:35:04	27.1	BDL	BDL
15458	06:35:04 - 06:50:12	24.9	BDL	BDL
15459	06:50:12 - 07:05:24	27.8	BDL	BDL
15460	07:05:24 - 07:20:34	27.5	BDL	BDL
15461	07:20:34 - 07:35:50	26.6	BDL	BDL
15462	07:35:50 - 07:51:05	24.4	BDL	BDL
15463	07:51:05 - 08:06:21	24.9	BDL	BDL
15464	08:06:21 - 08:21:34	26.5	BDL	BDL
15465	08:21:42 - 08:36:50	29.2	BDL	BDL
15466	08:36:50 - 08:52:14	27.0	BDL	BDL
15467	09:00:20 - 09:15:33	RS	RS	RS
15468	09:20:06 - 09:29:41	RS	RS	RS
15469	09:43:24 - 09:58:46	30.4	BDL	BDL
15470	09:58:46 - 10:14:12	31.7	BDL	BDL
15471	10:14:12 - 10:29:29	33.2	BDL	BDL
15472	10:29:29 - 10:44:48	31.4	BDL	BDL
15473	10:44:48 - 11:00:04	28.3	BDL	BDL
15474	11:44:08 - 11:59:25	20.3	BDL	BDL
15475	11:59:25 - 12:14:49	20.1	BDL	BDL
15476	12:14:49 - 12:30:14	23.8	BDL	BDL
15477	12:30;14 - 12:45:40	21.7	BDL	BDL
15478	13:58:26 - 14:13:41	6.8	BDL	BDL
15479	14:13:41 - 14:29:05	7.8	BDL	BDL
15480	14:29:05 - 14:44:28	8.2	BDL	BDL

Table B-3 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15481	14:44:38 - 14:59:46	10.4	BDL	BDL
15482	14:59:46 - 15:15:08	8.1	BDL	BDL
15483	15:15:08 - 15:30:29	9.1	BDL	BDL
15484	15:30:29 - 15:45:50	11.0	BDL	BDL
15485	15:45:50 - 16:01:06	12.6	BDL	BDL
15486	16:01:06 - 16:16:29	10.7	BDL	BDL
15487	19:59:41 - 20:14:56	50.2	1.7	BDL
15488	20:15:05 - 20:30:20	51.5	BDL	BDL
15489	20:30:20 - 20:45:46	45.7	BDL	BDL
15490	20:45:46 - 21:01:10	ND	ND	ND

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-4. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-4, July 13, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15504	01:00:09 - 01:15:06	32.8	BDL	BDL
15505	01:15:13 - 01:30:10	34.0	BDL	BDL
15506	01:30:10 - 01:45:13	33.3	BDL	BDL
15507	01:45:13 - 02:00:12	32.8	BDL	BDL
15508	02:00:12 - 02:15:14	30.6	1.5	BDL
15509	02:15:14 - 02:30:17	29.9	1.4	BDL
15510	02:30:17 - 02:45:14	29.4	1.5	BDL
15511	02:45:14 - 03:00:18	29.9	1.4	BDL
15512	03:00:18 - 03:15:18	29.9	1.4	BDL
15513	03:15:22 - 03:30:21	28.2	1.2	BDL
15514	03:30:21 - 03:45:24	26.4	1.3	BDL
15515	03:45:24 - 04:00:21	25.5	1.5	BDL
15516	04:00:26 - 04:15:24	25.0	BDL	BDL
15517	04:15:24 - 04:30:25	25.3	1.5	BDL
15518	04:30:25 - 04:45:21	24.4	1.2	BDL
15519	04:45:26 - 05:00:21	23.2	1.8	BDL
15520	05:00:21 - 05:15:24	23.8	1.5	BDL
15521	05:15:24 - 05:30:22	25.0	1.7	BDL
15522	05:30:28 - 05:45:25	24.9	1.8	BDL
15523	05:45:25 - 06:00:29	25.7	1.8	BDL
15524	06:00:29 - 06:15:30	26.7	1.3	BDL
15525	06:15:30 - 06:30:36	28.2	1.6	BDL
15526	06:30:36 - 06:45:38	28.7	1.6	BDL
15527	06:45:38 - 07:00:41	29.0	1.2	BDL
15528	07:00:41 - 07:15:46	34.4	BDL	BDL
15529	07:15:46 - 07:30:49	35.3	BDL	10.0
15530	07:30:49 - 07:46:00	41.9	BDL	ND
15531	07:46:00 - 08:01:10	42.7	BDL	ND
15532	08:01:10 - 08:16:14	43.4	BDL	ND
15533	08:16:30 - 08:31:22	ND	ND	ND
15534	08:31:22 - 08:46:30	ND	ND	ND
15535	08:46:30 - 09:01:36	ND	ND	ND
15536	09:01:41 - 09:16:45	ND	ND	ND
15537	09:16:45 - 09:31:52	42.6	BDL	BDL
15538	09:31:52 - 09:47:02	45.2	BDL	BDL
15539	09:47:09 - 10:02:10	52.1	BDL	BDL
15540	10:02:10 - 10:17:17	35.4	BDL	BDL
15541	10:17:17 - 10:32:20	30.7	BDL	BDL
15542	10:41:29 - 10:56:34	RS	RS	RS
15543	11:00:41 - 11:15:41	RS	RS	RS
15544	11:28:04 - 11:43:04	30.6	BDL	BDL
15545	11:43:04 - 11:58:10	33.3	BDL	8.2
15546	11:58:10 - 12:13:18	32.4	BDL	9.8
15547	12:13:18 - 12:28:20	36.8	BDL	9.1
15548	12:28:20 - 12:43:26	36.4	BDL	9.6

Table B-4 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15549	12:43:26 - 12:58:25	42.5	BDL	13.0
15550	12:58:30 - 13:13:30	37.5	BDL	10.5
15551	13:13:30 - 13:28:34	44.3	BDL	10.4
15552	13:28:34 - 13:43:34	38.7	BDL	8.3
15553	13:43:41 - 13:58:40	34.5	BDL	9.2
15554	13:58:40 - 14:13:45	37.6	BDL	BDL
15555	14:13:45 - 14:28:45	33.5	BDL	8.1
15556	14:28:50 - 14:43:49	32.7	BDL	BDL
15557	14:43:49 - 14:58:53	35.9	BDL	9.7
15558	14:58:53 - 15:13:52	34.9	BDL	9.6
15559	15:13:57 - 15:28:56	29.8	BDL	7.9
15560	15:28:56 - 15:44:01	23.6	BDL	BDL
15561	15:44:01 - 15:59:00	25.6	BDL	BDL
15562	15:59:05 - 16:14:02	27.7	BDL	BDL
15563	16:14:02 - 16:29:10	33.6	BDL	BDL
15564	16:29:10 - 16:44:10	31.2	BDL	BDL
15565	16:44:10 - 16:59:16	33.1	BDL	BDL
15566	16:59:16 - 17:14:16	32.1	BDL	BDL
15567	17:14:21 - 17:29:18	32.6	BDL	BDL
15568	17:29:18 - 17:44:24	28.2	BDL	BDL
15569	17:44:24 - 17:59:22	29.8	BDL	BDL
15570	17:59:29 - 18:14:26	29.9	BDL	BDL
15571	18:14:26 - 18:29:32	32.0	BDL	BDL
15572	18:29:32 - 18:44:30	29.2	BDL	BDL
15573	18:44:30 - 18:59:33	29.7	BDL	BDL
15574	18:59:33 - 19:14:37	30.4	BDL	BDL
15575	19:14:37 - 19:29:37	30.9	BDL	BDL
15576	19:29:44 - 19:44:42	31.8	BDL	BDL
15577	19:44:42 - 20:59:50	31.8	BDL	BDL
15578	19:59:50 - 20:14:49	27.1	BDL	BDL
15579	20:14:56 - 20:29:53	21.3	BDL	BDL
15580	20:29:53 - 20:45:04	19.7	BDL	BDL
15581	20:45:04 - 21:00:02	20.8	BDL	BDL
15582	21:00:02 - 21:15:05	20.8	BDL	BDL
15583	21:15:05 - 21:30:09	26.3	BDL	BDL
15584	21:30:09 - 21:45:08	26.6	BDL	BDL
15585	21:45:08 - 22:00:12	22.8	BDL	BDL
15586	22:00:12 - 22:15:10	21.5	BDL	BDL
15587	22:15:16 - 22:30:13	23.7	BDL	BDL
15588	22:30:13 - 22:45:25	19.7	BDL	BDL
15589	22:45:25 - 23:00:24	18.6	BDL	BDL
15590	23:00:30 - 23:15:26	18.4	BDL	BDL
15591	23:15:26 - 23:30:32	19.1	BDL	BDL
15592	23:30:32 - 23:45:30	20.5	BDL	BDL
15593	23:45:37 - 00:00:34	22.2	BDL	BDL
15594	00:00:34 - 00:15:37	18.9	BDL	BDL
15595	00:15:37 - 00:30:37	14.9	BDL	BDL

Table B-4 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15596	00:30:44 - 00:45:41	12.8	BDL	BDL
15597	00:45:41 - 01:00:44	16.9	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-5. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-5, July 14, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15598	01:00:44 - 01:15:42	15.4	BDL	BDL
15599	01:15:42 - 01:30:46	18.6	BDL	BDL
15600	01:30:46 - 01:45:49	ND	ND	ND
15601	01:45:49 - 02:00:48	16.7	BDL	BDL
15602	02:00:48 - 02:15:49	ND	ND	ND
15603	02:15:49 - 02:30:48	13.9	BDL	BDL
15604	02:30:52 - 02:45:50	13.7	BDL	BDL
15605	02:45:50 - 03:00:56	12.5	BDL	BDL
15606	03:00:56 - 03:15:56	14.0	BDL	BDL
15607	03:16:04 - 03:31:01	13.3	BDL	BDL
15608	03:31:01 - 03:46:04	13.5	BDL	BDL
15609	03:46:04 - 04:01:04	13.5	BDL	BDL
15610	04:01:10 - 04:16:08	12.0	BDL	BDL
15611	04:16:08 - 04:31:13	13.4	BDL	BDL
15612	04:31:13 - 04:46:14	14.7	BDL	BDL
15613	04:46:21 - 05:01:17	16.2	BDL	BDL
15614	05:01:17 - 05:16:21	15.0	BDL	BDL
15615	05:16:21 - 05:31:46	17.0	BDL	BDL
15616	05:31:53 - 05:46:52	20.4	BDL	BDL
15617	05:46:52 - 06:01:54	ND	ND	ND
15618	06:01:54 - 06:16:53	21.5	BDL	BDL
15619	06:16:53 - 06:32:01	23.7	BDL	BDL
15620	06:32:01 - 06:47:05	23.4	BDL	BDL
15621	06:47:05 - 07:02:05	21.0	BDL	BDL
15622	07:02:05 - 07:17:09	22.9	BDL	BDL
15623	07:17:00 - 07:32:09	25.5	BDL	BDL
15624	07:32:14 - 07:47:12	28.9	BDL	BDL
15725	07:47:12 - 08:02:16	ND	ND	ND
15726	08:02:16 - 08:17:16	ND	ND	ND
15627	08:17:22 - 08:32:17	28.9	BDL	BDL
15628	08:32:17 - 08:47:22	27.3	BDL	BDL
15629	08:47:22 - 09:02:26	24.6	BDL	BDL
15630	09:02:34 - 09:17:44	21.9	BDL	BDL
15631	09:17:44 - 09:32:45	23.5	BDL	BDL
15632	09:32:45 - 09:47:46	ND	ND	ND
15633	09:47:53 - 10:02:54	18.8	BDL	BDL
15634	10:14:18 - 10:29:26	19.4	BDL	BDL
15635	10:29:26 - 10:44:33	18.4	BDL	ND
15636	10:44:33 - 10:59:46	14.0	BDL	ND
15637	10:59:46 - 11:14:52	18.3	BDL	BDL
15638	11:15:01 - 11:30:01	21.3	BDL	BDL
15639	11:30:01 - 11:45:09	21.4	BDL	BDL
15640	11:45:09 - 12:00:13	ND	ND	ND
15641	12:00:21 - 12:15:21	ND	ND	ND
15642	12:15:21 - 12:30:30	31.1	BDL	7.6

