FORECASTING OF POLLUTANT DOSAGES;

A STUDY

BY

LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT

FOR

CALIFORNIA AIR RESOURCES BOARD

(Final Report in Compliance with Proposal #7-313-12
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SUMMARY

Pursuant to the objectives of the California State Air Resources Board to implement a new health warning system, a study was conducted by the Los Angeles County Air Pollution Control District. This study was designed to answer specific questions closely related to the overall problem of predicting, with a reasonable degree of certainty, the occurrence of average concentrations of oxidant equal to or greater than 0.20 ppm for 1-hour, and of carbon monoxide equal to or greater than 20 ppm for 8-hours, appropriate to issuance of the proposed health warnings. The California State Air Resources Board requested that: 1) the quantitative relationships between daily instantaneous maxima and daily maximum 1-hour averages $\geqq$ 0.20 ppm for oxidant, and daily instantaneous maxima and daily maximum 8-hour averages $\geqq$ 20 ppm for carbon monoxide be determined for each of the air monitoring areas in Los Angeles County; 2) the feasibility of forecasting the incidence of the proposed air pollution health warning criteria be ascertained; 3) the relationship between air pollution health warning incidents based upon specific hourly averages starting at an exact hour and those based upon moving time averages be determined; 4) selected meteorological variables be investigated as forecast indicators in addition to, or in lieu of, the instantaneous maximum concentrations. Also, the Board requested the District to determine the relationship between morning rates of change of oxidant and carbon monoxide concentrations and the attainment of selected dosages, i.e. oxidant concentrations $\geqq$ 0.20 ppm for one hour and carbon monoxide concentrations $\geqq$ 20 ppm for eight hours. This was done by: 5) determining the morning rates of change of both oxidant and carbon monoxide concentrations, at Central Los Angeles and at West San Gabriel Valley; and 6) relating these rates of change to the attainment during the day of selected dosages of oxidant (0.20 ppm for one hour) and carbon monoxide (20 ppm for eight hours) at both Central Los Angeles and West San Gabriel Valley areas.

CONCLUSIONS

1. A quantitative relationship between the oxidant daily instantaneous maxima and daily maximum 1-hour averages for the years 1969-1971 was determined for each of eleven air monitoring areas in Los Angeles County and found to be satisfactory for forecasting purposes depending upon ones ability to forecast instantaneous maxima with nearly 100% accuracy. Data from the twelfth area were insufficient to permit analysis. Quantitative relationships between carbon monoxide 8-hour averages and a series of differing time periods ranging from daily instantaneous maxima to 12-hour averages were developed using data for the same period and found to be unsatisfactory for forecasting purposes.

2. Forecasting the proposed health warning level for oxidant (0.20 ppm/hour) was found to be feasible given the daily instantaneous maximum. The degree of certainty in the health warning level forecast is provided in the standard error of the estimate for each station. Inability to forecast the correct daily instantaneous maximum within ± 0.01 ppm will, of course, affect the degree of certainty of the health warning level forecast. The calculated required daily instantaneous maxima concentrations to be 100 per cent assured of maximum 1-hour concentrations of 0.20, 0.30, 0.40, and 0.50 ppm are shown in the following table:

Maximum 1-hour Conc.	Coastal Areas		Central Areas			Inland Valleys				
	SWC	SC	Cent. L.A.	NWC	So. East	ESGV	WSGV	PWV	ESFV	WSFV
0.20 ppm	0.28	0.28	0.30	0.29	0.30	0.27	0.27	0.29	0.28	0.27
0.30 ppm	0.47	0.49	0.44	0.43	0.43	0.39	0.39	0.40	0.39	0.39
0.40 ppm	0.66	0.71	0.59	0.57	0.56	0.51	0.50	0.51	0.51	0.51
0.50 ppm	0.85	0.92	0.73	0.72	0.69	0.63	0.62	0.63	0.62	0.63

No practical method was found for forecasting the proposed health warning level for carbon monoxide.

3. No significant difference was found for either contaminant between the number of health warning incidents based upon specific hourly averages starting at an exact clock-hour, and those based upon moving time averages.

4. Selected meteorological variables, including wind speed, inversion base and maximum mixing height, were investigated as forecast indicators in addition to, and in lieu of, the instantaneous maximum concentrations. None was found suitable for forecasting carbon monoxide concentrations. As confirmed by the APCD meteorology section, oxidant levels are dependent on temperature, wind speed, and inversion strength. Each must be considered in the forecast for daily instantaneous maximum oxidant.

5. Morning rates of change of both oxidant and carbon monoxide concentrations were determined at Central Los Angeles and at West San Gabriel Valley. These rates of change were examined with respect to the attainment during the day of selected dosages of oxidant (0.20 ppm for one hour) and carbon monoxide (20 ppm for eight hours) at both Central Los Angeles and West San Gabriel Valley areas. The morning rate of buildup of either oxidant or carbon monoxide in a motor vehicular source area (Central Los Angeles) was found to be of little value in forecasting oxidant concentrations in a related receptor area (West San Gabriel Valley).

6. No relationship was found between rates of change in carbon monoxide concentration in the morning and the attainment during the day of selected dosages of oxidant and carbon monoxide at either Central Los Angeles or West San Gabriel Valley, vehicular source and receptor areas, respectively.

I. INTRODUCTION

Sustained levels of high contaminant concentrations and not peak values, in the medical opinion of Drs. Goldsmith and Beard, cause health damage. As a public health protective measure, two air pollution health warnings have been proposed: 1. The respiratory disease warning, based upon the prediction or attainment of an oxidant level in excess of 0.20 ppm for one hour (0.20 ppm/1-hr.); 2. The coronary disease warning system, based upon the prediction of the presence, or likely presence, of 20 ppm of carbon monoxide averaged over an eight-hour period (20 ppm/8 hr.). The respiratory disease warning is intended to protect sensitive individuals affected by respiratory disease such as bronchitis, emphysema, or asthma, and the coronary disease warning is intended to protect persons whose oxygen transport may be impaired by exceptionally high concentrations of carbon monoxide.

This warning system has been proposed for the South Coast Air Basin, but, prior to its implementation, it was considered necessary to know the feasibility of forecasting the occurrences of such incidents since appropriate defensive action can best be taken on the basis of a forecast attainment rather than upon actual attainment.

The Los Angeles County Air Pollution Control District was requested by the California State Air Resources Board to investigate the feasibility of forecasting average concentrations of oxidant and carbon monoxide - utilizing air monitoring data from its 12 stations. Since it is known that forecasting average concentrations for a period of time is more difficult than forecasting instantaneous maxima, the California State Air Resources Board awarded a contract to the Los Angeles County Air Pollution Control District to study the relationship between the daily instantaneous maxima and the averaging period concentrations proposed for the warning system. The results of this study should show if forecasting daily instantaneous maxima could be substituted for the proposed average concentrations.

II. OBJECTIVES

Utilizing air monitoring data from Los Angeles County it is the intent of this study to determine: 1) the quantitative relationship, if any, between instantaneous maximum concentrations of oxidant or carbon monoxide and concentrations of these contaminants averaged over appropriate time periods in relation to the proposed air pollution health warning levels (1 hour for oxidant, and 8 hours for carbon monoxide); 2) the feasibility of using various parameters for forecasting the incidence of the proposed air pollution health warning criteria; 3) the relationship between air pollution health warning

incidents based upon specific hourly averages starting at an exact hour and those based upon moving time averages; and 4) the relationship between rates of change in morning concentrations of oxidant and carbon monoxide and the attainment during the day of selected dosages of the same contaminants.

III. LOS ANGELES COUNTY AS THE BASIS FOR STUDY

If Los Angeles County is to be utilized as the basis for study of the feasibility of implementing this proposed warning system, it is necessary to examine, at least briefly, the topography and meteorology of the area and the important diverse characteristics of its air pollution problem.

If this warning system were to be applied to the total Los Angeles County area, (Figure 1), which is divided into three basins -- the Los Angeles Basin, the Upper Santa Clara River Valley Basin and the Antelope Valley Basin -- it would be necessary to examine the characteristics of air pollution in the whole area. Los Angeles County geography consists of beach, mountain and desert-like areas. This geographic variety results in a number of diverse meteorological patterns typical of these areas. Also, the pollutant density due to area sources varies greatly throughout the county. The influence of such meteorological and emission variables is evident at each of the air monitoring areas. The ten air monitoring or smog forecast areas in the Los Angeles Basin are shown in Figure 2. The Upper Santa Clara River Valley (USCRV) and Antelope Valley (AV), also shown, are each represented by a single air monitoring station.

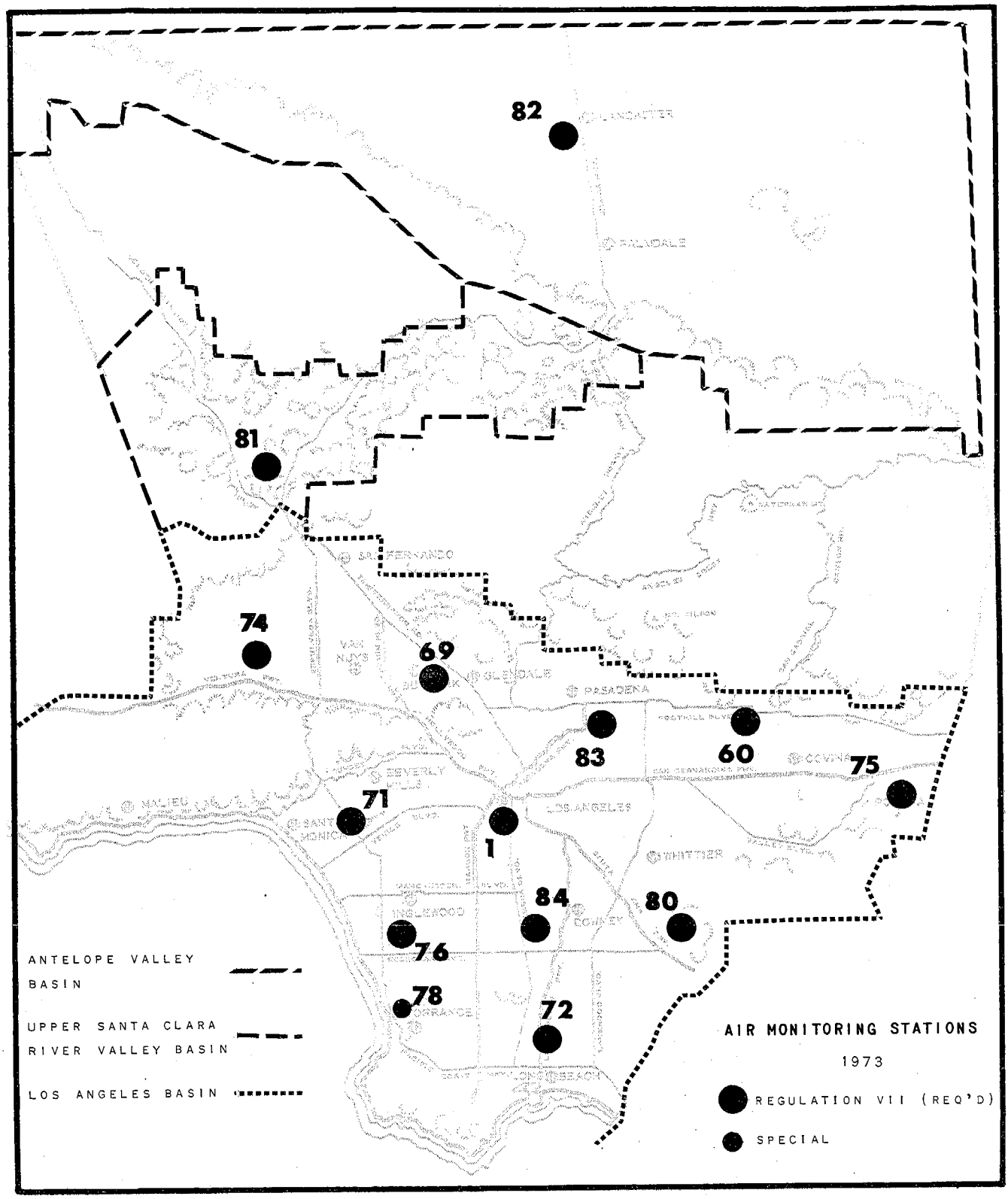
Figure 3 depicts the number of days per year on which the proposed criteria for oxidant (0.20 ppm/1 hour) and for carbon monoxide (20 ppm/8 hour) were equalled or exceeded at each of the twelve air monitoring areas in Los Angeles County during the period 1969-1971 inclusive. Data were not available for this entire period at Station 81 (Upper Santa Clara River Valley) and Station 82 (Antelope Valley), but the available data are indicated.

It is clear that each area has a distinctive problem with respect to these individual air contaminants. For example, the West San Gabriel Valley has never exceeded the proposed criterion for carbon monoxide, and the Pomona-Walnut Valley exceeded it on only one day in 1969 and 1970, respectively, and not at all in 1971. These stations have essentially an oxidant problem. In 1969 and 1970, the East San Gabriel Valley recorded 117 and 119 days on which oxidant concentrations equalled or exceeded 0.20 ppm/1 hour, and the Pomona-Walnut Valley experienced 93 and 96 such days. In 1971, both areas showed much improvement, with 88 and 38 days, respectively, equalling or exceeding the oxidant criterion. The West San Gabriel Valley was exposed to oxidant incidents much like the East San Gabriel Valley in 1969 and 1971, with 118 and 115 days, respectively, on which oxidant concentrations

FIGURE 1

AIR POLLUTION CONTROL DISTRICT - COUNTY OF LOS ANGELES

AIR MONITORING NETWORK



70D975

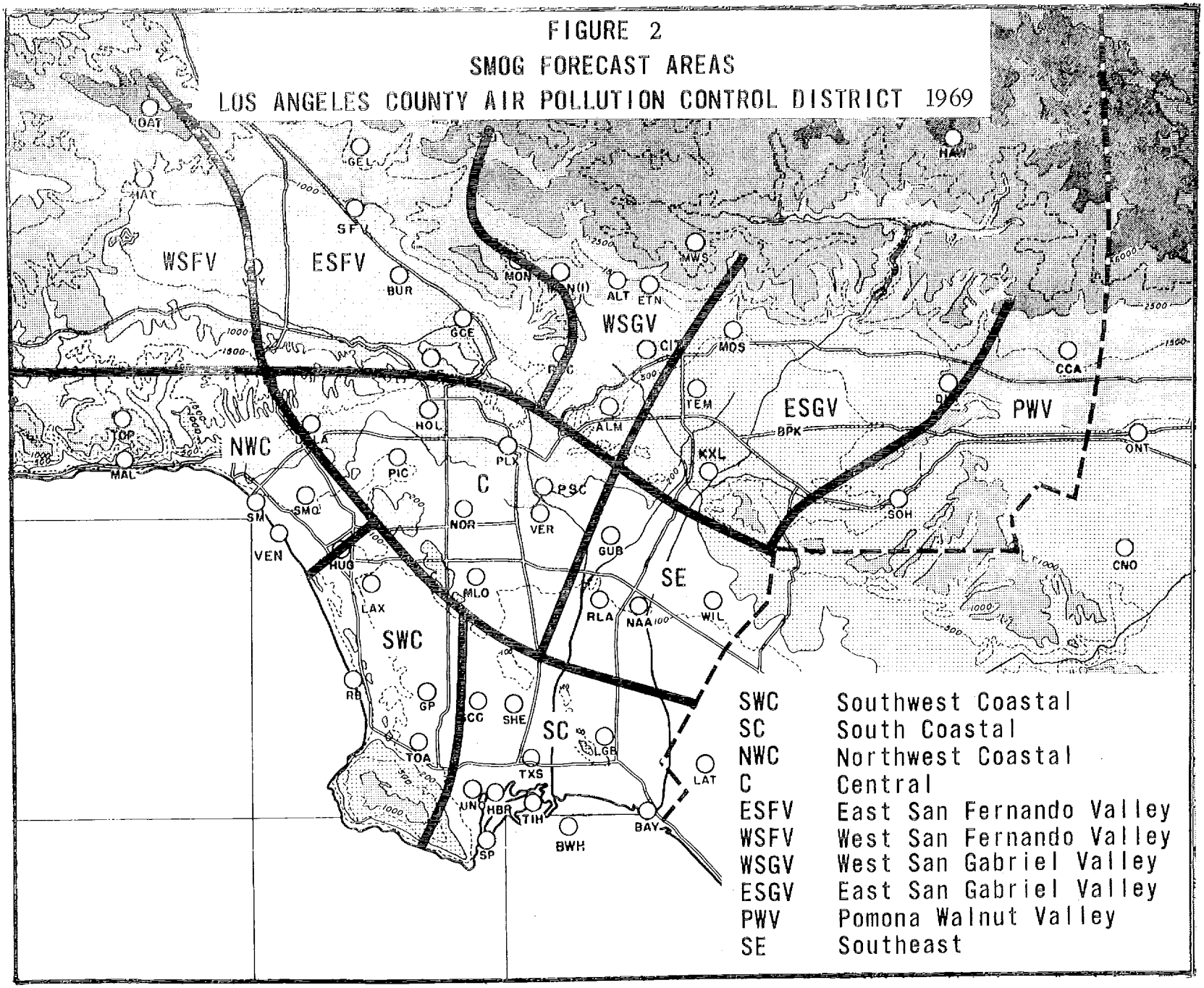
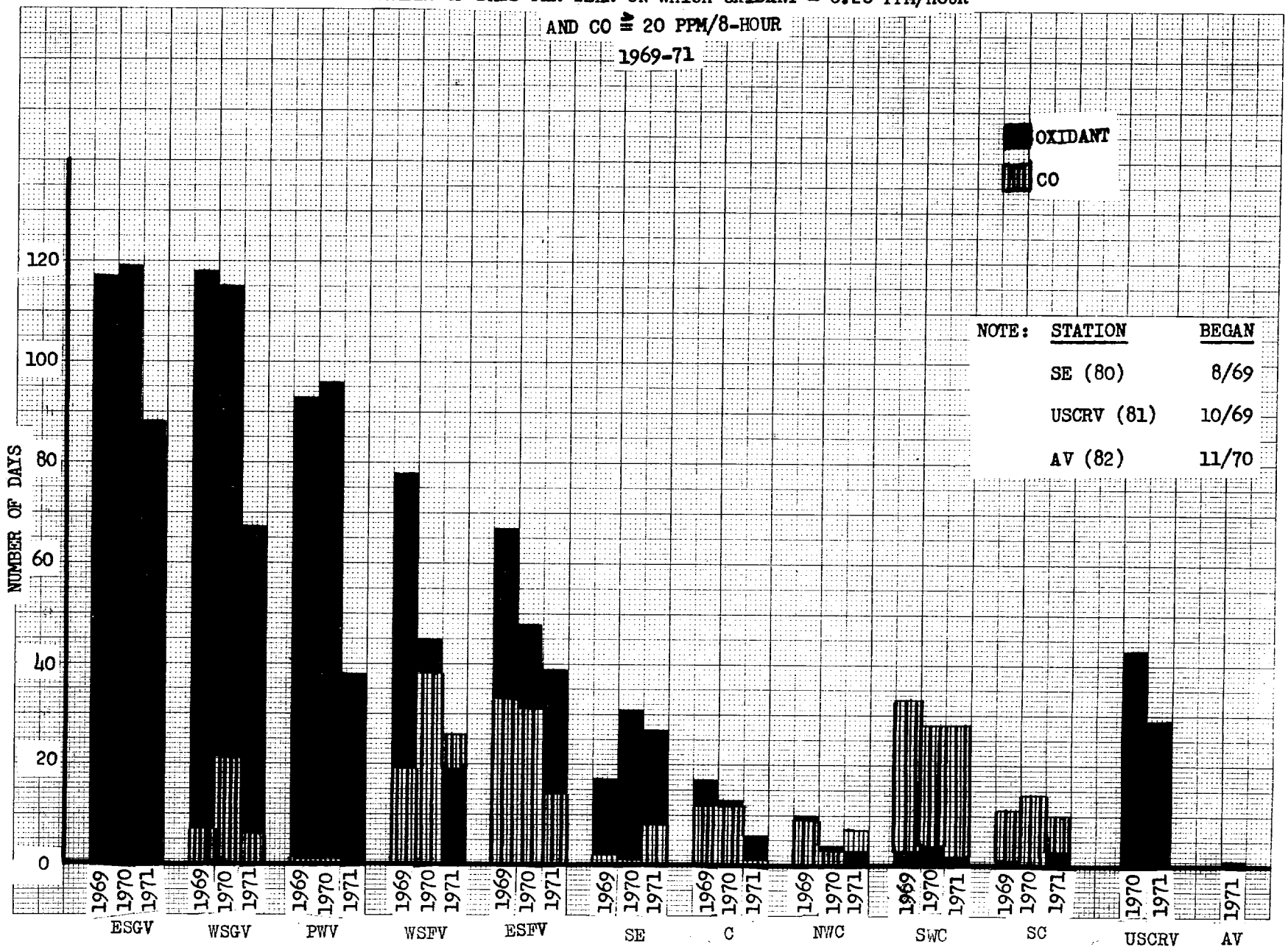


FIGURE 2
SMOG FORECAST AREAS
LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT 1969

FIGURE 3

NUMBER OF DAYS PER YEAR ON WHICH OXIDANT ≧ 0.20 PPM/HOUR AND CO ≧ 20 PPM/8-HOUR 1969-71



equalled or exceeded 0.20 ppm/1 hour. However, in 1971 this number dropped to 67 days. On the other hand, the West San Gabriel Valley has experienced higher concentrations of carbon monoxide than either the East San Gabriel Valley or the Pomona-Walnut Valley with 7, 21, and 6 days, respectively, in 1969, 1970 and 1971, on which the CO criterion of 20 ppm/8 hour average was equalled or exceeded.

A shift in pattern has occurred in the West San Fernando Valley, which experienced both oxidant and carbon monoxide incidents to varying degrees. Oxidant levels met the proposed criterion of 0.20 ppm/1 hour on 78, 45 and 19 days, respectively, in 1969, 1970 and 1971, showing a distinct decrease in oxidant levels over these years. This decrease in the number of oxidant days meeting the criteria was also evident, though not to the same degree, in the East San Fernando Valley, which experienced 67, 48 and 39 such days in 1969, 1970 and 1971, respectively. The carbon monoxide incidents in the East San Fernando Valley also decreased, from 33 and 31 in 1969 and 1970, to 11 in 1971. The pattern for West San Fernando Valley was more variable, and in 1971, for the first time in this study period, the number of carbon monoxide incidents (26) exceeded the number of oxidant incidents (19) in this area. This reversal was also shown at station 71, Northwest Coastal, although the total numbers of days were far less - 10, 4 and 3 days meeting the oxidant criterion in 1969, 1970 and 1971, respectively, and 9, 3 and 7 days meeting the CO criterion in this area for the respective years.

The two stations which experience a predominant carbon monoxide pollution problem are Southwest Coastal with 33, 28 and 28 days and the South Coastal, with 11, 14 and 10 days meeting the CO criterion, respectively, during the 1969, 1970, 1971 period. Equivalent oxidant days numbered 3, 4 and 2 at the Southwest Coastal, and 1, 0 and 3 at the South Coastal areas.

One might, therefore, assume that the level of instantaneous maxima associated with attainment of the air pollution health warning levels would differ throughout the Los Angeles basin, and be characteristic of each area.

IV. DATA UTILIZED AND PROCEDURES FOR DATA ANALYSES

The data selected for study cover a three year period, 1969-1971, from forecast areas listed as numbers 1-9, and a lesser time period for those listed as numbers 10-12, below:

1. Central Los Angeles
2. W. San Gabriel Valley
3. E. San Gabriel Valley
4. Pomona-Walnut Valley
5. E. San Fernando Valley
6. W. San Fernando Valley
7. Northwest Coastal
8. Southwest Coastal
9. South Coastal
10. Southeast
11. Upper Santa Clara River Valley
12. Antelope Valley

Stations to be utilized for specialized parts of this study were selected on the basis of the overall examination of data discussed in Section III.

A. Oxidant

For the determination of a quantitative relationship between daily instantaneous maxima and the attainment of the proposed health warning level for oxidant, pertinent data were selected. Using three years of data 1969-1971, for each day on which the proposed air pollution health warning level of 0.20 ppm/1-hour average was equalled or exceeded, the corresponding daily instantaneous maximum was recorded at each station. This provided the basic working data shown in Appendix Table I-A.

