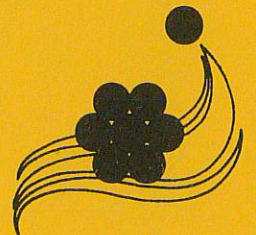


KNECHTEL

1984
AIR QUALITY
DATA SUMMARY

For Counties Of
King
Kitsap
Pierce
Snohomish



PUGET SOUND
AIR POLLUTION CONTROL AGENCY

Puget Sound Air Pollution Control Agency

Serving King, Kitsap, Pierce and Snohomish Counties

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1984
AIR QUALITY
DATA SUMMARY

measured and compiled by the
Technical Services Division

PUGET SOUND
AIR POLLUTION CONTROL AGENCY
200 West Mercer Street
P.O. Box 9863
Seattle, Washington 98109

1984 AIR QUALITY DATA SUMMARY

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REFERENCE COPIES OF THIS SUMMARY HAVE BEEN PLACED IN PUBLIC AND COLLEGE LIBRARIES WITHIN THE PUGET SOUND REGION. INDIVIDUAL COPIES ARE FOR SALE AT THE PUGET SOUND AIR POLLUTION CONTROL AGENCY SEATTLE HEADQUARTERS OFFICE.

PRICE: \$4.00 (plus \$2.00 postage and handling if mailed)

PUBLISHED JUNE, 1985
 TECHNICAL SERVICES DIVISION
 (206) 344-7326

INTRODUCTION

This thirteenth annual data summary presents air quality and meteorological data measured in the Puget Sound Region during 1984. The report begins with a table outlining the sampling network (with addresses) and a map of the network. Within the report are summaries of pollutant measurements together with interpretive comments. The last sections present meteorological data consisting of lower atmosphere temperature soundings, wind roses, and stability wind roses. The outside back cover outlines the National, Washington State, and Puget Sound Region ambient air quality standards. Summaries within the report show whether the actual pollutant levels in the Puget Sound Region meet or exceed these standards.

The year 1984 completes two years in a row without an Air Stagnation Advisory. This should be kept in mind during any review or determination of trends in the measured air quality levels.

A large tire fire erupted just east of Everett on September 24. The most significant emissions continued for about one month, but some smoldering lasted even to year end. Though there was not enough monitoring to fully document the impact, the monitoring station in downtown Everett, about one mile away, measured three 24 hour TSP values in excess of the 150 microgram per cubic meter standard. These were the first such violations observed at this Everett station in more than fourteen years of particulate monitoring there.

A section summarizing air quality using the nationally uniform Pollutant Standards Index (PSI) begins on page 6. The PSI provides a daily index of air quality using a simple numerical scale. This numerical scale is designed around the short term standard for each of the pollutants which is set to protect health. A table showing the pollutant concentration associated with the numerical breakpoints of the Index appears on the inside back cover. Every weekday the Agency reports the current PSI to the news media and the public. Anyone may obtain the current PSI also from the American Lung Association of Washington in Seattle by dialing 282-5565 or by dialing

1-800-732-9339 from outside Seattle.

In March, 1984, the U.S. Environmental Protection Agency proposed revisions to the national ambient air quality standards for particulate matter. As of June, 1985, final action on this proposal is still pending. Along with other changes the proposal defines a size specific method of measuring particulate matter as the method for the national primary standard. Our report presents a summary of suspended particulates smaller than or equal to 10 micrometers in diameter (PM10) as measured with a Size Selective Inlet high volume sampler at eight stations. Summaries for five of these stations also present data for the fraction smaller than 2.5 micrometers, termed "fine particulates", which is measured using a cyclone inlet sampler. Particulate matter ratios and correlation analyses are also presented. These summaries begin on page 20.

It is important that air quality measurements be precise and accurate. Nationally uniform requirements establish the procedures to audit and document the Precision and Accuracy of air quality data. A section beginning on page 28, titled Quality Assurance, summarizes the program and presents the Precision and Accuracy audit results.

The Agency operates one acid rain monitoring station as part of the state network. This station is located in Seattle at 14th Ave NE & NE 85th St. Weekly samples are sent to the Washington State Department of Ecology for analysis and final reporting.

All data collected are reported quarterly to the Washington State Department of Ecology; some of it is forwarded from there to the National Aerometric Data Bank maintained by the U.S. Environmental Protection Agency. The Department of Ecology conducts air monitoring within the Puget Sound area in addition to that done by our Agency. The Department also publishes an annual summary of data for the entire state. Inquiries concerning the statewide data should be directed to the Washington State Department of Ecology-PV11, Office of Hazardous Substances and Air Programs, Olympia, Washington 98504-8711.

PUGET SOUND AIR POLLUTION CONTROL AGENCY

Atmospheric Sampling Network

1984

Location	a Type of Sampling								
	A	B	C	D	E	F	G	H	I
01 Tolt River Watershed, King County, Wa	A								
*02 Highway 9 & 28th St NE, Lake Stevens, Wa	A								
*03 South End of Columbia Street, Marysville, Wa	A								
04 Medical-Dental Bldg, 2730 Colby, Everett, Wa	A	B	C	D					I
*05 Lynnwood HS, 3001 184th St SW, Lynnwood, Wa	A								
*06 Evergreen Point Bridge Toll Plaza, Medina, Wa							G		
*07 504 Bellevue Way NE, Bellevue, Wa	A						G		
*08 20050 SE 56th, Lake Sammamish State Park, Wa	A				E				
09 North 98th St & Stone Ave N, Seattle, Wa	A	B		D		F	G		I
*10 5701 8th Ave NE, Seattle, Wa	A						G		
*11 Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	A			D			G		
12 Public Safety Bldg, 604 3rd Ave, Seattle, Wa	A								
*13 Fire Station #10, 301 2nd Ave S, Seattle, Wa	A								
14 Harbor Island, 2555 13th Ave SW, Seattle, Wa	A						G	H	I
15 Harbor Island, 3400 13th Ave SW, Seattle, Wa	A						G	H	
16 Duwamish, 4401 E Marginal Way S, Seattle, Wa	A	B	C	D		F			I
*17 Georgetown, 6431 Corson Ave S, Seattle, Wa	A								
18 South Park, 723 S Concord St, Seattle, Wa	A						G	H	I
19 Duwamish Valley, 12026 42nd Ave S, King Co, Wa	A								
20 SE Dist Health Ctr, 3001 NE 4th St, Renton, Wa	A								
21 200 South 2nd St, Renton, Wa	A								
22 22916 86th Ave S, Kent, Wa	A			D	E	F			
23 Memorial Park, 850 N Central Ave, Kent, Wa	A								I
24 Federal Way HS, 1401 S 304 St, Federal Way, Wa	A	B		D					
25 115 E Main St, Auburn, Wa	A								
26 Sumner Jr HS, 1508 Willow St, Sumner, Wa	A			D	E		G	H	
27 Fife Sr High School, 5616 20th E, Fife, Wa	A								
28 2340 Taylor Way, Tacoma, Wa	A								I
29 Fire Station #12, 2316 E 11th St, Tacoma, Wa	A		C	D		F			I
30 Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	A								
31 Cascadia, 2002 E 28th St, Tacoma, Wa	A								
32 Willard School, S 32nd & S 'D' St, Tacoma, Wa	A			D					
33 Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	A								
34 SW 283rd & 101st Ave SW, Maury Island, Wa	A	B		D			G	H	
35 Ruston School, 5219 N Shirley St, Tacoma, Wa	A						G	H	
36 4716 North Baltimore St, Tacoma, Wa	A						G	H	
37 North 37th & Vassault Sts, Tacoma, Wa		B		D					
38 North 26th & Pearl Sts, Tacoma, Wa	A	B		D			G	H	
*39 Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	A								
*40 City Water Supply Pump House, Dupont, Wa	A						G	H	
41 City Hall, 239 4th St, Bremerton, Wa	A								

* Station operated by Washington State Department of Ecology (Additional ozone and all nitrogen dioxide and carbon monoxide sampling is performed by the Department of Ecology. Summaries of these data are included in this publication).

a Type of Sampling		

A Suspended Particulates (Total)	E Ozone (O3)	H Arsenic
B Sulfur Dioxide (SO2)	F Atmospheric Particles	I Suspended Particulates
C Suspended Particulates-COH'S	(b - scattering)	(size selective
D Wind Direction & Speed	G Lead	sampling-PM10; Fine
		Particulates)

AIR QUALITY AND METEOROLOGICAL SAMPLING SYSTEM

Pictures on this and the facing page show some of the sampling sites and the equipment used for sampling. Actual sampling at each station is documented in the table on page 2.

Sampling at 2340 Taylor Way, Tacoma measures three different fractions of Particulate Matter. To the left in the adjacent picture are two high volume samplers with Size Selective Inlets which collect the particulate fraction smaller than or equal to 10 micrometers diameter (PM10). In the center is a standard high volume sampler which measures Total Suspended Particulates (TSP). To the right is a cyclone inlet sampler collecting the particulate fraction smaller than 2.5 micrometers (Fine Particulates). All of these samplers collect particulate matter on a filter for the period of sampling, usually a 24-hour midnight to midnight time period every sixth day.