Table B-5 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15643	12:30:30 - 12:45:34	50.4	BDL	11.6
15644	12:45:42 - 13:00:41	61.4	BDL	18.4
15645	13:00:41 - 13:15:46	51.0	BDL	15.9
15646	13:15:46 - 13:30:46	33.5	BDL	9.5
15647	13:30:54 - 13:45:53	23.8	BDL	BDL
15648	13:45:53 - 14:00:57	22.0	BDL	BDL
15649	14:00:57 - 14:15:58	25.9	BDL	9.2
15650	14:15:58 - 14:31:02	35.3	BDL	11.7
15651	14:31:02 - 14:46:02	44.4	BDL	12.7
15652	14:46:08 - 15:01:08	43.5	BDL	13.1
15653	15:01:08 - 15:16:12	41.4	BDL	10.8
15654	15:16:12 - 15:31:13	37.0	BDL	10.5
15655	15:31:17 - 15:46:17	37.0	BDL	10.5
15656	15:46:17 - 16:01:22	38.3	BDL	10.7
15657	16:01:22 - 16:16:21	41.4	BDL	12.0
15658	16:16:30 - 16:31:26	37.6	BDL	10.5
15659	16:31:26 - 16:46:32	37.4	BDL	9.1
15660	16:46:32 - 17:01:33	37.8	BDL	9.7
15661	17:01:41 - 17:16:40	33.3	BDL	9.2
15662	17:16:40 - 17:31:45	32.6	BDL	7.7
15663	17:31:45 - 17:46:45	28.5	BDL	BDL
15664	17:46:54 - 18:01:53	29.7	BDL	7.4
15665	18:01:53 - 18:17:01	30.1	BDL	BDL
15666	18:17:01 - 18:32:02	27.3	BDL	BDL
15667		RS	RS	RS
15668		RS	RS	RS
15669	19:30:02 - 19:45:28	ND	ND	ND
15670	19:45:28 - 20:00:17	31.6	BDL	BDL
15671	20:00:24 - 20:15:12	ND	ND	ND
15672	20:15:17 - 20:30:04	21.3	BDL	BDL
15673	20:30:04 - 20:44:57	18.1	BDL	BDL
15674	20:44:57 - 20:59:49	18.0	BDL	BDL
15675	20:59:49 - 21:14:42	18.2	BDL	BDL
15676	21:14:42 - 21:29:37	18.8	BDL	BDL
15677	21:29:37 - 21:44:30	19.3	BDL	BDL
15678	21:44:30 - 21:59:25	23.1	BDL	BDL
15679	21:59:25 - 22:14:13	23.9	BDL	BDL
15680	22:14:18 - 22:29:05	28.1	BDL	BDL
15681	22:29:10 - 22:44:01	26.2	BDL	BDL
15682	22:44:01 - 22:58:53	21.3	BDL	BDL
15683	22:58:53 - 23:13:42	ND	ND	ND
15684	23:13:42 - 23:28:29	15.7	BDL	BDL
15685	23:31:10 - 23:46:18	8.2	BDL	BDL
15686	23:46:18 - 00:01:06	7.0	BDL	BDL
15687	00:01:06 - 00:16:04	4.7	BDL	BDL
15688	00:16:04 - 00:30:49	4.3	BDL	BDL

Table B-5 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15689	00:30:53 - 00:45:37	6.5	BDL	BDL
15690	00:45:44 - 01:00:24	5.5	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-6. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-6, July 15, 1987

File No.	Measurement Period	Concentrations (ppb)		
		NO_2	HONO	HCHO
15691	01:00:30 - 01:15:13	8.7	BDL	BDL
15692	01:15:13 - 01:30:00	6.1	BDL	BDL
15693	01:30:00 - 01:44:48	5.6	BDL	BDL
15694	01:44:48 - 01:59:38	4.7	BDL	BDL
15695	01:59:38 - 02:14:25	4.5	BDL	BDL
15696	02:14:25 - 02:29:16	4.6	BDL	BDL
15697	02:29:16 - 02:44:04	5.0	BDL	BDL
15698	02:44:04 - 02:58:50	5.2	BDL	BDL
15699	02:58:50 - 03:13:45	BDL	BDL	BDL
15700	03:13:45 - 03:28:28	4.4	BDL	BDL
15701	03:28:28 - 03:43:18	BDL	BDL	BDL
15702	03:43:18 - 03:58:09	BDL	BDL	BDL
15703	03:58:09 - 04:12:58	BDL	BDL	BDL
14704	04:12:58 - 04:27:46	BDL	BDL	BDL
15705	04:27:46 - 04:42:38	BDL	BDL	BDL
15706	04:42:38 - 04:57:30	BDL	BDL	BDL
15707	04:57:30 - 04:12:17	BDL	BDL	BDL
15708	05:12:22 - 05:27:09	BDL	BDL	BDL
15709	05:27:14 - 05:42:09	BDL	BDL	BDL
15710	05:42:09 - 05:56:58	BDL	BDL	BDL
15711	05:56:58 - 06:11:46	9.3	BDL	BDL
15712	06:11:46 - 06:12:12	ND	ND	ND
15713	06:15:04 - 06:15:18	ND	ND	ND
15714	06:15:32 - 06:30:18	17.8	BDL	BDL
15715	06:30:18 - 06:45:10	20.7	BDL	BDL
15716	06:45:10 - 07:00:12	17.1	BDL	BDL
15717	07:15:40 - 07:30:46	16.3	BDL	BDL
15718	07:30:46 - 07:45:38	11.1	BDL	BDL
15719	07:45:45 - 08:00:33	12.1	BDL	BDL
15720	08:00:33 - 08:15:22	13.9	BDL	BDL
15721	08:15:22 - 08:30:12	13.1	BDL	BDL
15722	08:30:12 - 08:45:06	13.4	BDL	BDL
15723	08:45:06 - 08:59:53	13.5	BDL	BDL
15724	08:59:53 - 09:14:44	13.2	BDL	BDL
15725	09:14:44 - 09:29:36	12.4	BDL	BDL
15726	09:29:41 - 09:44:29	12.0	BDL	BDL
15727	09:44:29 - 09:59:21	11.5	BDL	BDL
15728	09:59:21 - 10:14:10	12.4	BDL	BDL
15729	10:14:10 - 10:29:01	11.2	BDL	BDL
15730	10:29:06 - 10:44:10	10.3	BDL	BDL
15731	10:44:10 - 10:58:58	11.5	BDL	BDL
15732	10:58:58 - 11:13:48	11.2	BDL	BDL
15733	11:13:53 - 11:28:41	10.1	BDL	BDL
15734	11:28:41 - 11:43:33	9.5	BDL	BDL
15735	11:43:33 - 11:58:26	8.2	BDL	BDL

Table B-6 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15736	11:58:26 - 12:13:25	9.2	BDL	BDL
15737	12:13:30 - 12:13:52	ND	ND	ND
15738	12:16:02 - 12:31:00	12.6	BDL	BDL
15739	12:31:00 - 12:46:02	13.3	BDL	BDL
15740	12:46:02 - 13:01:04	12.3	BDL	BDL
15741	13:01:04 - 13:16:00	11.4	BDL	BDL
15742	13:16:06 - 13:31:00	6.9	BDL	BDL
15743	13:31:06 - 13:46:01	8.1	BDL	BDL
15744	13:46:01 - 14:01:00	7.0	BDL	BDL
15745	14:01:00 - 14:16:02	5.8	BDL	BDL
15746	14:16:02 - 14:31:05	5.6	BDL	BDL
15747	14:31:05 - 14:46:05	7.7	BDL	BDL
15748	14:46:05 - 15:01:04	8.5	BDL	BDL
15749	15:01:04 - 15:15:57	6.8	BDL	BDL
15750	15:15:57 - 15:30:57	6.9	BDL	BDL
15751	15:30:57 - 15:45:57	7.5	BDL	BDL
15752	15:45:57 - 16:00:57	8.0	BDL	BDL
15753	16:00:57 - 16:15:56	9.4	BDL	BDL
15754	16:15:56 - 16:30:56	11.5	BDL	BDL
15755	16:30:56 - 16:45:54	10.5	BDL	BDL
15756	16:45:54 - 17:00:49	12.7	BDL	BDL
15757	17:00:53 - 17:15:46	13.8	BDL	BDL
15758	17:15:53 - 17:30:45	14.2	BDL	BDL
15759	17:30:45 - 17:45:44	12.8	BDL	BDL
15760	17:45:44 - 18:00:40	14.5	BDL	BDL
15761	18:00:40 - 18:15:36	15.9	BDL	BDL
15762	18:15:36 - 18:30:34	16.1	BDL	BDL
15763	18:30:34 - 18:45:32	14.8	BDL	BDL
15764	18:45:32 - 19:00:24	16.9	BDL	BDL
15765	19:00:32 - 19:15:22	14.1	BDL	BDL
15766	19:15:30 - 19:30:22	13.9	BDL	BDL
15767	19:30:22 - 19:45:22	ND	ND	ND
15768	19:45:22 - 20:00:22	ND	ND	ND
15769	20:00:22 - 20:15:21	ND	ND	ND
15770	20:15:21 - 20:30:20	12.1	BDL	BDL
15771	20:30:20 - 20:45:13	ND	ND	ND
15772	20:45:18 - 21:00:12	ND	ND	ND
15773	21:00:18 - 21:15:09	ND	ND	ND
15774	21:15:09 - 21:30:12	10.5	BDL	BDL
15775	21:30:12 - 21:45:06	9.0	BDL	BDL
15776	21:45:06 - 22:00:01	8.8	BDL	BDL
15777	22:00:01 - 22:14:57	7.5	BDL	BDL
15778	22:14:57 - 22:29:53	8.3	BDL	BDL
15779	22:29:53 - 22:44:45	8.9	BDL	BDL
15780	22:44:52 - 22:59:41	8.4	BDL	BDL
15781	22:59:49 - 23:14:38	7.3	BDL	BDL
15782	23:14:38 - 23:29:34	6.3	BDL	BDL

Table B-6 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15783	23:29:34 - 23:44:30	ND	ND	ND
15784	23:44:30 - 23:59:29	5.4	BDL	BDL
15785	23:59:29 - 00:14:36	7.2	BDL	BDL
15786	00:14:36 - 00:29:33	7.7	BDL	BDL
15787	00:29:38 - 00:44:33	6.0	BDL	BDL
15788	00:44:40 - 00:59:30	7.7	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-7. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-7, August 27, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15837	01:00:34 - 01:15:38	42.8	BDL	BDL
15838	01:15:38 - 01:30:42	44.7	BDL	BDL
15839	01:30:42 - 01:45:53	40.5	BDL	BDL
15840	01:45:53 - 02:00:56	41.7	BDL	BDL
15841	02:00:56 - 02:16:00	41.1	BDL	BDL
15842	02:16:00 - 02:31:05	40.7	BDL	BDL
15843	02:31:05 - 02:46:09	30.1	BDL	BDL
15844	02:46:09 - 03:01:14	22.2	BDL	BDL
15845	03:01:20 - 03:16:18	20.8	BDL	BDL
15846	03:16:22 - 03:31:26	23.3	BDL	BDL
15847	03:31:26 - 03:46:32	23.1	BDL	BDL
15848	03:46:32 - 04:01:38	21.5	BDL	BDL
15849	04:01:38 - 04:16:44	22.8	BDL	BDL
15850	04:16:44 - 04:31:49	23.5	BDL	BDL
15851	04:31:54 - 04:47:00	28.5	1.9	BDL
15852	04:47:00 - 05:02:05	30.0	2.2	BDL
15853	05:02:05 - 05:17:16	26.8	BDL	BDL
15854	05:17:16 - 05:32:29	29.7	BDL	BDL
15855	05:32:29 - 05:47:40	45.3	1.9	BDL
15856	05:47:40 - 06:02:44	45.2	1.9	BDL
15857	06:02:44 - 06:17:49	39.4	1.9	BDL
15858	06:17:49 - 06:29:00	43.0	2.2	BDL
15859	06:30:01 - 06:45:05	41.0	1.7	BDL
15860	06:45:05 - 07:00:09	45.2	1.4	BDL
15861	07:00:09 - 07:15:13	47.8	1.2	BDL
15862	07:15:13 - 07:30:18	44.4	BDL	BDL
15863	07:30:24 - 07:45:24	41.9	BDL	BDL
15864	07:45:28 - 08:00:32	45.7	BDL	BDL
15865	08:00:32 - 08:15:38	55.1	BDL	BDL
15866	08:15:38 - 08:30:46	60.1	BDL	8.5
15867	08:30:46 - 08:45:53	73.2	BDL	15.7
15868	08:45:53 - 09:01:00	ND	ND	ND
15869	09:01:06 - 09:16:09	65.9	BDL	9.3
15870	09:16:09 - 09:31:10	62.1	BDL	BDL
15871	09:31:10 - 09:46:22	58.2	BDL	BDL
15872	09:46:22 - 10:01:25	57.4	BDL	BDL
15873	10:01:25 - 10:16:25	62.1	BDL	9.7
15874	10:16:30 - 10:31:29	65.3	BDL	11.2
15875	10:31:29 - 10:46:32	53.6	BDL	9.9
15876	10:46:32 - 11:01:32	ND	ND	ND
15877	11:01:32 - 11:16:32	44.2	BDL	10.1
15878	11:16:32 - 11:31:34	40.9	BDL	12.1
15879	11:31:40 - 11:46:36	43.2	BDL	10.6
15880	11:46:41 - 12:01:41	44.0	BDL	11.6
15881	12:01:41 - 12:16:44	39.2	BDL	9.3
15882	12:16:44 - 12:31:45	35.1	BDL	10.2

