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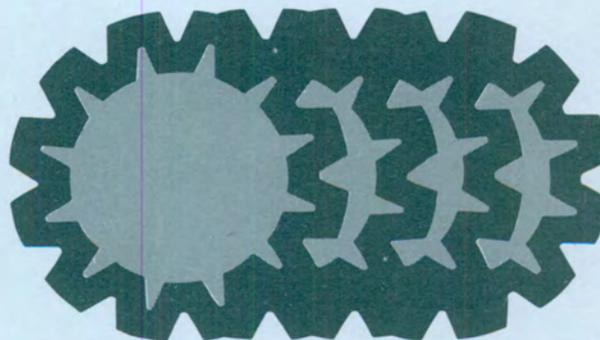
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CO In Vehicle Inspection Stations



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE / Public Health Service
Center For Disease Control / National Institute For Occupational Safety And Health

CO IN VEHICLE INSPECTION STATIONS
FEASIBILITY OF ACHIEVING THE NIOSH RECOMMENDED
CARBON MONOXIDE STANDARDS IN NEW JERSEY
MOTOR VEHICLE INSPECTION STATIONS

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Cincinnati, Ohio
September 1976

For sale by the Superintendent of Documents, U.S. Government
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HEW Publication No. (NIOSH) 76 – 200

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ABSTRACT

Environmental air sampling to determine exposure levels of carbon monoxide was conducted at thirty-one New Jersey Motor Vehicle Inspection Stations. This sampling was intended to supplement a mortality and morbidity study of the motor vehicle inspectors occupationally exposed to carbon monoxide.

Survey methods are explained along with factors which may hinder a correlation between the sampling data and the health status of the inspectors.

Based upon the survey, recommendations are made concerning the types of controls necessary for the inspection stations to meet the recommended NIOSH carbon monoxide standards.

ACKNOWLEDGMENTS

The authors appreciate the assistance and cooperation of the many people in the State of New Jersey Department of Law and Public Safety, Division of Motor Vehicles, who were involved with this study. We would also like to thank the following NIOSH personnel who assisted in collecting and analyzing the carbon monoxide samples: Ken Wallingford, Paul Johnson, Bob Phillips, Mitzi Preuss, Casey Sessions, and Don Turner.

INTRODUCTION

Established under the Occupational Safety and Health Act of 1970, the National Institute for Occupational Safety and Health (NIOSH) has the responsibility for conducting research for occupational safety and health standards. Recommendations from NIOSH are transmitted to the Department of Labor, which has the responsibility for the promulgation and enforcement of the standards. In 1972, NIOSH published a criteria document recommending the following levels for occupational exposure to carbon monoxide (CO)¹:

- 1) "Occupational exposure to carbon monoxide shall be controlled so that no worker shall be exposed at a concentration greater than 35 ppm (parts per million) determined as an 8-hour work day . . .
- 2) "No level of carbon monoxide to which workers are exposed shall exceed a ceiling concentration of 200 ppm."

As a means of confirming the protection offered to those workers who are continuously exposed to low levels of CO by the promulgation of this standard, the Division of Surveillance, Hazard Evaluations and Field Studies, NIOSH, initiated a combined mortality, morbidity and environmental study of New Jersey State motor vehicle inspectors in 1973-1974. This report documents the CO levels found in the working-areas of these vehicle inspectors during the environmental portion of the study and discusses the feasibility of achieving the NIOSH recommended standards in the New Jersey State Motor Vehicle Inspection Stations.

DESCRIPTION OF NEW JERSEY MOTOR VEHICLE INSPECTION STATIONS

New Jersey requires that all vehicles registered by the State be inspected at least once a year.² The inspections are performed at thirty-eight vehicle inspection stations located throughout the State. Each vehicle is inspected in assembly-line fashion as it stops in designated testing positions along the inspection lane, which is between 150-200 feet in length.

Although the testing procedures have been standardized in all thirty-eight motor vehicle inspection stations, variances occur in the surroundings of each inspection lane, from complete enclosure of the lane in a building with openings at each end for vehicles to enter and exit (figure 1); to partial enclosure of the lane which has a roof but almost no surface walls (figure 2); to no enclosure of the lane, where inspections are conducted outdoors (figure 3).