Frequency distributions, by station, were prepared for the daily instantaneous oxidant maxima on all days that the 1-hour average equalled or exceeded 0.20 ppm (Figures 4-9). However, it should be noted that there were some days having daily instantaneous maxima which equalled or exceeded 0.20 ppm that were excluded from the study because the daily maximum 1-hour averages associated with these days were less than 0.20 ppm, -- a situation likely to occur at maximum concentrations at, or just above, 0.20 ppm. For the ten forecast areas in the Los Angeles Basin, an average of 36 percent of the days with daily instantaneous maxima equal to or greater than 0.20 ppm had maximum 1-hour averages less than 0.20 ppm. The percentage was higher for the coastal areas, such as 69 percent for South Coastal, and less for the inland valleys, such as 17 percent for East San Gabriel Valley. This indicates the relative inadequacy of using a daily instantaneous maximum at, or just above, 0.20 ppm as the warning indicator.

Of the number of days, N, with a maximum 1-hour average greater than or equal to 0.20 ppm, the percentage on which any specific daily instan taneous maximum was equalled or exceeded could be determined directly from the prepared frequency distributions (See Table I). Also using the frequency distributions, and knowing the total number of days in the three year period, the percentage or total number of days per year on which any specific daily instantaneous maximum could be equalled or exceeded at each station could be estimated.

To forecast ozone levels of 1-hour duration, knowing the attained daily instantaneous maximum, a quantitative relationship between daily maximum 1-hour average and the daily instantaneous maximum was developed. Using the basic working data, a series of regression equations was developed for each station (Table II).

The value of X (daily instantaneous maximum) for any specific value of Y (daily maximum 1-hour average) greater than or equal to 0.20 ppm could be determined from the line of best fit. Since the prime interest centered

FIGURE 4

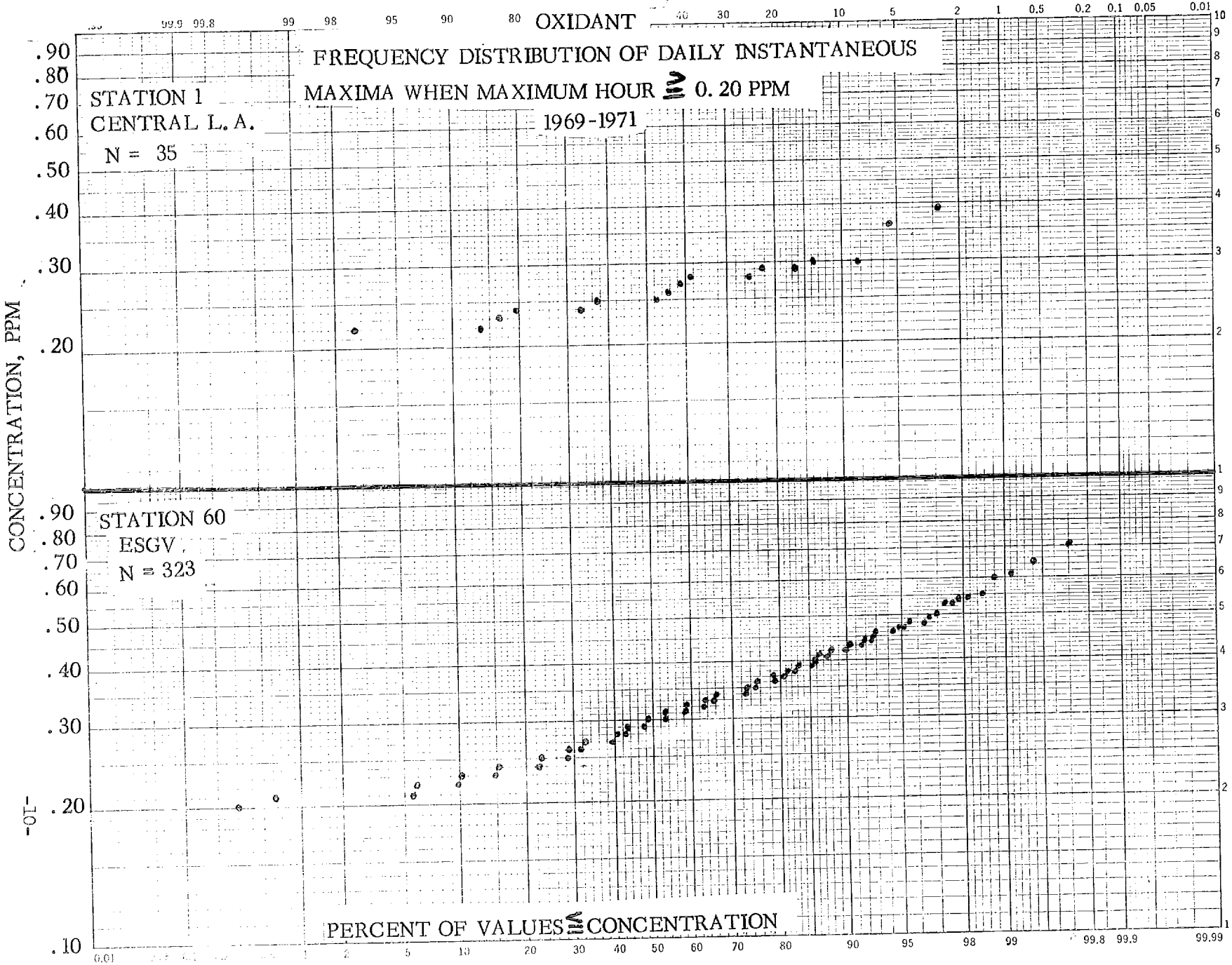

OXIDANT
FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS
MAXIMA WHEN MAXIMUM HOUR ≥ 0.20 PPM
1969-1971
STATION 1
CENTRAL L.A.
N = 35
STATION 60
ESGV
N = 323
CONCENTRATION, PPM
PERCENT OF VALUES ≤ CONCENTRATION

FIGURE 5

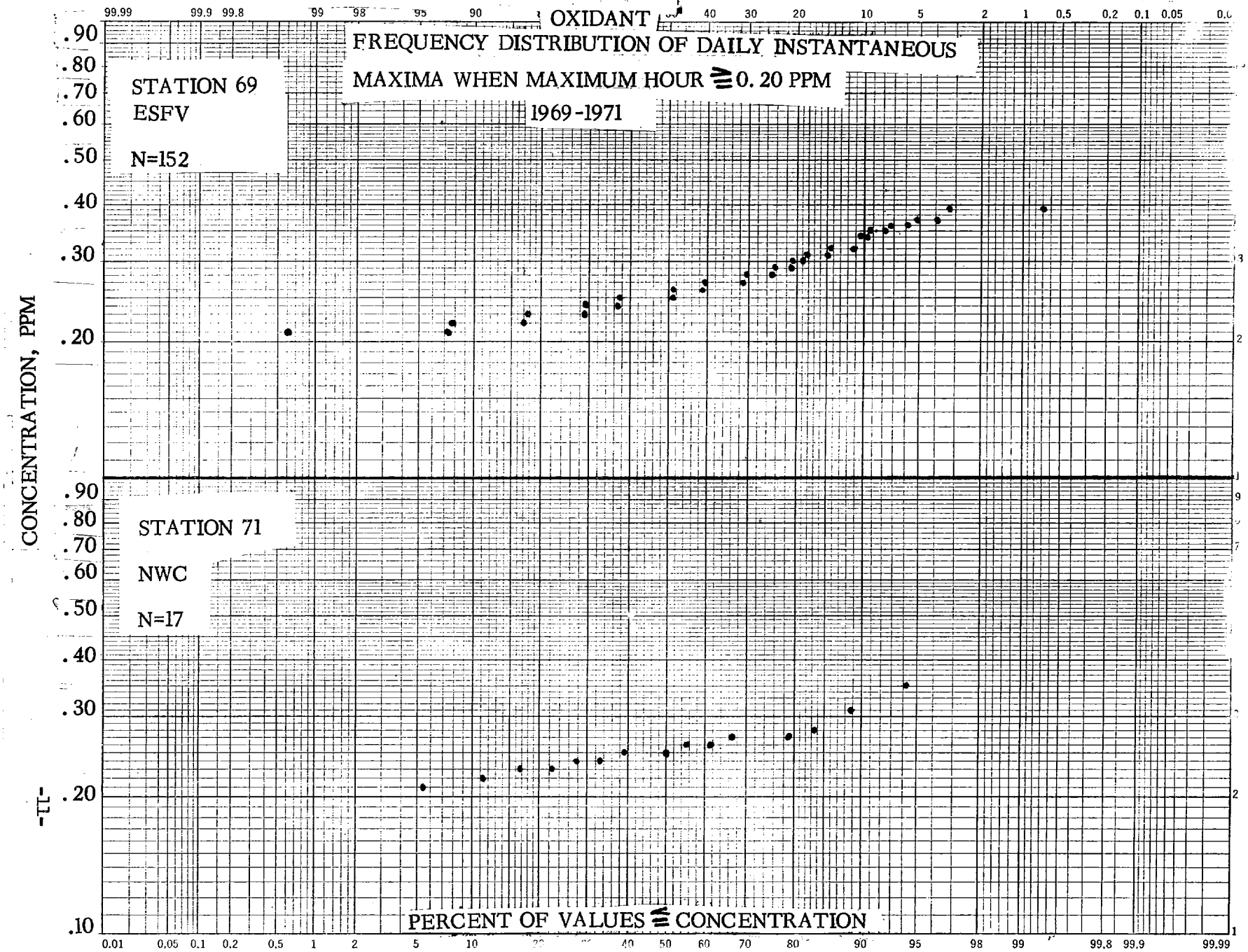
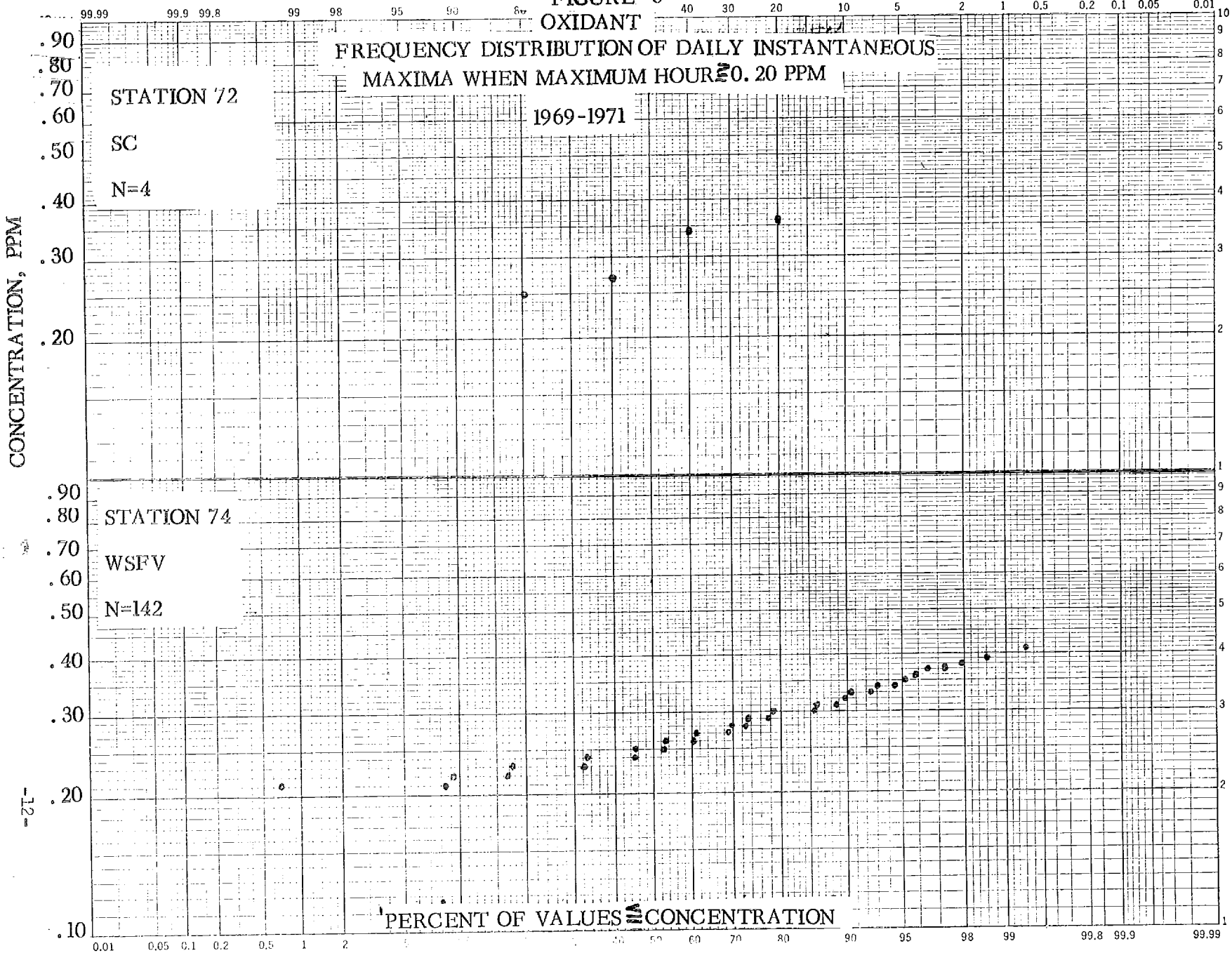

OXIDANT
FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS
MAXIMA WHEN MAXIMUM HOUR ≧ 0.20 PPM
1969-1971
STATION 69
ESFV
N=152
STATION 71
NWC
N=17
CONCENTRATION, PPM
PERCENT OF VALUES ≦ CONCENTRATION

FIGURE 6

OXIDANT

FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS MAXIMA WHEN MAXIMUM HOUR ≥ 0.20 PPM

1969-1971



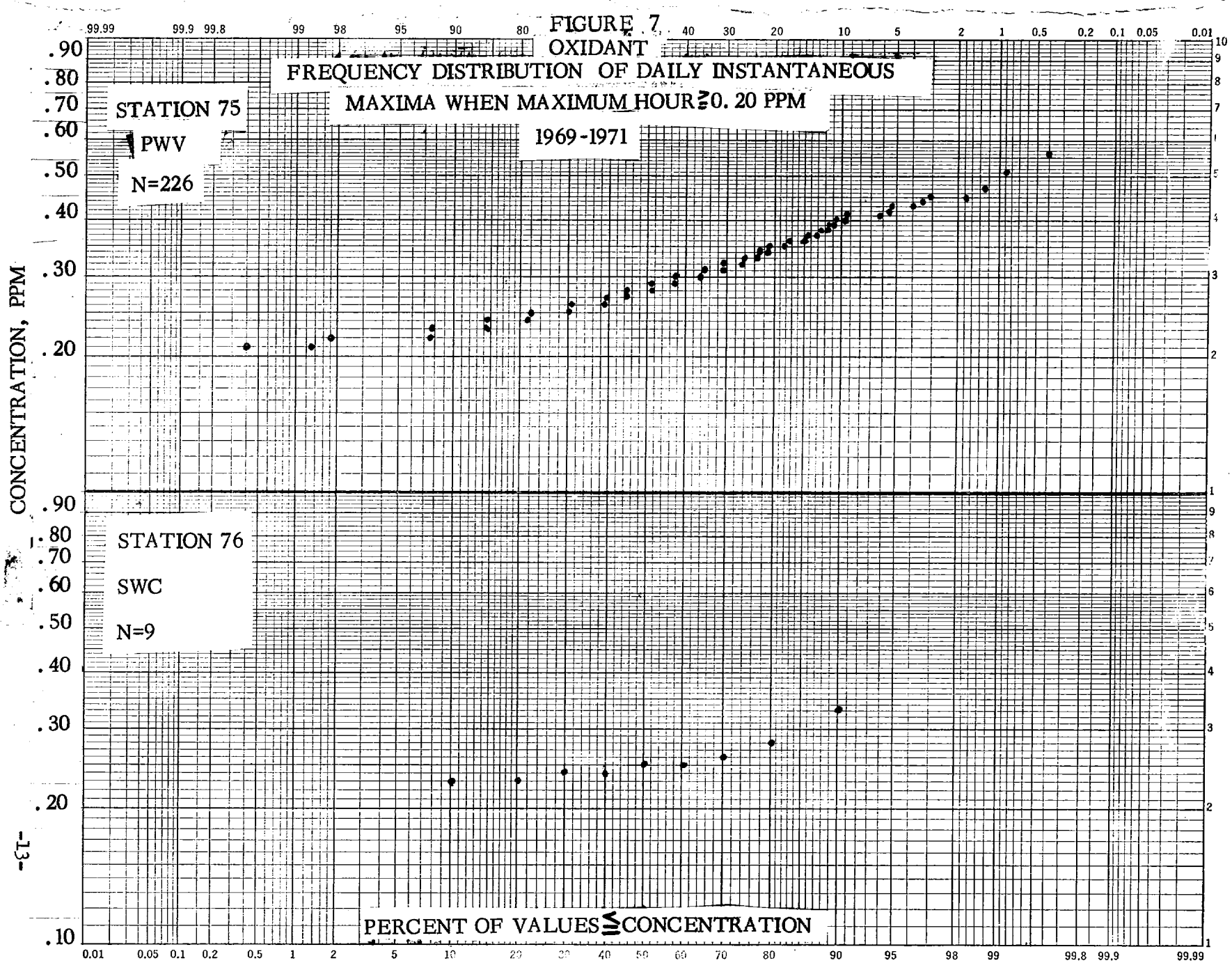
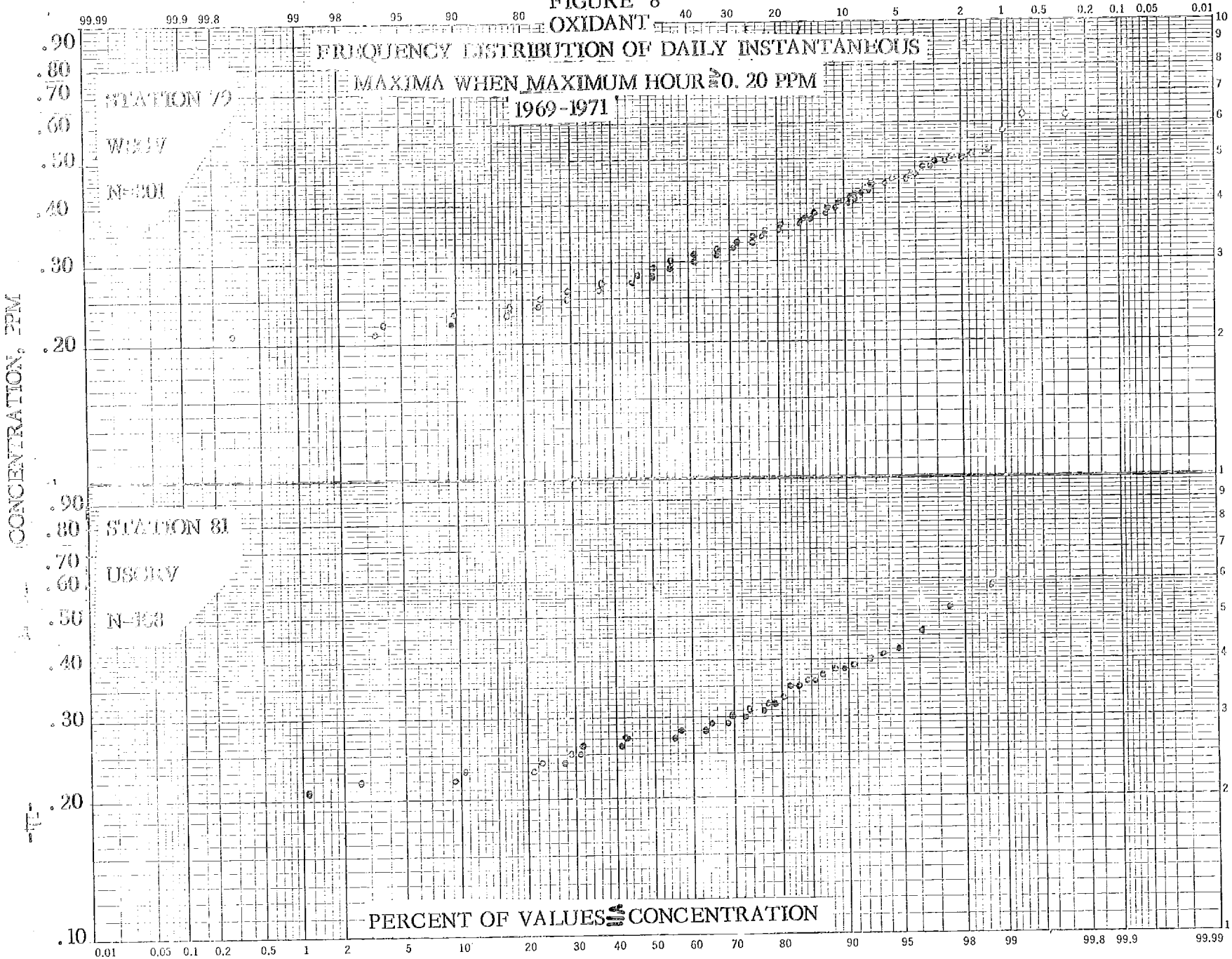


FIGURE 7
OXIDANT
FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS
MAXIMA WHEN MAXIMUM HOUR ≥ 0.20 PPM
1969-1971
STATION 75
PWV
N=226
STATION 76
SWC
N=9
CONCENTRATION, PPM
PERCENT OF VALUES ≤ CONCENTRATION

FIGURE 8


OXIDANT
FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS
MAXIMA WHEN MAXIMUM HOUR ≥ 0.20 PPM
1969-1971
STATION 79
N=201
STATION 81
N=168
CONCENTRATION, PPM
PERCENT OF VALUES ≤ CONCENTRATION

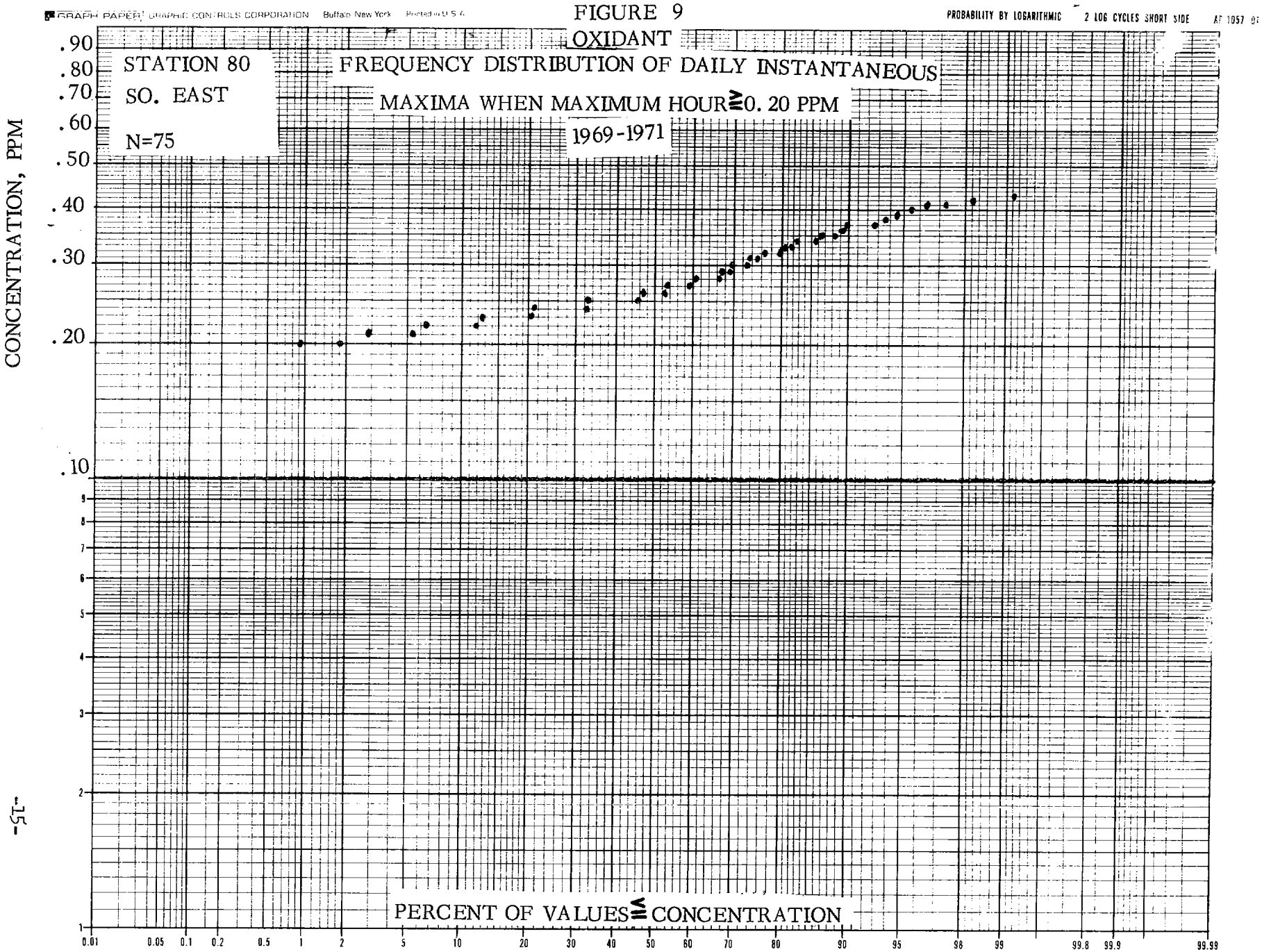

GRAPH PAPER GRAPHIC CONTROLS CORPORATION Buffalo New York Printed in U.S.A.
PROBABILITY BY LOGARITHMIC 2 LOG CYCLES SHORT SIDE
STATION 80
SO. EAST
N=75
OXIDANT
FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS
MAXIMA WHEN MAXIMUM HOUR ≥ 0.20 PPM
1969-1971
CONCENTRATION, PPM
.90
.80
.70
.60
.50
.40
.30
.20
.10
PERCENT OF VALUES ≤ CONCENTRATION
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99

FIGURE 9

TABLE I

OXIDANT

FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS MAXIMA (PPM)
ON DAYS WHEN MAXIMUM 1-HOUR AVERAGE ≧ 0.20 PPM
LOS ANGELES COUNTY - BY STATION
1969 - 1971

STATION (NUMBER)	AREA	NUMBER OF OBSERVATIONS	PERCENTILE 10	20	30	40	50	60	70	80	90[a]
(1)	Central	35	.22	.24	.24	.25	.25	.28	.28	.29	.30
(60)	ESGV	323	.23	.24	.26	.28	.30	.32	.34	.37	.43
(69)	ESFV	152	.22	.23	.24	.25	.25	.27	.28	.30	.34
(71)	NWC	17	.22	.23	.24	.25	.25	.26	.27	.28	.33
(72)	SC	4	.25	.25	.26	.27	.30	.34	.35	.36	.38
(74)	WSFV	142	.22	.23	.23	.24	.25	.26	.28	.30	.33
(75)	PWV	226	.23	.24	.25	.27	.28	.30	.32	.35	.40
(76)	SWC	9	.23	.23	.24	.24	.25	.25	.26	.28	.33
(79)	WSGV	301	.23	.24	.26	.27	.28	.30	.32	.35	.40
(80)	So. Ea.	75	.23	.23	.25	.26	.27	.28	.30	.33	.39
(81)	USCRV	108	.22	.23	.24	.25	.26	.28	.30	.33	.37
AVERAGE ALL STATIONS			.23	.24	.25	.26	.27	.29	.30	.32	.36
RANGE			.22-.25	.23-.25	.23-.26	.24-.28	.25-.30	.25-.34	.26-.35	.28-.37	.30-.43

(a) Hourly averages higher than 0.40 ppm occurred only at Stations 60, 74, 75, 79, 80 and 81.