Table B-7 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15883	12:31:45 - 12:46:48	30.6	BDL	9.1
15884	12:46:48 - 13:01:56	30.1	BDL	7.9
15885	13:01:56 - 13:16:57	30.9	BDL	9.7
15886	13:16:57 - 13:32:00	32.0	BDL	8.0
15887	13:32:00 - 13:47:01	42.4	BDL	10.9
15888	13:47:01 - 14:02:04	48.1	BDL	10.6
15889	14:02:04 - 14:17:25	40.0	BDL	9.3
NFN	14:17:25 - 14:30:06	ND	ND	ND
15890	14:30:06 - 14:45:05	45.2	BDL	7.5
15891	14:45:12 - 15:00:09	43.9	BDL	8.4
15892	15:00:09 - 15:15:12	49.4	BDL	8.2
15893	15:15:12 - 15:30:10	47.8	BDL	7.2
15894	15:30:10 - 15:45:13	48.0	BDL	10.9
15895	15:45:13 - 16:00:12	49.5	BDL	7.3
15896	16:00:18 - 16:15:14	47.0	BDL	7.7
15897	16:15:14 - 16:30:17	43.5	BDL	6.1
15898	16:30:56 - 16:54:49	RS	-	-
15899	17:00:29 - 17:15:24	-	-	RS
15900	17:41:50 - 17:56:49	-	-	RS
15901	18:09:12 - 18:24:14	RS	-	-
15904	18:59:53 - 19:14:52	45.9	BDL	BDL
15905	19:14:52 - 19:29:48	52.8	BDL	BDL
15906	19:29:54 - 19:44:49	69.9	BDL	BDL
15907	19:44:49 - 19:59:52	73.2	BDL	BDL
15908	19:59:52 - 20:14:49	74.4	BDL	BDL
15909	20:14:49 - 20:29:52	68.4	BDL	BDL
15910	20:29:52 - 20:44:49	60.4	BDL	BDL
15911	20:44:49 - 20:59:57	54.7	BDL	BDL
15912	20:59:57 - 21:15:00	53.0	BDL	BDL
15913	21:15:00 - 21:29:57	53.0	1.2	BDL
15914	21:29:57 - 21:45:00	56.8	BDL	BDL
15915	21:45:00 - 21:59:54	57.3	BDL	BDL
15916	22:00:02 - 22:14:54	57.9	BDL	BDL
15917	22:14:54 - 22:29:56	52.5	BDL	6.2
15918	22:29:56 - 22:44:52	49.2	BDL	BDL
15919	22:44:52 - 22:59:54	48.8	BDL	6.7
15920	22:59:54 - 23:14:50	44.1	BDL	5.9
15921	23:14:57 - 23:29:50	44.6	BDL	6.7
15922	23:29:50 - 23:44:50	45.1	BDL	BDL
15923	23:44:50 - 23:59:48	44.6	1.4	BDL
15924	23:59:48 - 00:14:50	37.6	1.1	BDL
15925	00:14:50 - 00:29:50	24.4	BDL	BDL
15926	00:29:57 - 00:44:48	22.7	BDL	BDL
15927	00:44:48 - 00:59:46	22.6	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-8. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-8, August 28, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15925	00:14:50 - 00:29:50	24.4	BDL	BDL
15926	00:29:57 - 00:44:48	22.7	BDL	BDL
15927	00:44:48 - 00:59:46	22.6	BDL	BDL
15928	00:59:46 - 01:14:38	26.5	BDL	BDL
15929	01:14:38 - 01:29:41	26.1	BDL	BDL
15930	01:29:41 - 01:44:37	23.1	1.1	BDL
15931	01:44:45 - 01:59:40	17.4	BDL	BDL
15932	01:59:40 - 02:14:41	16.5	BDL	BDL
15933	02:14:41 - 02:29:37	10.7	BDL	BDL
15934	02:29:37 - 02:44:38	11.4	BDL	BDL
15935	02:44:38 - 02:59:45	11.6	BDL	BDL
15936	02:59:45 - 03:14:42	12.7	BDL	BDL
15937	03:14:42 - 03:29:46	10.5	BDL	BDL
15938	03:29:46 - 03:44:49	15.4	BDL	BDL
15939	03:44:49 - 03:59:54	13.9	BDL	BDL
15940	03:59:54 - 04:14:56	22.2	BDL	BDL
15941	04:15:02 - 04:30:01	24.9	BDL	BDL
15942	04:30:01 - 04:45:08	34.6	BDL	BDL
15943	04:45:08 - 05:00:12	39.2	BDL	BDL
15944	05:00:12 - 05:15:11	45.0	1.2	BDL
15945	05:15:17 - 05:30:21	48.4	1.2	BDL
15946	05:30:29 - 05:45:24	49.4	BDL	BDL
15947	05:45:24 - 06:00:25	50.5	1.4	BDL
15948	06:00:25 - 06:15:22	52.6	1.6	BDL
15949	06:15:22 - 06:30:28	51.0	1.2	6.2
15950	06:30:28 - 06:45:29	52.6	BDL	6.4
15951	06:45:29 - 07:00:34	56.0	BDL	BDL
15952	07:00:34 - 07:15:38	54.5	BDL	BDL
15953	07:15:38 - 07:30:38	52.5	BDL	BDL
15954	07:30:46 - 07:45:45	60.2	BDL	9.3
15955	07:45:45 - 08:00:45	62.6	BDL	BDL
15956	08:00:50 - 08:15:52	68.2	BDL	9.0
15957	08:15:52 - 08:30:58	68.4	BDL	8.6
15958	08:30:58 - 08:46:00	72.8	BDL	8.5
15959	08:46:08 - 09:01:06	73.0	BDL	11.2
15960	09:01:06 - 09:16:13	76.7	BDL	9.8
15961	09:16:17 - 09:31:17	87.1	BDL	9.8
15962	09:31:17 - 09:46:18	75.4	BDL	7.4
15963	09:46:18 - 10:01:13	66.1	BDL	9.5
15964	10:01:21 - 10:16:10	54.7	BDL	11.9
15965	10:16:10 - 10:31:04	51.6	BDL	11.2
15966	10:31:09 - 10:46:12	51.9	BDL	11.9
15967	10:46:12 - 11:01:17	63.5	BDL	ND
15968	11:01:17 - 11:16:17	64.9	BDL	7.8
15969	11:16:25 - 11:31:22	66.7	BDL	8.7

Table B-8 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
15970	11:31:22 - 11:46:22	66.0	BDL	ND
15971	11:46:26 - 12:01:28	63.0	BDL	9.3
15972	12:01:28 - 12:16:33	59.4	BDL	7.7
15973	12:16:33 - 12:31:32	62.8	BDL	11.8
15974	12:31:41 - 12:46:37	60.7	BDL	10.4
15975	12:46:37 - 13:01:37	55.7	BDL	11.9
15976	13:01:42 - 13:16:42	54.3	BDL	14.3
15977	13:16:42 - 13:31:48	52.6	BDL	11.8
15978	13:31:48 - 13:46:46	ND	ND	ND
15979	13:46:54 - 14:01:50	ND	ND	ND
15980	14:01:50 - 14:16:52	39.2	BDL	10.6
15981	14:16:56 - 14:31:58	37.9	BDL	8.9
15982	14:31:58 - 14:47:02	39.1	BDL	9.1
15983	14:47:02 - 15:02:02	39.5	BDL	9.9
15984	15:02:02 - 15:17:08	40.4	BDL	12.1
15985	15:17:08 - 15:32:06	48.2	BDL	11.8
15986	15:32:12 - 15:47:13	55.4	BDL	10.8
15987	15:47:13 - 16:02:20	55.3	BDL	8.6
15988	16:02:20 - 16:17:22	62.9	BDL	7.7
15989	16:17:32 - 16:32:32	62.4	BDL	7.3
15990	16:32:32 - 16:47:41	60.1	BDL	BDL
15991	16:47:41 - 17:02:50	52.8	BDL	BDL
15992	17:02:50 - 17:14:33	48.4	BDL	BDL
15993	17:14:33 - 17:29:54	45.8	BDL	BDL
15994	17:29:54 - 17:44:54	37.4	BDL	BDL
15995	17:44:54 - 18:00:01	BDL	BDL	BDL
15996	18:00:01 - 18:15:04	51.5	BDL	BDL
15997	18:15:04 - 18:30:12	65.1	BDL	BDL
15998	18:30:12 - 18:45:20	66.8	BDL	BDL
15999	18:45:20 - 19:00:22	ND	ND	ND
16000	19:00:22 - 19:15:30	62.3	BDL	BDL
16001	19:15:30 - 19:30:40	41.4	BDL	BDL
16002	19:30:40 - 19:45:44	34.5	BDL	BDL
16003	19:45:44 - 20:00:52	ND	ND	ND
16004	20:00:52 - 20:15:50	19.2	BDL	BDL
16005	20:16:00 - 20:30:58	12.7	BDL	BDL
16006	20:30:58 - 20:46:14	10.5	BDL	BDL
16007	20:46:14 - 21:01:28	10.1	BDL	BDL
16008	21:01:28 - 21:14:32	30.8	BDL	BDL
16009	21:29:26 - 21:44:25	27.4	BDL	BDL
16010	21:44:25 - 21:59:24	25.1	BDL	BDL
16011	21:59:24 - 22:15:01	22.0	BDL	BDL
16012	22:15:01 - 22:30:00	18.3	BDL	BDL
16013	22:30:00 - 22:44:58	14.9	BDL	BDL
16014	22:44:58 - 22:59:58	18.5	BDL	BDL
16015	22:59:58 - 23:14:46	17.1	BDL	BDL
16016	23:14:46 - 23:29:42	17.0	BDL	BDL

Table B-8 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16017	23:29:42 - 23:44:42	17.0	BDL	BDL
16018	23:44:42 - 23:59:41	20.2	BDL	BDL
16019	23:59:41 - 00:14:37	30.9	BDL	BDL
16020	00:14:37 - 00:29:00	26.6	BDL	BDL
16021	00:29:00 - 00:45:22	26.0	BDL	BDL
16022	00:45:22 - 01:00:06	31.2	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-9. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-9, August 29, 1987