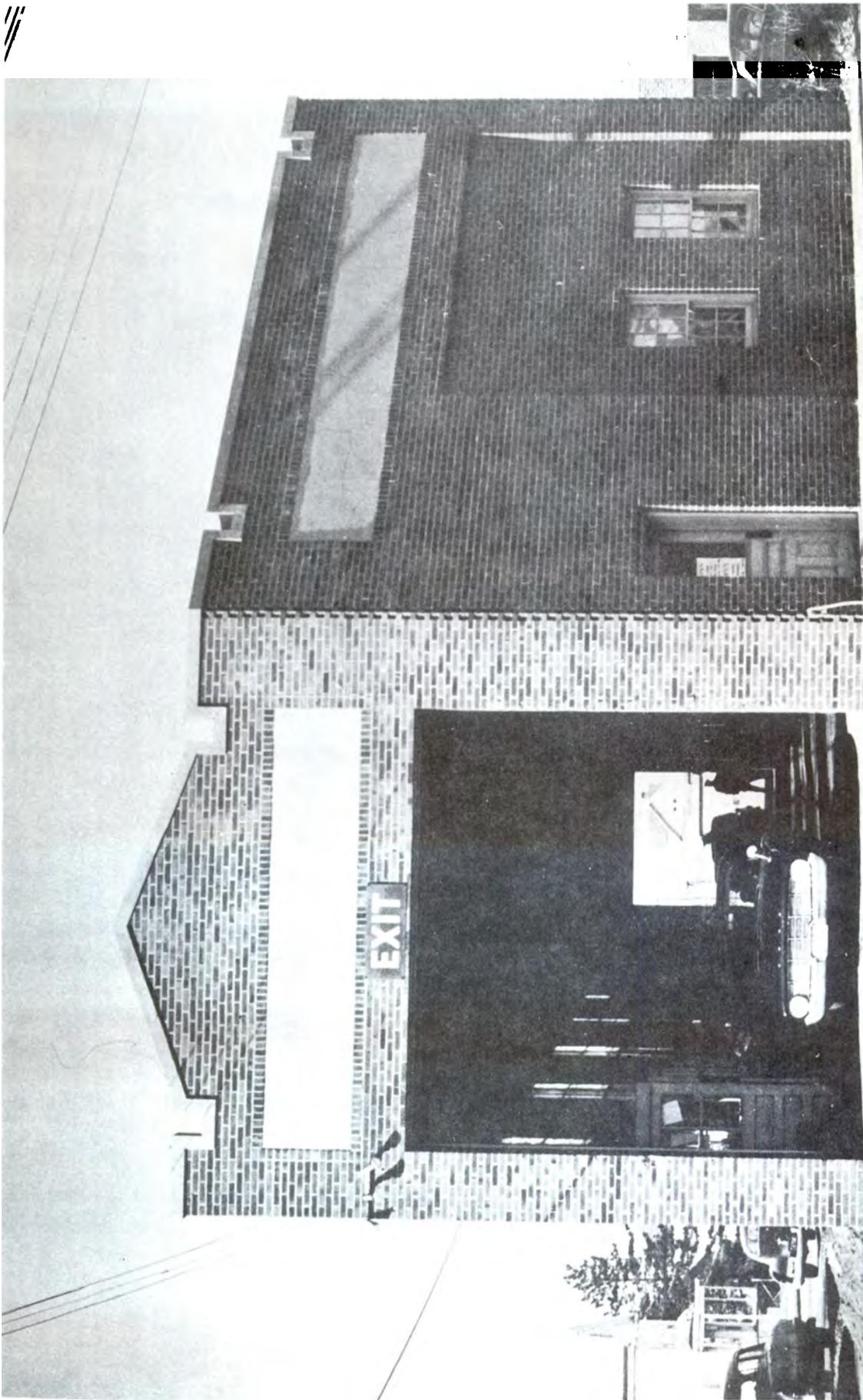


FIGURE 1
EXIT-END OF AN ENCLOSED, OLD STYLE, NEW JERSEY STATE MOTOR VEHICLE
INSPECTION STATION



MOTOR VEHICLE INSPECTION STATION

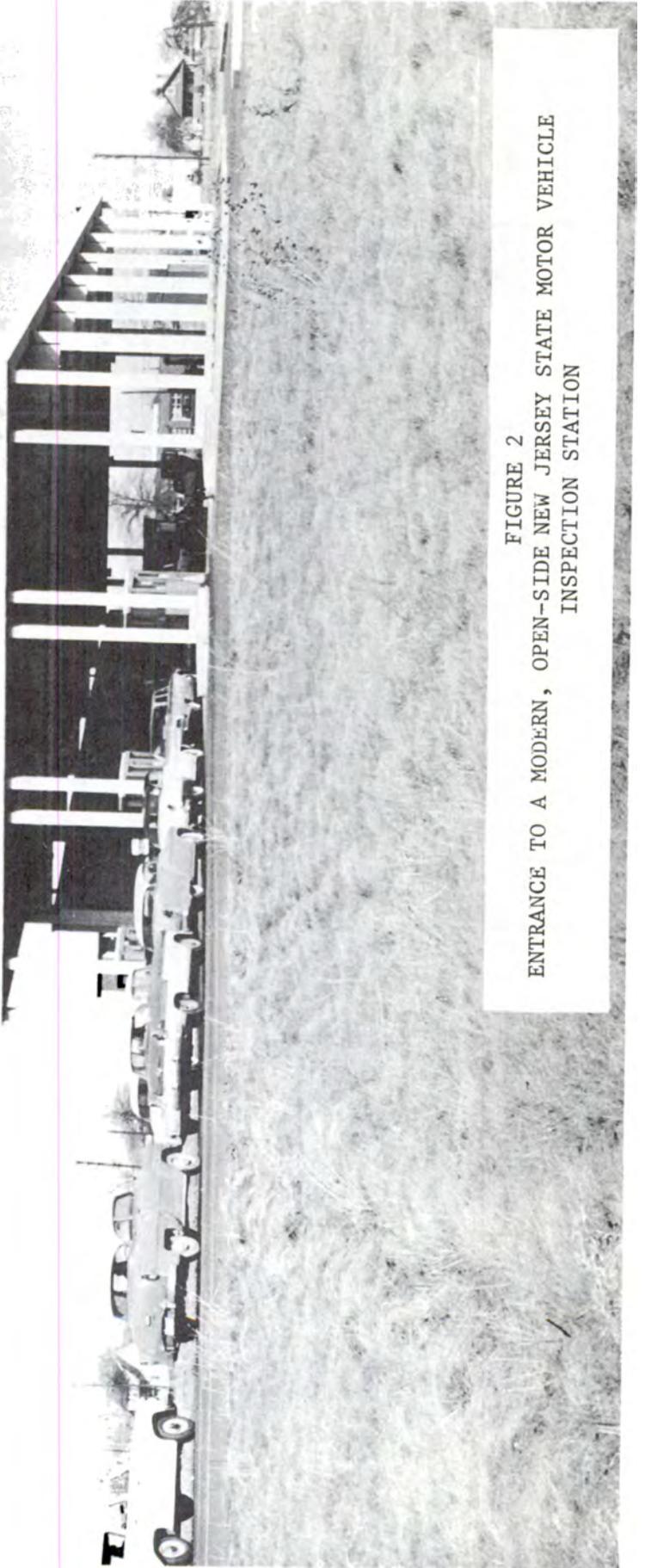


FIGURE 2
ENTRANCE TO A MODERN, OPEN-SIDE NEW JERSEY STATE MOTOR VEHICLE
INSPECTION STATION

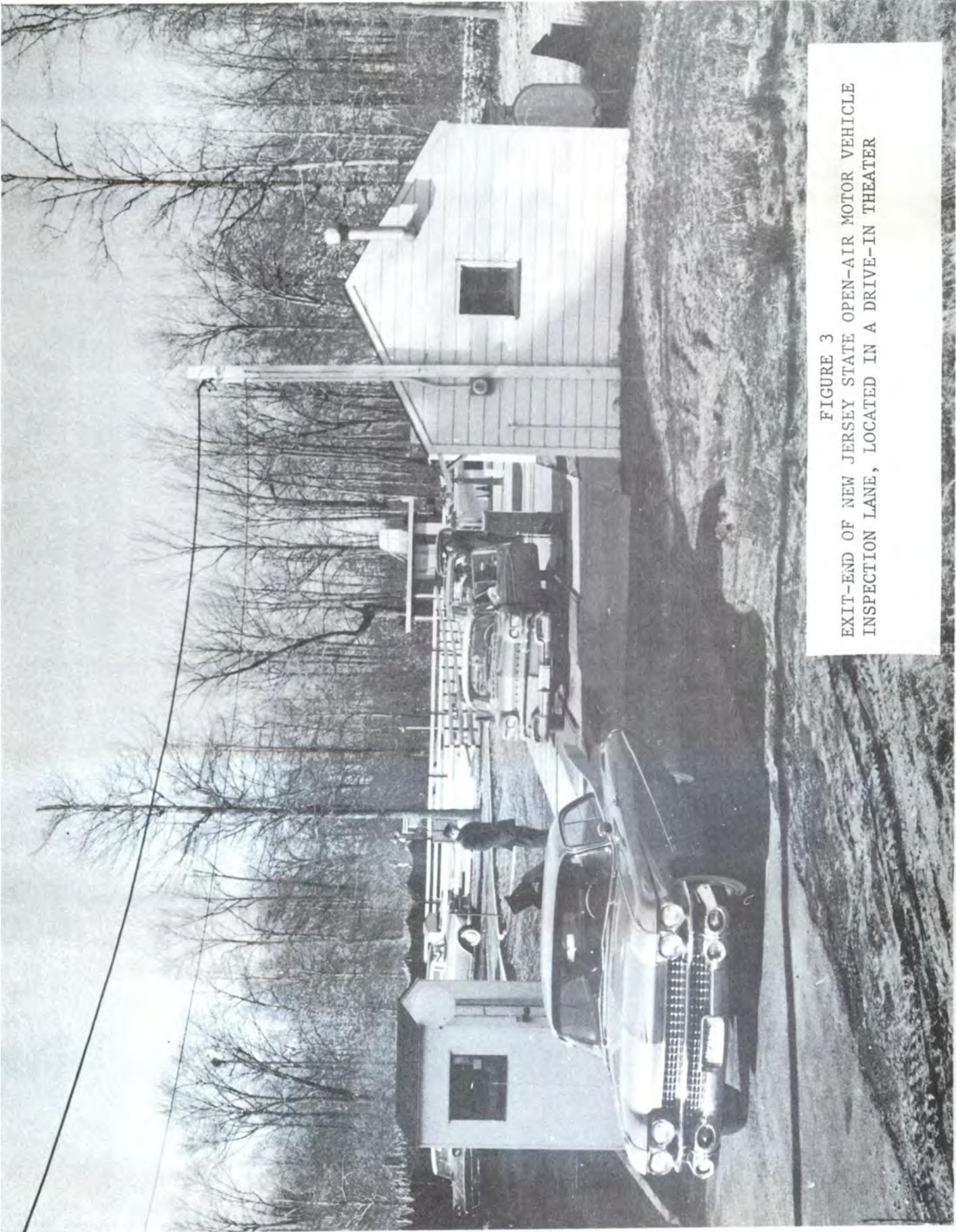


FIGURE 3
EXIT-END OF NEW JERSEY STATE OPEN-AIR MOTOR VEHICLE
INSPECTION LANE, LOCATED IN A DRIVE-IN THEATER

SURVEY METHODS

All thirty-eight motor vehicle inspection stations are listed in Appendix I, appearing in groups of stations which have similar architectural and ventilating features. Environmental sampling to determine CO exposure was conducted at thirty-one of the inspection stations using the following sampling methods.