TABLE II

OXIDANT

RELATIONSHIP BETWEEN DAILY INSTANTANEOUS MAXIMUM AND MAXIMUM 1-HOUR AVERAGE WHEN MAXIMUM 1-HOUR AVERAGE RANGE IS FROM 0.15 to 0.29 PPM

1969 - 1971

STATION NO.	Regression Equations[a]	Value of X When Y = 0.20 ppm	Sy[b] (pphm)
1	Y = 2.7 + 0.72 X	0.24	1.49
60	Y = 1.4 + 0.85 X	0.22	1.22
69	Y = 1.5 + 0.84 X	0.22	1.15
71	Y = 2.6 + 0.74 X	0.24	1.43
72	Y 6.5 + 0.56 X	0.24	1.37
74	Y = 1.7 + 0.83 X	0.22	1.12
75	Y = 1.2 + 0.84 X	0.22	1.51
76	Y = 4.9 + 0.64 X	0.24	1.31
79	Y = 0.7 + 0.88 X	0.22	1.31
80	Y = 2.5 + 0.76 X	0.23	1.35
81	Y = 1.8 + 0.83 X	0.22	1.47

(a) X = Daily instantaneous maximum

Y = Daily maximum 1-hr. average

(b) Sy = Standard error of the estimate

around the way X varied as Y equalled 0.20 ppm, an equation was developed using a range of values of Y equal to 0.20 to 0.29 ppm, thereby excluding points further from the critical area. To further improve upon the representative regression equation, samples were chosen to represent the population at or near the 0.20 ppm level. Approximately equal numbers below and above 0.20 ppm were selected, i.e. 0.15 to 0.29 ppm (Figure 10 - WSFV). The difference in the basic equations derived using 1-hour averages $\geq$ 0.20 ppm and using 1-hour averages from 0.15 to 0.29 ppm is illustrated using East San Gabriel Valley, Figure 11. (ESGV daily instantaneous maximum vs. 1- hour average). Consideration of values around the level of interest makes a more representative relationship, in this case, than one which includes widely scattered higher levels. Central Los Angeles (Figure 12) and West San Fernando Valley showed similar differences, justifying the refined regression equations at the levels shown in Table II for each air monitoring area. There were "Y" (1-hour average) intercepts ranging from .007 ppm to .06 ppm, correlation coefficients ranging from 0.86 to 0.95 and standard errors of the estimates averaging approximately 0.01 ppm. This demonstrates adequate correlation for forecasting purposes.

Since high oxidant values are usually associated with the late summer and fall, an examination was made of possible seasonal differences. Data for July-October (high oxidant potential) and November-June (low oxidant potential months) were grouped and seasonal regression equations were developed, Table III. From these it was concluded that there was no justification for a different minimum daily maximum to be associated with each season for the attainment of air pollution health warning levels. One daily maximum for each station should serve as the indicator throughout the year.

Accurate prediction of attainment of a daily instantaneous maximum ozone concentration as high as the predetermined value for each station indicates the probability of attainment of the air pollution health warning level of 0.20 ppm 1-hour average (Table II.) Even though all the stations had similar equations, some showed a particular resemblance to certain others. These could be arranged into three groups as follows: 1) Central Los Angeles, Northwest Coastal and Southeast; 2) West San Fernando Valley and Upper Santa Clara River Valley; 3) East San Fernando Valley and East San Gabriel Valley. The similarity between the stations in each group suggests that they represent similar oxidant-potential areas.

Daily instantaneous maximum oxidant levels are forecast for each of 12 forecast areas in Los Angeles County on a daily basis. In these forecasts, subjective evaluation and application of the following factors are made: 1) seasonal variation in sunshine; 2) cloud cover; 3) monthly station maximum averages; 4) frequency distributions of monthly station daily maximum ozone values; 5) maximum temperatures; 6) variability of average ozone values

FIGURE 10
OXIDANT

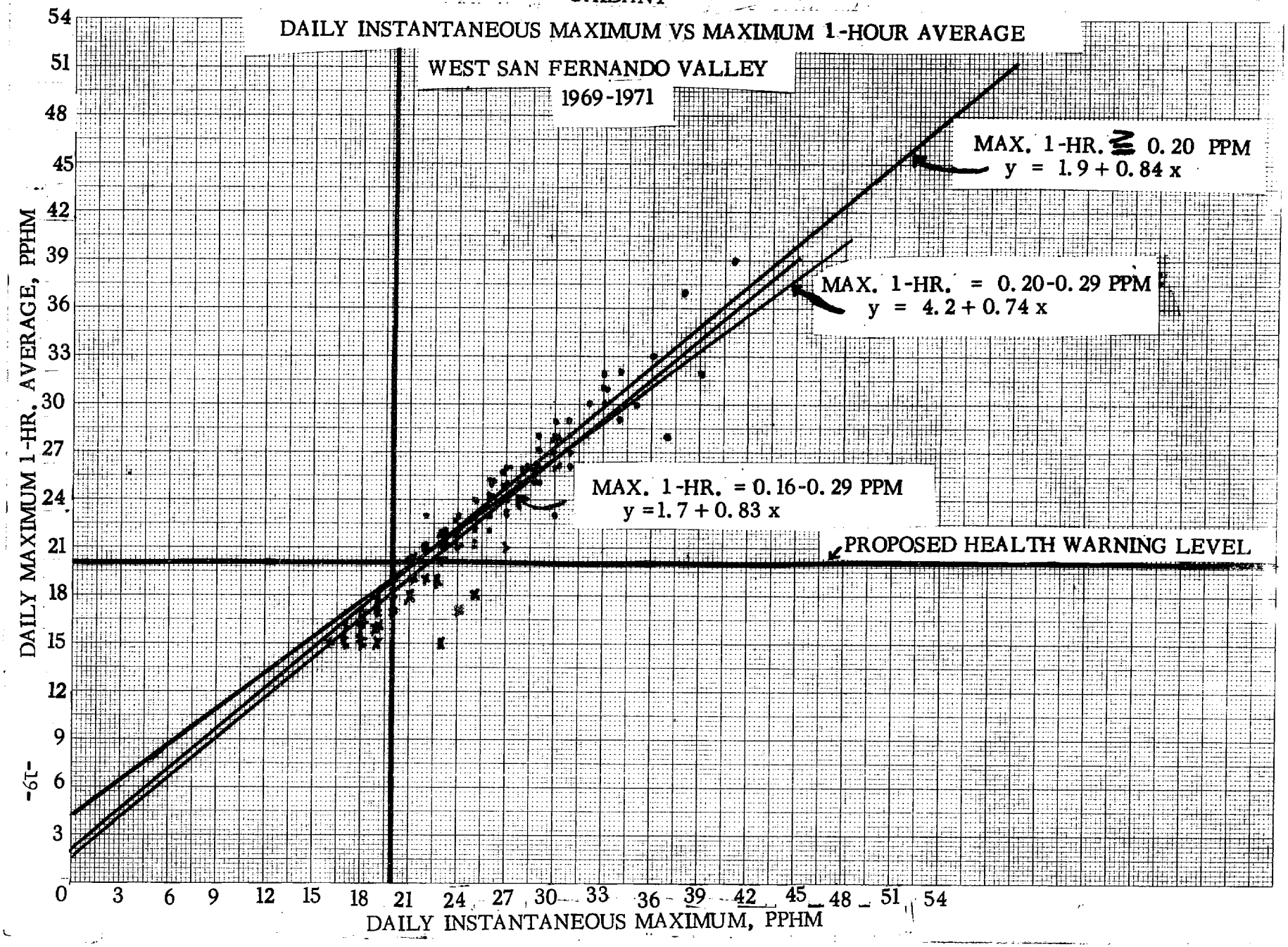


FIGURE 11
OXIDANT
DAILY INSTANTANEOUS MAXIMUM vs MAXIMUM 1-HOUR AVERAGE
EAST SAN GABRIEL VALLEY
1969-1971

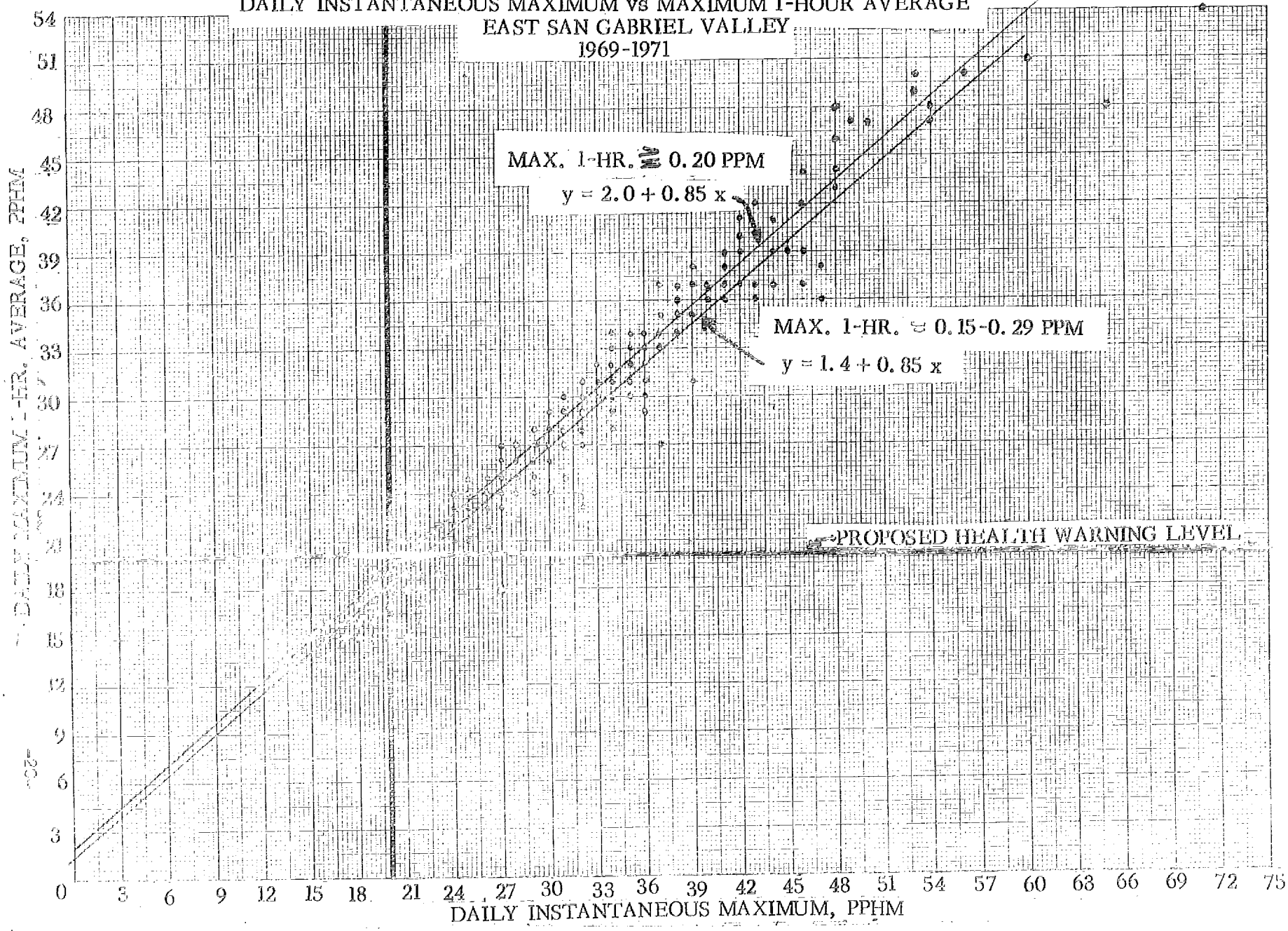


FIGURE 12
OXIDANT
DAILY INSTANTANEOUS MAXIMUM vs MAXIMUM 1-HOUR AVERAGE

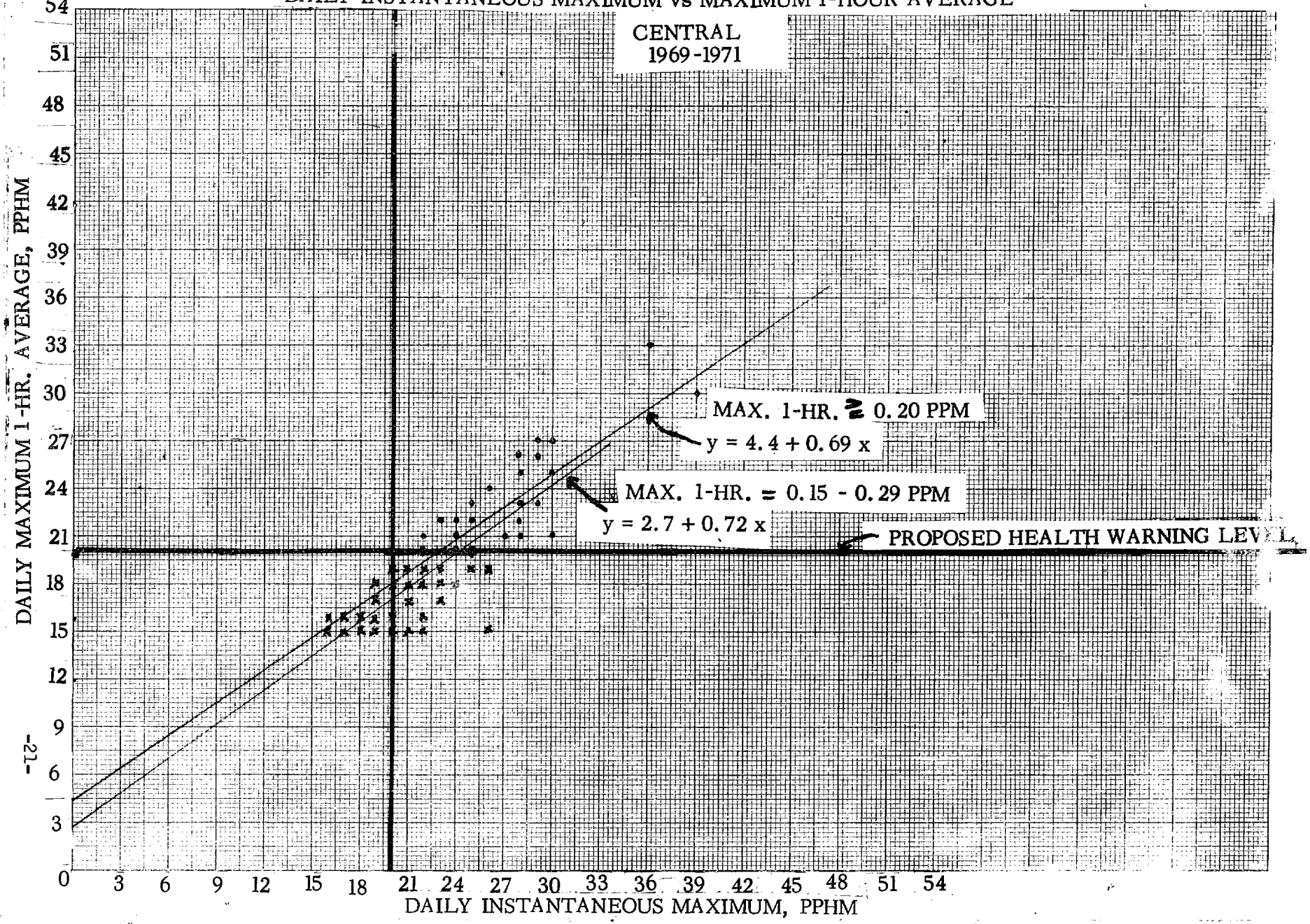


TABLE III

OXIDANT

SEASONAL CORRELATION, BY STATION

1969 - 1971

STATION RANGE (Max. 1-Hour)	EQUATION[a]	CORRELATION COEFFICIENT (r)	STD. ERROR OF ESTIMATE (Sy, pphm)	AVERAGE D. I. M.[b] (x)	N
West San Fernando Valley					
(July-Oct.) 16-19 pphm	Y = 1.8 + 0.82X	0.947	1.11	22.6	178
(Nov.-June) 16-19 pphm	Y = 1.2 + 0.86X	0.942	1.12	21.8	78
Pomona-Walnut Valley					
(July-Oct.) 15-29 pphm	Y = 1.5 + 0.83X	0.925	1.63	24.3	195
(Nov.-June) 15-29 pphm	Y = 0.7 + 0.85X	0.949	1.25	22.1	99
East San Fernando Valley					
(July-Oct.) 16-29 pphm	Y = 1.9 + 0.82X	0.936	1.15	22.5	180
(Nov.-June) 16-29 pphm	Y = 0.8 + 0.87X	0.959	1.08	23.0	72

(a) X = Daily Instantaneous Maximum

Y = Daily Maximum 1-Hour Average

(b) D. I. M. = Daily Instantaneous Maximum

by day of the week and holidays; 7) surface wind patterns; and 8) inversion strength. No one of these factors, as confirmed by the meteorology section, is sufficient by itself for oxidant forecast purposes. Thus, meteorological factors in addition to, or in lieu of, oxidant maxima, have little value in attempting to predict the occurrence of oxidant health warning incidents.

Clock Hour vs Moving 60-Minute average

In selecting the basic working data, the averages used were determined on a clock-hour to clock-hour basis. The possibility exists that using specific hourly averages starting at an exact hour may cause some air pollution health warning incidents to be overlooked. The probability of this occurrence was determined through examination and reevaluation of original strip-chart data. Daily maximum clock-hour averages were compared to daily maximum moving 60-minute averages. East San Gabriel Valley, being one of the highest oxidant potential areas, was selected for study. Limiting the amount of data, 58 days were selected at random from a total of 88 throughout 1971, the latest study year. There was a total of 15 days with the 60-minute moving average higher, by 0.01 ppm or greater, than the clock-hour maximum (Tables IV and V).

Of particular interest in determining whether air pollution health warning incidents were overlooked were clock-hour averages less than, but near, 0.20 ppm. Of the 23 days examined with a clock maximum 1-hour average of 0.18 or 0.19 ppm, 4 days had 60 minute moving averages greater than the clock maximum 1-hour by 0.01 ppm (Table V). None of these days would have been changed to a health warning day by changing the averaging procedure.

Since the oxidant strip chart values are determined by a visually estimated average, precision of plus or minus 0.01 ppm is usually the most that can be expected. Greater differences between the clock-hour averages and the 60-minute moving averages were observed as the absolute concentrations increased. This could be expected due to the logarithmic nature of the oxidant recorder scale, i.e. higher concentration per distance of pen travel (reduced resolution) at the upper ranges of the scale. In the range of the values of most frequent occurrence the agreement is very good. Also, at the higher levels, the nature of the curve is such that there are relatively large concentration changes per time interval. At lower concentrations the strip chart curve is smoother.

Therefore, for the purposes of this study, the use of the clock maximum 1-hour average is justified. Based upon the regression equations developed, no health warning days would have been missed due to the standard averaging procedure used.

TABLE IV

OXIDANT

COMPARISON OF AVERAGING METHODS

EAST SAN GABRIEL VALLEY

1971

(Maximum 1-Hour Average Equal to or Greater than 0.20 ppm or 20 pphm)

DATE	Concentration, pphm		
	Clock Max. 1-Hr. Avg. (A)	60-Min. Moving Avg. (B)	Difference (B-A)
1/20/71	21	21	0
2/11/71	20	20	0
3/28/71	23	23	0
30	22	22	0
4/ 2/71	23	23	0
10	24	25	1
11	26	26	0
5/12/71	20	20.5	0.5
13	25	26	1
24	22	23.5	1.5
6/12/71	20	21	1
13	24	24	0
7/ 7/71	26	27	1
8	36	36	0
9	36	36	0
10	36	36	0
11	30	32.5	2.5
13	33	33.5	0.5
20	30	30	0
21	30	30	0
8/ 3/71	32	32	0
4	27	27	0
5	28	28.5	0.5
6	37	37	0
8	31	31	0
11	26	26.5	0.5
25	25	26	1
28	32	32	0
9/ 9/71	30	30	0
10	39	39	0
13	48	54	6
23	28	28	0
10/ 9/71	44	45	1
12	31	34	3
13	31	33	2

TABLE V

OXIDANT

COMPARISON OF AVERAGING METHODS

EAST SAN GABRIEL VALLEY

1971

(Maximum 1-Hour Average 0.18 or 0.19 ppm, or 18 or 19 pphm)

DATE	Concentration, pphm		
	Clock Max. 1-Hr. Avg. (A)	60-Min. Moving Average (B)	Difference (B-A)
2/13/71	18	18	0
4/ 9/71	18	18	0
13	18	18	0
30	19	19	0
6/ 4/71	19	19	0
5	19	19	0
17	18	18	0
24	19	19	0
26	19	19	0
7/ 1/71	19	19	0
3	19	19	0
5	18	19	1
28	19	19	0
8/ 1/71	18	19	1
10	19	19.5	0.5
13	19	19	0
19	18	18.5	0.5
9/22/71	18	19	1
24	19	19.5	0.5
10/ 7/71	19	19	0
10	18	19	1
11/ 9/71	19	19	0
10	19	19	0

B. Carbon Monoxide

A quantitative relationship, if any, between daily instantaneous maxima and the attainment of the proposed health warning level, 20 ppm for an 8-hour average, was sought. First, 1969-1971 data were examined and instantaneous maxima and corresponding daily maximum 8-hour averages were recorded for days having a maximum 8-hour average greater than or equal to 20 ppm. East San Gabriel Valley, Upper Santa Clara River Valley, and Antelope Valley had no days with an 8-hour average greater than or equal to 20 ppm; Pomona-Walnut Valley had only two. (See Appendix Table IV-A.) It is also interesting to note the relative absence of summertime occurrences at any station.