File No.	Measurement Period	Concentrations (ppb)		
		NO_2	HONO	HCHO
16023	01:00:06 - 01:14:54	27.1	BDL	BDL
16024	01:14:54 - 01:29:46	18.4	BDL	BDL
16025	01:29:56 - 01:44:36	16.9	BDL	BDL
16026	01:44:42 - 01:59:30	17.7	BDL	BDL
16027	01:59:30 - 02:14:25	15.3	BDL	BDL
16028	02:14:25 - 02:29:20	16.6	BDL	BDL
16029	02:29:20 - 02:44:08	15.0	BDL	BDL
16030	02:44:08 - 02:59:00	15.4	BDL	BDL
16031	02:59:00 - 03:13:52	15.4	BDL	BDL
16032	03:13:52 - 03:28:40	14.7	BDL	BDL
16033	03:28:40 - 03:43:32	14.6	BDL	BDL
16034	03:43:32 - 03:58:24	15.0	BDL	BDL
16035	03:58:24 - 04:13:14	15.7	BDL	BDL
16036	04:13:14 - 04:28:09	17.9	BDL	BDL
16037	04:28:09 - 04:43:05	16.3	BDL	BDL
16038	04:43:05 - 04:57:57	23.0	BDL	BDL
16039	04:58:02 - 05:12:53	21.1	BDL	BDL
16040	05:12:53 - 05:27:46	19.8	BDL	BDL
16041	05:27:46 - 05:46:06	15.3	BDL	BDL
16042	05:46:06 - 06:00:57	20.0	BDL	BDL
16043	06:00:57 - 06:15:42	20.8	BDL	BDL
16044	06:15:42 - 06:30:33	25.1	1.2	BDL
16045	06:30:33 - 06:45:22	24.2	BDL	BDL
16046	06:45:22 - 07:00:16	25.4	BDL	BDL
16047	07:00:16 - 07:15:08	28.4	BDL	BDL
16048	07:15:08 - 07:30:00	26.5	BDL	BDL
16049	07:30:00 - 07:44:46	25.6	BDL	BDL
16050	07:44:46 - 07:59:38	32.9	BDL	BDL
16051	07:59:38 - 08:14:30	28.2	BDL	BDL
16052	08:14:30 - 08:29:22	23.2	BDL	BDL
16053	08:29:22 - 08:44:16	22.4	BDL	BDL
16054	08:44:16 - 08:59:08	20.5	BDL	BDL
16055	08:59:08 - 09:13:54	23.8	BDL	BDL
16056	09:16:06 - 09:31:02	20.3	BDL	BDL
16057	09:31:02 - 09:45:52	19.4	BDL	BDL
16058	09:45:52 - 10:00:42	24.4	BDL	BDL
16059	10:00:42 - 10:15:32	25.9	BDL	BDL
16060	10:15:32 - 10:30:22	24.9	BDL	BDL
16061	10:30:22 - 10:45:12	25.7	BDL	BDL
16062	10:45:12 - 10:59:56	27.3	BDL	BDL
16063	10:59:56 - 11:14:48	24.4	BDL	BDL
16064	11:14:48 - 11:29:34	21.3	BDL	9.5
16065	11:29:34 - 11:44:22	18.3	BDL	7.9
16066	11:44:22 - 11:59:12	17.0	BDL	BDL
16067	11:59:12 - 12:14:00	17.4	BDL	BDL

Table B-9 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16068	12:14:00 - 12:28:46	17.2	BDL	BDL
16069	12:28:53 - 12:43:36	16.6	BDL	9.0
16070	12:46:08 - 13:00:57	19.2	BDL	9.2
16071	13:00:57 - 13:15:48	19.8	BDL	8.5
16072	13:15:48 - 13:30:38	18.8	BDL	11.6
16073	13:30:38 - 13:45:30	16.5	BDL	11.8
16074	13:45:30 - 14:00:21	16.6	BDL	11.8
16075	14:00:21 - 14:15:12	16.3	BDL	11.1
16076	14:15:12 - 14:30:04	21.8	BDL	8.3
16077	14:30:04 - 14:44:56	18.2	BDL	7.1
16078	14:44:56 - 14:59:41	18.4	BDL	9.3
16079	14:59:41 - 15:14:48	16.1	BDL	7.3
16080	15:14:48 - 15:29:40	17.7	BDL	7.3
16081	15:29:40 - 15:44:32	18.0	BDL	11.3
16082	15:44:32 - 15:59:24	17.3	BDL	8.1
16083	15:59:24 - 16:14:09	18.5	BDL	6.9
16084	16:14:09 - 16:28:57	19.5	BDL	9.0
16085	16:28;57 - 16:43:48	20.7	BDL	9.2
16086	16:43:48 - 16:58:38	20.1	BDL	8.8
16087	17:01:58 - 17:16:41	22.5	BDL	7.5
16088	17:16:41 - 17:31:26	26.0	BDL	7.6
16089	17:31:26 - 17:46:19	24.9	BDL	BDL
16089	17:46:10 - 18:00:53	23.7	BDL	BDL
16091	18:00:53 - 18:15:36	20.6	BDL	BDL
16092	18:15:36 - 18:30:17	19.8	BDL	BDL
16093	18:30:17 - 18:44:56	21.3	BDL	BDL
16094	18:44:56 - 18:59:48	27.5	BDL	BDL
16095	18:59:48 - 19:14:38	29.2	BDL	BDL
16096	19:14:38 - 19:29:28	25.8	BDL	BDL
16097	19:31:20 - 19:46:09	19.9	BDL	BDL
16098	19:46:09 - 20:00:57	32.4	BDL	BDL
16099	20:00:57 - 20:15:52	42.1	BDL	BDL
16100	20:15:52 - 20:30:49	36.8	BDL	BDL
16101	20:30:49 - 20:45:41	36.4	BDL	BDL
16102	20:45:46 - 21:00:40	28.6	BDL	BDL
16103	21:00:48 - 21:15:30	27.6	BDL	BDL
16104	21:15:30 - 21:30:20	31.3	BDL	BDL
16105	21:30:20 - 21:45:09	34.5	BDL	BDL
16106	21:45:09 - 21:59:58	36.2	BDL	BDL
16107	21:59:58 - 22:14:49	32.6	BDL	BDL
16108	22:14:49 - 22:29:33	35.2	BDL	BDL
16109	22:29:40 - 22:44:30	37.2	BDL	BDL
16110	22:44:30 - 22:59:25	36.7	BDL	BDL
16111	22:59:25 - 23:14:18	35.6	BDL	BDL
16112	23:14:18 - 23:29:08	31.7	BDL	BDL
16113	23:29:08 - 23:44:00	34.3	BDL	BDL
16114	23:44:00 - 23:58:48	33.5	BDL	BDL

Table B-9 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16115	23:58:56 - 00:13:40	37.5	BDL	BDL
16116	00:13:46 - 00:28:33	38.2	BDL	BDL
16117	00:28:33 - 00:43:28	37.7	BDL	BDL
16118	00:46:06 - 01:00:54	38.7	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table B-10. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-10, September 2, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
NFN	00:00:00 - 00:15:00	ND	ND	ND
NFN	00:15:00 - 00:28:00	ND	ND	ND
16173	00:28:16 - 00:42:58	45.1	BDL	BDL
NFN	00:45:00 - 01:00:00	ND	ND	ND
NFN	01:00:00 - 01:15:00	ND	ND	ND
NFN	01:15:00 - 01:29:56	ND	ND	ND
16174	01:29:56 - 01:44:46	37.4	BDL	BDL
16175	01:44:46 - 01:59:42	38.2	ND	BDL
16176	01:59:42 - 02:14:36	36.7	1.2	BDL
16177	02:16:00 - 02:30:54	36.3	BDL	BDL
16178	02:30:54 - 02:45:53	33.0	1.4	BDL
16179	02:45:53 - 03:00:44	32.0	ND	BDL
16180	03:00:49 - 03:15:37	33.1	2.1	BDL
16181	03:15:37 - 03:30:33	33.4	2.6	BDL
16182	03:30:33 - 03:45:29	34.0	1.6	BDL
16183	03:45:29 - 04:00:25	34.5	2.0	BDL
16184	04:00:25 - 04:15:16	35.8	1.8	BDL
16185	04:15:21 - 04:30:09	34.9	2.1	BDL
16186	04:30:09 - 04:45:00	34.9	1.7	BDL
16187	04:45:05 - 05:00:01	35.0	2.0	BDL
16188	05:00:01 - 05:14:58	32.6	ND	BDL
16189	05:14:58 - 05:29:50	32.3	2.0	BDL
16190	05:29:54 - 05:44:46	34.6	1.6	BDL
16191	05:44:46 - 05:59:41	31.2	2.6	BDL
16192	05:59:41 - 06:14:37	29.3	2.8	BDL
16193	06:14:37 - 06:29:30	30.7	3.3	BDL
16194	06:29:30 - 06:44:24	32.9	3.0	BDL
16195	06:44:24 - 06:59:14	32.2	2.4	BDL
16196	06:59:14 - 07:14:09	37.2	2.6	BDL
16197	07:16:00 - 07:31:06	35.8	2.8	BDL
16198	07:31:06 - 07:46.04	45.8	1.8	BDL
16199	07:46:04 - 08:00:54	58.3	BDL	BDL
16200	08:00:54 - 08:15:50	68.0	BDL	BDL
16201	08:15:50 - 08:30:45	ND	ND	ND
16202	08:30:45 - 08:45:40	106	BDL	BDL
16203	08:45:40 - 09:00:34	115	BDL	BDL
16204	09:00:34 - 09:15:24	ND	ND	ND
16205	09:15:24 - 09:30:17	145	BDL	BDL
16206	09:30:17 - 09:45:17	156	BDL	10.3
16207	09:45:17 - 10:00:10	164	BDL	BDL
16208	10:00:10 - 10:15:04	166	BDL	11.4
16209	10:15:04 - 10:29:56	167	BDL	14.7
16210	10:29:56 - 10:44:42	169	BDL	14.4
16211	10:44:48 - 10:59:33	ND	ND	ND
16212	10:59:33 - 11:14:22	151	BDL	10.8

Table B-10 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16213	11:14:22 - 11:29:08	128	BDL	12.0
16214	11:29:08 - 11:44:00	ND	ND	ND
16215	11:44:00 - 11:58:48	ND	ND	ND
16216	12:01:22 - 12:16:16	105	BDL	13.2
16217	12:16:16 - 12:31:12	ND	ND	ND
16218	12:31:12 - 12:46:08	105	BDL	14.5
16219	12:46:08 - 13:00:56	116	BDL	20.4
16220	13:01:00 - 13:15:46	123	BDL	24.0
16221	13:15:52 - 13:30:37	113	BDL	15.7
16222	13:30:37 - 13:45:29	ND	ND	ND
16223	13:45:29 - 14:00:21	ND	ND	15.6
16224	14:00:21 - 14:15:16	63.0	BDL	8.6
16225	14:15:16 - 14:30:08	63.4	BDL	BDL
16226	14:30:14 - 14:45:05	57.7	BDL	7.8
16227	14:45:05 - 15:00:04	ND	ND	ND
16228	15:00:04 - 15:15:00	ND	ND	ND
16229	15:15:00 - 15:29:58	39.3	BDL	8.4
16230	15:29:58 - 15:44:50	47.0	BDL	8.0
16231	15:44:57 - 15:59:49	49.7	BDL	9.0
16232	15:59:49 - 16:14:45	43.0	BDL	BDL
16233	16:14:45 - 16:29:44	32.7	BDL	BDL
16234	16:29:44 - 16:44:44	34.4	BDL	2.1
16235	16:44:44 - 16:59:37	31.1	BDL	BDL
16236	16:59:42 - 17:14:36	28.7	BDL	BDL
16237	17:14:44 - 17:31:27	32.1	BDL	BDL
16238	17:31:21 - 17:46:18	45.3	BDL	BDL
16239	17:46:18 - 18:01:18	45.9	BDL	BDL
16240	18:01:18 - 18:16:25	49.2	BDL	BDL
16241	18:16:33 - 18:31:22	51.8	BDL	BDL
16242	18:31:22 - 18:46:21	39.7	BDL	BDL
16243	18:46:21 - 19:01:20	49.1	BDL	6.3
16244	19:01:20 - 19:16:18	51.5	BDL	BDL
16245	19:16:18 - 19:31:12	53.0	BDL	BDL
16246	19:31:18 - 19:46:08	49.3	BDL	BDL
16247	19:46:08 - 20:01:06	36.6	BDL	BDL
16248	20:01:06 - 20:16:02	28.8	BDL	BDL
16249	20:16:02 - 20:30:57	21.6	BDL	BDL
16250	20:30:57 - 20:45:49	24.5	BDL	BDL
16251	20:45:54 - 21:00:45	19.0	BDL	BDL
16252	21:00:53 - 21:15:44	19.3	BDL	BDL
16253	21:15:44 - 21:30:42	19.7	BDL	BDL
16254	21:30:42 - 21:45:40	RS	RS	RS
16255	21:45:40 - 22:00:34	23.2	BDL	BDL
16256	22:00:34 - 22:15:24	24.8	BDL	BDL
16257	22:15:30 - 22:30:17	25.4	BDL	BDL
16258	22:30:17 - 22:45:10	28.2	BDL	BDL
16259	22:45:10 - 23:00:01	34.6	BDL	BDL