North 37th & Vassault Sts, Tacoma

The Wind Direction and Speed sensor is mounted on a 10 meter tower. A sampling probe immediately left of the tower obtains an ambient air sample for analysis by instruments inside the station.



Inside a station are the telemetry electronics which translate the instrument signals for transmission over phone lines at the command of the central control station computer. A tape sampler analyzes Suspended Particulates measured as COHs. An analyzer operating on the principle of ultraviolet fluorescence measures Sulfur Dioxide. This measurement is also recorded at the site on a strip chart recorder.

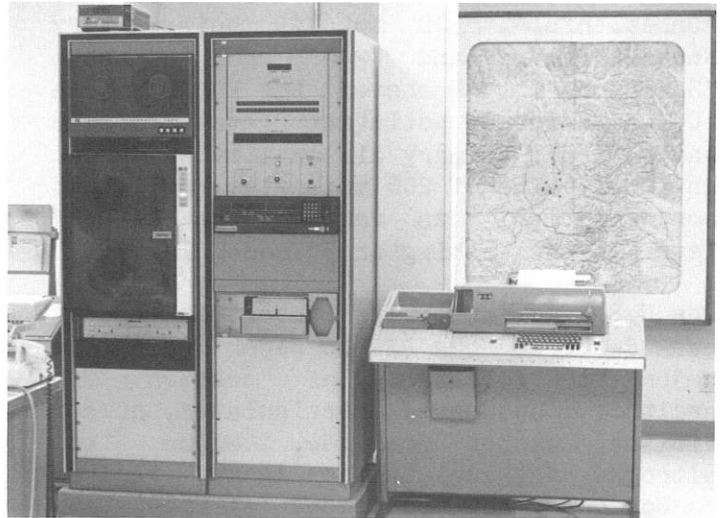


Station in Duwamish Valley
4401 E Marginal Way S, Seattle

On the roof, several standard high volume samplers enable every day sampling of Total Suspended Particulates. Two high volume samplers with a Size Selective Inlet (circular, dome shaped top) collect the PM10 fraction of particulate matter. A cyclone inlet sampler measures Fine Particulates. Separate sampling probes near the wind mast provide continuous sampling for analysis by a nephelometer, a tape sampler, and a sulfur dioxide analyzer all within the station.

Most data from all remote stations is immediately telemetered to the central station computer via phone lines.

Central station computer controls the entire network. It processes all incoming data, and computes 15-minute, 1-hour, and 24-hour averages for immediate printout on a continuous schedule around the clock every day of the year.



- Values for TSP, PM10, and Fine Particulates collected by each specific sampler are computed after each sampled filter is removed and transported to the laboratory where it is conditioned and weighed.
- All data is checked for validity by air quality specialists.
- After validation, the data is stored in permanent computer files and summarized at least monthly and annually. Once stored in final computer files, the data is readily available to meet a variety of needs.
- The data is used to document air quality levels throughout the region and thereby determine areas in which air quality standards are exceeded; to report the Pollutant Standards Index to the public; to maintain continuous surveillance for real-time episode avoidance; and to evaluate the effect of control and enforcement activities.

POLLUTANT STANDARDS INDEX

The Pollutant Standards Index (PSI) is a nationally uniform index for daily air quality reporting. In cooperation with the Washington State Department of Ecology, the Agency began reporting the PSI in 1980 for the Everett, Seattle, and Tacoma areas.

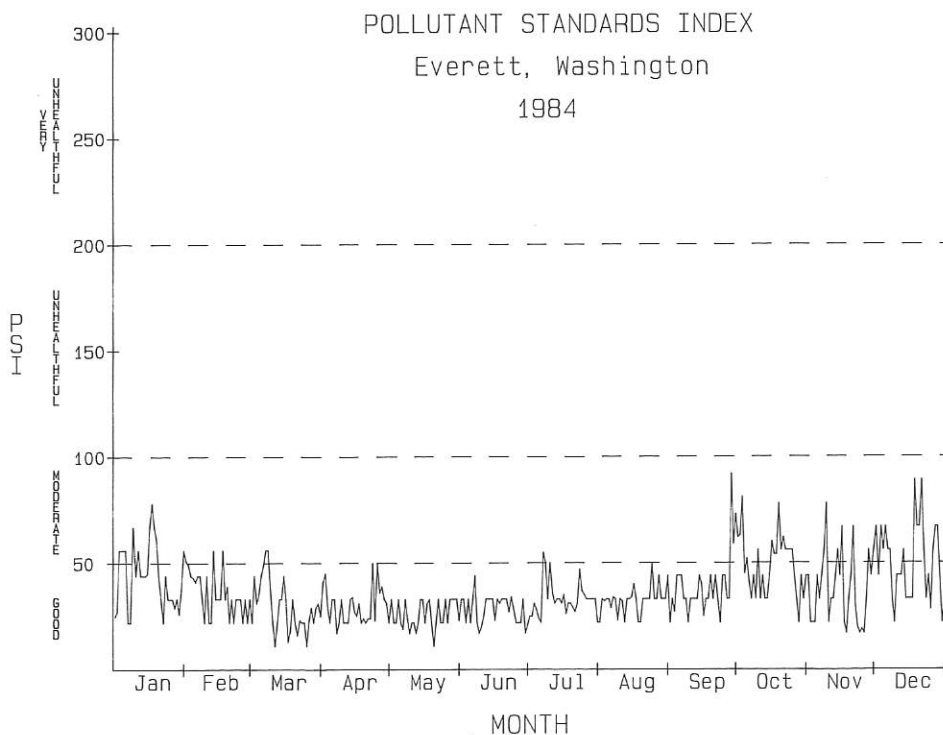
The PSI associates pollutant levels during a 24 hour period with potential health effects. The PSI is a range of values between zero and 500, with 0 to 50 indicating "Good" air quality, 51 to 100 being "Moderate", 101 to 199 considered "Unhealthful", 200 to 299 being "Very Unhealthful", and 300 and above "Hazardous". Whenever the PSI is above 100, a measured pollutant level exceeds the national primary air quality standard. An index value of 200 means the pollutant concentration has reached the "Alert" level in the Washington Episode Plan.

The U.S. Environmental Protection Agency has designed the PSI to report upon five major air pollutants of concern for health: suspended particulates, sulfur dioxide, carbon monoxide, ozone, and nitrogen dioxide. The Agency reviews carbon monoxide, suspended particulates, and sulfur dioxide in the Everett, Seattle and Tacoma areas to calculate the index.

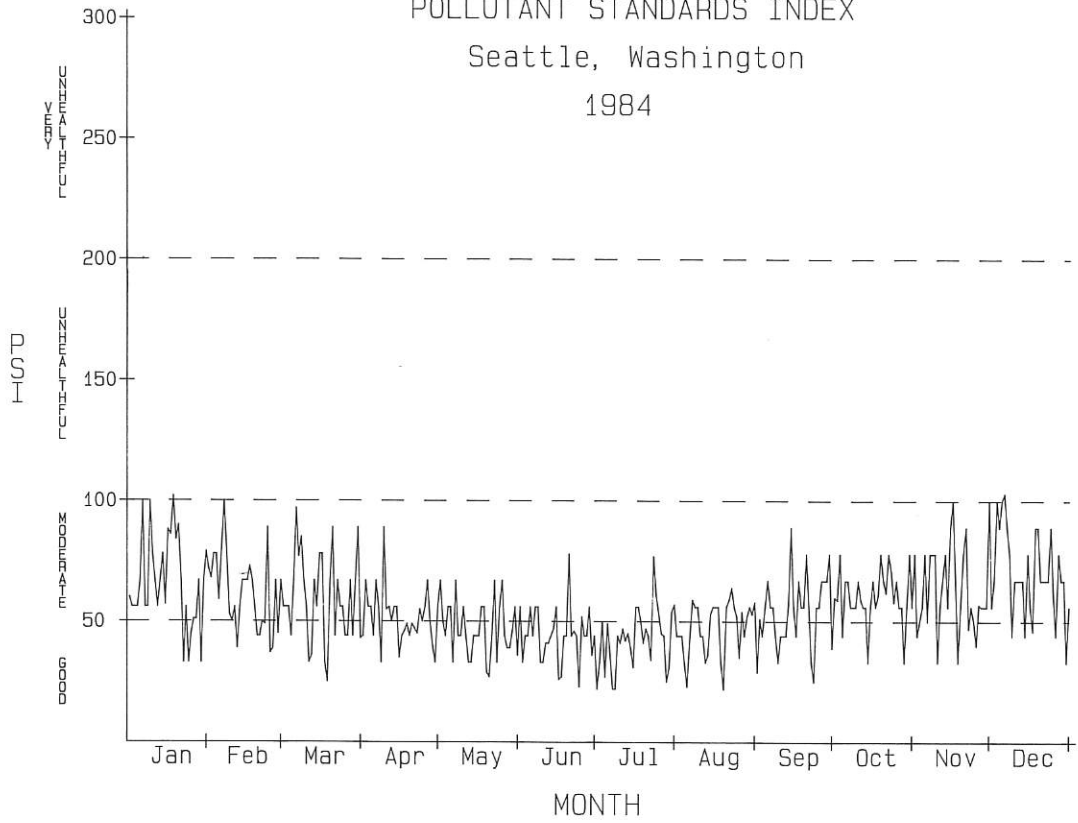
The index value for each day in each area is determined by the pollutant with the highest value on the PSI scale. Since the highest PSI value for each city frequently is measured downtown where traffic may be congested or in an industrial area, the values in many suburban residential areas are generally lower.