As in the case for oxidant, carbon monoxide frequency distribution graphs were constructed using daily instantaneous maxima. On days with an 8-hour average of 20 ppm or greater, the percentage of days for which specific concentrations of daily instantaneous maxima would be equalled or exceeded could be determined, Figures 13-16 and Table VI.

The Southwest Coastal air monitoring station, having the highest carbon monoxide values, was selected for examination. A scatter diagram was prepared plotting daily maximum 8-hour average vs. daily instantaneous maximum, Figure 17. This graph showed very little correlation between the variables. A quantitative analysis of the correlation was then made by developing a linear regression equation using data from 1969 and part of 1970. There was a "Y" (8-hour average) intercept of about 15 ppm, a correlation coefficient "r" of 0.6 and a standard error of the estimate Sy of 4.0 (refer to Table VII). This is inadequate correlation for reliable forecasting purposes. Since the range of daily maximum 8-hour concentrations, when 20 ppm or greater, is approximately 16 ppm, as shown in Figure 17, a line of best fit with a standard error of the estimate of 4.0 ppm (25% of 8-hour average) indicates poor correlation.

Other regression equations were developed for daily maximum 1-hour average vs. 8-hour average, daily instantaneous maxima less than or equal to 40 ppm vs. 8-hour average, and daily maximum 1-hour average less than or equal to 40 ppm vs. 8-hour average. Use of any of these relationships for forecasting purposes could be considered only fair at best (Table VII). Because of a seemingly good correlation between maximum 1-hour and 8-hour average concentrations, the daily maximum 1-hour average seemed to show some possibility for use in predicting the maximum 8-hour average. Unfortunately, at the Southwest Coastal area station the maximum 1-hour average occurs in the middle or at the end of the 8-hour averaging period, and thus would not be much use in

FIGURE 13

CARBON MONOXIDE

FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS MAXIMA

WHEN 8-HOUR AVERAGE ≧ 20 PPM

1969-1971

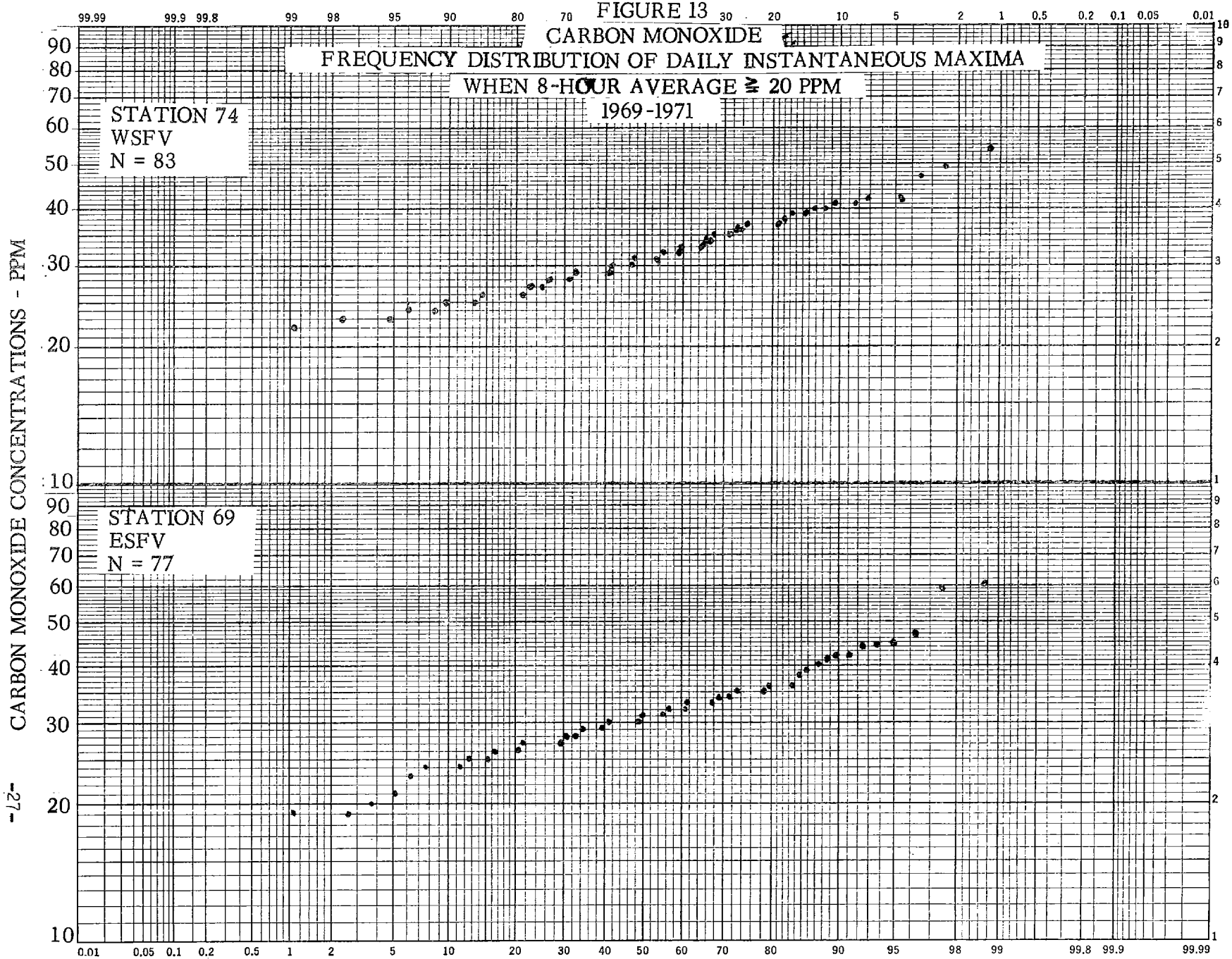


FIGURE 14

CARBON MONOXIDE

FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS MAXIMA

WHEN 8-HOUR AVERAGE ≧ 20 PPM

1969-1971

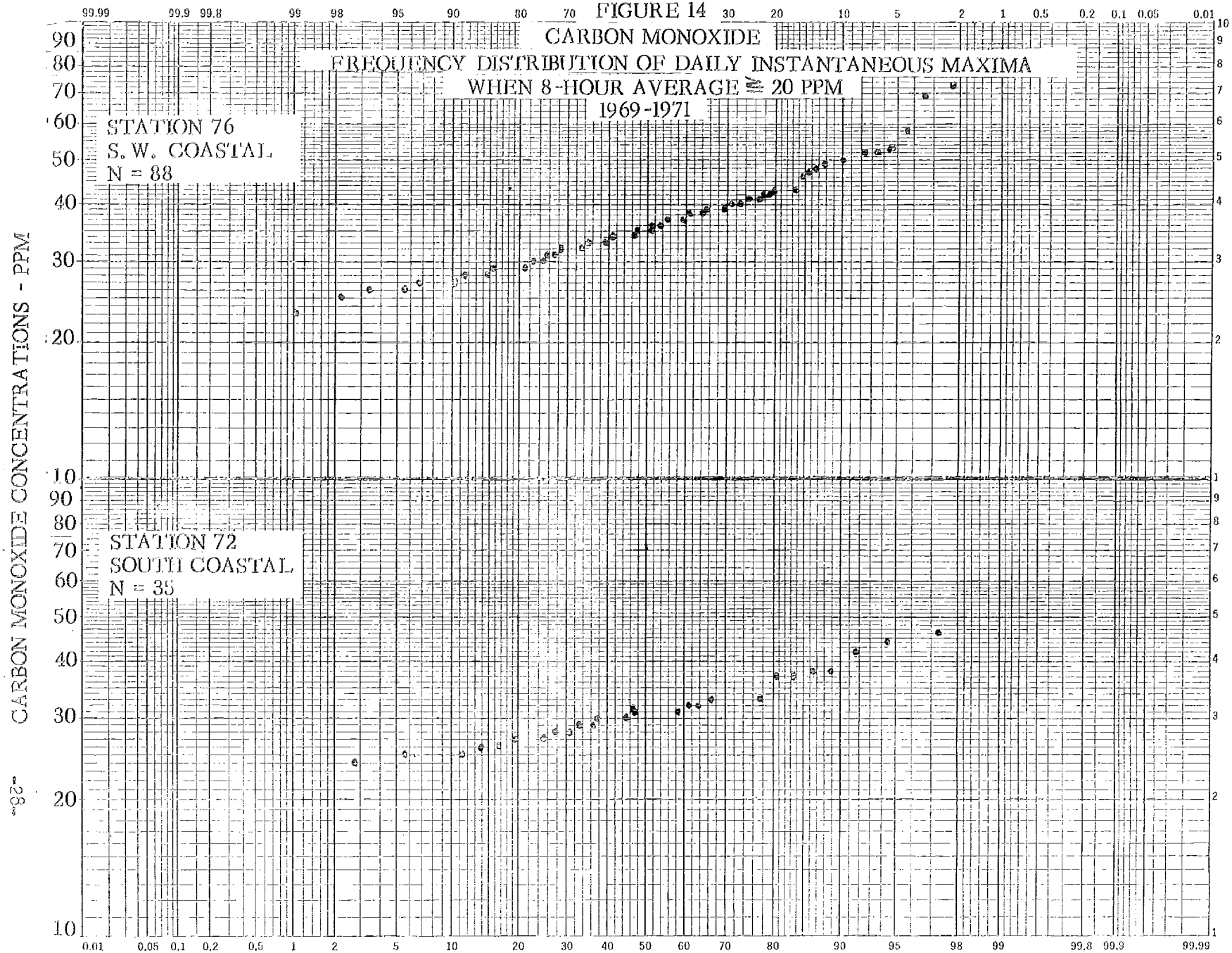
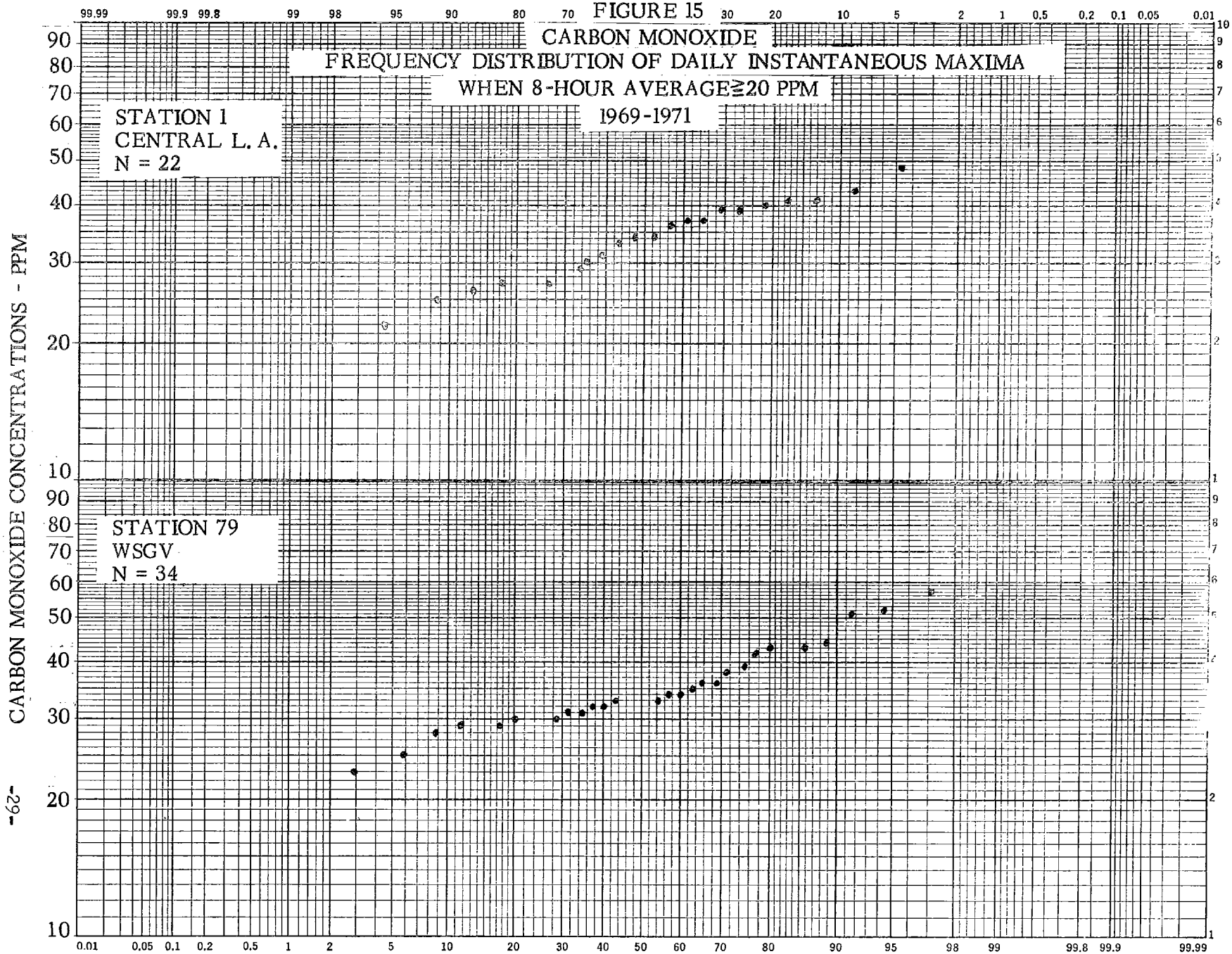


FIGURE 15


CARBON MONOXIDE
FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS MAXIMA
WHEN 8-HOUR AVERAGE≧20 PPM
1969-1971
STATION 1
CENTRAL L. A.
N = 22
STATION 79
WSGV
N = 34
CARBON MONOXIDE CONCENTRATIONS - PPM
99.99 99.9 99.8 99 98 95 90 80 70 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

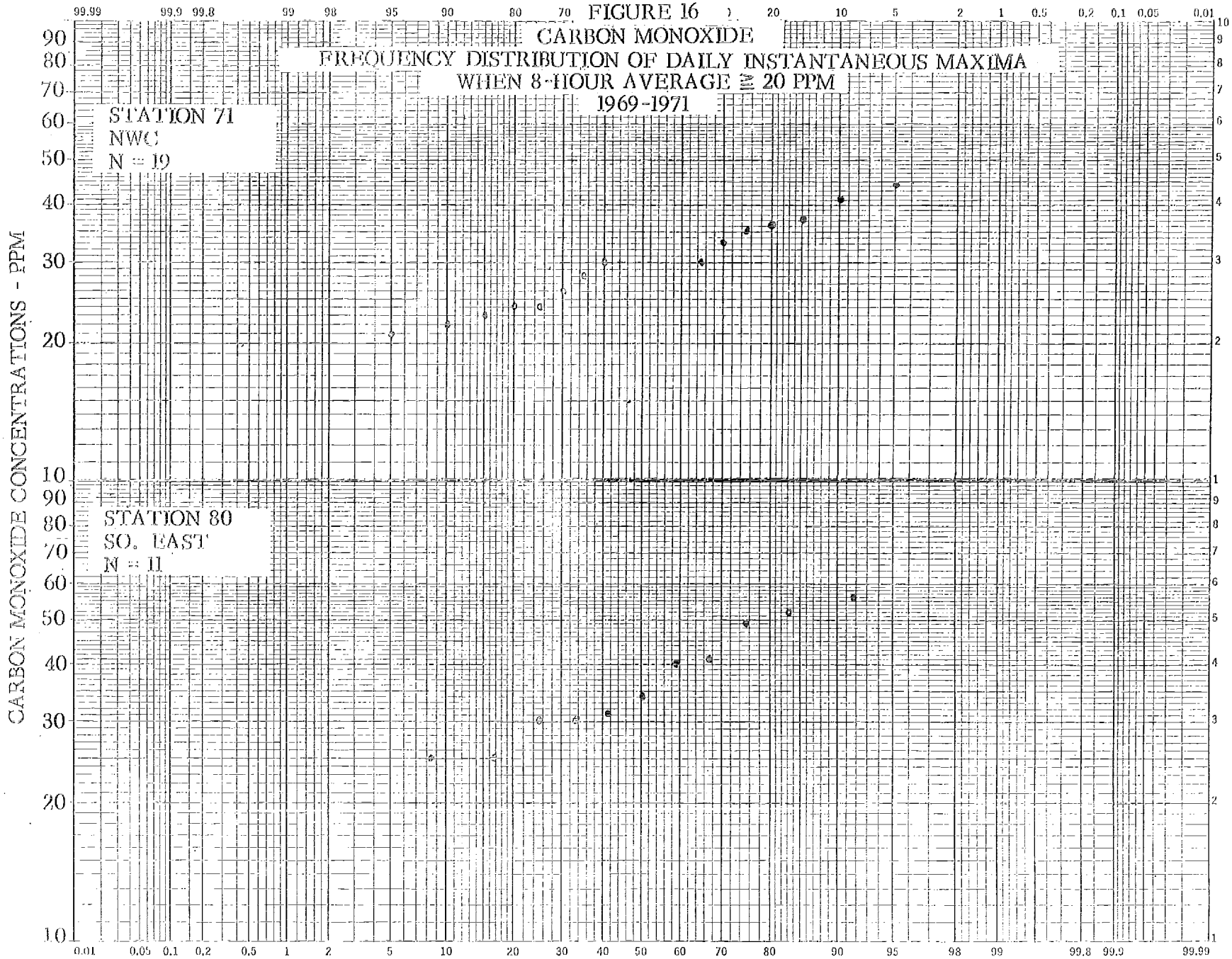


FIGURE 16
CARBON MONOXIDE
FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS MAXIMA
WHEN 8-HOUR AVERAGE ≧ 20 PPM
1969-1971
STATION 71
NWC
N = 19
STATION 80
SO. EAST
N = 11
CARBON MONOXIDE CONCENTRATIONS - PPM
99.99 99.9 99.8 99 98 95 90 80 70 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
90 80 70 60 50 40 30 20 10
10 9 8 7 6 5 4 3 2 1

TABLE VI

CARBON MONOXIDE

FREQUENCY DISTRIBUTION OF DAILY INSTANTANEOUS MAXIMA (ppm)
ON DAYS WHEN MAXIMUM 8-HOUR AVERAGE ≧ 20 PPM

LOS ANGELES COUNTY - BY STATION

1969 - 1971

STATION (No.) Area	NUMBER of OBSERV.	PERCENTILE 10	20	30	40	50	60	70	80	90
(74) WSFV	83	25	26	28	29	31	33	35	37	41
(69) ESFV	77	24	26	28	30	31	32	34	36	42
(76) SWC	88	27	29	32	34	35	38	40	43	50
(72) SC	35	25	27	28	30	31	32	33	35	41
(1) Central	22	26	27	28	32	34	37	39	41	43
(79) WSGV	34	29	30	31	32	33	34	37	43	48
(71) NWC	19	22	24	26	30	31	32	33	36	41
(80) So. Ea.	11	25	28	30	31	34	40	41	51	55
AVERAGE ALL STATIONS		25.4	27.1	28.9	31.0	32.5	34.8	36.5	40.3	45.1
RANGE		22-29	24-30	26-32	29-34	31-35	32-40	33-41	35-51	41-55

TABLE VII

CARBON MONOXIDE

RELATIONSHIP BETWEEN MAXIMUM 8-HOUR AVERAGE, DAILY INSTANTANEOUS MAXIMUM, AND OTHER AVERAGING PERIODS WHEN 8-HOUR AVERAGE $\geqq$ 20 PPM

LOS ANGELES COUNTY

1969 - 1970

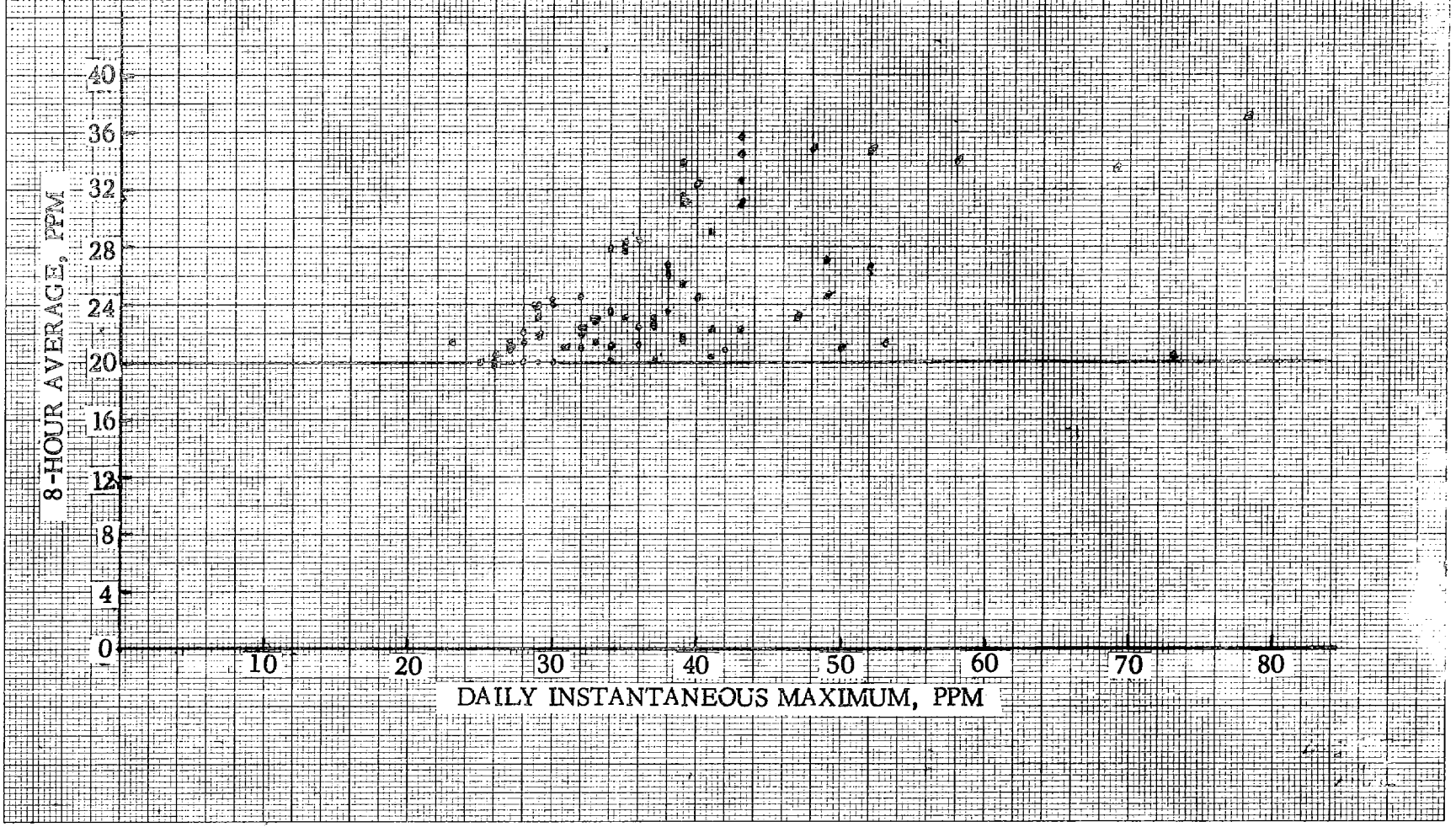
STATION	AVERAGING PERIOD	NUMBER of OBSERV.	EQUATION[a]	CORR. COEFF. (r)	STANDARD ERROR OF THE ESTIMATE (pphm) (Sy)
Southwest Coastal	D. I. M. [b]	34	Y = 15.3 + 0.248 X	0.613	4.00
	Max. 1-Hour	34	Y = 9.69 + 0.442 X	0.780	3.17
	D. I. M. [b] $\leqq$ 40 ppm	25	Y = 7.22 + 0.487 X	0.629	2.49
	Max. 1-Hour $\leqq$ 40 ppm	26	Y = 7.22 + 0.521 X	0.665	2.35
Central, WSGV, PMV (combined)	D. I. M. [b]	29	Y = 13 + 0.30 X	0.700	2.27
	Max. 1-Hour Avg.	29	Y = 12.3 + 0.35 X	0.719	2.21
	D. I. M. [b] $\leqq$ 40 ppm	23	Y = 14.0 + 0.26 X	0.452	2.55
	Max. 1-Hour $\leqq$ 40 ppm	26	Y = 12.7 + 0.34 X	0.595	2.33

(a) X = Concentration for averaging period
Y = 8-hour average

(b) D. I. M. = Daily Instantaneous Maximum

FIGURE 17

DAYS CARBON MONOXIDE 8-HOUR AVERAGE ≥ 20 PPM
SOUTHWEST COASTAL
1969-1971



forecasting even on a short-term basis. The maximum 1-hour averages were distributed 50% at the middle, 6% at the start and 44% at the end of the maximum 8-hour period, Figure 18.