Electronic CO meters (Ecolyzers made by Energetics Science, Inc., Model #2100) were used for all CO measurements. The Ecolyzers are generally accurate within ± 1 ppm on the 0-100 scale and ± 6 ppm on the 0-600 ppm scale.³ Each Ecolyzer was calibrated daily. Although these instruments can be used in a portable mode, they were operated on 120 volt outlets as a precautionary measure against failing batteries. Originally set on the 0-100 ppm scale, the meters were watched closely during the first few hours of each day of sampling to determine if the 0-600 ppm scale was more appropriate. Samples were taken as close to the breathing zone of the inspectors as possible. In single lane inspection stations, three sampling positions were chosen to give a general area average exposure. From those stations with two or more inspection lanes, the number of working positions sampled was normally increased to six.

Data storage of the CO measurements was accomplished with continuous strip-chart recorders connected to each Ecolyzer. Peak CO levels were read directly off the recorder strip-charts, but for purposes of determining average exposures the method of data reduction outlined by Smith and Nelson was followed.⁴ Daily averages for any given motor vehicle inspection station were obtained by computing the arithmetic mean of the hourly averages from the strip-chart(s) recorded that day.

Twenty-seven volunteer inspectors were given pre-shift and post-shift carboxyhemoglobin (COHb) tests. The tests were administered by breath analysis which gave an indication of CO exposure. To estimate COHb levels from expired air, the method developed by Ringold et al, was used.⁵ COHb levels were computed using the following equation:

$$\text{COHb in Percent} = 1.5 (\text{C}) \text{ of Expired Air in ppm}/5$$

The only other instruments used in this study were Anor Velometers, to determine wind velocities. Measurements were taken every two hours unless variations in velocities required additional sampling. Wind velocities were taken because of the diluting effect of the wind on CO concentrations within the vehicle inspection stations. The velometers were held approximately five feet above the floor in the general working areas of the vehicle inspectors during the wind measurements. Daily averages were computed as the arithmetic mean of the bi-hourly measurements.

SAMPLING RESULTS AND INTERPRETATION OF DATA

The results of the 117 days of CO monitoring conducted over an eight-month period are presented in Appendix I and summarized in Table I.

Associated with each daily CO average listed in Appendix I are corresponding values for "vehicle/hour" and wind velocity. The vehicle/hour value indicates the activity of the inspection station during the sampling period. The values were computed by dividing the total number of vehicles inspected per hour at the station (information provided by the station supervisor) by the number of inspection lanes located at the station. The wind velocity "value" is a semi-quantitative measurement of the air movement near the inspection lanes. A sampling period with wind velocity measurements averaging less than 150 feet per minute (fpm) is recorded in the appendix as calm. Sampling periods which average 150-300 fpm are recorded as breeze, and sampling periods which averaged greater than 300 fpm are recorded as windy.

An indication of the ambient exposure to CO can be obtained from the final column of Appendix I which presents the lowest CO value recorded during the sampling period.

Table I separates the outdoor vehicle inspection stations from all other stations because the CO exposures found in the outdoor stations were consistently lower than those exposures generally found in the other stations. This fact should be important for any morbidity or mortality studies performed on this population of vehicle inspectors. It should be noted that the averages presented in Table I are averages of the daily averages presented in Appendix I.

The results of the breath analysis for COHb levels are listed in Table II along with the corresponding daily average exposure values recorded in Appendix I. It is not intended that this very limited comparison between area sampling and COHb levels prove the validity of areas sampling for CO. However, there is a direct relationship between the increase in measured area CO levels and the corresponding percent increase between pre- and post-COHb levels (COHb levels of smokers were not considered since they are artificially elevated by CO exposure from smoking). It should be noted that four of six inspectors at the Asbury Park inspection station had estimated COHb levels of 4.7 percent and higher, even though the general area exposure to CO was shown to be a seemingly low 20 ppm. Assuming the breath analysis tests were conducted properly, this may be an indication that the environmental sampling procedure under-estimates the actual CO exposure. Studies need to be conducted to validate the use of general area CO sampling before they are used for compliance purposes since the intent of the NIOSH recommended standard is to insure that no worker (non-smoker) exceeds the recommended five (5) percent COHb level.

Table III presents information concerning ambient exposure to CO in New Jersey as provided by the New Jersey State Health Department. The Table lists average ambient CO levels for 1973 as recorded at twenty testing stations which are part of the New Jersey Continuous Air Monitoring Network. The Table also lists the maximum hourly average CO concentration recorded at each station during the year. Although the annual averages are generally insignificant when compared to occupational exposure to CO, it is apparent from the maximum hourly averages that the ambient concentrations can be a major factor when considering occupational standards at 35 ppm.

ACHIEVING RECOMMENDED CARBON MONOXIDE STANDARDS

With improved work practices, most of the vehicle inspection stations could comply with the NIOSH recommended standard for CO of 35 ppm TWA. The NIOSH standard was exceeded only on 11 of the 117 days of sampling. However, all stations had peak levels of CO which exceeded the NIOSH recommended ceiling of 200 ppm. Achieving this NIOSH recommended standard may require extensive revisions in the motor vehicle inspection procedures and/or the inspection facilities themselves.