Table B-10 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16260	23:00:01 - 23:14:53	18.4	BDL	BDL
16261	23:14:53 - 23:29:40	18.3	BDL	BDL
16262	23:29:46 - 23:44:32	19.9	BDL	BDL
16263	23:44:32 - 23:59:28	18.7	BDL	BDL
16264	23:59:28 - 00:14:22	16.6	BDL	BDL
16265	00:14:22 - 00:29:16	17.5	BDL	BDL
16266	00:29:16 - 00:44:04	17.7	BDL	BDL
16267	00:44:04 - 00:59	17.3	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period
NFN = No File Number

Table B-11. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode S-11, September 3, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16268	00:59:04 - 01:13:50	9.7	BDL	BDL
16269	01:13:50 - 01:28:44	8.1	BDL	BDL
16270	01:28:44 - 01:43:38	11.6	BDL	BDL
16271	01:43:38 - 02:00:37	8.8	BDL	BDL
16272	02:00:37 - 02:15:22	11.6	BDL	BDL
16273	02:15:22 - 02:30:13	9.6	BDL	BDL
16274	02:30:13 - 02:45:08	9.3	BDL	BDL
16275	02:45:53 - 03:00:44	13.2	BDL	BDL
16276	03:00:44 - 03:14:54	9.6	BDL	BDL
16277	03:14:54 - 03:29:41	12.4	BDL	BDL
16278	03:29:41 - 03:44:32	19.6	BDL	BDL
16279	03:44:32 - 03:59:24	10.4	BDL	BDL
16280	03:59:24 - 04:14:14	4.6	BDL	BDL
16281	04:14:14 - 04:29:01	BDL	BDL	BDL
16282	04:29:01 - 04:43:54	4.8	BDL	BDL
16283	04:43:54 - 04:58:48	BDL	BDL	BDL
16284	04:58:48 - 05:13:41	BDL	BDL	BDL
16285	05:13:41 - 05:28:36	BDL	BDL	BDL
16286	05:28:36 - 05:43:24	4.4	BDL	BDL
16287	05:43:10 - 06:00:56	7.0	BDL	BDL
16288	06:01:02 - 06:15:48	15.3	BDL	BDL
16289	06:15:48 - 06:30:44	9.5	BDL	BDL
16290	06:30:44 - 06:45:37	9.6	BDL	BDL
16291	06:45:37 - 07:00:33	16.2	BDL	BDL
16292	07:00:33 - 07:15:22	14.9	BDL	BDL
16293	07:15:28 - 07:30:18	16.2	BDL	BDL
16294	07:30:26 - 07:45:13	ND	ND	ND
16295	07:45:13 - 08:00:09	20.8	BDL	BDL
16296	08:00:09 - 08:15:04	22.6	BDL	BDL
16297	08:15:04 - 08:30:02	22.0	BDL	BDL
16298	08:30:02 - 08:44;58	25.0	BDL	BDL
16299	08:44;58 - 08:59:57	ND	ND	ND
16300	08:59:57 - 09:15:01	ND	ND	ND
16301	09:15:01 - 09:30:02	26.6	BDL	BDL
16302	09:30:02 - 09:44:57	28.7	BDL	BDL
16303	09:44:57 - 09:59:50	30.0	BDL	BDL
16304	09:59:57 - 10:14:42	28.6	BDL	BDL
16305	10:14:42 - 10:29:34	27.6	BDL	BDL
16306	10:29:34 - 10:44:26	29.8	BDL	BDL
16308	10:44:26 - 10:44:26	25.5	BDL	BDL
16308	10:59:20 - 11:14:08	25.2	BDL	BDL
16309	11:14:08 - 11:28:58	23.2	BDL	BDL
16310	11:28:58 - 11;46;01	20.0	BDL	BDL
16311	11;46;10 - 12:00:54	18.8	BDL	BDL
16312	12:00:54 - 12:15:46	18.5	BDL	BDL

Table B-11 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16313	12:15:46 - 12:30:40	16.5	BDL	BDL
16314	12:30:40 - 12:45:33	15.9	BDL	BDL
16315	12:45:33 - 13:00:24	13.2	BDL	BDL
16316	13:00:32 - 13:15:20	5.6	BDL	BDL
16317	13:15:20 - 13:30:14	5.9	BDL	BDL
16318	13:30:14 - 13:45:08	BDL	BDL	BDL
16319	13:45:08 - 14:00:02	8.4	BDL	BDL
16320	14:00:02 - 14:15:01	7.2	BDL	BDL
16321	14:15:01 - 14:29:48	4.2	BDL	BDL
16322	14:29:48 - 14:44:42	4.7	BDL	BDL
16323	14:44:42 - 14:59:37	4.8	BDL	BDL
16324	14:59:37 - 15:14:34	BDL	BDL	BDL
16325	15:14:34 - 15:29:32	5.1	BDL	BDL
16326	15:29:32 - 15:44:22	5.4	BDL	BDL
16327	15:44:22 - 15:59:18	5.2	BDL	BDL
16328	15:59:18 - 16:14:16	5.4	BDL	BDL
16329	16:14:16 - 16:29:16	6.3	BDL	BDL
16330	16:29:16 - 16:44:08	6.0	BDL	BDL
16331	16:44:08 - 16:59:08	5.7	BDL	BDL
16332	16:59:08 - 17:14:00	6.7	BDL	BDL
16333	17:33:00 - 17:37:46	RS	RS	RS
16334	17:41:06 - 17:55:50	RS	RS	RS
16335	18:03:16 - 18:18:04	RS	RS	RS
16336	18:19:25 - 18:34:16	RS	RS	RS
16337	18:54:06 - 19:00:10	RS	RS	RS
16338	19:17:08 - 19:22:00	RS	RS	RS
16339	19:31:36 - 19:46:28	5.1	BDL	BDL
16340	19:46:28 - 20:01:22	BDL	BDL	BDL
16341	20:01:22 - 20:16:17	BDL	BDL	BDL
16342	20:16:17 - 20:31:09	6.6	BDL	BDL
16343	20:31:09 - 20:46:00	7.9	BDL	BDL
16344	20:46:00 - 21:00:49	7.9	BDL	BDL
16345	21:00:49 - 21:15:45	9.3	BDL	BDL
16346	21:15:45 - 21:30:40	5.2	BDL	BDL
16347	21:30:40 - 21:45:48	BDL	BDL	BDL
16348	21:45:48 - 22:00:48	6.6	BDL	BDL
16349	22:00:48 - 22:15:48	4.4	BDL	BDL
16350	22:15:48 - 22:30:37	4.2	BDL	BDL
16351	22:30:37 - 22:45:33	4.4	BDL	BDL
16352	22:45:33 - 23:00:30	4.7	BDL	BDL
16353	23:00:30 - 23:15:29	BDL	BDL	BDL
16354	23:15:29 - 23:30:24	BDL	BDL	BDL
16355	23:30:29 - 23:45:24	BDL	BDL	BDL
16356	23:45:24 - 00:00:26	BDL	BDL	BDL
16357	00:00:26 - 00:15:30	BDL	BDL	BDL
16358	00:15:30 - 00:30:32	BDL	BDL	BDL

Table B-11 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16359	00:30:32 - 00:45:33	3.3	BDL	BDL
16267	00:45:33 - 01:00:29	5.1	BDL	BDL

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

APPENDIX C

TIME-RESOLVED CONCENTRATION DATA FOR LONG BEACH FALL EPISODES

Table C-1. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode F-1, November 11, 1987

File No.	Measurement Period	Concentrations (ppb)		
		NO_2	HONO	HCHO
-	00:00:00 - 00:15:00	ND	ND	ND
16536	00:15:00 - 00:29:44	68.9	7.3	16.6
16537	00:29:44 - 00:44:30	67.5	7.4	16.0
16538	00:44:30 - 00:59:14	65.0	7.5	18.9
16539	00:59:14 - 01:13	59.2	6.1	12.9
16540	01:15:04 - 01:29:54	52.1	5.9	13.1
16541	01:29:58 - 01:44:56	50.2	5.3	11.2
16542	01:45:04 - 02:00:04	48.2	5.6	10.6
16543	02:00:04 - 02:15:26	46.8	5.2	10.2
16544	02:15:26 - 02:30:57	45.1	4.8	10.3
16545	02:30:57 - 02:46:21	44.0	4.6	9.5
16546	02:46:28 - 02:58	43.1	4.9	11.2
16547	03:00:04 - 03:14:36	43.5	4.7	8.1
16548	03:14:36 - 03:28	44.1	4.8	7.6
16549	03:30:05 - 03:44:49	44.2	4.7	7.8
16550	03:44:57 - 03:59:40	43.2	5.1	8.8
16551	03:59:40 - 04:14:29	45.0	5.2	7.3
16552	04:14:29 - 04:29:20	42.5	5.2	8.6
16553	04:29:20 - 04:44:10	42.0	5.3	8.9
16554	04:44:10 - 04:59:10	39.7	5.5	8.5
16555	04:59:10 - 05:14:02	39.4	5.0	7.9
16556	05:15:34 - 05:30:21	41.3	4.3	8.2
16557	05:30:21 - 05:49:09	39.9	4.1	7.1
16558	05:45:12 - 05:59:58	40.2	4.4	8.1
16559	06:00:06 - 06:14:49	41.7	3.4	8.8
16560	06:14:49 - 06:29:40	44.0	3.7	10.0
16561	06:29:40 - 06:44:29	44.1	3.6	8.6
16562	06:44:29 - 06:59	45.6	3.3	9.0
16563	07:00:13 - 07:15:10	SUN	SUN	SUN
16564	07:15:18 - 07:30:17	SUN	SUN	SUN
16565	07:30:17 - 07:45:13	SUN	SUN	SUN
16566	07:45:13 - 08:00:09	SUN	SUN	SUN
16567	08:00:09 - 08:15:14	SUN	SUN	SUN
16568	08:15:14 - 08:30:34	SUN	SUN	SUN
16569	08:30:42 - 08:45:32	RS	-	-
16570	08:45:32 - 09:00:36	RS	-	-
16571	09:00:36 - 09:15:57	-	-	RS
16572	09:15:57 - 09:31:09	97.0	BDL	ND
16573	09:31:09 - 09:46:30	94.6	BDL	ND
16574	09:46:38 - 10:01:45	83.2	BDL	13.9
16575	10:01:15 - 10:13:30	76.2	BDL	12.4
16576	10:13:49 - 10:28:38	67.5	BDL	11.1
16577	10:28:38 - 10:43:34	50.1	BDL	ND
16578	10:43:34 - 10:58:30	ND	ND	ND
16579	10:58:30 - 11:13:25	ND	ND	ND