Carbon monoxide data for central Los Angeles, West San Gabriel Valley, and Pomona-Walnut Valley were combined and various regression equations were developed. These stations were combined because of the scarcity of days with concentrations greater than or equal to 20 ppm and would represent inland areas. For these stations, instantaneous maximum and maximum 1-hour average equations had 8-hour average, "Y", intercepts of 13 and 12 ppm respectively and correlation coefficients slightly better than that for Lennox (Table VII). Further investigation of relationships, daily instantaneous maximum and maximum 1-hour average $\leqq$ 40 ppm vs. 8-hour average, showed little change, with the correlation coefficient lower than those using all values. The daily instantaneous maximum and the daily maximum 1-hour average almost always occurred two to three hours from either the start or end of the maximum 8-hour averaging period, again not a suitable time of occurrence for forecasting purposes.

It was observed that an 8-hour average of 20 ppm (the health warning level) is usually reached as much as 6 hours before the end of the daily maximum 8-hour average period exceeding 20 ppm. Taking the periods having an 8-hour average of 20 ppm or more, correlations were made with that average and the hourly averages of the 1st, 1st and 2nd, 1st thru 3rd, and 1st thru 4th hours for that period (Tables VIII and IX). Correlation coefficients were all less than 0.1, indicating no significant relationship between the first four hours of an 8-hour period in which the final average was greater than or equal to 20 ppm, and that final value. Therefore, moving averages of 2, 3 or 4 hours cannot be used to forecast, during a potential accumulation period, the attainment of future 8-hour averages of 20 ppm or higher.

Single hourly averages prior to the daily maximum hour were checked for correlation with the 8-hour average. Hourly averages occurring 4, 5 and 6 hours prior to the maximum were tested. The 6th hour prior to the maximum hour showed no correlation with the maximum 8-hour average. The correlation coefficients increased with the 5th and 4th hours, but were still poor, with the 4th hour the better of the two (Tables X and XI).

The 4th hour prior to the hour of the maximum usually occurred either at 1800-2000, or at 0300. Two-hour averages consisting of 1800-1900 or 0200-0300 were correlated with maximum 8-hour averages; correlation was poor. Two-hour averages at 1900-2000 or 0200-0300 showed better correlation but not good enough for forecasting. For the two-hour average for 0200-0300 vs. maximum 8-hour average (occurring at the

FIGURE 18
CARBON MONOXIDE

DISTRIBUTION OF MAXIMUM 1-HOUR AVERAGES IN 8-HOUR PERIOD WHEN 8-HOUR AVERAGE CONCENTRATION IS EQUAL TO OR GREATER THAN 20 PPM

SOUTHWEST COASTAL

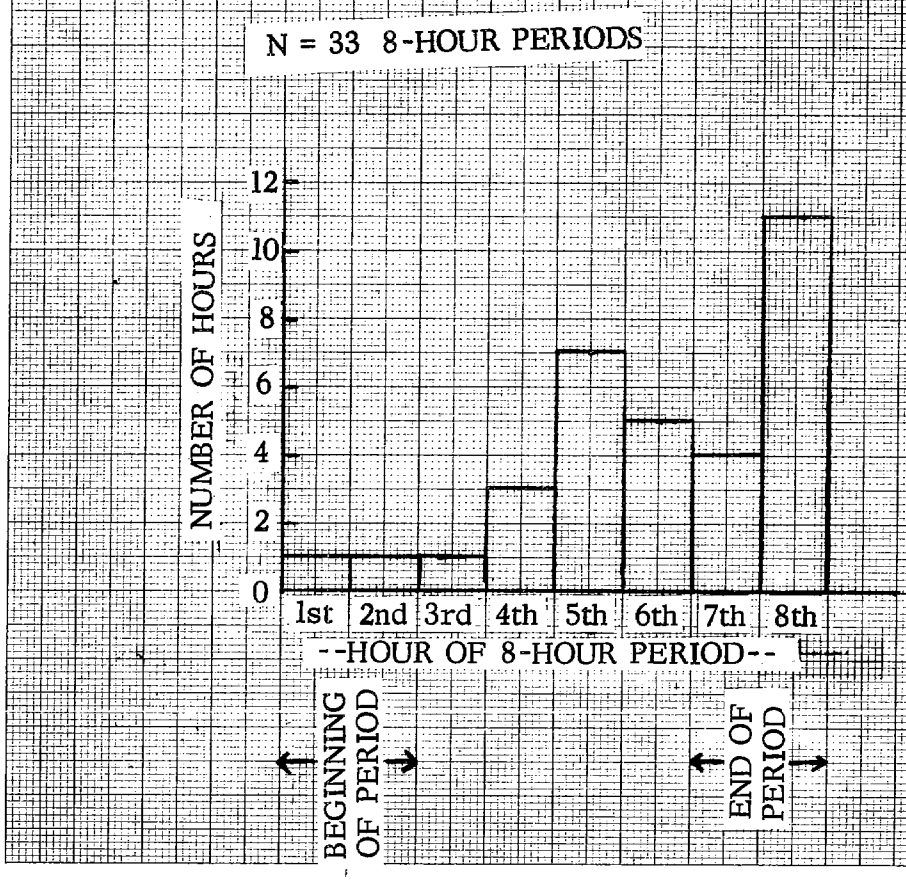


TABLE VIII

CARBON MONOXIDE

RELATIONSHIP BETWEEN FIRST 8-HOUR AVERAGE $\geqq$ 20 PPM (USUALLY NOT DAILY MAXIMUM) AND VARIOUS TIME PERIOD AVERAGES IN THE 8-HOUR INTERVAL

SOUTHWEST COASTAL
1969 - 1970

Hour in 8-Hour Interval	Number	Equation[a]	Corr. Coeff. (r)	Standard error of the Estimate (Sy)
1st	35	Y = 20.9 - 0.003X	- 0.018	0.805
1st and 2nd	35	Y = 20.6 + 0.022X	0.124	0.799
1st, 2nd, and 3rd	35	Y = 20.6 + 0.017X	0.093	0.801
1st through 4th	35	Y = 20.6 + 0.017X	0.0807	0.802

(a) X = Concentration for averaging period

Y = 8-hour average

TABLE IX

CARBON MONOXIDE

FIRST 8-HOUR AVERAGE ≧ 20 PPM AND VARIOUS AVERAGES IN THE INTERVAL

SOUTHWEST COASTAL

1969 - 1970

Date	Max. 8-Hr. Avg. Hours	Avg.	Hour (Max. 1-Hr.)	First 8-Hour Average ≧ 20 ppm Hours	Avg.	1st. Hr.	Avg. 1-2	Avg. 1-3	Avg. 1-4	Max. Avg.	Hr. Hr.
1/1-2/69	19-02	21.8	23	18-01	21.6	11	13.5	13.6	16.2	30	00
(2) -3	00-07	36.9	07	18-01	20.9	9	9.5	10.0	13.0	36	01
3-4	19-02	34.5	00	14-21	20.4	6	5.0	9.0	13.5	41	20
(5) -6	01-08	27.1	08	22-05	20.6	15	14.0	17.6	19.3	25	00
16	00-07	20.1	07	00-07	20.1	22	21.5	21.0	20.0	26	07
10/11-12	20-03	22.5	00	19-02	21.9	11	15.0	16.7	18.0	28	23-00
29-30	23-06	23.0	06	21-04	21.4	15	18.5	21.0	21.8	26	23
10/31-11/1	20-03	23.4	00	18-01	21.4	10	11.0	13.0	15.8	32	00
11/11-12	20-03	20.5	23	19-02	20.1	10	11.5	14.7	17.0	27	23
12	16-23	25.2	23	15-22	22.2	8	18.0	23.3	21.3	34	17
17-18	17-00	23.0	22	16-23	21.0	11	13.5	16.3	18.2	31	22
18-19	17-00	20.9	17	17-00	20.9	25	20.5	18.0	15.8	29	00
22-23	22-05	33.8	23	18-01	21.8	9	9.5	10.3	16.0	37	23
26-27	20-03	34.8	23	15-22	23.1	13	13	13.3	13.7	39	23
27-28	17-00	21.2	00	17-00	21.2	19	23.0	23.7	24.0	33	00
28-29	20-03	27.8	23	16-23	21.0	6	6.0	8.3	10.5	42	33
12/2-3	17-00	24.3	23	16-23	22.3	13	16.0	15.3	17.0	34	22
10-11	18-01	20.0	22	18-01	20.0	16	13.5	16.0	18.3	27	22
11-12	21-04	22.6	00	20-03	20.0	7	11.0	15.7	19.5	36	00
12-13	20-03	30.9	00	16-23	20.6	11	11.5	11.0	11.0	40	23
(14-) 15	00-07	34.0	07	19-02	20.0	9	9.0	10.7	11.3	29	00-02
23	02-09	22.8	07	00-07	20.1	14	15.5	16.0	16.5	30	07
12/31-1/1/70	20-03	24.0	20	18-01	21.4	9	8.5	15.0	18.0	28	01-20
1/8/70	01-08	21.5	08	00-07	20.6	22	20.0	20.3	19.8	28	07
2/2	01-08	20.4	08	01-08	20.4	10	10.0	10.0	9.8	48	07
(2) -3	01-08	20.9	08	22-05	20.8	20	21.5	22.3	22.8	24	00
6	02-09	22.3	07	01-08	22.1	16	16.0	15.7	15.8	38	07
(6-) 7	00-07	28.4	07	20-03	21.1	9	10.0	12.7	14.3	31	03
7-8	19-02	23.1	01	19-02	20.0	5	9.5	11.7	14.0	27	23
14-15	22-05	21.9	01	20-03	21.1	10	11.5	14.0	15.8	31	01
3/13	01-08	20.9	07	00-07	20.0	16	16.0	17.3	17.8	29	07
4/4-5	22-05	20.0	01	22-05	20.0	14	16.5	17.7	19.8	26	01
5/2-3	22-05	28.0	00	18-01	20.1	7	7.5	9.3	10.5	35	00
14-15	23-06	21.1	00	21-04	20.8	15	16.5	19.7	21.3	26	23-00
(1-) 2	00-07	21.9	00	22-05	20.8	14	16.0	20.0	21.5	28	00

TABLE X

CARBON MONOXIDE

RELATIONSHIP BETWEEN MAXIMUM 8-HOUR AVERAGE, MAXIMUM 1-HOUR AVERAGE, AND OTHER AVERAGING PERIODS WHEN 8-HOUR AVERAGE $\geqq$ 20 PPM

SOUTHWEST COASTAL
-1969-

Averaging Period	Number	Equation[a]	Corr. Coeff. (r)	Standard Error of the Estimate (pphm) (Sy)
Max. 1-Hour	22	Y = 7.16 + 0.524X	0.891	2.59
First Hour of 8-Hour Period	22	Y = 9.61 + 0.718X	0.825	3.22
First Two Hours of 8-Hour Period	22	Y = 9.30 + 0.701X	0.864	2.88
First Four Hours of 8-Hour Period	22	Y = 6.54 + 0.789X	0.846	3.04
6th Hour Prior to Max. 1-Hour	22	Y = 26.0 - 0.003X	-0.004	5.71
5th Hour Prior to Max. 1-Hour	22	Y = 19.6 + 0.364X	0.453	5.09
4th Hour Prior to Max. 1-Hour	22	Y = 15.0 + 0.525X	0.702	4.06
2-Hour @18-1900 or 02-0300	22	Y = 20.2 + 0.339X	0.393	5.25
2-Hour @19-2000 or 02-0300	22	Y = 16.0 + 0.513X	0.635	4.41
2-Hour @02-0300	6	Y = 0.35 + 1.18 X	0.968	1.90

(a) X = Concentration for averaging period
Y = 8-hour average

TABLE XI

CARBON MONOXIDE

AVERAGE CONCENTRATIONS FOR VARIOUS TIME INTERVALS ON DAYS WHICH HAVE DAILY MAXIMUM 8-HOUR AVERAGE ≧ 20 PPM

SOUTHWEST COASTAL
1969

Date	Max. 8-Hour Period	Max. 8-Hour Avg. (PPM)	Hour Averages (PPM) of Max. 8-Hour Period 1	1-2	1-4	Hour Average prior to Max. 1-Hour Average 6th hr.	5th hr	4th hr.	Hour of Max. 1-hr. Avg.	2-Hour Average 18-1900 02-0300*	19-2000
1/1,2	19-02	21.8	16	15.0	20.2	8	11	16	23	13.5	15.0
3	00-07	36.9	31	33.5	32.0	36	31	30	07	30.5*	
3,4	19-02	34.5	30	35.5	30.0	18	30	41	00	24.0	35.5
6	01-08	27.1	24	22.5	22.5	21	21	24	08	21.0*	
16	00-07	20.1	22	21.5	20.0	21	20	17	07	18.5*	
10/11,12	20-03	22.5	19	19.5	22.2	7	11	19	00	9.0	15.0
29,30	23-06	23.0	26	25.0	23.2	24	22	21	06	20.5*	
10/31-11/1	20-03	23.4	17	20.5	23.5	10	12	17	00	11.0	14.5
11/11,12	20-03	20.5	13	17.0	21.2	11	8	10	23	9.0	11.5
12	16-23	25.2	28	31.0	23.2	34	15	16	23	15.5	19.0
17,18	17-00	23.0	16	19.0	18.5	11	16	22	22	21.0	18.0
18,19	17-00	20.9	25	20.5	16.1	18	25	16	22	14.5	11.0
22,23	22-05	33.8	30	33.5	31.5	12	17	30	02	9.5	11.0
26,27	20-03	34.8	36	36.5	39.8	14	15	18	23	16.5	27.0
27,28	17-00	21.2	19	23.0	24.0	27	25	25	00	26.0	25.0
28,29	20-03	27.8	27	27.0	31.5	6	13	17	23	15.0	22.0
12/2,3	17-00	24.3	19	16.5	19.2	19	14	22	23	18.0	22.0
10,11	18-01	20.0	16	13.5	18.2	9	13	16	22	13.5	16.0
11,12	21-04	22.6	15	20.0	26.8	8	9	7	00	8.5	8.0
12,13	20-03	30.9	26	26.0	30.2	10	11	26	00	10.5	18.5
15	00-07	34.0	29	29.0	29.0	29	29	19	07	29.0*	
23	02-09	22.8	17	17.5	18.5	17	17	18	07	17.5*	

morning peak traffic time), N = 6, correlation was good. The Y intercept = 0.35, correlation coefficient = 0.97. Even though the 0200-0300 average showed promise in the forecasting of the morning maximum 8-hour average, the vast majority of the 8-hour maxima equal to or greater than 20 ppm occur around midnight. Refer to Table XI. This frequent time interval of nearly 24 hours between the 0200-0300 average and the subsequent 8-hour maximum occurring near midnight precluded the general use of an 0200-0300 average to predict the maximum 8-hour average.

Summer and winter scatter diagrams of carbon monoxide daily instantaneous maxima at Southwest Coastal Station versus mixing height, inversion base or wind speed resulted in a random scatter. There was no direct relationship between carbon monoxide concentration and any of these meteorological variables; and as a consequence they have little value in attempting to predict the occurrence of carbon monoxide health warning periods.

Clock-Hour Versus Moving 480-Minute Average

The 8-hour average used in the carbon monoxide basic data tabulation comprises eight visually estimated clock-hour averages. An objective of this study was to determine the relationship between proposed carbon monoxide health warning incidents based upon specific hourly averages starting at an exact hour and those based upon moving time averages. Examination of the basic data revealed a usual peaking time near midnight; therefore, the beginning and ending of the maximum 8-hour period would most likely occur at 2000, 2100 and 0300, 0400. At or near these times, concentrations are not usually changing rapidly. For a 480-minute moving average of 20 ppm to be increased by 1 ppm, an exact clock-hour would have to be replaced by a 60-minute average approximately 10 ppm higher in concentration. In either case, any 60-minute averaging period would be a visual estimation of plus or minus 1 ppm or 5 percent at the 20 ppm level. Within the limits of the visually estimated average, the 8-hour average based upon specific hourly averages starting at an exact hour are related 1:1 to those based upon moving time averages.

V. RATES OF CONTAMINANT BUILD-UP RELATIVE TO ATTAINMENT OF SPECIFIC CONCENTRATIONS

The atmospheric concentration of directly emitted contaminants such as carbon monoxide should represent a resultant between the rates of contaminant emission into a given air parcel and the rates of dilution and/or

dispersion of the contaminant. For carbon monoxide, the emission rate may be dependent on the traffic flow, vehicle density and mode of vehicle operation. The dilution and/or dispersion rates may be dependent upon wind speed and vertical diffusion rate, which, in turn is related to the maximum mixing height determined by the presence or absence of a stable thermal inversion. It might be assumed, then, that the rate of increase in atmospheric carbon monoxide in the early morning may reflect conditions favorable or unfavorable for contaminant build-up, and particularly for subsequent photochemical formation and accumulation of oxidant.

Similarly, the rate of early morning oxidant formation in a source area such as downtown Los Angeles and in an effect area such as Pasadena might be relatable to subsequent maximum concentrations or oxidant dosages attained in either type of area.

In order to study these possible relationships, days were selected when the carbon monoxide 8-hour average equalled or exceeded 20 ppm at downtown Los Angeles during 1969-1971. Daily instantaneous maximum oxidant values were recorded for downtown Los Angeles and for West San Gabriel Valley. The rate of change in morning carbon monoxide concentration at downtown Los Angeles was determined by taking the average of the number of parts per million per hour increases for three hours just prior to the morning peak concentration (Table XII). A graph was constructed plotting rate of change in carbon monoxide concentration at downtown Los Angeles versus daily instantaneous maximum oxidant at downtown Los Angeles and West San Gabriel Valley (Figure 19). From the graph it is readily apparent that there is no direct relationship between the morning rate of increase in carbon monoxide concentration at downtown Los Angeles and subsequent daily instantaneous maximum oxidant concentrations at downtown Los Angeles (source area) or West San Gabriel Valley (receptor area).

In a like manner, days of high oxidant at a receptor area, West San Gabriel Valley, were examined; and the rates of change in morning CO concentrations were determined at central Los Angeles and West San Gabriel Valley. Table XIII. No direct relationship could be demonstrated between high oxidant concentrations at a receptor area, WSGV, and the morning rate of change of CO concentration at central Los Angeles, a source area, or WSGV (Figures 20 and 21).

Meteorological considerations might explain the lack of direct association between morning carbon monoxide build-up and the subsequent attainment of maximum ozone dosages. There are certain phenomena which allow maximum concentrations of carbon monoxide and oxidant to occur in the winter months and in the summer, respectively.

TABLE XII

MORNING CO RATE CHANGE AT CENTRAL LOS ANGELES VS. PEAK OXIDANT AT CENTRAL LOS ANGELES AND WEST SAN GABRIEL VALLEY WHEN CENTRAL LOS ANGELES CO 8-HOUR AVERAGE ≧ 20 PPM

1969 - 1971

DATE	TIME (PST)	CO-D. I. M.[a], ppm CENT. L. A.	CO-RATE CHANGE, ppm/hr. 3 HOURS PRIOR TO CO MAX. CENT. L.A.	OXIDANT-D. I. M.[a], ppm CENT. L. A.	OXIDANT-D. I. M.[a], ppm WSGV
1- 7-69	08	31	5.3	0.13	0.20
9-10-69	08	34	5.0	0.20	0.42
9-30-69	07	37	5.7	0.25	0.50
12-15-69	07	41	5.0	0.14	0.14
12-16-69	08	48	6.0	0.09	0.08
1-21-70	10	33	2.0	0.03	0.04
1-23-70	09	27	3.3	0.04	0.14
11-13-70	07	34	6.3	0.07	0.11
11-24-70	07	40	8.0	0.02	0.13
11- 9-71	07	29	4.0	0.09	0.14

(a) D. I. M. = Daily Instantaneous Maximum

FIGURE 19

RELATIONSHIP BETWEEN RATE OF CHANGE IN CARBON MONOXIDE AT CENTRAL AND DAILY INSTANTANEOUS MAXIMUM (DIM) OXIDANT AT CENTRAL AND WEST SAN GABRIEL VALLEY WHEN CENTRAL CO 8-HR. AVERAGE ≥ 20 PPM

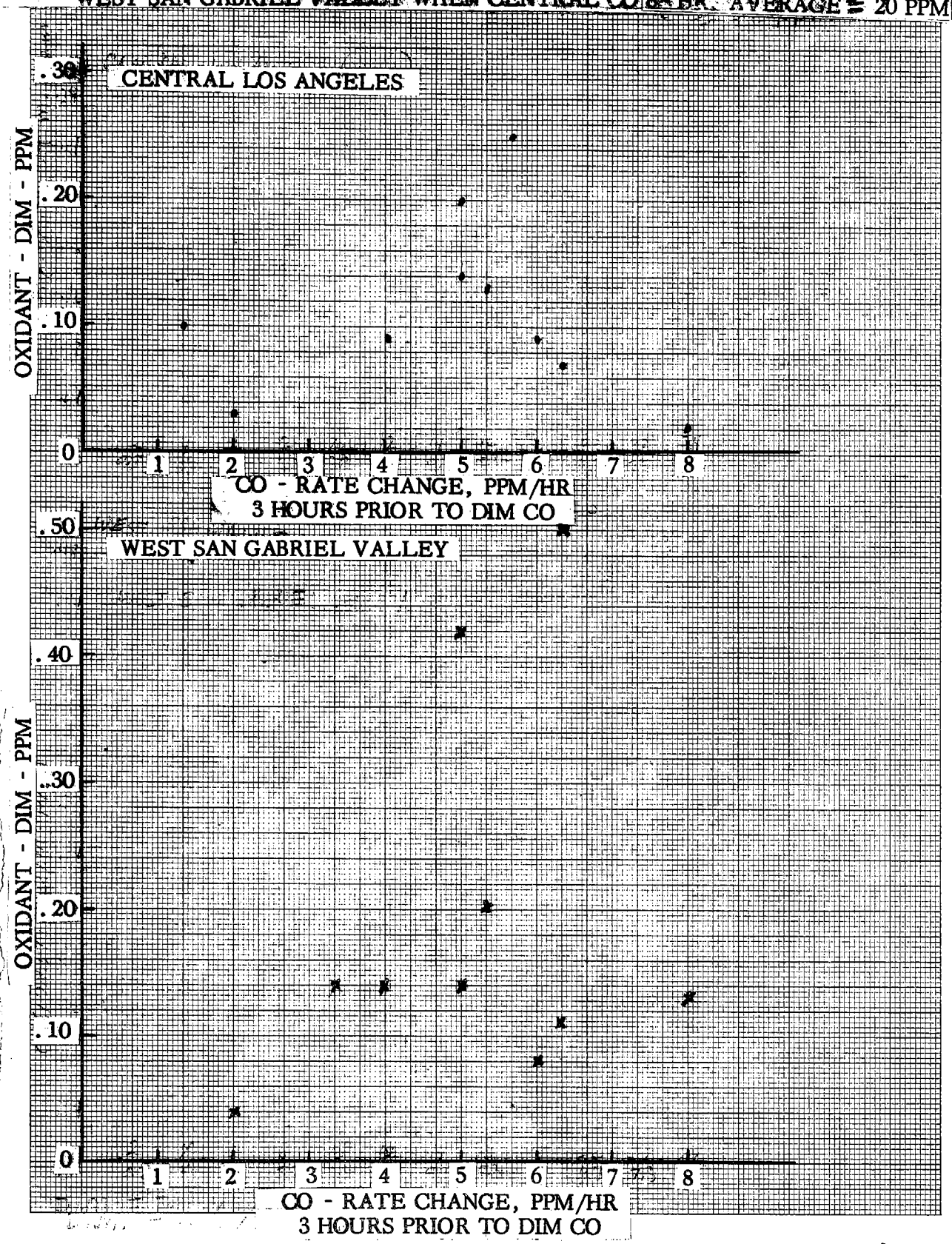


TABLE XIII

CENTRAL LOS ANGELES AND WEST SAN GABRIEL VALLEY MORNING CO RATE CHANGE VS. DAILY INSTANTANEOUS MAXIMUM OXIDANT AT WEST SAN GABRIEL VALLEY WHEN DAILY INSTANTANEOUS MAXIMUM OXIDANT ≧ 0.35 PPM