The accompanying graphs plot each daily PSI for Everett, Seattle, and Tacoma during 1984. The higher PSI values tend to occur during the fall and winter months often coinciding with air stagnation periods. A 1984 summary table shows the number of days in each PSI interval by month and also lists the maximum index for each month, the date of occurrence, and the pollutant determining that index value. A summary table for the period Jan, 1980 - Feb, 1985 presents by year the number of days in each air quality category as well as the number of days each pollutant determined the PSI. A summary specifically of the unhealthful days is also included.

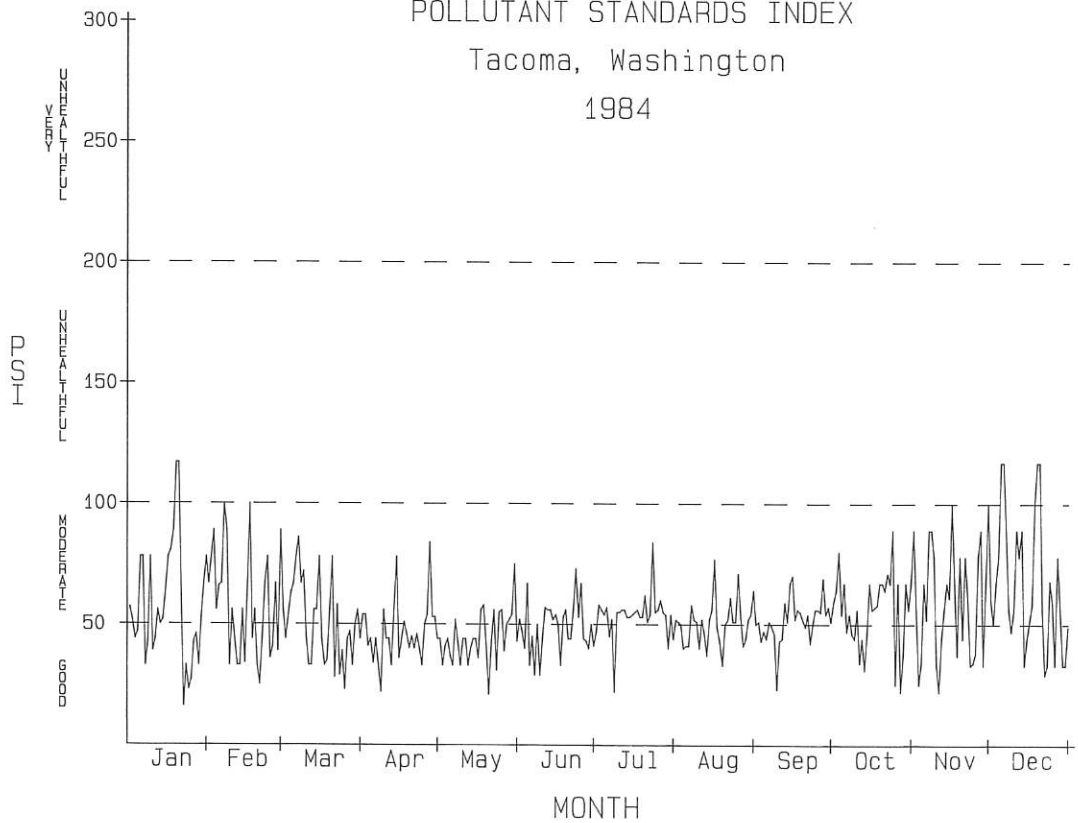
Air quality in Bellevue is principally determined by levels of carbon monoxide. During 1984 the air quality in Bellevue was unhealthful due to carbon monoxide on 2 days; these were Jan 9 and Dec 4 with PSI values of 117 and 133 respectively.



POLLUTANT STANDARDS INDEX
Seattle, Washington
1984



POLLUTANT STANDARDS INDEX
Tacoma, Washington
1984



POLLUTANT STANDARDS INDEX

1984

EVERETT														
AIR QUALITY	(PSI Interval)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
		Number of Days in Each PSI Interval during Each Month												
GOOD	(0 to 50)	20	26	29	30	31	30	30	31	27	16	23	16	309
MODERATE	(51 to 100)	11	3	2	0	0	0	1	0	3	15	7	15	57
UNHEALTHFUL	(101 to 199)	0	0	0	0	0	0	0	0	0	0	0	0	0
VERY UNHEALTHFUL	(200 to 299)	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum PSI each month		78	56	56	50	33	44	55	50	92	81	78	89	92
Date		17th	13th#	7th#	23rd#	1st#	7th	7th	24th	28th	3rd	9th	18th#	Sep 28
Pollutant		CO	CO	CO	S02	CO	CO	S02	S02	TSP	TSP	CO	CO	TSP
SEATTLE														
AIR QUALITY	(PSI Interval)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
		Number of Days in Each PSI Interval during Each Month												
GOOD	(0 to 50)	4	9	10	16	20	22	24	14	11	3	8	5	146
MODERATE	(51 to 100)	26	20	21	14	11	8	7	17	19	28	22	25	218
UNHEALTHFUL	(101 to 199)	1	0	0	0	0	0	0	0	0	0	0	1	2
VERY UNHEALTHFUL	(200 to 299)	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum PSI each month		102	100	97	89	67	78	77	64	89	78	100	103	103
Date		18th	7th	6th	9th	1st#	20th	23rd	22nd	14th	3rd#	16th#	6th	Dec 6
Pollutant		TSP	CO	TSP	CO	CO	CO	TSP	TSP	CO	CO	CO	TSP	TSP
TACOMA														
AIR QUALITY	(PSI Interval)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
		Number of Days in Each PSI Interval during Each Month												
GOOD	(0 to 50)	14	12	16	20	22	17	5	13	12	10	11	10	162
MODERATE	(51 to 100)	15	17	15	10	9	13	26	18	18	21	19	17	198
UNHEALTHFUL	(101 to 199)	2	0	0	0	0	0	0	0	0	0	0	4	6
VERY UNHEALTHFUL	(200 to 299)	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum PSI each month		117	100	86	84	75	73	84	77	70	89	100	117	117
Date		19th#	7th#	7th	27th	30th	23rd	23rd	16th	15th	24th	16th#	5th#	Jan 19#
Pollutant		CO	CO	TSP	TSP	TSP	TSP	TSP	TSP	TSP	CO	CO	CO	CO

TSP = Total Suspended Particulates; CO = Carbon Monoxide; S02 = Sulfur Dioxide.

Earliest date of occurrence

POLLUTANT STANDARDS INDEX

January, 1980 - February, 1985

EVERETT													
	Days in Each Air Quality Category				Pollutant Determining the PSI						Highest Value		
	Good	Moderate	Unhealthful	Very Unhealthful	All Days			Unhealthful Days			PSI	Date	Pollutant
					TSP	CO	SO2	TSP	CO	SO2			
1980	340	19	0	0	356	-	3	0	-	0	60	Jan 23	TSP
1981	350	11	0	0	340	-	21	0	-	0	62	Jan 16	TSP
1982	334	30	1	0	277	70	18	0	1	0	117	Dec 30	CO
1983	308	56	1	0	191	150	24	0	1	0	117	Nov 30	CO
1984	309	57	0	0	105	217	44	0	0	0	92	Sep 28	TSP
1985*	30	29	0	0	7	47	5	0	0	0	100	Jan 3#	CO
Totals	1671	202	2	0	1276	484	115	0	2	0			

SEATTLE													
	Days in Each Air Quality Category				Pollutant Determining the PSI						Highest Value		
	Good	Moderate	Unhealthful	Very Unhealthful	All Days			Unhealthful Days			PSI	Date	Pollutant
					TSP	CO	SO2	TSP	CO	SO2			
1980	73	275	18	0	95	270	1	1	17	0	194	Jan 23	TSP
1981	69	267	28	1	109	254	2	5	24	0	213	Jan 15	CO
1982	86	268	10	1	96	264	5	1	10	0	214	Feb 6	TSP
1983	98	258	9	0	101	261	3	0	9	0	183	Jan 28	CO
1984	146	218	2	0	111	242	13	2	0	0	103	Dec 6	TSP
1985*	6	45	8	0	22	37	0	3	5	0	183	Jan 3	CO
Totals	478	1331	75	2	534	1328	24	12	65	0			