An example of the nature of this problem is given in Table IV which documents the peak levels recorded during thirty minutes of personal "breathing-zone" sampling conducted at the auto-emissions testing position at the Atco inspection station. In testing for auto emissions, the inspector inserts the tip of the probe (approximately five feet in length) into the exhaust pipe of the vehicle being tested. A total of eleven vehicles were inspected and five produced enough CO to cause peak exposures above the 200 ppm ceiling level recommended by NIOSH, even though the average CO exposure over the thirty-minute period was less than 15 ppm. Although this represents an extreme example of the problem, the strip-chart recordings during the 117 days of CO sampling demonstrated that the 200 ppm ceiling level was generally exceeded at least ten times during a working day at one of the testing positions. The strip-charts also documented extreme variations in peak exposures from one testing position to another. A five-hour sampling period at the Asbury Park inspection station resulted in a general area average exposure value of 20 ppm, while the inspector at the second testing position was exposed to thirty-four peaks above 200 ppm, with eleven of those peaks above 500 ppm. The health effects of these peak exposures are questionable since they normally last for less than 30 seconds, but they do exceed the NIOSH recommended ceiling level of 200 ppm which presently does not consider the length of exposure.

It should be noted that the Atco station (previous example) is a single-lane, outdoor inspection station representing the optimum "fresh-air" environment when compared to the enclosed and semi-enclosed inspection stations. Achieving the 200 ppm ceiling level at even this station would require that almost all auto emissions be removed from the inspectors. A system of local exhaust could be used for this purpose.

Insuring compliance with a 35 ppm TWA standard would be much easier in comparison to achieving the 200 ppm ceiling standard. As mentioned previously, the recommended TWA standard was only exceeded on eleven of the 117 days of sampling. A program of continuous CO monitoring could alert a station supervisor that the CO exposure levels were rapidly approaching a 35 ppm TWA. He would then have the option of decreasing the rate of inspections, closing down one of the inspection lanes (for multi-lane stations), or stopping all inspections completely. From the data presented in Appendix I, it would be expected that the enclosed and semi-enclosed inspection stations would require this decrease of operations on three or four days per month. A public relations program may be appropriate to quell possible complaints resulting from the inspection delays.

The following suggestions would also be useful in lowering the TWA exposure to CO.

- 1) Vehicles awaiting inspection should be far enough away from the inspection lanes so that exhaust does not contribute to the exposure of the inspectors.
- 2) Inspectors should be rotated so that no inspector works an entire day at a high exposure position.
- 3) Fresh air should be supplied to the inspection booths.
- 4) All inspectors should be encouraged not to smoke since COHb levels are raised by smoking.

CONCLUSIONS

The CO sampling presented in this report was initiated to supplement mortality and morbidity studies of the occupational related health effects of chronic exposure to low concentrations of CO. There are at least three major factors which will confound any correlation between the CO data presented and any health effects experienced by the New Jersey motor vehicle inspectors. These factors are: 1) exposures to toxic substances, including CO, while off work; 2) exposures to toxic substances other than CO while working; and 3) the extreme variations in levels of exposure to CO.

The problem of assessing the health effects from toxic substances to which a worker may be exposed to while not working is a common weakness, if the toxic substance is a common pollutant, as is CO. Besides the obvious control for smoking habits, the variations in ambient exposure to CO between metropolitan and rural areas of New Jersey should be tested for significance during any health analysis. It also may be necessary to consider the amount of time each inspector spends driving to work since this could provide a major source of CO exposure.

CO is only one of numerous known toxic substances found in auto exhaust (i.e., lead aldehyde, hydrocarbons, oxides of nitrogen). Although it may be possible to estimate exposures to the other toxic substances on the basis of measures CO levels,⁵ it would be extremely difficult to pinpoint a specific substance as the cause of any adverse health effects. In fact, the "substance" at fault may be a combination of different toxic substances.⁶ It may be more appropriate to consider any morbidity or mortality studies of the motor vehicle inspectors as studies of the "Health Effects of Exposures to Automotive Emissions."

Variations in levels of carbon monoxide exposure have two areas of concern: 1) variations of CO levels measured from day to day and 2) peak exposures to CO levels which may vary from minute to minute. Daily CO averages measured at the Wayne and Deptford inspection stations range from a low of 11 ppm to a high of 38 ppm while the Paramis station starts with a low of 22 ppm and climbs to a high of 105 ppm. Variations in measurements such as these indicate a need for more comprehensive sampling at some of the inspection stations.

The peak exposures introduce a challenge to the two part CO standards recommended by NIOSH.¹ The original purpose of the concurrent morbidity and mortality studies of the New Jersey vehicle inspectors was to document the health effects of chronic exposures to CO. Although these workers are generally exposed to levels at or below the 35 ppm TWA standard recommended by NIOSH, they are often exposed to CO levels above the recommended ceiling of 200 ppm for brief periods of time. If it is assumed that the 200 ppm ceiling standard has been recommended to prevent adverse health effects from peak exposures to CO, then it may be impossible to determine if the excess in morbidity or mortality patterns found in the New Jersey population was caused by exposures to low concentrations of CO or by the exposures to the peak concentrations. If, however, there is no excess in either morbidity or mortality patterns in the population, then the recommended ceiling standard for CO should possibly be reevaluated. Such a reevaluation could result in either an increase in the ceiling concentration or a specification in the length of time the 200 ppm level can be exceeded.