1969 - 1971

Date	Oxidant-D.I.M., ppm WSGV	CO - D.I.M. ppm		CO rate change, ppm/hr. 3 hours prior to CO maximum	
		WSGV	DOLA	WSGV	DOLA
1969					
5-17	0.36	12	8	0.7	1.0
6-30	0.44	10	32	1.0	5.3
7-1	0.36	12	19	1.7	2.7
7-2	0.40	11	14	0.7	2.7
7-3	0.36	10	12	0	1.3
7-30	0.37	-	20	-	3.0
7-31	0.44	-	23	-	3.0
8-1	0.43	8	20	1.0	2.3
8-3	0.39	6	8	0.3	0.7
8-4	0.38	11	19	1.3	3.3
8-5	0.45	12	30	1.0	5.3
8-7	0.38	13	19	1.0	4.7
8-8	0.36	18	15	1.0	2.0
8-10	0.35	9	9	0	0.3
8-14	0.36	10	12	0.7	2.0
8-15	0.39	8	14	0.3	2.7
8-19	0.35	-	16	-	3.7
8-20	0.62	-	28	-	5.7
8-21	0.49	-	31	-	7.0
8-22	0.43	-	41	-	7.7
8-24	0.36	8	8	0.3	0.3
9-2	0.36	-	19	-	4.0
9-6	0.36	13	17	1.7	2.7
9-9	0.36	-	23	-	1.0
9-10	0.42	-	34	-	5.0
9-11	0.38	-	17	-	7.7
9-27	0.39	7	10	0.7	0.7
9-28	0.46	-	8	-	1.0
9-29	0.51	-	23	-	5.0
9-30	0.50	-	37	-	4.3

Date	Oxidant-D. I. M, ppm WSGV	CO - D. I. M. ppm WSGV	CO - D. I. M. ppm DOLA	CO rate change, ppm/hr. 3 hours prior to CO maximum WSGV	CO rate change, ppm/hr. 3 hours prior to CO maximum DOLA
1970					
5-14	0.37	20	32	1.0	5.0
5-15	0.35	12	39	2.3	8.7
5-16	0.52	13	15	0	2.0
5-17	0.40	-	16	-	0.3
6-1	0.46	9	12	1.0	1.0
6-2	0.48	14	27	2.0	5.3
6-3	0.40	9	14	1.3	3.0
6-25	0.44	12	23	1.0	2.3
7-2	0.57	13	27	1.0	5.0
7-3	0.42	9	14	1.0	2.7
7-4	0.49	10	13	0	0.7
7-13	0.35	13	16	0.7	3.3
7-16	0.45	7	10	0.7	1.3
7-31	0.39	10	27	1.7	6.0
8-7	0.42	18	28	2.0	7.3
8-24	0.36	12	12	1.7	3.0
8-25	0.44	10	13	1.3	2.3
8-31	0.38	10	12	1.3	2.3
9-2	0.35	8	6	0.7	2.3
9-9	0.35	11	15	1.0	3.3
9-10	0.35	16	16	1.3	3.0
9-16	0.48	19	24	3.7	4.7
9-17	0.45	20	25	4.3	3.7
9-18	0.45	19	18	2.7	3.7
9-25	0.41	19	26	3.0	5.0
10-1	0.50	24	22	4.7	3.0
1971					
6-20	0.37	11	12	-	0.7
7-9	0.35	11	22	-	3.3
7-10	0.38	11	13	-	0.3
8-6	0.40	9	22	1.0	3.3
9-10	0.37	13	20	1.0	4.0
9-11	0.36	9	18	-	1.3
9-12	0.44	10	18	-	1.7
9-13	0.62	18	34	3.0	5.0
9-23	0.35	16	29	2.0	4.0
10-9	0.41	-	22	-	-

FIGURE 20

RELATIONSHIP BETWEEN RATE OF CHANGE IN CO AT WSGV AND DAILY INSTANTANEOUS MAXIMUM (DIM) OXIDANT AT WSGV WHEN DIM OXIDANT ≥ 0.35 PPM AT WSGV

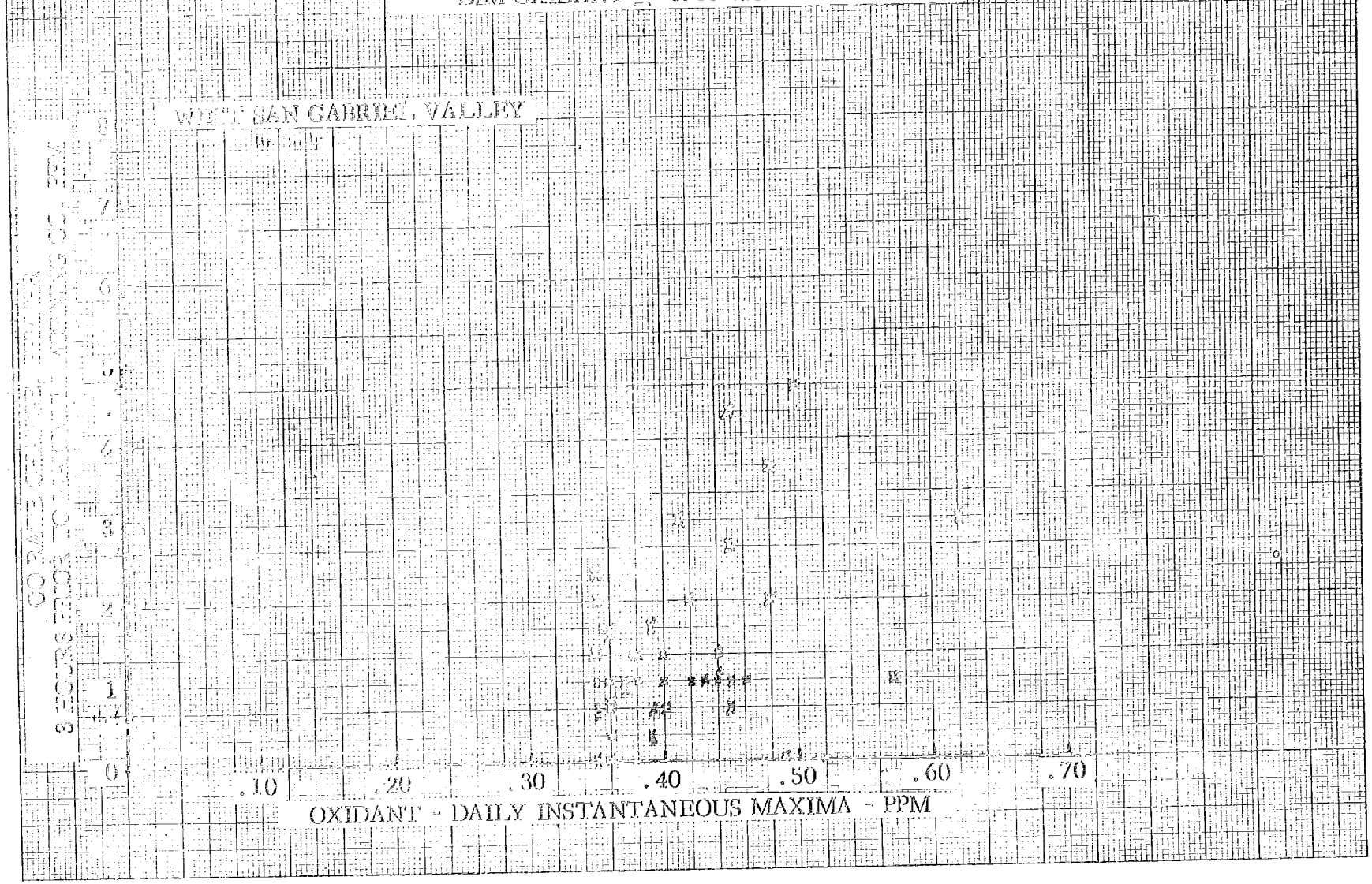
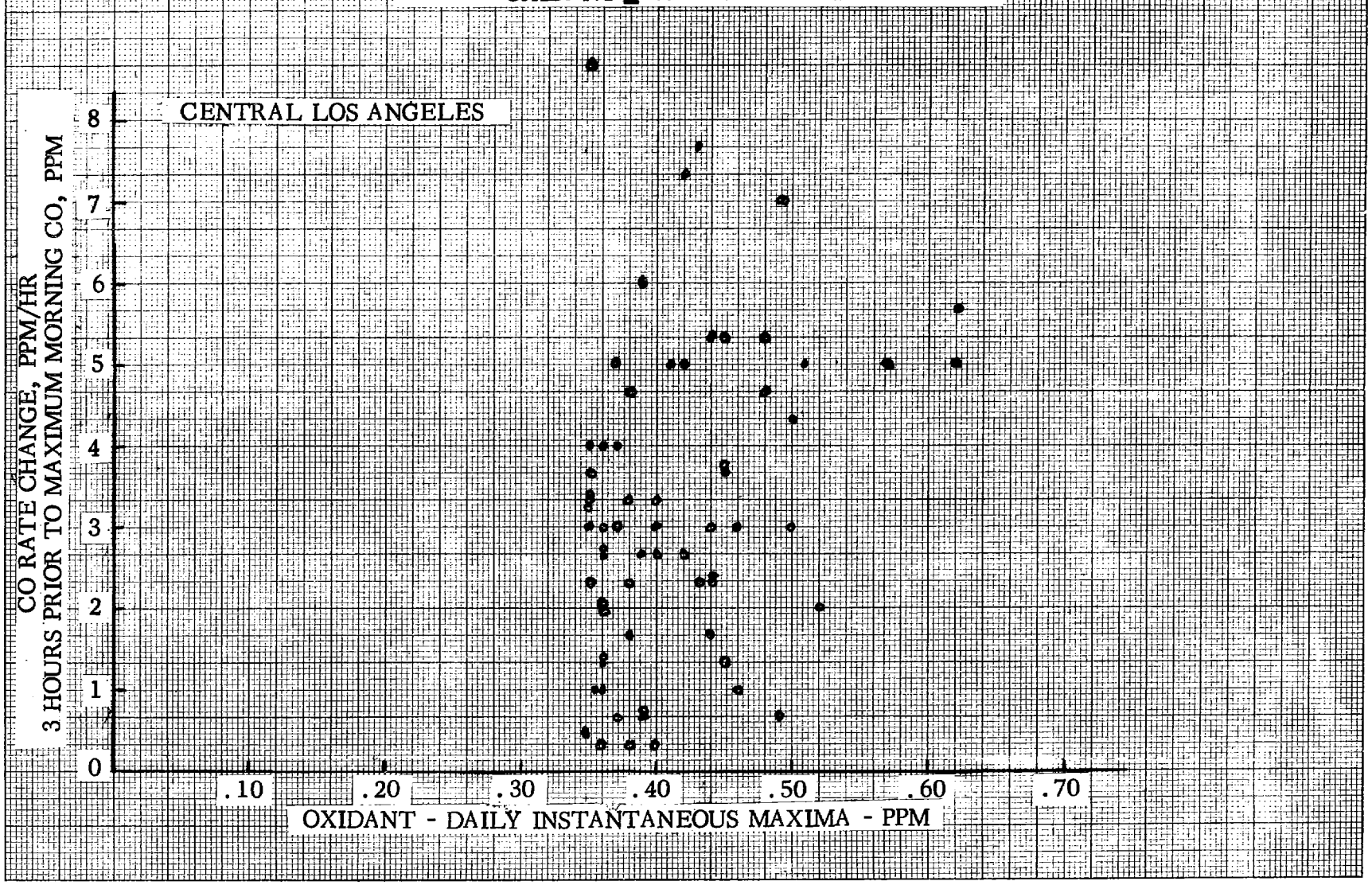


FIGURE 21

RELATIONSHIP BETWEEN RATE OF CHANGE IN CO AT CENTRAL AND DAILY INSTANTANEOUS MAXIMUM (DIM) OXIDANT AT WSGV WHEN DIM OXIDANT ≧ 0.35 PPM AT WSGV



Surface inversions, the single most important factor in carbon monoxide build-up (given a constant source such as morning peak vehicle traffic), are found most frequently during the winter. This phenomenon prevents vertical dispersion of contaminants such as carbon monoxide, directly emitted into the atmosphere, resulting initially in higher concentrations. However, wintertime surface inversions are usually lifted by midday, the time of maximum oxidant formation. (Note hour of instantaneous maxima in Appendix Table I-A). Even on the winter days with a persistent inversion, the amount of radiant energy is insufficient for accumulation of high concentrations of photochemical oxidant.

Summer and fall inversions in Los Angeles, on the other hand, are characterized by their great strength and persistence. This, along with an abundance of radiant energy, allows maximum photochemical oxidant formation in a given air parcel. In the summer, due to the earth's heat radiation together with a summertime wind pattern, surface inversions are rare; consequently, highest carbon monoxide levels are not usually experienced during this season.

The rate of change (ppm/hour) of oxidant concentration was determined for each hour prior to the daily maximum 1 hour average at Central Los Angeles and West San Gabriel Valley. This determination was made for three concentration ranges of the maximum 1 hour average, 0.20-0.29 ppm, 0.30-0.39 ppm and 0.40-0.49 ppm. Examination of data from both central Los Angeles and West San Gabriel Valley resulted in the conclusion that the daily instantaneous maximum oxidant concentration attained has no dependence upon the rate of change (ppm/hour) at any given hour prior to its attainment. The data are shown in Table XIV. However, the average rate change over at least three hours immediately prior to the maximum oxidant concentration can be directly related to the ultimate concentration attained. Unfortunately, this does not provide an aid in forecasting since the average rate of change of the associated three hour period cannot be determined until after the 1 hour maximum has occurred.

In summary, the morning rates of change of both oxidant and carbon monoxide concentrations at central Los Angeles and at West San Gabriel Valley were determined. These rates of change were examined with respect to the attainment during the day of selected dosages of oxidant (0.20 ppm per one hour) and carbon monoxide (20 ppm for eight hours) at both central Los Angeles and West San Gabriel Valley areas. No association was found either between the rate of morning build-up of carbon monoxide in a motor vehicular source area (central Los Angeles) and oxidant concentrations measured in a related receptor area (West San Gabriel Valley), or between the rate of change of oxidant concentration at any given hour prior to attainment of the daily instantaneous oxidant maximum and the ultimate maximum attained at central Los Angeles. Also, there was no association between the rate of change of oxidant concentration at any given hour prior to attainment of the daily instantaneous oxidant maximum and the ultimate maximum attained at West San Gabriel Valley.

TABLE XIV

OXIDANT RATE CHANGE (PPHM/HOUR) FOR GIVEN HOURS
WEST SAN GABRIEL VALLEY AND CENTRAL LOS ANGELES

TIME (PST)	MAXIMUM 1 HOUR OXIDANT CONCENTRATION, PPHM											
	WEST SAN GABRIEL VALLEY									CENTRAL		
	20-29			30-39			40-49			20-29		
	Mean	Range	N	Mean	Range	N	Mean	Range	N	Mean	Range	N
08-09	4.0	0-9	116	5.6	2-11	55	6.3	5-9	8	5.7	0-13	15
09-10	4.7	0-14	122	6.1	1-12	59	6.3	4-9	8	6.9	2-12	14
10-12	5.3	0-14	121	7.3	0-16	56	9.3	4-16	9	4.8	0-9	11
11-12	3.7	0-15	114	6.5	1-17	45	10.7	5-17	7	3.3	1-7	3
12-13	2.9	0-10	49	5.0	1-9	19	4.3	3-7	3	4	4	1
13-14	2.6	0-8	16	5.8	3-11	3	2	2	1			
14-15	3.0	2-4	2									

VI. CONCLUSIONS

1. A quantitative relationship between the oxidant daily instantaneous maxima and the proposed oxidant air pollution health warning level, 0.22 ppm/1 hour, was determined for each of eleven of the twelve air monitoring areas in Los Angeles County using data for the years 1969-1971. Each station had a minimum specific daily instantaneous maximum that was associated with the attainment of 0.20 ppm for 1 hour. This characteristic minimum value for each station was 0.22, 0.23 or 0.24 ppm, depending on the station location. At, or above, these specified minimum levels for the daily instantaneous maxima at each of the stations, there was a very high probability that the proposed health warning level would be attained. For the inland valleys, having the greatest number of incidents, there was at least a 90 per cent chance of a proposed health warning incident, provided the minimum specified daily instantaneous maximum was attained. There was a probability of occurrence of at least 85 per cent and 80 per cent for the central and coastal areas respectively. Attainment of daily instantaneous maxima that are higher than the specified minimum levels greatly increases the probability of a proposed health warning occurrence. Attainment of an oxidant daily instantaneous maximum of 0.28 ppm makes attainment of a proposed health warning level a virtual certainty.

   Quantitative relationships between the proposed carbon monoxide air pollution health warning level, 20 ppm/8-hour average, and a series of differing time period averages ranging from daily instantaneous maxima to several hours were determined using data for the years 1969-1971. Wide scattering about the line of best fit for these relationships proved to be excessive for use as an indicator of a specific concentration associated with the proposed carbon monoxide air pollution health warning level.

2. Forecasting the proposed health warning level for oxidant (0.20 ppm/1 hour) was found to be feasible given the daily instantaneous maximum. The degree of certainty in the health warning level forecast is provided in the standard error of the estimate for each station and is dependent upon ones ability to forecast the daily instantaneous maximum with virtually 100% accuracy. It was found that the attainment of higher levels than the specified daily instantaneous maxima would insure a greater probability of occurrence for the proposed health warning level.

3. The relationship between proposed air pollution health warning incidents based upon specific hourly averages starting at an exact hour and those based upon moving time averages was found to be 1:1.

4. Selected meteorological variables (inversion base height, wind speed, temperature) were investigated as forecast indicators in addition to, and in lieu of, the instantaneous maximum concentrations. None were found suitable for forecasting carbon monoxide or oxidant concentrations. As confirmed by the APCD meteorology section, oxidant levels are dependent on temperature, wind speed, and inversion strength. Each must be considered in the forecast for daily instantaneous maximum oxidant concentrations, and not one of them is satisfactory by itself.

5. Morning rates of change of both oxidant and carbon monoxide concentrations were determined at central Los Angeles and at West San Gabriel Valley. These rates of change were examined with respect to the attainment during the day of selected dosages of oxidant (0.20 ppm for 1 hour) and carbon monoxide (20 ppm for 8 hours) at both central Los Angeles and West San Gabriel Valley areas. The morning rate of buildup of either oxidant or carbon monoxide in a motor vehicular source area(Central Los Angeles) was found to be of little value in forecasting oxidant concentrations in a related receptor area (West San Gabriel Valley).

6. No relationship was found between rates of change in concentration and the attainment during the day of selected dosages of either oxidant or carbon monoxide at central Los Angeles. Similarly, at West San Gabriel Valley, no relationship was found between rates of change in concentration and the attainment during the day of selected dosages of either oxidant or carbon monoxide at West San Gabriel Valley.

APPENDIX

TABLE I-A-1

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

EAST SAN GABRIEL VALLEY
-1969-

Date	Max. 1-Hr.	Inst. Max. (DIM)	Hr. DIM[a]
3-18	20	21	14
27	22	26	14
28	23	24	15
29	37	40	15
30	30	31	14
4-17	20	24	13
28	21	25	13
5-16	40	42	13
17	41	42	13
18	30	31	14
19	23	24	13
21	24	27	15
22	27	30	15
23	32	34	15
24	28	31	15
25	27	28	15
26	35	38	13
27	20	22	13
28	34	36	15
29	32	35	12
30	27	28	13
6- 4	21	22	14
5	20	21	14
6	21	23	15
14	25	27	15
18	20	21	13
26	21	23	14
28	28	30	13
29	37	38	14
30	46	48	13
7- 1	37	41	11
2	35	37	13
3	29	30	13
4	23	24	13
5	20	21	15
8	22	24	13
9	26	27	13
7-10	30	31	14
11	29	30	11
14	24	27	13
15	22	23	15
16	24	26	11
17	21	22	12
18	24	24	14
19	21	24	12
21	28	29	13
22	25	27	12
23	25	25	14
24	22	24	13
25	20	21	14
26	24	24	14
28	23	24	12
29	28	29	14
30	38	39	13
31	37	43	11
8- 1	27	28	13
2	27	27	15
3	30	31	14
4	42	43	13
5	42	43	15
7	28	32	14
8	29	32	12
9	23	26	12
10	27	31	14
11	34	36	14
12	25	27	12
13	27	30	13
14	39	41	12
15	37	39	13
16	25	27	12
17	25	26	14
18	30	32	13
19	36	38	13
20	50	56	13
21	54	71	12
22	51	60	12
23	30	32	14
8-24	21	24	16
25	22	25	14
26	24	26	13
27	28	31	13
28	25	27	12
29	24	27	12
30	33	36	12
31	34	36	12
9- 1	32	35	13
2	42	46	12
3	38	39	12
4	35	37	12
5	29	30	13
6	35	39	13
7	23	24	13
8	38	41	12
9	33	37	13
10	39	44	14
11	37	37	13
17	23	27	14
18	26	29	14
19	24	25	14
22	23	24	13
23	26	27	13
24	33	34	13
25	34	37	13
26	23	26	14
27	41	44	14
28	41	42	14
29	38	47	13
30	27	37	13
10- 1	22	24	13
8	29	34	14
9	21	22	12
11- 1	24	28	14
3	20	22	14
4	23	24	13
14	20	21	14

(a) DIM = Daily Instantaneous Maximum

continue on next page

TABLE I-A-1

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

EAST SAN GABRIEL VALLEY
-1970-

Date	Max. 1-Hr.	Inst. Max. (DIM)	Hr. DIM[a]
3-22	24	25	15
23	20	24	14
4- 9	25	31	14
10	24	29	13
11	24	27	13
12	20	21	14
5-14	30	36	13
15	26	30	15
16	42	43	14
17	36	41	13
18	21	23	11
22	28	32	13
23	20	21	13
30	30	33	14
31	29	30	12
6- 1	43	48	13
2	47	49	12
3	30	33	14
6	22	23	12
7	24	25	14
11	20	21	13
18	24	25	13
19	28	31	12
20	32	34	13
21	26	27	14
23	27	29	13
24	35	39	12
25	47	54	12
26	33	35	13
30	37	41	13
7- 1	29	31	14
2	48	54	12
3	34	37	14
4	42	46	15
5	27	28	11
8	30	32	12
9	30	34	13
10	28	34	13
7-11	28	29	13
12	24	25	13
13	32	34	13
14	33	36	13
15	33	36	12
16	42	46	14
17	23	24	12
18	20	21	12
19	28	30	13
20	24	25	13
21	24	26	16
23	28	29	14
24	32	33	13
25	28	31	13
26	25	27	14
27	33	37	14
28	29	36	13
29	26	28	13
30	27	32	13
31	39	46	13
8- 1	33	34	13
2	30	32	12
3	27	28	12
4	25	25	13
5	34	35	13
6	49	53	13
7	58	61	12
8	26	30	12
9	27	30	14
10	33	35	13
11	33	34	13
12	30	33	12
13	33	35	13
14	31	33	14
15	27	29	13
16	32	34	14
17	25	29	13
19	27	30	14
20	27	30	14
21	32	34	13
22	32	34	13
8-23	29	34	13
24	48	48	13
25	36	40	13
26	40	42	13
28	27	30	13
29	24	26	13
30	23	24	13
31	39	42	13
9- 1	31	34	14
2	38	39	14
3	33	34	12
4	32	33	13
6	22	24	15
7	32	34	13
8	33	34	12
9	34	38	13
10	44	46	13
11	47	50	13
15	29	34	14
16	50	53	13
17	38	41	14
18	37	42	13
21	20	22	13
22	23	25	13
25	21	23	12
30	24	32	14
10- 1	36	47	14
4	21	25	13
9	21	21	14
11	23	25	13
12	21	23	13
13	20	22	13
16	26	27	14
17	26	27	14
18	26	27	15
19	21	22	12
30	22	24	14
31	25	27	15
11- 1	24	30	14
2	20	21	15

(a) DIM = Daily Instantaneous Maximum

continue on next page

TABLE I-A-1

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

EAST SAN GABRIEL VALLEY
-1971-

Date	Max. 1-Hr.	Inst. Max. (DIM)	Hr. DIM
1-20	21	23	12
2-11	20	21	15
3-28	23	25	15
30	22	26	12
4- 2	23	25	14
10	24	27	13
11	26	27	14
5-12	20	21	14
13	25	27	14
24	22	24	12
6-12	20	22	13
13	24	25	13
14	31	35	15
15	34	34	13
16	20	23	16
18	23	27	13
19	30	32	14
20	31	34	16
21	26	29	12
22	27	29	14
23	26	29	13
7- 2	24	25	13
4	22	22	13
6	20	20	14
7	26	28	14
8	36	38	14
7- 9	36	38	14
10	36	43	12
11	30	35	14
12	20	21	12
13	33	36	14
14	21	23	11
15	21	22	13
17	23	27	13
18	26	29	12
19	25	28	12
20	30	32	13
21	30	33	14
22	21	23	12
23	20	22	15
24	21	21	15
25	22	23	14
26	27	31	14
27	30	32	14
29	22	25	12
30	23	26	14
31	28	32	13
8- 3	32	33	14
4	27	30	12
5	28	32	12
6	37	44	14
7	25	26	11
8	31	32	14
9	29	31	12
11	26	29	13
12	22	24	13
15	21	23	13
8-16	24	29	13
18	24	27	12
23	22	24	13
24	20	22	13
25	25	29	13
26	23	32	12
27	32	36	14
28	32	34	13
29	30	31	12
31	23	25	14
9- 1	21	23	14
2	22	23	13
3	21	22	14
4	31	34	14
5	23	24	12
7	28	31	13
8	39	45	13
9	30	32	12
10	39	42	12
11	35	39	13
12	37	46	13
13	48	65	13
14	24	27	13
15	20	21	12
18	23	25	14
23	28	31	13
10- 8	28	31	13
9	44	48	15
11	25	29	14
12	31	39	13
13	31	36	1[illegible]