Table C-1 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16580	11:13:25 - 11:28:32	52.1	BDL	13.0
16581	11:30:10 - 11:45:01	ND	BDL	ND
16582	11:45:01 - 11:59:56	60.0	BDL	15.5
16583	11:59:56 - 12:14:50	56.0	BDL	17.2
16584	12:14:54 - 12:29:56	54.2	BDL	16.2
16585	12:29:56 - 12:44:58	52.6	BDL	15.9
16586	12:45:06 - 13:00:14	43.5	BDL	16.5
16587	13:00:14 - 13:15:23	38.1	BDL	16.4
16588	13:15:23 - 13:30:38	34.6	BDL	18.2
16589	13:30:41 - 13:45:58	30.5	BDL	17.7
16590	13:45:58 - 14:01:05	31.1	BDL	18.5
16591	14:01:05 - 14:14:05	34.2	BDL	17.7
16592	14:14:34 - 14:29:24	28.3	BDL	17.3
16593	14:29:32 - 14:44:21	33.5	BDL	15.7
16594	14:44:21 - 14:59:14	69.6	BDL	19.5
16595	14:59:14 - 15:14:10	96.5	BDL	16.6
16596	15:14:10 - 15:29:04	105	BDL	17.9
16597	15:29:04 - 15:43:57	138	BDL	18.6
16598	15:44:05 - 15:58:54	147	BDL	16.2
16599	16:00:37 - 16:15:26	129	BDL	9.3
16600	16:15:26 - 16:30:20	119	BDL	7.2
16601	16:30:20 - 16:45:17	108	1.0	8.5
16602	16:45:17 - 17:00:09	96.0	0.7	6.4
16603	17:00:09 - 17:15:02	89.0	2.0	10.5
16604	17:15:10 - 17:29:58	86.6	1.9	10.0
16605	17:29:58 - 17:45:00	89.8	1.5	8.4
16606	17:45:00 - 18:00:04	94.6	1.3	8.6
16607	18:00:04 - 18:14:58	ND	ND	ND
16608	18:14:58 - 18:29:54	ND	ND	ND
16609	18:30:04 - 18:45:06	89.8	1.4	7.6
16610	18:45:06 - 19:00:26	77.3	ND	ND
16611	19:00:26 - 19:15:44	78.8	1.5	6.0
16612	19:15:44 - 19:31:00	85.0	1.9	9.4
16613	19:31:00 - 19:46:00	90.1	2.3	9.7
16614	19:46:09 - 20:00:58	92.2	ND	8.5
16615	20:00:58 - 20:15:53	99.2	2.5	8.6
16616	20:15:53 - 20:30:50	101	ND	ND
16617	20:30:50 - 20:45:44	103	ND	ND
16618	20:45:44 - 21:00:37	ND	ND	ND
16619	21:00:46 - 21:15:34	ND	ND	ND
16620	21:15:34 - 21:30:28	85.7	6.4	10.6
16621	21:30:28 - 21:45:46	83.2	6.9	13.4
16622	21:45:46 - 22:00:41	80.1	7.9	16.9
16623	22:00:41 - 22:15:34	78.9	7.4	16.1
16624	22:15:42 - 22:30:32	76.6	7.9	16.1
16625	22:30:32 - 22:45:25	72.4	8.2	14.7
16626	22:45:25 - 23:00:18	72.7	8.5	16.4

Table C-1 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16627	23:00:22 - 23:15:16	69.7	8.3	13.2
16628	23:15:16 - 23:30:09	66.0	9.0	16.4
16629	23:30:17 - 23:45:06	61.5	9.7	15.7
16630	23:45:06 - 00:00:00	64.0	9.7	17.1

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period
FOG = Signal attenuated by fog
SUN = Sun on out-of-focus mirrors

Table C-2. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode F-2, November 12, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16631	00:00:00 - 00:14:53	70.2	10.0	19.4
16632	00:14:57 - 00:29:50	71.9	11.2	23.6
16633	00:29:50 - 00:44:44	71.0	10.4	21.1
16634	00:44:44 - 00:59:41	75.5	10.8	25.4
16635	00:59:41 - 01:14:34	69.8	10.1	17.0
16636	01:14:34 - 01:29:29	78.4	10.0	15.4
16637	01:29:38 - 01:44:28	83.1	10.6	17.0
16638	01:44:28 - 02:00:17	82.5	10.5	15.7
16639	02:00:17 - 02:15:14	81.2	10.3	15.2
16640	02:15:44 - 02:30:09	72.0	9.9	11.3
16641	02:30:09 - 02:45:04	71.4	10.3	10.6
16642	02:45:12 - 03:00:01	78.2	10.0	12.5
16643	03:00:01 - 03:14:57	84.5	9.9	11.4
16644	03:14:87 - 03:29:56	70.2	9.1	8.5
16645	03:29:56 - 03:44:52	70.4	9.7	9.3
16646	03:44:52 - 03:59:46	69.9	9.8	9.1
16647	03:59:56 - 04:14:45	72.0	9.1	9.1
16648	04:14:45 - 04:29:41	68.1	9.1	7.7
16649	04:29:41 - 04:44:57	68.0	9.5	10.1
16650	04:44:57 - 04:59:53	68.5	9.7	8.8
16651	04:59:53 - 05:14:48	66.2	10.0	10.3
16652	05:14:57 - 05:29:46	74.5	9.5	12.0
16653	05:29:46 - 05:44:42	64.3	9.2	9.9
16654	05:44:42 - 05:59:41	64.5	9.5	11.7
16655	05:59:41 - 06:14:36	64.0	9.3	12.3
16656	06:14:36 - 06:29:32	67.7	8.2	9.6
16657	06:29:41 - 06:44:30	78.4	9.1	9.3
16658	06:44:30 - 06:59:25	81.0	8.8	13.1
16659	06:59:25 - 07:14:20	83.5	8.5	13.4
16660	07:14:24 - 07:29:40	86.1	8.4	15.6
16661	07:29:40 - 07:44:36	85.9	7.3	16.0
16662	07:44:14 - 07:59:33	93.2	6.1	18.0
16663	07:59:33 - 08:14:28	93.2	5.1	17.1
16664	08:14:28 - 08:29:22	89.4	4.0	15.4
16665	08:29:25 - 08:44:20	84.1	1.6	12.6
16666	08:44:20 - 08:59:16	RS	-	-
16667	08:59:25 - 09:14:13	-	-	RS
16668	09:14:13 - 09:29:08	-	-	RS
16669	09:28:08 - 09:44:02	ND	ND	ND
16670	09:45:56 - 10:00:45	103	BDL	12.6
16671	10:00:56 - 10:16:04	107	BDL	15.0
16672	10:16:04 - 10:31:29	115	BDL	14.7
16673	10:31:29 - 10:45	109	BDL	14.7
16674	10:45:36 - 11:00:52	130	BDL	16.3
16675	11:00:52 - 11:16:12	135	BDL	18.1

Table C-2 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16676	11:16:21 - 11:31:34	147	BDL	16.2
16677	11:31:34 - 11:46:54	125	BDL	17.1
16678	11:46:54 - 12:02:24	115	BDL	12.9
16679	12:02:24 - 12:17:42	106	BDL	13.0
16680	12:17:42 - 12:28	94.9	BDL	13.8
16681	12:30:12 - 12:45:04	78.8	BDL	10.3
16682	12:45:04 - 13:00:00	104	BDL	11.4
16683	13:00:00 - 13:14:54	113	BDL	16.2
16684	13:14:54 - 13:29:52	134	BDL	16.0
16685	13:29:52 - 13:44:45	133	BDL	15.9
16686	13:44:45 - 13:59:40	102	BDL	12.4
16687	13:59:40 - 14:14:36	102	BDL	12.2
16688	14:14:36 - 14:29:29	94.6	BDL	12.8
16689	14:29:29 - 14:44:25	72.4	BDL	10.1
16690	14:44:25 - 14:59:21	78.2	BDL	8.4
16691	14:59:21 - 15:14:17	68.7	BDL	6.4
16692	15:14:17 - 15:29:10	67.1	BDL	6.2
16693	15:29:13 - 15:44:05	81.0	BDL	6.5
16694	15:44:09 - 15:58:53	102	BDL	9.6
16695	15:59:02 - 16:13:50	117	BDL	11.1
16696	16:14:00 - 16:28:52	147	BDL	13.9
16697	16:29:01 - 16:43:53	161	BDL	12.8
16698	16:44:02 - 16:58:53	154	BDL	11.8
16699	16:59:02 - 17:13:53	141	BDL	9.8
16700	17:14:02 - 17:28:53	126	BDL	8.3
16701	17:29:02 - 17:43:54	116	1.3	10.8
16702	17:43:54 - 17:58:56	111	1.7	10.1
16703	17:58:56 - 18:13:56	99.4	1.5	11.1
16704	18:13:56 - 18:28:56	90.2	1.4	10.9
16705	18:28:56 - 18:43:56	86.1	1.5	9.6
16706	18:43:56 - 18:58:56	85.2	1.1	8.3
16707	18:58:56 - 19:13:48	83.1	1.5	8.5
16708	19:13:48 - 19:28:38	81.5	1.5	8.2
16709	19:28:38 - 19:43:33	78.0	1.4	8.5
16710	19:43:33 - 19:59:29	ND	ND	ND
16711	19:59:29 - 20:15:28	ND	ND	ND
16712	20:15:28 - 20:30:08	72.4	2.3	ND
16713	20:30:08 - 20:44:48	71.7	2.5	8.1
16714	20:45:02 - 20:59:52	70.4	2.0	9.1
16715	21:00:00 - 21:14:46	67.4	3.0	13.1
16716	21:14:53 - 21:29:41	68.1	ND	ND
16717	21:29:48 - 21:44:37	63.0	4.1	14.1
16718	21:44:44 - 21:59:32	62.2	4.4	16.4
-	21:59:32 - 22:15:38	ND	ND	ND
16719	22:15:38 - 22:30:29	57.5	4.5	16.4
16720	22:30:29 - 22:45:26	54.3	3.9	10.8
16721	22:45:26 - 23:00:22	ND	ND	ND

Table C-2 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16722	23:00:22 - 23:15:18	62.9	3.9	12.9
16723	23:15:18 - 23:30:13	68.9	3.8	10.3
16724	23:30:13 - 23:45:08	68.4	4.0	5.6
16725	23:45:08 - 00:00:02	68.0	3.9	8.3

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period

Table C-3. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode F-3, November 13, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16726	00:00:02 - 00:14:57	85.4	5.4	9.0
16727	00:14:57 - 00:29:33	FOG	FOG	FOG
16728	00:29:33 - 00:44:02	FOG	FOG	FOG
16729	00:44:02 - 00:58:32	FOG	FOG	FOG
16730	00:58:32 - 01:13:00	FOG	FOG	FOG
16731	01:13:00 - 01:27:29	FOG	FOG	FOG
16732	01:27:29 - 01:41:58	FOG	FOG	FOG
16733	01:41:58 - 01:56:28	FOG	FOG	FOG
16734	01:56:28 - 02:10:57	FOG	FOG	FOG
16735	02:10:57 - 02:25:30	FOG	FOG	FOG
16736	02:25:30 - 02:40:28	FOG	FOG	FOG
16737	02:40:28 - 02:55:24	62.9	4.5	11.7
16738	02:55:24 - 03:10:05	FOG	FOG	FOG
16739	03:10:05 - 03:24:38	FOG	FOG	FOG
16740	03:24:38 - 03:39:36	FOG	FOG	FOG
16741	03:39:36 - 03:54:34	FOG	FOG	FOG
16742	03:54:34 - 04:09:32	70.7	3.2	6.0
16743	04:09:32 - 04:24:25	58.9	3.1	5.1
16744	04:24:29 - 04:39:22	57.5	2.6	9.3
16745	04:39:22 - 04:54:20	52.4	2.4	8.5
16746	04:54:26 - 05:09:16	52.3	3.0	7.0
16747	05:09:16 - 05:24:10	48.6	4.1	6.8
16748	05:24:10 - 05:39:05	47.0	2.7	8.9
16749	05:39:05 - 05:54:00	46.3	2.9	7.2
16750	05:54:00 - 06:08:54	44.2	ND	8.0
16751	06:08:54 - 06:23:49	36.2	3.2	8.1
16752	06:23:56 - 06:30	ND	ND	ND
16753	06:31:09 - 06:46:21	38.2	3.4	10.2
16754	06:46:28 - 07:01:37	39.5	2.8	10.9
16755	07:01:37 - 07:16:45	39.9	3.5	7.7
16756	07:16:45 - 07:31:38	41.5	3.2	8.1
16757	07:31:38 - 07:46:25	41.7	2.3	9.7
16758	07:46:32 - 08:01:18	43.7	2.2	7.1
16759	08:01:25 - 08:16:12	57.6	2.1	10.8
16760	08:16:20 - 08:31:05	RS	RS	RS
16761	08:31:05 - 08:46:00	RS	RS	RS
16762	08:46:00 - 09:00:54	RS	RS	RS
16763	09:00:54 - 09:15:49	RS	RS	RS
16764	09:15:49 - 09:30:41	ND	ND	ND
16765	09:30:41 - 09:45:33	43.0	BDL	8.8
16766	09:45:33 - 10:00:26	24.6	BDL	7.3
16767	10:00:26 - 10:15:20	29.6	BDL	7.4
16768	10:15:20 - 10:30:14	26.4	BDL	6.0
16769	10:30:14 - 10:45:08	RS	RS	RS
16770	10:45:08 - 11:00:02	30.7	BDL	6.3