TACOMA													
	Days in Each Air Quality Category				Pollutant Determining the PSI						Highest Value		
	Good	Moderate	Unhealthful	Very Unhealthful	All Days			Unhealthful Days			PSI	Date	Pollutant
					TSP	CO	SO2	TSP	CO	SO2			
1980	83	271	12	0	256	107	3	4	8	0	160	Apr 12	TSP
1981	74	278	10	3	222	137	6	1	12	0	227	Jan 12	CO
1982	119	242	4	0	255	101	9	0	4	0	167	Dec 30	CO
1983	140	222	3	0	228	128	9	1	2	0	137	Dec 23	TSP
1984	162	198	6	0	207	149	10	0	6	0	117	Jan 19#	CO
1985*	8	45	6	0	22	36	1	0	6	0	150	Jan 16	CO
Totals	586	1256	41	3	1190	658	38	6	38	0			

* Through Feb 1985
 # Earliest date of occurrence

SUSPENDED PARTICULATES

Introduction

Suspended Particulates is a general term for small particles of dust, soot, organic matter, and compounds containing sulfur, nitrogen, and metals. Particulates, when sampled by the standard high volume federal reference method, are called Total Suspended Particulates (TSP). Total Suspended Particulate samplers effectively collect particulate matter up to diameters in the range of 25 to 45 micrometers.

In March, 1984, the U.S. Environmental Protection Agency proposed revisions to the national ambient air quality standards for particulate matter. The proposal would: (1) define a size specific method of measuring particulate matter; (2) establish new numerical levels for the standards; and (3) revise the statistical form of the standards. For the primary standard the measurement method would collect only those particulates smaller than or equal to 10 micrometers in diameter (PM10). Though not specifically part of the proposal, the fraction of particulate matter with diameters smaller than 2.5 micrometers is generally referred to by the term "fine particulates".

During 1984 the Agency measured the PM10 fraction of suspended particulates at eight stations using the Size Selective Inlet (SSI) high volume sampler. A cyclone inlet sampler measured the fine particulate fraction concurrently at five of these stations. Data from this size selective sampling is summarized in this section along with the analysis of TSP from a continuing more extensive network.

Particulate Sources and Measured Levels

Particulates directly enter the air from industrial operations, from fuel combustion, from auto and truck traffic, from construction, and from other sources. These emissions may change from day to day due to intermittent industrial operations, equipment upset or breakdown and traffic variations. The fine particulate fraction includes gaseous transformation products such as sulfates, nitrates, and some organics.

Once present in the air particulates are dispersed and transported by the wind. Valleys, hills, and large bodies of water

affect the local direction and speed of the wind. Lower atmosphere stability influences how quickly particulates are dispersed. Measured 24 hour particulate levels may differ significantly from day to day responding to how much enters the air and how quickly meteorological processes disperse the particulates. Tables in this section summarize 24 hour measurements and document that high 24 hour levels are often recorded at many stations on the same day.