In conclusion, any morbidity or mortality studies of the adverse effects of chronic exposures to CO using the population of New Jersey motor vehicle inspectors would have to resolve the problems associated with the three confounding factors mentioned above. However, if no excess in mortality or morbidity patterns are found in this population, even though the inspectors are being exposed to peak levels of CO above the 200 ppm ceiling level recommended by NIOSH, then these studies could be useful in reevaluating the recommended standard.

Table I

SUMMARY OF CARBON MONOXIDE RESULTS
 FOR NEW JERSEY MOTOR VEHICLE INSPECTION STATIONS
 August 29, 1973 - May 10, 1974

No. of Days Sampled	Cars/Lane-Hour			Carbon Monoxide TWA (ppm)		
	Mid-90% Range* Low - High	Average	Standard Deviation	Mid-90% Range Low - High	Average	Standard Deviation
16	17 50	35.0	10.4	4 21	10.0	6.4
97	15 45	31.1	9.0	11 40	24.4	13.3

Outdoor Station

All Other Stations

*The figures appearing in the lower 5% and upper 5% were not included.

Table II

NEW JERSEY MOTOR VEHICLE INSPECTION STATIONS
CARBON MONOXIDE STUDY

Breath Analyses for Carboxyhemoglobin

<u>Measured Carbon Monoxide</u>			<u>Estimated COHb</u> (per cent)		<u>Δ%</u>
<u>Working Position</u>	<u>Pre-Shift</u>	<u>Post-Shift</u>	<u>Pre-Shift</u>	<u>Post-Shift</u>	
Plainfield-Outside Lane, General Area Exposure < 10 ppm					
1 Lift	6	12	1.7	2.9	1.2
2 Lift	7	12	1.9	2.9	1.0
*3 Lift	39	40	8.3	8.5	0.2
4 Lights and Brakes	4	17	1.3	3.9	2.6
*5 Lights and Brakes	23	35	5.1	7.5	2.4
Plainfield-Inside Lane, General Area Exposure = 20 ppm					
6 Lift	5	15	1.5	3.5	2.0
7 Lift	5	16	1.5	3.7	2.2
8 Lift	6	15	1.7	3.5	1.8
9 Lift	12	12	2.9	2.9	0
10 Lights and Brakes	5	20	1.5	4.5	3.0
*11 Lights and Brakes	30	29	6.5	6.3	0.2
Eatontown, General Area Exposure = 14 ppm					
12 Lift	8	17	2.1	3.9	1.8
13 Lift	9	18	2.3	4.5	1.8
*14 Lift	38	36	8.1	7.7	-.4
15 Lights and Brakes	6	11	1.7	2.7	1.0
16 Lights and Brakes	8	13	2.1	3.1	1.0
17 Lights and Brakes	9	12	2.3	2.9	0.6
*18 Lights and Brakes	18	22	4.1	4.9	0.8

*Smokers

Table II (continued)

NEW JERSEY MOTOR VEHICLE INSPECTION STATIONS
CARBON MONOXIDE STUDY

Breath Analyses for Carboxyhemoglobin

<u>Measured Carbon Monoxide</u>		<u>Estimated COHb (per cent)</u>		
<u>Working Position</u>	<u>Pre-Shift</u>	<u>Post-Shift</u>	<u>Pre-Shift</u>	<u>Post-Shift</u>
Eatontown, General Area Exposure = 14 ppm				
*19 Sticker	23	25	5.1	5.5
*20 Sticker	35	33	7.5	7.1
Asbury Park, General Area Exposure = 20 ppm				
21 Lift	11	21	2.7	4.7
22 Lift	12	25	2.9	5.5
*23 Lift	17	41	3.9	8.7
24 Lights and Brakes	9	12	2.3	2.9
25 Lights and Brakes	9	21	2.3	4.7
26 Lights and Brakes	15	22	3.5	4.9
27 Sticker	9	13	2.3	3.1
				<u>Δ%</u>
				0.4
				0.4
				2.0
				2.6
				4.8
				0.6
				2.4
				1.4
				0.8

*Smokers

Table III

AMBIENT LEVELS OF CARBON MONOXIDE AS PROVIDED BY THE
NEW JERSEY STATE HEALTH DEPARTMENT
DURING THE 1973 YEAR

New Jersey Motor Vehicle Stations
Carbon Monoxide Study

CITY	MAXIMUM HOURLY AVERAGE OF CO (ppm)	ANNUAL AVERAGE CO LEVEL (ppm)
Ancora	14.9	1.43
Asbury Park	16.7	2.63
Atlantic City	21.0	3.8 ^a
Burlington	32.8	4.93
Freehold	55.0	3.62
Bayon	18.4	1.77
Camden	34.4	3.10
Elizabeth	52.2	5.10
Newark	40.6	4.70
Hackensack	31.4	3.78
Jersey City	33.6	6.27
Morristown	40.6	6.13 ^b
Patterson	71.9	5.01
Paulsboro	26.8	4.08
Pennsgrove	33.7	3.58
Phillipsburg	17.8	2.04
Pirth Amboy	30.5	5.69
Sommerville	56.6	4.69
Toms River	30.5	4.06
Trenton	41.6	6.12

a - Only six months of monitoring

b - Only nine months of monitoring

Table IV

PEAK EXPOSURES TO CARBON MONOXIDE

New Jersey Motor Vehicle Inspection Station
Carbon Monoxide Study

ATCO STATION

Vehicle	CO Emissions From Vehicle (ppm)	Peak CO Exposure To Inspector (ppm)
1	8K	200
2	10K	50
3	40K	350
4	60K	125
5	15K	50
6	75K	>600
7	40K	400
8	90K	>600
9	35K	75
10	10K	50
11	65K	>600

a - Results of auto emission test for carbon monoxide with test probe inside exhaust pipe of vehicle

b - Breathing zone sample as recorded by an Ecolyzer Maximum value on scale is 600 ppm