TABLE I-A-2

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

WEST SAN GABRIEL VALLEY
-1969-

DATE	MAX. 1-HR.	INST. MAX (DIM)	HR. DIM[a]	DATE	MAX 1-HR	INST. MAX. (DIM)	HR. DIM	DATE	MAX 1-HR.	INST. MAX. (DIM)	HR. DIM
3/18	20	22	13	7/12	29	31	12	8/26	30	33	12
19	24	25	14	14	23	26	12	27	33	36	12-13
27	20	24	13	15	26	27	14	28	26	27	12
28	29	32	14	16	24	26	11-12	29	22	24	12
29	30	32	13-14	18	25	27	12	30	29	30	12
30	26	27	13	20	20	21	12	31	29	32	11
				21	28	32	12				
4/17	20	24	12	22	20	26	13	9/1	31	34	12
28	20	26	12	23	25	27	13	2	35	36	11
				24	24	26	12	3	30	31	11
5/8	20	22	12-13	25	20	22	13-14	4	29	31	11
9	25	30	12	26	23	25	14	5	27	30	12
10	23	25	13	27	22	24	14	6	30	36	12
14	23	26	13	28	20	23	12	7	20	22	12
16	30	33	12	29	25	27	14	8	26	27	12
17	34	36	13	30	35	37	12	9	33	36	12
18	26	27	12-13	31	34	44	11	10	39	42	11
19	20	21	13					11	36	38	13
22	21	23	13-14	8/1	41	43	12	12	23	27	11
23	25	28	13-14	2	28	29	12	17	23	25	13
24	25	28	13	3	36	39	12-13	18	32	34	13
25	28	29	14	4	37	38	12	19	25	31	14
26	30	32	12	5	44	45	13	23	20	21	13
28	28	30	12	7	35	38	14	24	28	30	12
29	26	27	12	8	32	36	10-11	25	32	34	12
30	24	25	13	9	23	29	12-14	26	25	27	13
31	22	23	14	10	32	35	13	27	37	39	13
				11	28	29	13	28	40	46	13
6/6	21	23	14	12	24	26	11-15	29	41	51	11
14	22	24	14	13	32	34	13	30	36	50	12
28	21	22	12	14	34	36	11				
29	31	37	12	15	37	39	12	10/1	22	24	12
30	42	44	12	16	26	27	13	8	30	33	13
				17	22	24	13	9	23	26	13
7/1	33	36	11-13	18	29	32	12	27	21	23	14
2	38	40	13	19	32	35	12	29	22	23	12
3	34	36	14	20	52	62	12				
4	24	25	13	21	41	49	11	11/1	23	27	13
8	23	24	13	22	32	43	11	2	21	23	15
9	28	29	12	23	32	34	12	3	25	26	13
10	31	33	12-13	24	33	36	14	4	21	22	12-13
11	24	27	10-11	25	24	25	12	14	21	23	14

(a) DIM = Daily Instantaneous Maximum

(Continue next page)

TABLE I-A-2

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

WEST SAN GABRIEL VALLEY
-1970-

DATE	MAX 1-HR.	INST. MAX.	HR. DIM
3/22	23	24	14
23	21	25	13
4/3	22	23	13
9	25	28	12-13
10	26	29	12
11	21	23	11
12	21	22	13
5/14	35	37	12
15	33	35	14
16	46	52	13
17	37	40	12
18	22	22	11
22	24	26	12
30	20	22	13
31	25	27	12
6/1	44	46	13
2	46	48	12
3	35	40	12
18	20	21	14
19	30	32	12
20	27	31	12
21	24	26	13
23	26	28	12
24	29	31	11
25	32	44	11
26	31	33	12
30	36	38	12
7/1	30	32	12
2	51	57	11
3	39	42	13
4	45	49	14
5	30	31	11
8	30	31	12
9	29	32	12
10	20	26	12
11	23	26	12
7/12	20	22	12-14
13	33	35	12
14	24	27	12-13
15	22	25	11-13-14
16	39	45	13
17	25	27	13
18	21	22	12
19	28	30	13
20	29	30	13
21	22	24	15
23	24	24	13
24	28	31	13
25	27	29	12
26	26	27	13
27	25	30	12-13
28	29	33	12
29	21	22	11
30	20	24	11-12
31	33	39	12
8/1	30	32	14
2	20	21	11-12
4	22	29	11
5	26	27	12
6	32	34	12
7	40	42	11
8	27	30	12
9	28	31	13
10	27	30	13
11	30	31	13
12	24	26	13
13	22	26	12
14	22	23	13
15	25	26	14
16	21	23	12
21	24	27	12
22	23	24	12
23	28	29	12
24	30	36	12
25	37	44	12
8/26	23	26	12
27	25	25	14
28	24	25	14
31	35	38	12
9/1	26	28	13 -15
2	34	35	13
3	29	32	12-13
4	27	30	12-13
7	27	28	12
8	26	30	11
9	33	35	12
10	33	35	12
11	30	31	11
15	28	30	12
16	45	48	12
17	40	45	12
18	41	45	12
19	23	25	12
21	20	21	13
22	25	29	10
23	21	22	14
24	26	27	14
25	38	41	13
26	23	25	15
28	23	25	13
30	26	30	13
10/1	42	50	13
2	20	22	13
4	21	23	12
9	26	27	13
11	29	30	14
12	21	23	13
16	22	23	12
17	31	33	13
18	29	31	14
19	20	23	13
30	21	24	13-14
31	26	27	13
11/1	30	32	14
2	25	26	13

(Continue next page)

TABLE I-A-2

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

WEST SAN GABRIEL VALLEY
-1971-

DATE	MAX 1-HR	INST. MAX.	HR. DIM	DATE	MAX 1-HR	INST. MAX.	HR. DIM
2/11	23	27	14-15	8/2	22	23	15
				3	33	33	13
5/13	20	22	12	5	21	25	12
24	20	21	11-12	6	32	40	13
				7	25	26	13
6/14	28	29	13	8	27	28	13
15	31	33	12	9	28	29	12
16	26	27	14	11	23	24	12
18	22	25	12	18	22	25	11-12
19	26	28	12	19	20	21	13-14
20	33	37	13-14	23	20	22	12
21	26	28	11	25	22	24	12
22	27	30	12-14	26	24	28	11
23	30	32	12	27	28	29	13
				28	28	30	12
7/2	21	23	12	29	23	24	12
3	22	23	13				
4	20	21	12	9/4	27	29	13
7	27	28	12	7	22	25	12
8	27	30	12	8	29	31	11
9	33	35	13	9	27	31	11
10	33	38	11	10	31	37	11
11	32	33	13	11	34	36	12
13	33	34	12	12	39	44	12
17	21	23	13	13	53	62	11
19	20	22	11	14	22	26	12
20	23	26	12	18	23	26	12
21	22	23	13	23	32	35	12
22	20	21	12-14	24	23	24	12
23	20	21	14				
25	21	23	13	10/7	21	23	13
26	25	29	13	8	26	28	14
27	26	27	12-14	9	37	41	13
29	26	28	14	11	23	27	13
30	27	30	13	12	30	32	12
31	22	27	11-13	13	29	31	13

TABLE I-A-3

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

POMONA WALNUT VALLEY
1970 - 1971

DATE	MAX. 1-HR.	INST. MAX. (DIM)	HR. DIM	DATE	MAX. 1-HR.	INST. MAX. (DIM)	HR. DIM
	1970				1971		
8/1	26	30	12-13	5/13	23	25	14
2	22	23	12	24	21	22	13
3	22	25	12				
5	31	36	14	6/13	21	22	14
6	33	35	13	14	29	32	15
7	33	41	12	15	24	26	12
8	22	25	12	22	20	23	12
11	27	29	13				
12	21	24	12	7/8	24	26	13-14
13	30	34	14	9	24	26	12
14	20	25	13	10	34	36	13
15	20	23	13	11	22	24	16
16	22	24	13	13	30	32	15
17	21	23	14	19	22	23	13
18	21	23	13	20	24	26	13
21	24	26	13	21	23	26	13-14
22	23	27	13	26	25	26	14
23	27	29	13	27	22	25	13
24	32	34	15	31	21	23	13
25	29	33	14				
26	35	39	14	8/4	26	30	13
28	22	25	12	5	25	28	12-13
29	26	30	14	6	22	28	15
30	23	27	15	8	24	27	15
31	32	34	14	9	26	28	12
				16	21	23	13
9/2	30	32	13-14	27	23	28	15
3	23	24	13	28	30	32	14
4	27	29	13	29	22	29	14
6	28	30	15				
7	27	32	14	9/4	29	30	14
8	27	29	12	5	23	24	13
9	33	36	13	7	20	26	14
10	42	45	14	8	35	37	13
11	38	43	12	9	29	30	13
15	24	29	14	10	20	26	13
16	38	41	13	12	31	43	13
17	30	37	14	13	22	26	13
18	36	37	14				
22	40	43	15	10/8	20	22	14
30	27	30	14	9	28	31	16
				12	22	24	14
10/4	24	27	14	13	26	28	13
11	22	24	14-16				
12	21	23	14				
16	21	24	14				
17	24	26	15				
18	23	25	15				
31	29	32	15				
11/1	25	32	14				

TABLE I-A-4

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

EAST SAN FERNANDO VALLEY
-1969-1970-

Date	Max. 1-Hr.	Inst. Max. (DIM)	Hr. DIM[a]
1969			
3/28	21	24	14
29	28	30	13
30	29	31	14
4/17	21	22	13
20	21	25	13
5/ 9	23	25	11
10	22	26	13
16	25	26	12
17	27	28	13
18	20	21	13
23	22	22	13
24	22	27	13
25	22	25	15
28	26	28	12
29	27	31	11
30	22	23	14
6/29	29	31	12
30	33	35	11
7/ 1	29	34	12
2	37	39	13
3	34	36	14
4	24	25	15
8	21	22	12
9	21	23	12
10	27	32	13
11	21	23	11
12	25	27	12
15	22	26	14
16	25	26	11
17	21	22	11
23	21	24	13
29	20	21	13
30	25	27	12
31	22	27	10
8/ 1	35	39	12
3	29	32	13
4	23	27	11
5	33	36	13
8/ 6	20	23	14
7	34	39	11
8	32	35	11
9	27	29	12
10	21	25	12
12	21	23	11
13	21	23	13
14	24	27	11
15	25	26	11
16	24	25	12
18	20	21	12
19	21	22	11
20	38	39	12
21	34	37	11
23	23	28	11
24	27	29	13
25	23	25	13
27	20	21	14
9/ 2	20	21	12
6	21	22	14
9	20	25	11
27	20	21	13
28	23	25	12
29	21	25	12
30	20	23	12
10/ 8	20	25	12
29	22	23	15
11/ 4	20	22	12
1970			
4/10	20	22	12
5/14	23	27	15
15	28	29	13
16	27	31	12
17	24	27	11
6/ 1	28	31	13
2	31	34	12
3	27	29	13
6/19	20	23	12
21	20	21	13
24	22	24	12
30	30	32	13
7/ 2	28	36	12
3	33	35	12
4	35	37	13
7	21	22	12
8	21	25	12
16	23	25	12
17	22	24	11
19	23	25	13
20	21	25	13
24	22	23	13
25	20	21	13
27	20	22	13
31	21	24	11
8/ 1	31	32	13
2	24	25	12
3	23	24	13
6	26	30	13
7	25	26	11
8	22	24	11
10	21	23	13
11	28	29	13
12	22	25	11
13	20	21	11
15	29	30	13
24	24	26	12
25	26	28	11
31	22	23	12
9/ 2	21	23	13
3	23	25	14
10	23	26	14
11	20	22	14
16	29	31	12
17	23	28	12
18	21	24	11
10/ 1	34	39	12

(a) DIM = Daily Instantaneous Maximum

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TABLE I-A-4

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

EAST SAN FERNANDO VALLEY
-1971-

Date	Max. 1-Hr.	Inst. Max. (DIM)	Hr. DIM
2-11	20	26	14
6-13	21	21	13
14	25	28	12
15	23	28	12
16	25	27	12
19	25	28	14
20	27	30	13
21	20	22	14
22	23	25	14
23	24	27	12
7- 9	21	23	12
13	25	27	12
26	21	24	13
27	20	21	14
28	20	22	12
29	21	23	13
30	21	24	12
8- 1	23	24	14
2	21	23	13
3	22	25	11
6	23	27	11
7	20	22	13
8	22	23	12
9	26	28	13
26	20	23	11
27	25	26	11
28	24	25	13
29	21	23	12
9- 4	24	25	13
7	25	27	12
8	24	28	12
10	24	26	11
11	22	27	13
12	24	32	12
13	31	37	11
14	22	24	12
23	21	22	13
10- 8	25	26	13
9	30	32	14

TABLE I-A-5

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

WEST SAN FERNANDO VALLEY
1969 - 1971

DATE	MAX. 1-HR	INST. MAX (DIM)	HR. DIM
1969			
3/18	23	24	14
28	21	23	13-14
29	29	30	12
30	22	23	12
31	21	22	14
4/20	20	21	12
29	22	23	13
5/10	26	27	13-14
16	33	36	13
17	28	29	12-13
18	20	21	12
22	24	26	14
23	26	29	13
24	24	26	14
25	25	26	13
28	25	28	12
29	32	33	14
30	23	25	14
6/4	20	21	13
5	23	27	13
14	22	24	13
20	20	21	15
23	21	22	14
29	26	28	13-14
7/1	20	24	10
2	39	41	13
3	28	30	14
4	22	24	14
8	22	25	12
10	20	23	11
11	21	23	9
16	22	24	13
21	20	23	12
25	26	29	13
26	25	28	13
29	26	27	13
30	30	33	13
31	21	24	11
8/1	29	34	12
3	27	31	12
4	26	31	13
5	30	35	12
6	25	27	13-14
7	29	31	14
8	26	30	12-13
9	21	25	13
10	22	23	14
12	23	25	11
8/13	25	27	11
14	27	30	11
15	26	28	12
16	21	27	10-11
21	21	23	10
23	20	23	11
24	22	23	10
25	22	23	11
27	25	29	12
28	26	27	15
29	21	23	11-12
30	28	20	12
31	24	25	12
9/1	23	27	12-13
2	24	26	11
3	23	25	11
6	20	23	12
11	22	24	10-11
12	23	30	11
17	21	24	13
18	24	26	13
22	21	24	13
24	28	30	12
25	27	29	13
26	28	30	13
27	32	39	14
28	26	29	11
10/1	25	27	14
8	22	24	13
9	20	22	13
1970			
3/25	20	-	16
5/22	22	25	12
31	20	21	12
6/1	22	26	11
2	20	23	9
3	32	34	14
18	20	24	12
19	24	25	13
20	23	24	15
21	22	23	13
24	22	23	12
26	20	22	10-11
7/1	25	27	12
3	31	33	12
4	22	25	10
5	23	26	13
16	24	26	139
17	26	28	15
7/19	22	23	13
20	20	23	12
26	20	21	11
27	27	30	13
31	22	24	12
8/1	37	38	12-13
2	27	31	11
3	20	22	10
6	28	31	12
7	28	37	11-12
10	23	25	12
11	25	26	15
12	21	24	12
15	22	24	13
23	23	24	12
24	24	27	12
9/1	22	23	11
2	20	21	13
3	22	23	12
9	25	29	13
10	31	33	14
11	25	27	11
17	21	25	12
18	20	22	12
10/9	20	22	13
11	22	24	13
17	20	21	14
1971			
6/14	20	21	11
15	21	27	12
18	21	22	13
19	25	26	13
20	25	27	12
21	21	23	11
22	20	21	12
23	26	30	12
7/8	21	22	13
14	22	24	15-16
27	21	22	14
28	20	21	11
8/1	20	22	13
8	24	26	11-12
23	20	21	12
28	21	23	12
9/8	20	22	13
14	32	34	12
10/8	30	32	14

TABLE I-A-6

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

SOUTHEAST
1969 - 1971

DATE	MAX. 1-HR.	INST. MAX. (DIM)	HR. DIM[a]
		1969	
8/19	20	25	11
20	29	32	11
21	43	46	11
22	43	58	10
23	22	27	12
9/1	22	27	11
2	22	23	11
3	24	27	13
4	22	24	12
6	24	30	12
9	26	31	12
17	20	23	13
27	26	28	13
28	33	37	12
29	34	36	11
10/29	30	31	14
11/1	21	29	13
		1970	
3/13	24	28	16
14	20	21	13
22	23	24	14
23	28	32	13
5/14	26	28	12
17	26	28	12
6/1	32	35	13
2	22	26	13
25	27	35	12
7/2	36	39	14
4	33	38	14
26	22	25	12
27	25	29	12
28	20	26	11
30	21	23	12
8/1	25	29	14
5	21	23	14
6	25	26	11
7	31	36	12
24	25	30	12
9/6	24	27	12
7	21	22	12
10	23	30	12
16	20	23	11
17	21	27	11
18	25	33	12
22	24	26	11
25	22	27	13
30	20	22	13
10/31	24	26	13
11/1	24	26	12
		1971	
1/19	20	22	14
2/10	20	23	14
6/14	24	27	13
15	24	26	11
20	22	27	15
7/8	21	24	13
10	21	27	11
11	26	28	14
13	22	24	14
31	21	23	11
8/4	23	26	12
8	20	22	16
25	20	22	11
26	25	28	11
27	23	27	13
28	21	23	13
29	22	24	12
9/8	23	31	11
10	25	27	12
11	37	42	11
12	34	40	12
13	39	52	12
18	20	23	13
23	20	22	12
10/9	36	41	13
10	23	29	13
11	31	38	13

(a) DIM = Daily Instantaneous Maximum

TABLE I-A-7

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

CENTRAL, NORTHWEST COASTAL, SOUTHWEST COASTAL AND SOUTH COASTAL
1969 - 1971

DATE	MAX. 1-HR.	INST. MAX. (DIM)	HR. DIM
NORTHWEST COASTAL			
1969			
3/27	20	24	14
30	21	25	13
4/20	26	31	13
5/25	22	24	13
27	21	23	14
8/5	25	26	13
7	30	35	13
26	20	23	14
11/1	20	26	13
2	21	21	14
1970			
2/7	24	25	14
5/15	22	27	9
9/30	21	27	12
10/1	20	22	13
1971			
1/18	22	27	13
8/8	20	25	15
10/10	26	27	13
SOUTH COASTAL			
8/10/69	22	27	14
9/12/71	27	34	11
10/9 /71	26	36	14
10	22	25	12
CENTRAL			
1969			
3/27	26	29	12
4/28	20	24	11
5/25	20	22	14
29	20	22	14
6/29	26	28	11
7/31	23	28	9
8/1	27	30	11
7	30	39	12
8	20	22	10
20	21	30	13
22	20	25	10
23	20	24	13
9/28	21	27	11
30	22	25	11
10/29	21	24	14
11/1	20	24	13
4	20	22	15
1970			
5/15	23	29	13
16	27	29	13
17	25	28	10
7/4	21	22	12
25	20	24	11
8/1	23	28	11
7	22	25	10
8	22	25	11
9/25	25	30	12
30	21	28	12
10/1	33	36	12
11/1	22	24	12
1971			
3/29	20	25	11
6/20	24	26	13
9/12	23	25	11
10/9	22	25	13
10	22	23	13
11	22	28	12
SOUTHWEST COASTAL			
1969			
4/27	20	23	15
10/7	25	33	12
11/1	24	28	13
1970			
3/13	21	24	14
22	23	25	15
5/1	20	23	12
10/1	23	26	13
1971			
8/8	21	25	15
10/10	20	24	11

TABLE I-A-8

DAYS ON WHICH OXIDANT CONCENTRATIONS
(1-HOUR AVERAGE) EQUALLED OR EXCEEDED 0.20 PPM

UPPER SANTA CLARA RIVER VALLEY, ANTELOPE VALLEY
1969 - 1971

DATE	MAX. 1-HR.	INST. MAX. (DIM)	HR. DIM [a]
USCRV (BEGAN 10/69)			
1969			
10/8	20	21	15
1970			
5/21	20	20	14
22	25	27	13-14
31	21	23	14
6/3	31	34	13-16
4	24	25	13
6	22	22	13
18	26	27	13
19	36	37	13
20	39	41	14
21	30	30	15
22	25	26	12-13
23	21	23	12
26	32	33	12
30	21	23	17
7/1	29	32	14
3	39	42	13-14
4	34	35	13
5	30	32	12
6	24	27	14
7	23	26	12-13
8	26	28	12
9	20	23	16
10	31	33	13
11	26	27	13-14
12	20	21	14-15
13	25	28	13-14
14	23	25	12-13-14
15	25	27	12-14
16	41	43	16
17	36	38	15
20	30	34	14-15
21	21	24	11-12
22	23	24	12
24	26	29	15
25	23	24	12
26	24	25	13
27	22	24	13
28	27	28	13
30	21	27	14
31	20	22	13
8/1	31	35	14
2	20	25	15
3	22	24	12
4	30	30	12
5	33	35	13
7	26	37	13
8	21	25	13
9	25	26	14
10	39	40	13
11	31	37	14
12	38	39	13
13	35	36	13
14	21	25	12
15	33	34	14-15
16	24	25	13
17	20	23	13
18	22	24	13
20	29	30	14
21	21	24	12
22	25	26	13
23	29	30	12
24	30	31	11
25	31	32	14
29	20	21	12-14
30	22	23	13
31	21	23	12
9/1	30	31	15
2	29	31	15
9	32	34	14
10	34	37	13
11	36	41	13
15	23	-	16
16	22	25	17
21	21	-	15
23	20	22	14
24	31	32	13
10/9	21	28	15
10	23	24	14
11	25	28	12
12	24	25	15
13	23	25	14
16	21	22	15
17	21	22	14
31	22	25	14
1971			
6/18	23	24	12
19	20	22	13-15
21	23	25	12
22	25	26	13-14
23	26	28	14
24	21	23	12-13-14
7/1	20	20	14
2	22	23	13
9	23	25	12
13	21	24	13
14	25	28	13
15	23	23	13
20	24	27	13-14
21	23	24	13
22	28	29	13
23	22	23	13
26	21	24	15
27	30	32	14
28	27	29	17
8/1	24	24	15
7	20	21	14
8	26	27	13
9	23	25	14
17	21	22	13
18	22	23	13
9/14	25	27	13-14
15	24	25	13
10/12	23	25	14
13	24	26	14
ANTELOPE VALLEY			
8/1/71	20	24	14

(a) DIM = Daily Instantaneous Maximum

TABLE II-A

OXIDANT CORRELATION SUMMARY

LOS ANGELES COUNTY
—1969 - 1971—

Station Range (Max. 1-hour)	Equation[a]	Corr. Coeff. "r"	Std. Error of Estimate (Sy)	Avg. DIM pphm (x)	N
WEST SAN FERNANDO VALLEY					
Total ≧ 20 pphm	Y = 1.9 + 0.84 X	0.942	1.24	26.1	141
" 20-29 "	Y = 4.2 + 0.74 X	0.903	1.11	25.3	129
" 16-29 "	Y = 1.7 + 0.83 X	0.945	1.12	22.4	256
(July-Oct) 16-29 pphm	Y = 1.8 + 0.82 X	0.947	1.11	22.6	178
(Nov-June) 16-29 pphm	Y = 1.2 + 0.86 X	0.942	1.12	21.8	78
POMONA-WALNUT VALLEY					
Total ≧ 20 pphm	Y = 0.8 + 0.87 X	0.950	1.85	29.8	225
" 20-29 "	Y = 5.1 + 0.70 X	0.833	1.61	26.8	168
" 15-29 "	Y = 1.2 + 0.84 X	0.936	1.51	23.5	294
(July-Oct) 15-29 pphm	Y = 1.5 + 0.83 X	0.925	1.63	24.3	195
(Nov-June) 15-29 "	Y = 0.7 + 0.85 X	0.949	1.25	22.1	99
WEST SAN GABRIEL VALLEY					
Total ≧ 20 pphm	Y = 2.0 + 0.85 X	0.969	1.59	30.2	299
" 20-29 "	Y = 1.7 + 0.85 X	0.911	1.19	26.1	203
" 15-29 "	Y = 0.7 + 0.88 X	0.952	1.31	23.0	345
(July-Oct) 15-29 pphm	Y = 1.0 + 0.87 X	0.938	1.44	24.2	209
(Nov-June) 15-29 "	Y = 0.6 + 0.88 X	0.963	1.07	21.3	136
SOUTHWEST COASTAL					
Total ≧ 20 pphm	Y = 8.2 + 0.53 X	0.888	0.94	25.7	9
" ≧ 16 "	Y = 4.9 + 0.64 X	0.867	1.31	23.7	17
(July-Oct) ≧ 16 pphm	Y = 5.2 + 0.63 X	0.958	1.05	24.5	6

(a) X = Daily Instantaneous Maximum
Y = Daily Maximum 1-Hour Average

continue on next page

TABLE II-A (cont.)