Table C-3 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16771	11:00:02 - 11:14:54	30.5	BDL	9.3
16772	11:14:54 - 11:29:48	35.3	BDL	9.8
16773	11:29:48 - 11:44:41	34.2	BDL	6.2
16774	11:44:41 - 11:59:33	34.7	BDL	6.7
16775	11:59:33 - 12:14:25	ND	ND	ND
16776	12:16:12 - 12:31:02	35.7	BDL	BDL
16777	12:31:02 - 12:45:56	39.7	BDL	7.5
16778	12:45:56 - 13:00:48	32.3	BDL	5.1
16779	13:00:48 - 13:15:40	30.8	BDL	BDL
16780	13:15:40 - 13:30:34	29.1	BDL	5.1
16781	13:30:34 - 13:45:28	23.5	BDL	BDL
16782	13:45:28 - 14:00:18	22.1	BDL	BDL
16783	14:00:21 - 14:15:13	17.7	BDL	BDL
16784	14:15:16 - 14:30:06	18.5	BDL	BDL
16785	14:30:14 - 14:45:00	21.1	BDL	BDL
16786	14:45:08 - 14:59:56	25.5	BDL	BDL
16787	15:00:02 - 15:14:49	22.6	BDL	BDL
16788	15:14:57 - 15:29:42	21.0	BDL	BDL
16789	15:29:50 - 15:44:37	19.4	BDL	BDL
16790	15:44:45 - 15:59:30	23.0	BDL	BDL
16791	15:59:38 - 16:14:24	30.4	BDL	BDL
16792	16:14:24 - 16:29:16	29.2	BDL	BDL
16793	16:29:16 - 16:44:08	30.2	BDL	BDL
16794	16:44:08 - 16:58:58	33.9	BDL	BDL
16795	17:06:26 - 17:16:01	ND	ND	ND
16796	17:16:01 - 17:30:50	37.5	BDL	BDL
16797	17:30:50 - 17:45:46	47.6	BDL	BDL
16798	17:45:46 - 18:00:41	44.4	BDL	BDL
16799	18:00:41 - 18:15:36	ND	BDL	ND
16800	18:15:36 - 18:30:29	45.8	BDL	BDL
16801	18:30:29 - 18:45:22	51.6	BDL	BDL
16802	18:45:22 - 19:00:12	48.4	BDL	BDL
16803	19:00:12 - 19:14:57	40.3	BDL	BDL
16804	19:14:57 - 19:29:44	30.1	BDL	BDL
16805	19:29:44 - 19:44:32	30.6	0.9	BDL
16806	19:44:32 - 19:59:24	20.5	0.8	BDL
16807	19:59:24 - 20:14:14	21.9	BDL	BDL
16808	20:14:14 - 20:29:04	28.6	BDL	BDL
16809	20:29:04 - 20:44:17	26.5	BDL	BDL
16810	20:44:17 - 20:59:09	26.5	BDL	BDL
16811	21:01:34 - 21:16:24	16.7	BDL	BDL
16812	21:16:24 - 21:31:18	21.3	BDL	BDL
16813	21:31:18 - 21:46:12	22.8	BDL	BDL
16814	21:46:12 - 22:01:04	24.5	BDL	BDL
16815	22:01:04 - 22:15:58	21.5	BDL	BDL
16816	22:15:58 - 22:30:52	22.3	BDL	BDL
16817	22:30:52 - 22:45:46	36.4	BDL	BDL

Table C-3 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16818	22:45:46 - 23:00:40	38.5	RAIN	RAIN
16819	23:00:40 - 23:15:32	29.8	RAIN	RAIN
16820	23:15:36 - 23:30:28	22.7	RAIN	RAIN
16821	23:30:30 - 23:45:20	25.9	RAIN	RAIN
16822	23:45:29 - 00:00:14	20.8	RAIN	RAIN

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period
FOG = Signal attenuated by fog
SUN = Sun on out-of-focus mirrors
RAIN= Signal attenuated by rain

Table C-4. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode F-4, December 3, 1987

File No.	Measurement Period	Concentrations (ppb)		
		NO_2	HONO	HCHO
16915	23:59:37 - 00:14:22	52.1	11.1	13.0
16916	00:14:22 - 00:29:18	54.8	11.9	BDL
16917	00:29:18 - 00:44:10	59.6	12.3	5.7
16918	00:44:10 - 00:58:50	FOG	FOG	FOG
16919	00:58:50 - 01:16:25	FOG	FOG	FOG
16920	01:16:25 - 01:31:08	56.2	11.0	BDL
16921	01:31:16 - 01:45:52	50.4	14.0	ND
16922	01:45:52 - 02:00:42	50.2	13.5	BDL
16923	02:00:42 - 02:15:32	FOG	FOG	FOG
16924	02:15:32 - 02:30:12	FOG	FOG	FOG
16925	02:30:12 - 02:45:08	56.8	13.2	6.2
16926	02:45:08 - 02:59:58	FOG	FOG	FOG
16927	02:59:58 - 03:14:50	FOG	FOG	FOG
16928	03:14:50 - 03:29:29	FOG	FOG	FOG
16929	03:29:29 - 03:44:24	FOG	FOG	FOG
16930	03:44:24 - 03:59:41	FOG	FOG	FOG
16931	03:59:41 - 04:14:09	FOG	FOG	FOG
16932	04:14:09 - 04:28:46	FOG	FOG	FOG
16933	04:28:46 - 04:43:16	FOG	FOG	FOG
16934	04:43:16 - 04:58:00	FOG	FOG	FOG
16935	04:58:00 - 05:01:21	FOG	FOG	FOG
16936	05:01:21 - 05:31:08	FOG	FOG	FOG
16937	05:31:08 - 05:45:47	FOG	FOG	FOG
16938	05:45:57 - 06:00:48	71.2	13.5	9.1
16939	06:00:48 - 06:15:36	81.9	13.4	ND
16940	06:15:36 - 06:30:13	FOG	FOG	FOG
16941	06:30:13 - 06:44:58	FOG	FOG	FOG
16942	06:44:58 - 06:59:53	90.2	14.3	15.8
16943	06:59:53 - 07:14:46	91.9	15.3	ND
16944	07:14:46 - 07:29:33	96.6	13.8	17.7
16945	07:29:36 - 07:44:22	103	15.2	15.7
16946	07:44:26 - 07:59:10	120	14.9	23.9
16947	07:59:10 - 08:14:09	ND	ND	ND
16948	08:14:09 - 08:28:57	ND	ND	ND
16949	08:29:05 - 08:43:48	158	12.2	27.2
16950	08:43:56 - 08:58:40	154	12.1	22.1
16951	09:01:45 - 09:16:40	153	10.0	22.5
16952	09:16:40 - 09:31:40	ND	ND	ND
16953	09:31:40 - 09:46:40	ND	ND	ND
16954	09:46:40 - 10:01:38	ND	ND	ND
16955	10:01:38 - 10:16:37	ND	ND	ND
16956	10:16:37 - 10:31:29	164	1.7	22.0
16957	10:31:29 - 10:46:21	210	1.6	27.3
16958	10:46:21 - 11:01:13	237	2.0	29.1
16959	11:01:13 - 11:16:06	244	2.4	31.1

Table C-4 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
16960	11:16:06 - 11:30:58	239	2.2	40.1
16961	11:30:58 - 11:45:46	231	1.5	29.7
16962	11:45:50 - 12:00:38	203	BDL	29.2
16963	12:00:42 - 12:15:36	RS	RS	RS
16964	12:15:36 - 12:30:32	RS	RS	RS
16965	12:30:32 - 12:45:20	RS	RS	RS
16966	12:45:26 - 13:00:12	177	BDL	28.6
16967	13:00:20 - 13:14:57	183	BDL	ND
16968	13:15:05 - 13:29:44	ND	BDL	ND
16969	13:29:52 - 13:44:37	177	BDL	32.3
16970	13:44:45 - 13:59:32	167	BDL	29.4
16971	13:59:40 - 14:14:22	151	BDL	26.4
16972	14:14:22 - 14:29:12	149	BDL	22.9
-	14:29:12 - 14:47:12	ND	ND	ND
16973	14:47:12 - 15:01:53	ND	ND	ND
16974	15:01:53 - 15:16:48	134	BDL	11.1
16975	15:16:48 - 15:31:37	133	BDL	ND
16976	15:31:44 - 15:46:29	141	BDL	12.4
16977	15:46:37 - 16:01:26	119	BDL	10.9
16978	16:01:26 - 16:16:20	154	BDL	15.3
16979	16:16:20 - 16:31:17	134	BDL	11.5
16980	16:31:17 - 16:46:10	177	BDL	9.7
16981	16:46:10 - 17:01:06	140	1.0	10.0
16982	17:01:06 - 17:16:04	138	2.0	6.4
16983	17:16:04 - 17:31:00	128	2.8	8.8
16984	17:31:00 - 17:45:56	124	2.9	11.5
16985	17:45:56 - 18:00:49	124	3.7	ND
16986	18:00:49 - 18:15:40	105	4.0	10.0
16987	18:15:40 - 18:30:30	94.4	ND	ND
16988	18:30:30 - 18:45:21	108	3.8	5.9
16989	18:45:21 - 19:00:16	91.1	3.5	5.7
16990	19:00:16 - 19:15:10	ND	ND	ND
16991	19:15:10 - 19:30:05	ND	ND	ND
16992	19:30:05 - 19:44:57	100	7.0	10.5
16993	19:44:57 - 19:59:50	102	7.0	12.5
16994	19:59:50 - 20:14:45	99.5	6.5	14.5
16995	20:14:45 - 20:29:40	FOG	FOG	FOG
16996	20:29:40 - 20:44:36	FOG	FOG	FOG
16997	20:44:36 - 20:59:32	FOG	FOG	FOG
16998	20:59:32 - 21:14:29	FOG	FOG	FOG
16999	21:14:29 - 21:29:16	81.5	12.4	12.6
17000	21:29:16 - 21:44:28	ND	ND	ND
17001	21:46:01 - 22:00:53	79.6	10.2	13.5
17002	22:00:53 - 22:15:49	76.5	9.9	14.2
17003	22:15:49 - 22:30:42	79.3	9.3	11.0
17004	22:30:42 - 22:45:36	69.1	8.6	7.1
17005	22:45:36 - 23:00:26	64.3	10.8	8.8

Table C-4 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
17006	23:00:26 - 23:15:09	ND	ND	ND
17007	23:15:09 - 23:30:01	FOG	FOG	FOG
17008	23:30:01 - 23:44:57	FOG	FOG	FOG
17009	23:44:57 - 23:59:41	ND	ND	ND
17010	23:59:41 - 00:14:33	56.2	11.5	9.6

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period
FOG = Signal attenuated by fog
SUN = Sun on out-of focus mirrors