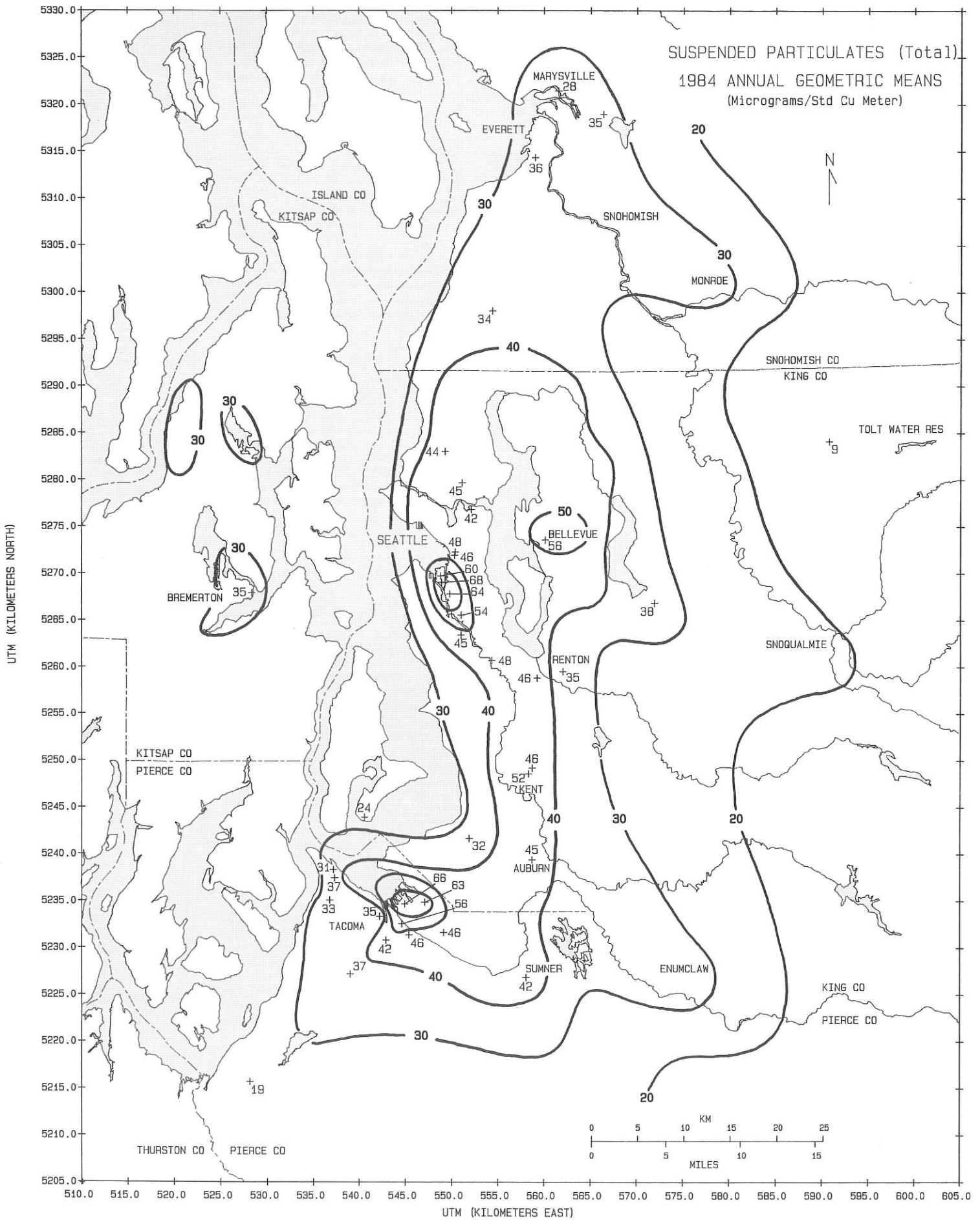
Annual Average TSP Map

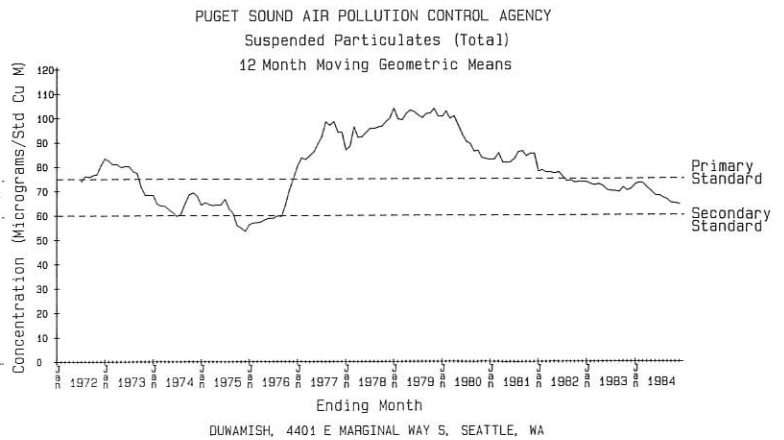
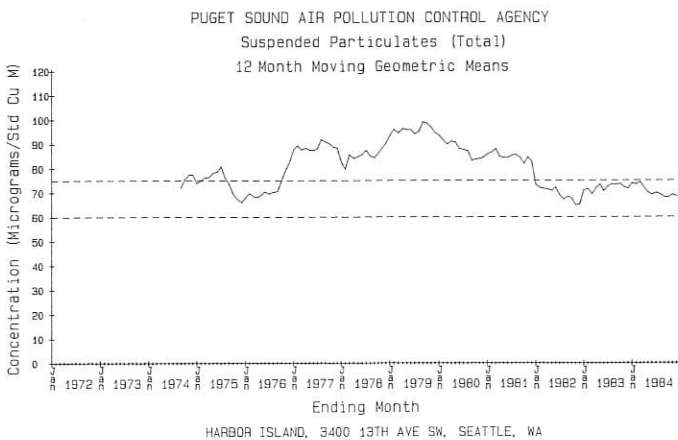
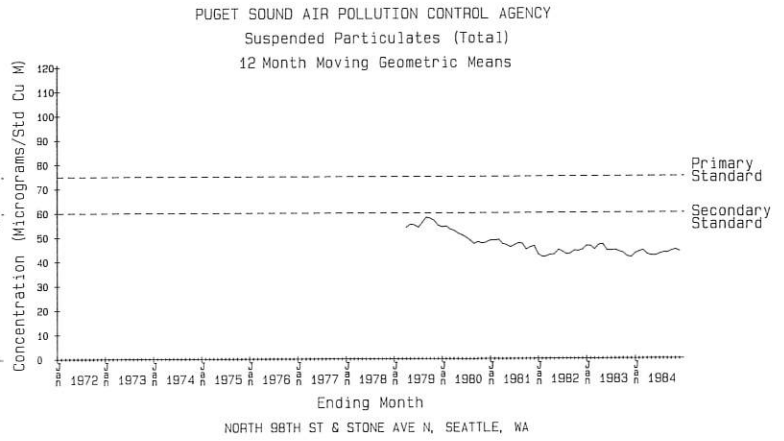
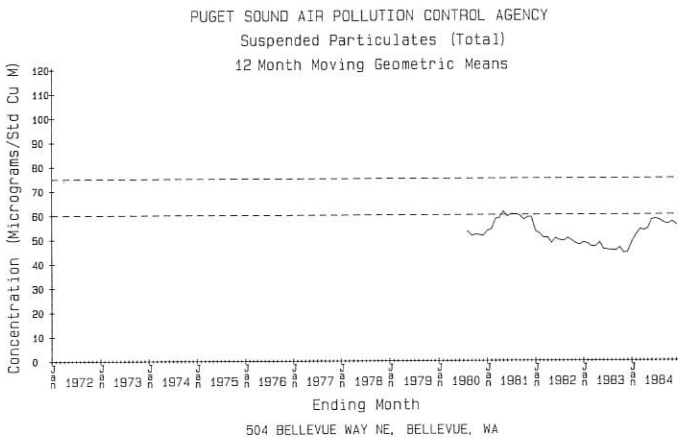
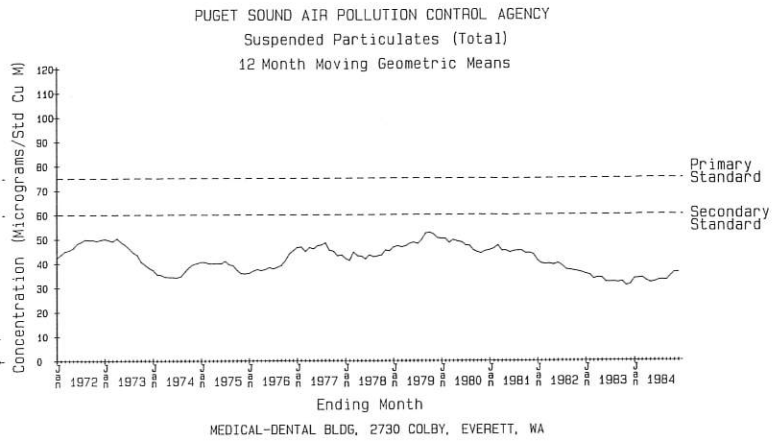
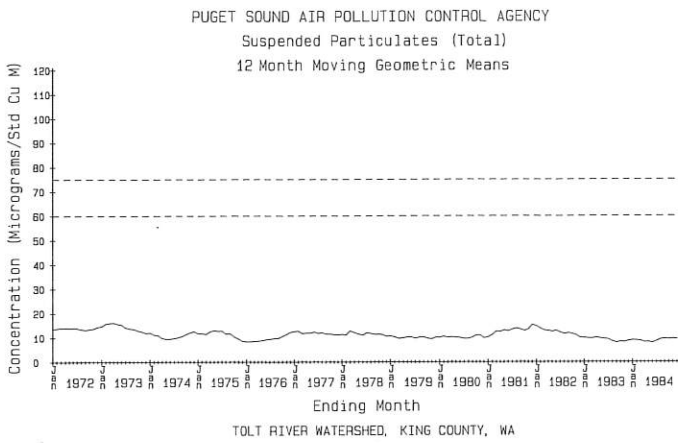
A map of annual geometric mean TSP values for calendar year 1984 follows this page. Actual values at each sampling station, together with a particulate emission inventory, local wind roses and topography, provide the basis for the map.

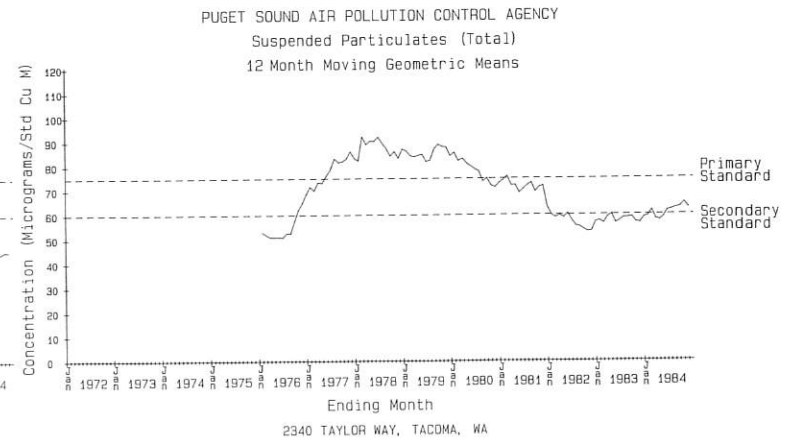
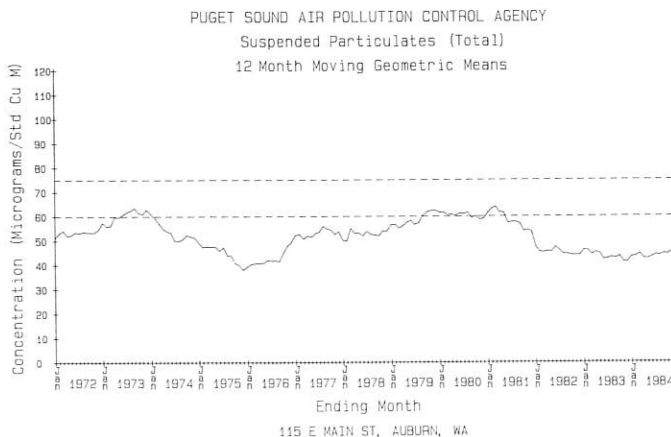
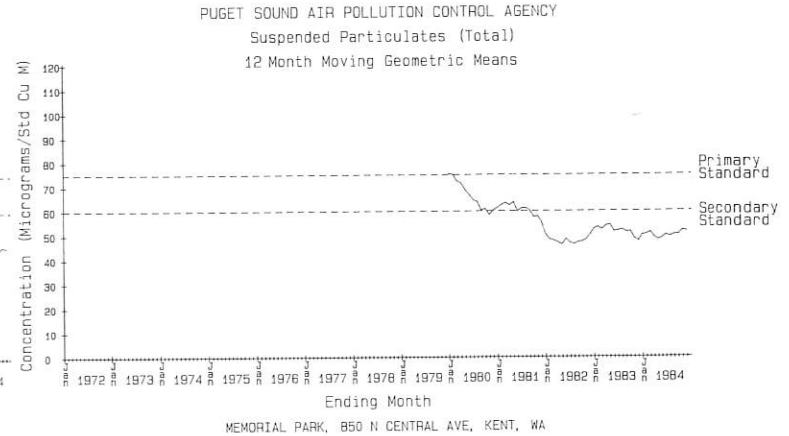
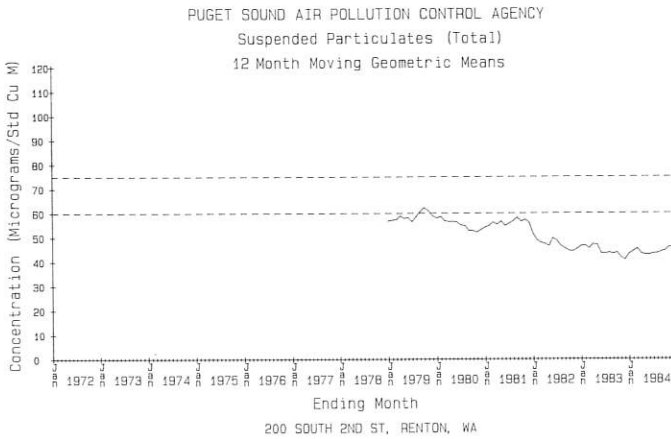
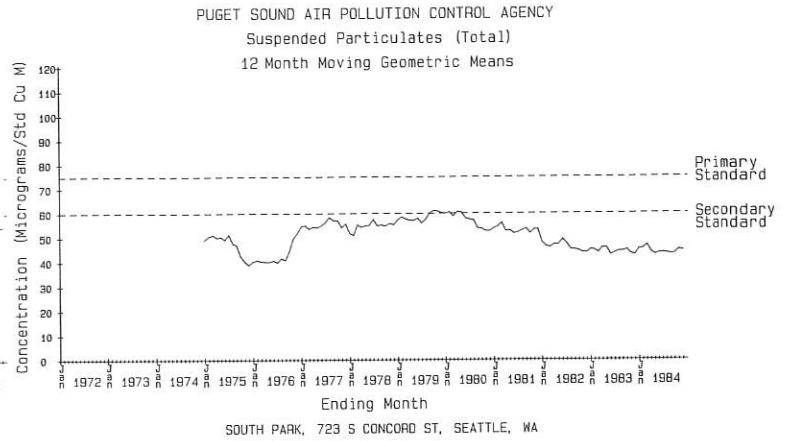
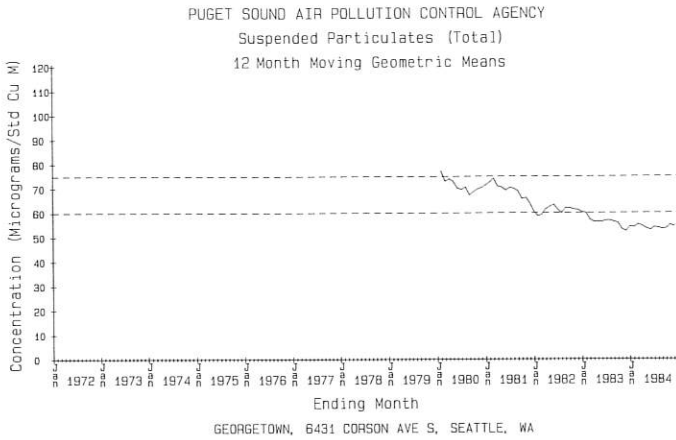
The annual concentration of TSP at a location may be determined by interpolating between adjacent isopleths (lines connecting points of equal concentration). The Tacoma Port area and the Harbor Island-Duwamish Valley area of Seattle record the highest concentrations. At the end of 1984 the annual primary standard has been met, however the history of previous years exceeding the primary standard in these two industrial areas suggests a careful plan must be followed to maintain the standard.