*K = 1000

REFERENCES

1. National Institute for Occupational Safety and Health, "Criteria for a Recommended Standard . . . Occupational Exposure to Carbon Monoxide". DHEW Publication No. (HSM) 73-11000, 1972.
2. State of New Jersey, Department of Law and Public Safety, Division of Motor Vehicles, "Report on the Motor Vehicle Inspection Program and Its Relationship to Highway Safety". September, 1969.
3. Carl D. Parker and R.B. Strong, "Evaluation of Portable, Direct-Reading Carbon Monoxide Meters". HEW Publication No. (NIOSH) 75-106.
4. Franklin Smith and A. Carl Nelson, Jr. "Guidelines for Development of a Quality Assurance Program: Reference Method for the Continuous Measurement of Carbon Monoxide in the Atmosphere". Environmental Protection Agency No. EPA-R4-73-028a, June, 1973.
5. Alan Ringold, M.D. et. al., "Estimating Recent Carbon Monoxide Exposures: A Rapid Method". Arch. Env. Hlth. 5: 308-318, 1962.
6. Stephen, M. Ayres, M.D. et. al., "Health Effects of Exposure to High Concentrations of Automative Emissions". Arch. Env. Hlth., Vol. 27.

APPENDIX

CARBON MONOXIDE LEVELS
New Jersey Motor Vehicle Inspection Stations
August 29, 1973 - May 10, 1974

Station	Date	Hours Sampled	Average CO Conc. (ppm)	Cars/Lane Hour Avg.	Wind Measmt.	Lowest CO Conc. (ppm)
Group 1: "OLD STYLE" ENCLOSED SINGLE LANE STATIONS						
Bridgeton	3/29/74	7	33	40	Windy	<5
	4/ 7/74	8	34	45	Calm	<5
Cape May	NO ENVIRONMENTAL DATA					
Flemington	NO ENVIRONMENTAL DATA					
Freehold	4/ 3/74	12	23	36	Breeze	<5
	4/ 4/74	9	25	23	Windy	<5
	4/ 5/74	3	26	16	--	<5
	4/ 2/74	7	32	34	Breeze	<5
Mt. Holly	3/22/74	6.5	16	33	Breeze	9
	3/27/74	7	18	42	Calm	<5
	3/26/74	8	20	34	Breeze	<5
	5/ 7/74	6	22	--	--	10
	3/25/74	8	34	32	Calm	<5
Newton	NO ENVIRONMENTAL DATA					
Plainfield	3/20/74	7	17	31	Calm	<5
	6/30/75	4	20	43	Windy	<5
Ridgewood	11/27/73	7	9	44	Breeze	<5
	11/30/73	6	23	36	Breeze	<5
	11/29/73	8	49	43	Calm	<5
Salem	3/29/74	4.5	12	33	Windy	<5
	4/ 2/74	9	25	32	Breeze	<5
	4/ 1/74	8.5	38	33	Windy	<5
Somerville	3/18/74	4	25	44	Calm	<5
	3/20/74	9	28	32	Breeze	6
	3/21/74	8	29	--	--	<5
	3/19/74	12	33	45	Calm	7

CARBON MONOXIDE LEVELS (Continued)
 New Jersey Motor Vehicle Inspection Stations
 August 29, 1973 - May 10, 1974

Station	Date	Hours Sampled	Average CO Conc. (ppm)	Cars/Lane Hour Avg.	Wind Measmt.	Lowest CO Conc. (ppm)
Toms River	NO ENVIRONMENTAL DATA					
Washington	NO ENVIRONMENTAL DATA					
Westfield	3/13/74	9	26	36	--	<5
Group II: "OLD STYLE"/MULTI-LANE STATIONS						
Asbury Park (two lanes)	7/ 2/75	6	20	25	Breeze	<5
Atlantic City (two lanes)	9/ 4/73 8/31/73	7 6	12 28	25 --	Windy Windy	<5 <5
Jersey City (three lanes)	12/18/73 12/19/73 12/10/73 12/11/73 12/12/73	6.5 6.5 6.5 8.5 7	9 13 16 18 23	15 13 21 20 15	Breeze Breeze Windy -- Breeze	<5 <5 <5 <5 <5
Montclair (two lanes)	12/ 7/73 12/ 6/73 12/ 5/73	7 8.5 7	22 30 33	-- 26 13	Breeze Breeze Breeze	<5 <5 <5
Morristown (two lanes)	12/13/73 12/14/73 12/12/73 12/10/73	5.5 5 10 6	12 15 36 47	25 25 32 32	Breeze Breeze Breeze Calm	<5 <5 <5 <5
Newark (four lanes)	12/13/73 12/15/73 12/12/73 12/11/73 12/18/73 12/10/73	7 5 8.5 5 6 5.5	2 12 20 23 29 43	21 26 23 26 15 27	Windy Breeze Breeze Breeze Breeze --	<5 <5 <5 <5 <5 <5