Table C-5. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode F-5, December 10, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
17108	00:00:16 - 00:15:13	89.5	13.6	21.6
17109	00:15:20 - 00:30:13	95.8	13.8	19.7
17110	00:30:13 - 00:45:13	103	14.3	26.0
17111	00:45:13 - 01:00:09	113	13.4	26.9
17112	01:00:17 - 01:15:10	109	13.4	24.3
17113	01:15:10 - 01:30:06	107	12.6	23.7
17114	01:30:06 - 01:45:04	109	12.6	21.5
17115	01:45:04 - 02:00:01	ND	ND	ND
17116	02:00:01 - 02:14:56	ND	ND	ND
17117	02:14:56 - 02:29:58	ND	ND	ND
17118	02:29:58 - 02:44:50	ND	ND	ND
17119	02:44:50 - 02:59:46	105	14.9	15.6
17120	02:59:46 - 03:14:18	104	15.2	16.2
17121	03:14:48 - 03:29:49	103	11.3	14.3
17122	03:29:52 - 03:44:53	ND	ND	ND
17123	03:44:53 - 03:59:52	108	14.9	17.6
17124	03:59:52 - 04:14:50	91.0	13.4	15.8
17125	04:14:57 - 04:29:52	92.1	12.1	14.5
17126	04:29:52 - 04:44:50	93.5	13.2	19.0
17127	04:44:50 - 04:59:49	88.4	13.5	16.7
17128	04:59:56 - 05:14:52	93.9	12.7	ND
17129	05:14:52 - 05:29:50	88.1	13.2	16.5
17130	05:29:50 - 05:44:50	104	13.7	ND
17131	05:44:57 - 05:59:50	97.2	13.7	19.9
17132	05:59:50 - 06:14:48	95.8	13.6	ND
17133	06:14:48 - 06:29:48	86.6	14.9	21.3
17134	06:29:54 - 06:44:49	85.0	14.1	20.5
17135	06:44:49 - 06:59:45	87.0	12.4	20.9
17136	06:59:45 - 07:14:41	84.4	11.8	20.3
17137	07:14:41 - 07:29:44	ND	ND	ND
17138	07:29:44 - 07:44:42	93.1	11.7	19.8
17139	07:45:25 - 08:00:25	102	7.8	20.6
17140	08:00:34 - 08:15:33	107	7.9	21.5
17141	08:15:33 - 08:30:38	104	6.0	22.9
17142	08:30:38 - 08:45:38	112	3.7	24.0
17143	08:45:46 - 09:00:40	118	4.1	21.9
-	09:00 - 09:33	SLT	SLT	SLT
17145	09:33:25 - 09:48:20	RS	-	-
17146	09:48:20 - 10:03:25	RS	-	-
17147	10:03:25 - 10:18:26	-	-	RS
17148	10:18:34 - 10:33:30	-	-	RS
17149	10:33:30 - 10:48:33	-	-	RS
17150	10:48:33 - 11:03:32	-	-	RS
17151	11:03:32 - 11:15:28	ND	BDL	ND
17152	11:15:28 - 11:30:28	ND	BDL	ND

Table C-5 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
17153	11:30:28 - 11:45:32	ND	BDL	ND
17154	11:45:40 - 12:00:40	ND	ND	ND
17155	12:00:40 - 12:15:45	ND	ND	ND
17156	12:15:45 - 12:30:50	ND	ND	ND
17157	12:30:58 - 12:46:00	ND	ND	ND
17158	12:46:00 - 13:01:05	ND	ND	ND
17159	13:01:05 - 13:16:09	ND	ND	ND
17160	13:16:09 - 13:31:33	232	BDL	33.2
17161	13:31:33 - 13:46:32	216	BDL	32.9
17162	13:46:32 - 14:01:30	200	BDL	24.6
17163	14:01:30 - 14:16:30	156	BDL	25.3
17164	14:16:33 - 14:31:38	111	BDL	13.9
17165	14:31:38 - 14:46:38	ND	BDL	ND
17166	15:00:22 - 15:15:13	131	BDL	6.9
17167	15:15:13 - 15:30:10	137	BDL	9.3
17168	15:30:10 - 15:45:09	113	BDL	7.1
17169	15:45:17 - 16:00:12	102	BDL	ND
17170	16:00:12 - 16:15:12	103	BDL	6.8
17171	16:15:12 - 16:30:14	104	BDL	6.8
17172	16:30:22 - 16:45:18	101	BDL	8.0
17173	16:50:17 - 16:59:48	87.5	BDL	8.1
17174	17:00:33 - 17:15:32	76.2	BDL	10.8
17175	17:15:32 - 17:30:33	69.3	BDL	8.2
17176	17:30:33 - 17:45:37	61.7	BDL	7.7
17177	17:45:45 - 18:00:42	60.4	BDL	9.0
17178	18:00:42 - 18:15:42	60.2	2.4	8.3
17179	18:15:42 - 18:30:42	56.8	3.6	10.9
17180	18:30:53 - 18:45:50	57.4	3.1	10.8
17181	18:45:50 - 19:00:53	ND	ND	ND
17182	19:00:53 - 19:15:54	53.2	3.0	12.9
17183	19:16:04 - 19:31:01	54.8	2.8	12.1
17184	19:31:01 - 19:46:02	54.1	ND	10.4
17185	19:46:02 - 20:01:04	50.1	3.6	15.2
17186	20:01:13 - 20:16:08	48.2	5.3	17.7
17187	20:16:08 - 20:31:09	48.7	5.7	16.4
17188	20:31:09 - 20:46:28	52.2	5.3	14.8
17189	20:46:28 - 21:01:33	45.6	6.4	11.2
17190	21:03:33 - 21:16:36	44.9	6.9	13.0
17191	21:16:36 - 21:31:37	45.0	6.8	12.1
17192	21:31:37 - 21:45:18	44.3	8.4	11.6
17193	21:45:37 - 22:00:34	43.6	8.6	12.1
17194	22:00:34 - 22:15:57	ND	ND	ND
17195	22:15:41 - 22:30:42	41.9	9.0	9.1
17196	22:30:42 - 22:45:45	42.9	9.1	13.0
17197	22:45:45 - 23:00:46	43.0	9.2	9.6
17198	23:00:54 - 23:15:50	39.9	9.2	7.8
17199	23:15:50 - 23:30:53	43.2	8.1	7.1

Table C-5 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
17200	23:30:53 - 23:45:53	42.2	8.7	8.3
17201	23:46:02 - 00:00:58	51.3	8.6	8.5

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period
SLT = Stray Light Test

Table C-6. Fifteen Minute Average NO_2, HONO and HCHO Concentrations (ppb) at Long Beach. SCAQS Episode F-6, December 11, 1987

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
17202	00:00:58 - 00:16:02	52.0	8.4	6.8
17203	00:16:02 - 00:31:08	76.2	8.2	7.2
17204	00:31:16 - 00:46:10	ND	ND	ND
17205	00:46:10 - 01:01:16	94.0	9.8	8.3
17206	01:01:16 - 01:13	100	8.6	7.6
17207	01:14:06 - 01:28:37	FOG	FOG	FOG
17208	01:28:37 - 01:43:14	FOG	FOG	FOG
17209	01:45:05 - 01:59:36	FOG	FOG	FOG
17210	01:59:36 - 02:14:12	FOG	FOG	FOG
17211	02:14:12 - 02:28:49	FOG	FOG	FOG
17212	02:28:58 - 02:43:29	FOG	FOG	FOG
17213	02:43:29 - 02:58:05	FOG	FOG	FOG
17214	02:58:05 - 03:12:42	FOG	FOG	FOG
17215	03:12:52 - 03:27:22	FOG	FOG	FOG
17216	03:27:22 - 03:41:58	FOG	FOG	FOG
17217	03:41:58 - 03:56:34	FOG	FOG	FOG
17218	03:56:44 - 04:11:14	FOG	FOG	FOG
17219	04:11:14 - 04:25:50	FOG	FOG	FOG
17220	04:25:50 - 04:40:26	FOG	FOG	FOG
17221	04:40:36 - 04:55:06	FOG	FOG	FOG
17222	04:55:06 - 05:09:42	FOG	FOG	FOG
17223	05:09:42 - 05:24:18	FOG	FOG	FOG
17224	05:31:25 - 05:46:05	FOG	FOG	FOG
17225	05:46:05 - 06:00:44	FOG	FOG	FOG
17226	06:00:44 - 06:15:20	FOG	FOG	FOG
17227	06:15:29 - 06:30:22	ND	ND	ND
17228	06:30:22 - 06:45:16	ND	ND	ND
17229	06:45:16 - 07:00:02	ND	ND	ND
17230	07:00:02 - 07:15:06	ND	ND	ND
17231	07:15:06 - 07:30:10	ND	ND	ND
17232	07:30:10 - 07:45:12	ND	ND	ND
17233	07:45:12 - 08:00:14	97.5	7.4	9.0
17234	08:00:17 - 08:15:18	83.3	5.8	BDL
17235	08:15:18 - 08:30:20	92.6	5.0	6.8
17236	08:30:20 - 08:45:24	97.2	4.1	BDL
17237	08:45:33 - 09:00:25	ND	ND	ND
17238	09:00:25 - 09:15:26	67.5	1.6	BDL
17239	09:15:26 - 09:30:28	76.1	BDL	5.0
17240	09:30:38 - 09:45:34	RS	-	-
17241	09:45:34 - 10:00:37	-	-	RS
17242	10:00:37 - 10:15:38	-	-	RS
17243	10:15:48 - 10:30:44	RS	-	-
17244	10:30:44 - 10:45:44	92.1	BDL	5.8
17245	10:45:44 - 11:00:45	ND	ND	ND
17246	11:00:54 - 11:15:49	89.8	BDL	ND

Table C-6 (continued) - 2

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
17247	11:15:49 - 11:30:56	84.7	BDL	6.6
17248	11:30:56 - 11:45:58	91.5	BDL	8.1
17249	11:45:58 - 12:01:04	96.1	BDL	6.9
17250	12:01:04 - 12:16:04	86.7	BDL	ND
17251	12:16:04 - 12:31:04	86.1	BDL	9.3
17252	12:31:04 - 12:46:05	90.3	BDL	10.1
17253	12:46:05 - 13:01:02	93.3	BDL	9.8
17254	13:01:02 - 13:16:02	90.7	BDL	10.1
17255	13:16:02 - 13:31:04	105	BDL	13.7
17256	13:31:13 - 13:46:09	116	BDL	12.5
17257	13:46:09 - 14:01:10	102	BDL	8.8
17258	14:01:10 - 14:15:04	97.3	BDL	9.5
17259	14:15:04 - 14:30:25	91.8	BDL	9.8
17260	14:30:25 - 14:45:29	94.2	BDL	11.1
17261	14:45:29 - 15:00:32	124	BDL	11.3
17262	15:00:32 - 15:15:32	137	BDL	15.0
17263	15:15:32 - 15:30:32	146	BDL	13.5
17264	15:30:32 - 15:45:57	128	BDL	ND
17265	15:46:06 - 16:01:04	133	BDL	11.0
17266	16:01:01 - 16:16:02	143	BDL	8.5
17267	16:16:02 - 16:31:04	131	BDL	7.1
17268	16:31:13 - 16:46:09	139	BDL	7.9
17269	16:46:09 - 17:01:10	141	BDL	6.6
17270	17:01:10 - 17:16:14	137	BDL	6.4
17271	17:16:24 - 17:31:21	133	BDL	5.1
17272	17:31:21 - 17:45:08	128	BDL	9.3
17273	17:45:29 - 18:00:26	121	BDL	11.1
17274	18:00:26 - 18:15:29	120	BDL	10.7
17275	18:15:32 - 18:30:36	119	2.6	14.6
17276	18:30:36 - 18:45:38	112	3.6	11.7
17277	18:45:38 - 19:00:42	113	4.7	9.7
17278	19:00:52 - 19:15:50	101	4.7	13.6
17279	19:15:50 - 19:30:53	98.7	4.2	13.2
17280	19:30:53 - 19:45:58	90.0	5.1	16.0
17281	19:46:08 - 20:01:17	80.3	6.3	15.0
17282	20:01:17 - 20:16:20	83.6	6.5	12.6
17283	20:16:20 - 20:31:21	86.8	7.9	11.9
17284	20:31:30 - 20:44:52	85.4	7.2	10.4
17285	20:45:16 - 21:00:10	77.6	7.8	14.5
17286	21:00:10 - 21:15:17	80.0	7.4	ND
17287	21:15:17 - 21:30:30	80.6	7.0	10.3
17288	21:30:30 - 21:45:25	80.4	7.2	16.5
17289	21:45:25 - 22:00:29	77.0	7.5	18.0
17290	22:00:29 - 22:15:32	75.5	7.0	14.6
17291	22:15:42 - 22:30:40	77.7	9.3	19.0
17292	22:30:40 - 22:45:44	76.4	8.6	11.5
17293	22:45:44 - 23:00:48	86.5	8.6	12.4

Table C-6 (continued) - 3

File No.	Measurement Period	Concentrations (ppb) NO_2	HONO	HCHO
17294	23:00:58 - 23:15:56	97.1	7.7	13.9
17295	23:15:56 - 23:31:00	106	8.6	19.9
17296	23:31:00 - 23:46:05	107	8.9	17.9
17297	23:46:05 - 00:01:13	ND	ND	ND

ND = No data available
BDL = Below detection limit
RS = Reference spectrum acquired during this period
FOG = Signal attenuated by fog
SUN = Sun on out-of-focus mirors