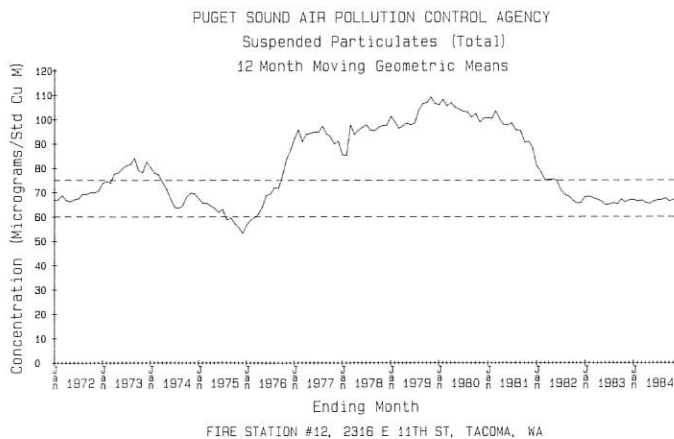
Suspended Particulate Trends

Graphic plots of TSP geometric means permit visual review of long term trends, but to depict any trend such plots require many years of data. Moving geometric mean charts for several stations follow the map. A 12 month moving geometric mean compares directly to the annual primary and secondary standards which are shown by reference lines on the charts. One station near the Tolt Water Reservoir presents consistently low TSP values, which appear unaffected by the urban areas. Stations in the industrialized Seattle Duwamish Valley and Tacoma Port area show values lower than the annual primary standard at the end of 1975, rising above this standard from 1977 through 1981, and decreasing again late in 1982 to values between the primary and secondary standards.

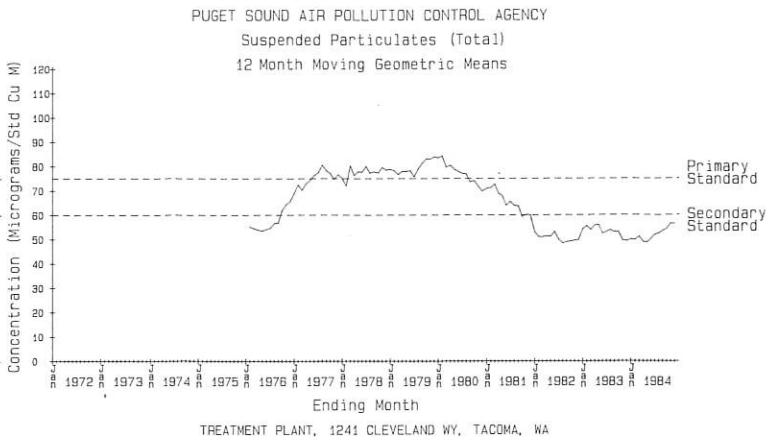




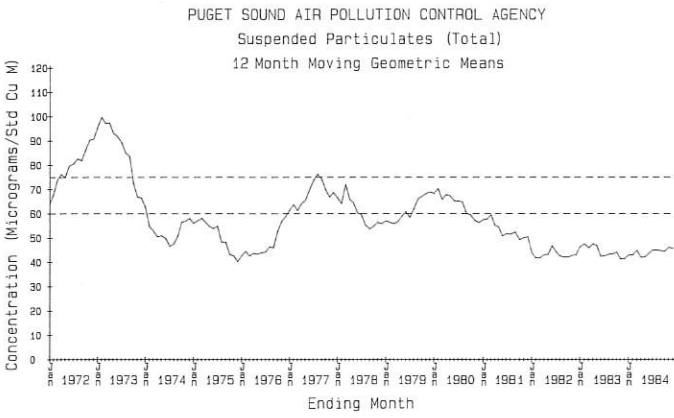




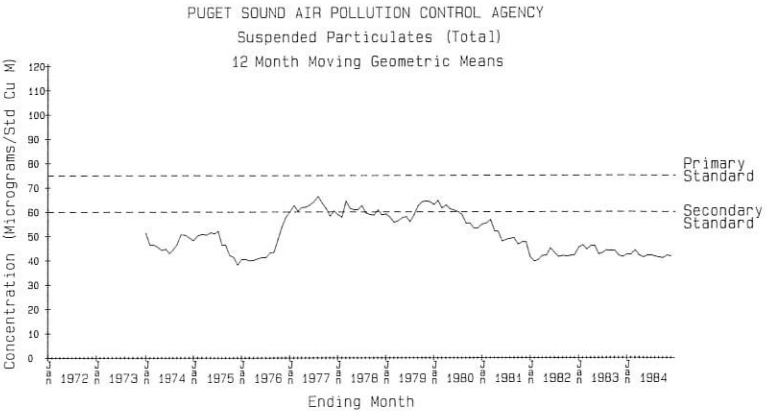
FIRE STATION #12, 2316 E 11TH ST, TACOMA, WA



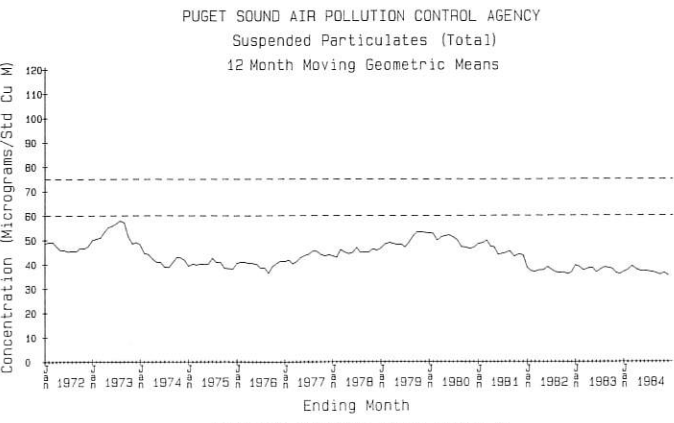
TREATMENT PLANT, 1241 CLEVELAND WY, TACOMA, WA