CARBON MONOXIDE LEVELS (Continued)
 New Jersey Motor Vehicle Inspection Stations
 August 29, 1973 - May 10, 1974

Station	Date	Hours Sampled	Average CO Conc. (ppm)	Cars/Lane Hour Avg.	Wind Measmt.	Lowest CO Conc. (ppm)
Group III: THREE LANE ENCLOSED STATIONS						
Camden	9/ 6/73	7	7	29	Windy	<5
	3/16/74	9	16	45	Calm	6
	3/25/74	8	24	42	Breeze	8
	3/28/74	5	27	32	Breeze	<5
	3/22/74	9	30	36	Breeze	<5
	3/27/74	9	31	43	Breeze	<5
	5/ 8/74	4	31	--	--	<5
	8/29/74	8.5	65	33	Calm	<5
Eatontown	4/ 4/74	8	21	--	--	6
	4/ 2/74	5	32	31	Windy	7
	7/ 1/75	7	14	36	Windy	<5
Trenton	5/ 6/74	5	16	--	--	<5
	9/ 5/73	8.5	31	30	Breeze	<5
	8/30/73	6.5	40	33	Calm	<5
Wayne	12/ 6/73	8.5	11	29	Windy	<5
	12/ 5/73	9	27	31	Windy	<5
	12/ 4/73	8	29	33	Breeze	<5
	12/ 3/73	8.5	38	34	Breeze	<5
Group IV: THREE LANE SEMI-OPEN STATIONS						
Lodi	11/28/73	8	14	36	Windy	<5
	11/30/73	6	14	34	Windy	<5
	12/ 3/73	7	17	31	Calm	<5
	12/ 4/73	8	22	28	Windy	<5
	12/ 5/73	8	25	29	Windy	<5
	11/27/73	7	38	36	Windy	<5

CARBON MONOXIDE LEVELS (Continued)
 New Jersey Motor Vehicle Inspection Stations
 August 29, 1973 - May 10, 1974

Station	Date	Hours Sampled	Average CO Conc. (ppm)	Cars/Lane Hour/Avg.	Wind Measmt.	Lowest CO Conc. (ppm)
Paramus	12/ 3/73	3	22	34	Windy	<5
	12/ 5/73	8	27	29	Breeze	<5
	11/30/73	8.5	27	36	Breeze	<5
	11/28/73	7	30	37	Breeze	<5
	12/ 4/73	8	40	34	Breeze	<5
	11/27/73	7.5	105	34	Calm	<5
Rahway	3/14/74	5	27	--	Breeze	<5
	3/15/74	9	34	30	Breeze	<5
Group V: OUTDOOR SINGLE LANE STATIONS						
Atco	3/27/74	7	4	53	Windy	<5
	3/26/74	7	13	50	Calm	<5
	3/24/74	6.5	13	45	Windy	7
Hackensack	12/ 3/73	7.5	11	40	Windy	<5
Livingston	12/11/73	6.5	5	27	Windy	<5
	12/12/73	8	5	32	Windy	<5
	12/14/73	3	6	17	Windy	<5
	12/13/73	6	7	24	Windy	<5
	12/10/73	8.5	11	36	Windy	<5
North Brunswick NO ENVIRONMENTAL DATA						
Saddle Brook	11/30/73	5	2	37	Windy	<5
	12/ 6/73	7	10	34	Windy	<5
	12/ 7/73	7	16	34	Windy	<5
	12/ 4/73	7	21	44	Breeze	<5
	12/ 3/73	2	25	34	Windy	10
Union	3/18/74	6	4	36	Windy	<5
	3/20/74	8.5	7	17	Breeze	<5

CARBON MONOXIDE LEVELS (Continued)
 New Jersey Motor Vehicle Inspection Stations
 August 29, 1973 - May 10, 1974

Station	Date	Hours Sampled	Average CO Conc. (ppm)	Cars/Lane Hour Avg.	Wind Measmt.	Lowest CO Conc. (ppm)
Group VI: MISCELLANEOUS STATIONS						
Deptford	3/22/74	6	11	22	Breeze	<5
	3/25/74	8	13	30	Breeze	<5
	3/28/74	6	16	39	Windy	8
	3/27/74	8	18	37	Breeze	8
	5/ 9/74	6	18	--	--	<5
	3/26/74	8	38	30	Calm	22
Highland Park	3/13/74	8	11	40	Windy	<5
	3/14/74	12	14	41	Windy	<5
	3/12/74	8	14	41	Windy	<5
	3/15/74	6	34	41	Breeze	<5
Manahawkin	NO ENVIRONMENTAL DATA					
Millville	3/30/74	7	13	47	Windy	7
	3/29/74	8	18	54	Breeze	8
	4/ 1/74	8	23	47	Breeze	<5
Secaucus	12/18/73	8	9	9	Windy	<5
	12/19/73	7.5	12	34	Windy	<5
	12/10/73	7	12	21	Windy	<5
	12/13/73	8	14	15	--	<5
	12/14/73	6	16	16	Windy	<5
	12/12/73	9	17	19	Breeze	<5
Whippany	12/12/73	8	18	25	Breeze	<5
	12/10/73	6	23	26	Windy	<5
	12/11/73	6	24	29	Windy	<5
	12/13/73	7	26	27	Calm	<5
	12/14/73	6	28	28	Calm	<5