Station / Range	Equation	Corr. Coeff. "r"	Std. Error of Estimate (Sy)	Avg. DIM (x)	N
SOUTHEAST					
Total ≧ 20 pphm	Y = 3.4 + 0.75 X	0.944	1.84	29.0	75
" 20-29 "	Y = 7.7 + 0.57 X	0.791	1.40	26.3	61
" 15-29 "	Y = 2.5 + 0.76 X	0.923	1.35	22.9	123
(July-Oct) 15-29 pphm	Y = 3.3 + 0.72 X	0.910	1.30	22.8	92
EAST SAN FERNANDO VALLEY					
Total ≧ 20 pphm	Y = 1.1 + 0.87 X	0.948	1.32	26.6	153
" 20-29 "	Y = 4.0 + 0.75 X	0.884	1.22	25.4	136
" 16-29 "	Y = 1.5 + 0.84 X	0.944	1.13	22.7	252
(July-Oct) 16-29 pphm	Y = 1.9 + 0.82 X	0.936	1.15	22.5	180
(Nov-June) 16-29 "	Y = 0.8 + 0.87 X	0.959	1.08	23.0	72
EAST SAN GABRIEL VALLEY					
≧ 20 pphm	Y = 2.0 + 0.85 X	0.972	1.73	31.4	323
≧ 15 pphm	Y = 0.8 + 0.88 X	0.980	1.61	27.6	465
20-29 pphm	Y = 5.1 + 0.72 X	0.903	1.14	25.9	184
15-29 pphm	Y = 1.4 + 0.85 X	0.952	1.22	22.9	326
(July-Oct) 15-29 pphm	Y = 2.2 + 0.82 X	0.947	1.25	24.0	178
CENTRAL					
≧ 20 pphm	Y = 4.4 + 0.69 X	0.847	1.66	26.4	35
20-29 pphm	Y = 6.6 + 0.60 X	0.720	1.54	25.8	33
17-29 pphm	Y = 3.9 + 0.69 X	0.855	1.31	22.8	87
15-29 pphm	Y = 2.7 + 0.72 X	0.859	1.49	21.4	132

continue on next page

TABLE II-A (cont.)

Station / Range	Equation	Corr. Coeff. "r"	Std. Error of Estimate (Sy)	Avg. DIM (x)	N
NORTHWEST COASTAL					
≧ 20 pphm	Y = 4.7 + 0.70 X	0.830	1.62	25.8	17
≧ 17 "	Y = 3.2 + 0.725 X	0.858	1.60	22.8	42
≧ 15 "	Y = 2.6 + 0.74 X	0.898	1.43	20.9	67
(July-Oct)≧15	Y = 2.6 + 0.73 X	0.884	1.55	20.7	37
SOUTH COASTAL					
Total ≧ 20 pphm	Y = 10.1 + 0.47 X	0.941	1.09	30.5	4
" ≧ 18 "	Y = 6.5 + 0.56 X	0.941	1.37	25.9	8
(July-Oct)≧18 pphm	Y = 5.0 + 0.61 X	0.889	1.91	29.4	5
UPPER SANTA CLARA RIVER VALLEY					
Conc. ≧ 20 pphm	Y = 0.10 + 0.92 X	0.959	1.49	27.6	112
Conc. 15-29 pphm	Y = 0.183 + 0.83 X	0.915	1.47	21.0	110

TABLE III-A

OXIDANT

STATISTICAL DATA SUMMARY

LOS ANGELES COUNTY

1969 - 1971

STATION RANGE (Max 1-hour)	$\sum X$	$\sum X^2$	$\sum Y$	$\sum Y^2$	$\sum XY$	N
SOUTHWEST COASTAL						
M.H.[a] $\geqq$ 0.20 ppm	231	6009	197	4341	5099	9
" $\geqq$ 0.16 ppm	403	9747	340	6904	8183	17
July-Oct $\geqq$ 16	147	3727	123	2575	3092	6
EAST SAN FERNANDO VALLEY						
M.H. 0.20 - 0.29 ppm	3450	88806	3125	72729	80238	136
" $\geqq$ 0.20 ppm	4063	111013	3690	91590	100688	153
" 0.16 - 0.19 ppm	2260	44302	2036	35890	39819	116
0.16 - 0.29 ppm	5710	133108	5161	108619	120057	252
(Nov-June) 0.16-0.29 ppm	1658	39422	1498	32186	35575	72
WEST SAN FERNANDO VALLEY						
M.H. 0.20 - 0.29 ppm	3262	83760	2966	69054	75946	129
" $\geqq$ 0.20 ppm	3683	98619	3355	81751	89665	141
" 0.16 - 0.19 ppm	2464	48190	2216	38826	43174	127
" 0.16 - 0.29 ppm	5726	131950	5182	107880	119120	256
(Nov-June)	1701	38101	1560	32046	34889	78
POMONA-WALNUT VALLEY						
M.H. 0.20 - 0.29 ppm	4501	122569	4020	97598	109092	168
" $\geqq$ 0.20 ppm	6698	208660	6019	168823	187257	225
" 0.15 - 0.19 ppm	2419	46941	2120	35936	40976	126

(a) M.H. = Maximum 1-Hour Average

continue on next page

TABLE III-A (cont.)

OXIDANT

STATION RANGE (Max 1-hour)	ΣX	ΣX^2	ΣY	ΣY^2	ΣXY	N
CENTRAL						
M.H.[a] $\geqq$ 0.20 ppm	480	12980	417	9817	11261	18
('70 - '71) $\geqq$ 0.20 ppm	925	24929	794	18334	21318	35
M.H., $\geqq$ 0.30 ppm	75	2817	63	1989	2358	2
M.H, 0.20 - 0.29 ppm	850	22112	731	16345	18960	33
M.H., 0.15 - 0.19 ppm	1971	39729	1660	28062	33260	99
('69 - '71) M.H., 0.15 - 0.19 ppm	699	14147	579	9663	11649	35
('70) M.H., 0.15 - 0.19 ppm	1192	23948	1001	16839	20021	60
('70 - '71) M.H., 0.15 - 0.29 ppm	2821	61841	2391	44407	52220	132
M.H., 0.15 + 0.16 ppm	836	15706	688	10528	12785	45
NORTHWEST COASTAL						
M.H. $\geqq$ 0.20 ppm	438	11464	385	8845	10044	17
M.H., $\geqq$ 0.17 ppm	956	22304	828	16712	19241	42
M.H., $\geqq$ 0.15 ppm	1400	30246	1214	22678	26105	67
M.H. $\geqq$ 0.15 ppm (July-Oct)	767	16463	661	12197	14116	37
0.15 - 0.16 ppm (July-Oct)	250	4496	217	3367	3879	14
SOUTH COASTAL						
M.H., $\geqq$ 0.20 ppm	122	3806	97	2373	2998	4
M.H., $\geqq$ 0.18 ppm	207	5631	169	3669	4528	8
M.H., $\geqq$ 0.18 ppm (July-Oct)	147	4431	115	2697	3448	5

(a) M.H. = Maximum 1-Hour Average

continue on next page

TABLE III-A (cont.)

OXIDANT

STATION RANGE (Max 1-hour)	ΣX	ΣX^2	ΣY	ΣY^2	ΣXY	N
SOUTHEAST						
M.H.[a] $\geqq$ 0.20 ppm	2172	66500	1884	49592	57256	75
M.H. $\geqq$ 0.40 ppm	279	13229	232	9040	10890	6
M.H. $\geqq$ 0.30 ppm	853	32769	722	23430	27610	23
M.H., 0.15 - 0.19 ppm	1214	24022	1052	17978	20735	62
M.H., 0.15 - 0.29 ppm (Nov-June)	723	17673	633	13523	15422	31
EAST SAN GABRIEL VALLEY						
M.H. $\geqq$ 30 (1969)	2167	85715	1994	71916	78337	57
M.H., 0.20 - 0.29 ppm ('70)	1754	48248	1597	39765	43719	65
M.H., 0.20 - 0.29 ppm ('70 - '71)	3304	88976	3005	73207	80575	125
M.H., 0.15 - 0.19 ppm ('70)	885	17173	789	13623	15266	46
M.H., 0.15 - 0.19 ppm ('70 - '71)	1982	38180	1776	30554	34083	104
M.H., 0.15 - 0.19 ppm	2695	51683	2427	41799	46379	142
M.H., 0.15 - 0.19 ppm Nov-June ('69 - '71)	3198	71540	2893	58567	64619	148
M.H., 0.15 - 0.29 ppm (July- Oct.)	4268	105904	3904	88316	96544	178

(a) M.H. = Maximum 1-Hour Average

(continue on next page)

TABLE III-A (cont.)

OXIDANT

STATION RANGE (Max 1-hour)	$\sum X$	$\sum X^2$	$\sum Y$	$\sum Y^2$	$\sum XY$	N
POMONA-WALNUT VALLEY						
M.H.[a], 0.15 - 0.29 ppm	6920	169510	6140	133534	150068	294
(Nov-June) 0.15 - 0.29 ppm	2189	50289	1943	39661	44574	99
WEST SAN GABRIEL VALLEY						
M.H., 0.20 - 0.29 ppm	5303	140435	4860	118018	128581	203
" $\geq$ 30 ppm	3713	147799	3376	121348	133633	96
" 0.15 - 0.19 ppm	2644	49902	2382	40232	44648	142
" 0.15 - 0.29 ppm	7947	190337	7242	158250	173229	345
(Nov-June) 0.15 - 0.29 ppm	2892	63970	2634	53102	58198	136
(Nov-June) 0.15 - 0.19 ppm	1487	27611	1345	22489	24874	81

(a) M.H. = Maximum 1-Hour Average

TABLE IV-A-1

DAYS ON WHICH CARBON MONOXIDE 8-HOUR AVERAGE
EQUALLED OR EXCEEDED 20 PPM

EAST SAN FERNANDO VALLEY
1969 - 1971

DATE	INST. MAX.	MAX 1-HOUR	8-HR. AVG.	HOUR[a]
1969				
1-2	30	30	23.4	23
3	28	28	22.4	00
6	33	33	29.0	23
7	35	35	30.5	01
3-25	25	24	21.1	23
26	24	24	20.8	00
10-6	26	24	20.1	22
29	44	41	31.3	21
30	38	37	28.9	22
31	42	42	35.3	23
11/1	35	34	34.8	00
2	33	31	27.8	00
3	19	19	20.3	00
21	34	32	26.1	23
22	36	34	28.8	01
23	27	27	25.4	00
24	33	32	23.0	22
25	40	35	28.6	21
26	60	51	35.6	21
27	19	19	24.9	00
12-6	29	24	20.0	23
7	29	27	21.0	02
10	32	29	22.6	23
11	28	26	23.1	22
12	59	54	41.6	22
13	34	33	36.3	00
14	27	27	23.1	00
15	45	43	34.0	23
16	42	41	35.5	01
24	26	25	20.3	23
25	31	29	22.3	03
30	27	27	21.0	23
31	41	28	29.4	23
1970				
1-1	39	38	34.5	02
2	29	24	22.0	00
20	30	28	23.3	23
21	27	26	24.0	00
22	32	30	28.6	23
23	30	29	28.1	00
2-6	47	46	35.6	23
7	44	44	34.9	00
8	35	34	25.6	00
9	25	24	20.1	02
1970				
3-12	25	24	20.3	23
13	23	23	20.8	01
9-26	27	25	21.6	23
27	24	23	21.6	00
10-2	31	30	20.8	05
29	36	35	27.0	23
30	29	29	27.1	00
31	33	33	26.9	23
11-1	32	32	29.6	01
11	24	24	20.5	05
16	30	28	24.0	23
17	31	30	25.3	00
18	24	24	21.5	00
23	36	35	30.1	23
24	34	34	30.6	00
12-7	30	28	24.8	23
8	35	34	26.9	03
10	32	32	29.0	23
11	35	35	27.5	00
31	33	33	23.3	23
1971				
1-1	20	19	22.6	00
16	31	29	21.5	21
17	28	27	20.1	22
27	36	32	21.5	20
30	31	27	21.6	22
31	21	20	21.3	22
2-11	30	28	22.1	23
12	30	25	21.1	00
14	26	25	21.0	01
11-2	29	26	21.5	21
5	27	26	23.3	03
23	26	25	22.6	23
24	27	26	23.1	00
12-17	33	29	21.9	21

(a) Fourth hour of 8-hour period

TABLE IV-A-2

DAYS ON WHICH CARBON MONOXIDE 8-HOUR AVERAGE
EQUALLED OR EXCEEDED 20 PPM

WEST SAN FERNANDO VALLEY
1969 - 1971

DATE	INST. MAX.	MAX 1-HOUR	8-HR. DIM	HOUR[a]
1969				
1-5	27	27	20.3	23
6	35	31	26.3	22
7	22	21	23.9	00
10-31	42	40	38.3	23
11-1	47	45	38.6	00
3	31	29	23.8	23
4	28	24	23.3	00
9	25	24	20.1	00
21	32	32	26.0	23
22	32	31	32.3	23
23	42	38	32.4	00
12-12	39	36	28.6	23
13	42	42	32.9	23
14	49	36	32.4	00
15	34	28	25.5	00
25	24	24	20.4	00
29	28	27	21.8	23
30	27	26	21.9	23
31	37	34	27.6	23
1970				
1-1	30	28	27.9	00
7	28	26	23.0	23
8	29	26	23.1	00
20	29	28	21.3	22
21	23	22	20.8	00
22	37	36	30.4	23
23	39	35	29.9	00
10-1	26	25	22.0	23
2	24	23	22.0	00
9	30	29	22.6	23
10	26	26	23.1	00
29	54	54	41.4	22
30	33	33	37.4	00
31	36	35	31.1	23
11-1	35	34	31.5	00
10	33	33	26.5	23
11	35	34	27.4	00
15	28	27	21.1	23
16	41	40	34.9	22
17	31	31	32.1	00
20	30	30	23.6	23
11-21	27	30	24.8	00
23	41	41	34.4	23
24	40	39	32.8	00
12-3	34	33	27.3	23
4	29	28	26.5	00
5	25	24	22.0	23
6	30	30	25.0	23
7	40	40	32.0	22
8	31	30	30.0	00
11	28	26	22.6	23
12	37	37	29.8	23
13	39	38	31.5	01
25	33	33	24.9	23
26	30	30	24.9	00
27	29	29	22.9	00
29	29	27	24.5	23
30	26	25	24.0	00
1971				
1-9	31	30	22.9	23
10	25	25	23.1	00
16	26	26	20.6	01
20	29	24	20.5	01
25	38	37	27.6	22
26	31	28	26.3	00
28	37	35	29.4	23
29	41	37	30.1	23
30	32	30	29.9	00
31	37	35	29.0	23
2-1	31	30	28.0	00
8	25	23	20.5	23
9	26	24	20.8	00
11	33	31	29.3	23
12	35	33	28.0	00
13	32	29	24.5	23
14	29	25	24.1	00
10-8	26	24	20.5	23
9	23	20	20.0	00
11-4	37	34	27.6	22
5	24	23	25.5	00
9	36	33	25.4	22
10	23	22	23.6	00
23	29	24	20.4	23
24	33	30	25.3	23
25	26	21	23.9	23

(a) Fourth hour of 8-hour period

TABLE IV-A-3

DAYS ON WHICH CARBON MONOXIDE 8-HOUR AVERAGE
EQUALLED OR EXCEEDED 20 PPM

SOUTHWEST COASTAL
1969 - 1971

DATE	INST. MAX.	MAX. 1-HOUR	8-HR. AVG.	HOUR[a]
1969				
1-1	29	29	21.8	23
2	30	30	24.4	23
3	78	65	36.9	05
4	43	41	34.4	00
6	49	43	27.1	05
16	26	26	20.1	04
10-11	28	28	21.9	23
12	32	28	22.5	00
30	33	30	23.0	03
31	29	29	22.8	23
11-1	34	32	23.4	00
11	29	27	20.1	23
12	38	34	25.9	21
13	35	32	23.0	00
17	37	31	23.0	21
18	31	29	20.9	21
19	53	44	21.3	04
22	39	37	25.5	09
23	39	39	33.8	06
26	52	47	34.6	23
27	48	43	34.8	00
28	52	43	26.5	23
29	34	27	27.8	00
12-2	40	34	24.3	21
3	41	30	20.3	00
10	28	27	20.0	22
11	36	31	21.1	23
12	41	40	29.0	23
13	43	41	30.9	00
14	30	28	20.0	23
15	58	48	34.0	05
23	33	30	22.8	06
31	29	28	24.0	23
1970				
1-1	-	30	26.5	00
8	33	29	21.5	05
2-2	73	48	20.4	05
3	34	25	20.9	03
6	43	38	22.3	06
7	36	32	28.4	04
8	29	26	23.1	02
15	32	31	21.9	02
3-13	32	29	20.9	05
4-5	26	26	20.0	02
5-2	34	29	23.5	23
3	35	35	28.0	02
15	27	26	21.1	03
9-25	39	37	31.5	23
26	43	41	35.6	01
11-13	40	39	32.4	23
14	42	41	32.5	00
17	34	31	20.1	04
18	26	26	20.5	00
22	25	24	20.0	03
23	28	27	21.3	04
24	27	26	21.5	00
12-3	27	26	21.0	23
4	37	37	28.1	23
5	38	38	26.6	00
10	32	32	22.4	22
11	31	30	21.0	00
27	23	23	21.4	01
1971				
1-1	30	27	24.0	04
16	33	29	23.0	03
17	29	26	24.0	23
18	69	49	33.4	05
19	47	35	23.1	04
26	41	34	22.1	20
27	37	29	20.1	00
28	38	34	23.5	21
29	32	29	24.5	23
30	35	33	27.8	01
2-11	36	33	22.4	22
12	37	31	22.4	00
13	27	24	20.9	01
10-5	42	30	20.8	23
6	49	39	24.5	03
11	50	32	20.8	05
11-20	39	33	31.0	05
23	39	34	21.5	06

(a) Fourth hour of 8-hour period.

TABLE IV-A-4

DAYS ON WHICH CARBON MONOXIDE 8-HOUR AVERAGE
EQUALLED OR EXCEEDED 20 PPM

Southwest Coastal, West San Gabriel Valley, Central L. A.
1969 - 1971

DATE	INST. MAX.	MAX. 1-HOUR	8-HR. AVG.	HOUR[a]
1971	Southwest Coastal			
11-24	38	32	23.6	05
25	32	28	24.0	01
12-1	33	27	22.3	05
6	34	26	23.1	04
8	28	23	21.9	23
9	35	29	21.4	00
17	46	34	21.5	06
18	40	32	21.8	00
30	37	32	28.0	23
31	49	43	34.0	04
1969	West San Gabriel Valley			
1-1	25	23	20.9	01
11-26	33	25	20.0	20
12-12	51	41	25.8	21
13	38	30	23.9	21
15	52	49	30.1	20
16	34	33	23.9	20
31	36	32	28.3	23
1970				
1-1	33	31	29.9	00
8	31	29	20.3	21
21	29	28	22.8	17
22	44	42	27.4	21
23	28	27	24.4	00
2-2	30	26	20.6	22
4	31	27	22.3	22
5	32	32	20.3	00
6	43	37	27.6	22
7	36	26	24.5	00
10-29	43	37	24.6	21
31	30	29	22.6	22
11-1	33	24	20.5	00
13	39	35	20.1	21
16	29	28	22.9	21
17	33	29	23.9	21
23	43	42	28.4	21
24	23	19	22.3	00
12-4	30	28	20.8	21
7	29	28	23.9	21
31	32	30	25.9	23
1971				
1-1	30	30	25.6	00
15	33	27	20.0	21
16	42	39	22.1	21
18	57	35	23.8	21
19	34	26	21.4	20
25	35	33	23.1	20
1969	Central Los Angeles			
1-3	36	36	22.3	21
7	31	28	20.0	09
9-10	34	33	21.4	06
30	37	32	21.1	07
10-29	39	37	20.6	19
31	43	39	27.4	21
11-1	27	25	26.0	00
26	41	38	24.0	21
12-12	39	36	28.6	21
13	27	26	23.9	00
15	41	35	26.1	23
16	48	39	28.4	06
1970				
1-1	25	22	21.0	00
21	33	26	23.1	09
23	27	25	20.9	11
2-6	30	28	20.6	23
7	37	28	20.4	00
11-13	34	29	23.1	22
14	26	25	20.1	00
23	22	22	20.4	23
24	40	37	20.9	06
1971				
11-9	29	24	20.4	10

(a) Fourth hour of 8-hour period.

TABLE IV-A- 5

DAYS ON WHICH CARBON MONOXIDE 8-HOUR AVERAGE EQUALLED OR EXCEEDED 20 PPM.

SOUTHEAST, SOUTH COASTAL, POMONA-WALNUT VALLEY, NORTHWEST COASTAL

1969 - 1971

Date	Inst. Max.	Max. 1-Hour	8-Hr. Avg.	Hour[a]
1969		Southeast		
12-12-69	34	29	21.1	22
16	25	24	20.4	08
1970				
12-30-70	30	29	20.6	23
1971				
1-15-71	41	37	26.0	23
16	31	27	25.3	23
17	25	25	24.3	00
18	56	45	27.0	21
19	52	32	20.5	00
26	40	33	20.0	21
27	49	43	20.4	20
29	30	26	22.1	21
1969		South Coastal		
1- 3-69	33	31	25.0	22
4	30	28	23.8	00
10-31	25	23	20.6	00
11- 1	31	28	21.6	01
20	44	31	21.0	20
23	30	30	21.9	01
26	27	25	22.4	23
27	26	24	21.6	00
12-12	38	33	26.8	23
13	37	36	28.8	01
15	27	26	21.0	02
1970				
2- 8-70	31	26	21.1	01
10-30	31	31	21.9	07
11-13	46	44	33.0	20
14	33	32	29.9	00
17	25	24	21.6	04
24	24	23	20.3	01
12- 4-70	33	32	25.4	23
5	29	28	23.6	00
7	31	29	22.3	20
10	33	32	23.5	22
11	33	33	24.8	23
12	28	24	23.9	00
16	25	24	21.5	01
31	26	26	21.5	23
1971				
1- 1-71	30	29	25.8	03
17	28	23	23.5	23
18	38	32	26.4	06
19	42	41	26.1	05
28	37	31	20.6	19
29	29	27	21.9	23
30	32	28	23.8	02
2-10	27	24	20.5	23
12	31	25	20.9	23
13	32	28	22.4	01
1969		Pomona-Walnut Valley		
12-16-69	23	23	20.8	20
1970				
1-22-70	28	28	21.6	20
1969		Northwest Coastal		
1- 2-69	30	28	21.5	22
3	44	36	21.3	23
10-30	30	28	22.8	21
31	30	28	20.1	22
11- 1	24	24	20.6	23
2	30	27	20.8	00
26	41	41	30.6	22
27	21	21	24.8	00
12-12	36	33	23.9	21

(a) Fourth Hour of 8-Hour Period

continue on next page

TABLE IV-A-5 (cont.)

Date	Inst. Max.	Max. 1-Hour	8-Hr. Avg.	Hour
1970	Northwest Coastal (cont.)			
10-29-70	33	33	23.8	22
12- 4	30	30	21.9	22
31	30	28	22.5	23
1971				
1- 1-71	22	20	22.0	00
15	37	34	24.4	22
16	24	23	22.4	00
17	23	21	20.1	23
18	35	31	21.0	21
29	28	27	21.0	23
30	26	24	20.6	00

(a) Fourth Hour of 8-Hour Period

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