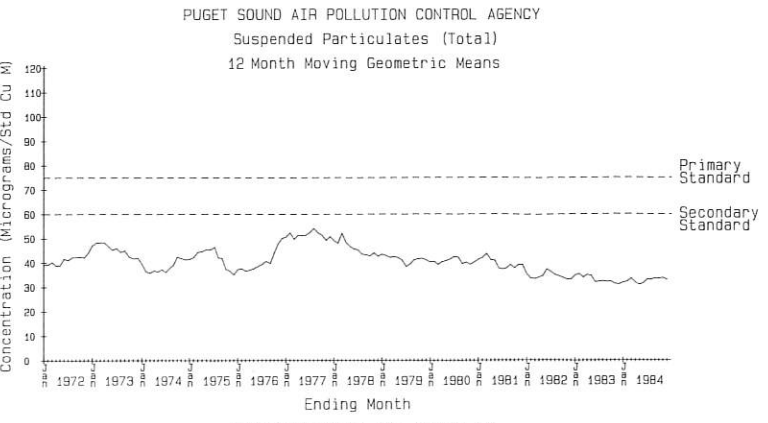
CASCADIA, 2002 E 28TH ST, TACOMA, WA



WILLARD SCHOOL, S 32ND & S 'D' ST, TACOMA, WA



HESS BLDG, 901 TACOMA AVE S, TACOMA, WA



NORTH 26TH & PEARL STS, TACOMA, WA

SUSPENDED PARTICULATES (Total)
Micrograms per Standard Cubic Meter

Sampled by Standard High Volume Glass Fiber filters

1984

Location	Monthly Arithmetic Averages												No. Of Obs.	Year Mean	Year Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Tolt River Watershed, King County, Wa	9	5	11	7	11	11	30	27	16	15	5	4	57	13	9
Highway 9 & 28th St NE, Lake Stevens, Wa	58	39	51	33	24	32	46	74					53	41	35
South End of Columbia Street, Marysville, Wa ^a			38		22	23	35	33	34	60	30	43	48	35	28
Medical-Dental Bldg, 2730 Colby, Everett, Wa	54	31	39	27	27	31	46	44	42	90	34	35	61	42	36
Lynnwood HS, 3001 184th St SW, Lynnwood, Wa	72	42	28	26	27	23	32	34	41	57	33	39	58	39	34
504 Bellevue Way NE, Bellevue, Wa	102	109	80	48	85	72	62	51	49	61	33	34	60	66	56
20050 SE 56th, Lake Sammamish State Park, Wa	71	48	48	35	34	33	62	50	43	47	34	23	60	44	38
North 98th St & Stone Ave N, Seattle, Wa	64	49	50	35	40	34	55	73	46	74	37	38	61	50	44
5701 8th Ave NE, Seattle, Wa	80	58	47	39	37	34	43	42	46	75	44	48	58	49	45
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	81	60	58	33	33	27	33	37	38	72	41	44	59	47	42
Public Safety Bldg, 604 3rd Ave, Seattle, Wa	77	60	62	40	42	37	50	50	49	72	45	40	61	52	48
Fire Station #10, 301 2nd Ave S, Seattle, Wa			65	44	44	37	49	48	48	73	46	37	50	50	46
Harbor Island, 2555 13th Ave SW, Seattle, Wa	98	82	76	54	52	41	65	58	69	91	60	53	61	67	60
Harbor Island, 3400 13th Ave SW, Seattle, Wa	109	93	85	63	60	47	80	71	64	94	74	60	61	75	68
Duwamish, 4401 E Marginal Way S, Seattle, Wa	106	94	82	61	50	47	64	68	72	82	70	87	354	73	64
Georgetown, 6431 Corson Ave S, Seattle, Wa	82	66	72	45	50	48	81	60	62	79	52	39	60	61	54
South Park, 723 S Concord St, Seattle, Wa	81	56	66	29	33	35	47	44	50	70	55	43	60	51	45
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	95	61	71	31	36	34	53	48	50	77	56	50	61	56	48
SE Dist Health Ctr, 3001 NE 4th St, Renton, Wa	57	32	43	23	33	27	44	46	41	54	39	32	61	40	35
200 South 2nd St, Renton, Wa	75	62	57	34	37	37	49	49	49	68	47	38	61	50	46
22916 86th Ave S, Kent, Wa	76	46	57	34	39	39	68	66	53	61	47	36	61	52	46
Memorial Park, 850 N Central Ave, Kent, Wa	96	61	68	37	43	42	74	59	50	66	51	47	59	58	52
Federal Way HS, 1401 S 304 St, Federal Way, Wa	49	33	41	22	29	26	33	35	38	65	30	29	61	36	32
115 E Main St, Auburn, Wa	82	51	52	30	40	35	54	50	49	59	42	53	61	50	45
Sumner Jr HS, 1508 Willow St, Sumner, Wa	73	46	52	25	41	35	55	50	44	53	46	46	61	48	42
Fife Sr High School, 5616 20th E, Fife, Wa	76	50	56	26	42	45	68	62	54	68	53	49	60	55	46
2340 Taylor Way, Tacoma, Wa	95	71	75	39	65	51	111	93	89	92	65	47	61	75	63
Fire Station #12, 2316 E 11th St, Tacoma, Wa	83	63	77	65	73	72	82	90	79	81	66	71	120	75	66
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	88	63	64	37	56	46	72	76	81	87	52	59	61	65	56
Cascadia, 2002 E 28th St, Tacoma, Wa	82	54	64	26	46	41	64	52	54	66	45	61	61	55	46
Willard School, S 32nd & S 'D' St, Tacoma, Wa	79	54	59	27	36	32	42	44	51	67	48	47	61	49	42
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	66	48	49	23	33	26	33	42	37	47	41	37	59	41	35
SW 283rd & 101st Ave SW, Maury Island, Wa	37	35	34	16	18	18	24	27	28	44	22	23	59	27	24
Ruston School, 5219 N Shirley St, Tacoma, Wa	54	43	41	21	26	25	36	32	33	50	29	27	61	35	31
4716 North Baltimore St, Tacoma, Wa	59	47	44	21	29	30	50	50	44	57	33	34	60	42	37
North 26th & Pearl Sts, Tacoma, Wa	53	41	41	20	27	30	55	35	43	46	31	30	61	38	33
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	78	53	57	24	35	32	51	41	55	73	38	33	60	48	37
City Water Supply Pump House, Dupont, Wa	31	19	24	10	15	18	33	36	30	39	15	19	59	24	19
City Hall, 239 4th St, Bremerton, Wa	46	40	39	29	34	26	34	44	39	53	39	29	60	38	35

^a sampling started 2/18/84

SUSPENDED PARTICULATES (Total)
Micrograms per Standard Cubic Meter

Sampled by Standard High Volume Glass Fiber filters

1984

Statistical Summary

Location	No. Of Obs.	Frequency Distribution - Percent											Arith Mean	Geom Mean	Geom Std Dev	Arith Std Dev
		10	20	30	40	50	60	70	80	90	95					
Tolt River Watershed, King County, Wa	57	4	5	5	7	9	10	16	21	31	36	13	9	2.20	10.65	
Highway 9 & 28th St NE, Lake Stevens, Wa	53	15	22	24	30	33	39	43	50	69	105	41	35	1.75	27.73	
South End of Columbia Street, Marysville, Wa	48	11	16	21	23	26	35	39	43	56	107	35	28	1.92	26.24	
Medical-Dental Bldg, 2730 Colby, Everett, Wa	61	19	23	26	30	36	39	43	54	61	98	42	36	1.67	28.76	
Lynnwood HS, 3001 184th St SW, Lynnwood, Wa	58	19	23	25	26	31	35	42	48	60	87	39	34	1.66	24.97	
504 Bellevue Way NE, Bellevue, Wa	60	26	36	43	45	51	59	67	81	135	164	66	56	1.75	42.28	
20050 SE 56th, Lake Sammamish State Park, Wa	60	18	23	29	32	34	43	53	61	74	89	44	38	1.77	28.00	
North 98th St & Stone Ave N, Seattle, Wa	61	24	29	32	36	41	45	55	66	91	101	50	44	1.62	27.78	
5701 8th Ave NE, Seattle, Wa	58	27	32	35	40	44	48	52	56	68	105	49	45	1.50	23.46	
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	59	23	28	33	37	40	42	48	55	91	106	47	42	1.59	25.32	
Public Safety Bldg, 604 3rd Ave, Seattle, Wa	61	31	35	38	42	47	49	55	63	90	93	52	48	1.45	23.13	
Fire Station #10, 301 2nd Ave S, Seattle, Wa	50	27	33	38	42	47	50	53	56	64	105	50	46	1.45	22.24	
Harbor Island, 2555 13th Ave SW, Seattle, Wa	61	33	41	46	50	59	65	67	76	113	150	67	60	1.56	34.77	
Harbor Island, 3400 13th Ave SW, Seattle, Wa	61	40	46	52	59	69	74	81	90	119	165	75	68	1.54	36.99	
Duwamish, 4401 E Marginal Way S, Seattle, Wa	354	35	42	48	56	62	70	80	96	119	160	73	64	1.64	42.48	
Georgetown, 6431 Corson Ave S, Seattle, Wa	60	30	35	39	47	54	59	69	76	107	121	61	54	1.62	33.02	
South Park, 723 S Concord St, Seattle, Wa	60	24	29	31	36	41	49	57	67	96	118	51	45	1.69	30.58	
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	61	23	31	35	39	48	53	58	74	96	120	56	48	1.70	34.88	
SE Dist Health Ctr, 3001 NE 4th St, Renton, Wa	61	17	20	26	30	34	41	44	56	63	88	40	35	1.67	21.13	
200 South 2nd St, Renton, Wa	61	26	30	35	39	46	49	53	57	102	105	50	46	1.55	25.28	
22916 86th Ave S, Kent, Wa	61	22	29	31	40	45	52	60	74	87	97	52	46	1.68	28.40	
Memorial Park, 850 N Central Ave, Kent, Wa	59	30	33	39	44	49	53	59	69	99	117	58	52	1.62	33.02	
Federal Way HS, 1401 S 304 St, Federal Way, Wa	61	17	21	26	27	32	34	39	44	56	72	36	32	1.64	22.79	
115 E Main St, Auburn, Wa	61	25	29	34	39	44	48	57	65	86	99	50	45	1.58	25.08	
Sumner Jr HS, 1508 Willow St, Sumner, Wa	61	18	25	32	41	46	48	53	59	85	88	48	42	1.72	26.29	
Fife Sr High School, 5616 20th E, Fife, Wa	60	17	24	32	43	50	59	65	75	92	116	55	46	1.84	31.70	
2340 Taylor Way, Tacoma, Wa	61	27	35	44	55	60	66	98	101	145	180	75	63	1.82	47.36	
Fire Station #12, 2316 E 11th St, Tacoma, Wa	120	33	40	50	56	63	73	83	106	128	169	75	66	1.67	42.45	
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	61	27	32	41	51	55	63	73	87	115	140	65	56	1.73	38.55	
Cascadia, 2002 E 28th St, Tacoma, Wa	61	18	25	31	42	47	56	65	75	90	131	55	46	1.89	35.58	
Willard School, S 32nd & S 'D' St, Tacoma, Wa	61	19	24	29	33	44	53	58	69	75	97	49	42	1.77	31.65	
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	59	19	23	25	30	34	38	46	51	67	78	41	35	1.66	24.53	
SW 283rd & 101st Ave SW, Maury Island, Wa	59	14	16	19	22	23	25	29	33	49	52	27	24	1.56	13.67	
Ruston School, 5219 N Shirley St, Tacoma, Wa	61	18	20	23	27	30	33	36	45	56	77	35	31	1.62	20.64	
4716 North Baltimore St, Tacoma, Wa	60	19	24	26	33	37	42	45	50	67	93	42	37	1.66	24.01	
North 26th & Pearl Sts, Tacoma, Wa	61	16	20	26	30	32	35	41	46	69	87	38	33	1.68	22.70	
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	60	14	18	25	37	39	47	53	63	81	114	48	37	2.06	39.79	
City Water Supply Pump House, Dupont, Wa	59	8	10	13	14	20	22	26	33	46	62	24	19	2.00	17.34	
City Hall, 239 4th St, Bremerton, Wa	60	22	25	28	30	33	36	39	45	58	83	38	35	1.48	17.49	

SUSPENDED PARTICULATES (Total)
Micrograms per Standard Cubic Meter

Sampled by Standard High Volume Glass Fiber filters

1984

Summary of Maximum and 2nd High Observed Concentrations

Location	Jan	Jan	Jan	Jan	Feb	Mar	Mar	Jul	Jul	Jul	Aug	Aug	Sep	Oct	Oct	Dec	Dec
	18	19	20	31	6	7	8	11	17	23	10	16	28	3	21	5	6
	Wed	Thu	Fri	Tue	Mon	Wed	Thu	Wed	Tue	Mon	Fri	Thu	Fri	Wed	Sun	Wed	Thu
Tolt River Watershed, King County, Wa	--	--	--	--	--	--	--	40	--	--	--	42	--	--	--	--	--
Highway 9 & 28th St NE, Lake Stevens, Wa	--	--	--	--	--	133	--	--	--	--	136	--	--	--	--	--	--
South End of Columbia Street, Marysville, Wa	--	--	--	--	--	115	--	--	--	--	--	--	230	191	--	--	--
Medical-Dental Bldg, 2730 Colby, Everett, Wa	--	--	--	--	--	--	111	--	--	--	--	--	--	--	--	--	--
Lynnwood HS, 3001 184th St SW, Lynnwood, Wa	--	154	--	--	--	--	111	--	--	--	--	--	--	--	--	--	--
504 Bellevue Way NE, Bellevue, Wa	--	--	--	171	--	217	--	--	--	--	--	--	--	--	--	--	--
20050 SE 56th, Lake Sammamish State Park, Wa	--	164	--	--	--	134	--	--	--	--	--	--	--	--	--	--	--
North 98th St & Stone Ave N, Seattle, Wa	--	--	--	--	--	110	--	--	--	--	110	--	--	159	--	--	--
5701 8th Ave NE, Seattle, Wa	--	118	--	--	--	--	--	--	--	--	--	--	--	118	123	--	--
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	--	123	--	--	--	111	--	--	--	--	--	--	--	--	--	--	--
Public Safety Bldg, 604 3rd Ave, Seattle, Wa	--	--	--	125	--	--	--	--	--	--	--	--	--	131	--	--	--
Fire Station #10, 301 2nd Ave S, Seattle, Wa	--	--	--	--	--	132	--	--	--	--	--	--	--	131	--	--	--
Harbor Island, 2555 13th Ave SW, Seattle, Wa	--	--	--	--	--	165	--	--	--	--	--	--	--	178	--	--	--
Harbor Island, 3400 13th Ave SW, Seattle, Wa	--	189	--	--	--	187	--	--	--	--	--	--	--	--	--	--	--
Duwamish, 4401 E Marginal Way S, Seattle, Wa	262	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	263
Georgetown, 6431 Corson Ave S, Seattle, Wa	--	179	--	--	--	168	--	--	--	--	--	--	--	--	--	--	--
South Park, 723 S Concord St, Seattle, Wa	--	139	--	--	--	157	--	--	--	--	--	--	--	--	--	--	--
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	--	211	--	--	--	145	--	--	--	--	--	--	--	--	--	--	--
SE Dist Health Ctr, 3001 NE 4th St, Renton, Wa	--	--	--	--	--	102	--	--	--	--	--	--	--	91	--	--	--
200 South 2nd St, Renton, Wa	--	--	--	--	111	139	--	--	--	--	--	--	--	--	--	--	--
22916 86th Ave S, Kent, Wa	--	141	--	--	--	149	--	--	--	--	--	--	--	--	--	--	--
Memorial Park, 850 N Central Ave, Kent, Wa	--	191	--	--	--	164	--	--	--	--	--	--	--	--	--	--	--
Federal Way HS, 1401 S 304 St, Federal Way, Wa	--	--	--	--	--	82	--	--	--	--	--	--	--	162	--	--	--
115 E Main St, Auburn, Wa	--	144	--	--	--	109	--	--	--	--	--	--	--	--	--	--	--
Sumner Jr HS, 1508 Willow St, Sumner, Wa	--	163	--	--	--	106	--	--	--	--	--	--	--	--	--	--	--
Fife Sr High School, 5616 20th E, Fife, Wa	--	167	--	--	--	127	--	--	--	--	--	--	--	--	--	--	--
2340 Taylor Way, Tacoma, Wa	--	222	--	--	--	--	--	--	--	--	--	--	--	--	--	--	210
Fire Station #12, 2316 E 11th St, Tacoma, Wa	--	--	263	--	--	--	--	--	--	--	--	--	--	--	227	--	--
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	--	202	--	--	--	--	--	--	--	--	--	--	--	183	--	--	--
Cascadia, 2002 E 28th St, Tacoma, Wa	--	197	--	--	--	146	--	--	--	--	--	--	--	--	--	--	--
Willard School, S 32nd & S 'D' St, Tacoma, Wa	--	197	--	--	--	127	--	--	--	--	--	--	--	--	--	--	--
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	--	153	--	--	--	105	--	--	--	--	--	--	--	--	--	--	--
SW 283rd & 101st Ave SW, Maury Island, Wa	--	--	--	--	--	75	--	--	--	--	--	--	--	--	--	98	--
Ruston School, 5219 N Shirley St, Tacoma, Wa	--	128	--	--	--	--	--	--	--	--	--	--	--	88	--	--	--
4716 North Baltimore St, Tacoma, Wa	114	141	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
North 26th & Pearl Sts, Tacoma, Wa	--	133	--	--	--	--	--	96	--	--	--	--	--	--	--	--	--
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	--	269	--	--	--	131	--	--	--	--	--	--	--	--	--	--	--
City Water Supply Pump House, Dupont, Wa	--	85	--	--	--	--	--	--	67	--	--	--	--	--	--	--	--
City Hall, 239 4th St, Bremerton, Wa	--	--	--	--	--	89	--	--	--	--	--	--	--	92	--	--	--

-- Indicates no sample on specified day

SUSPENDED PARTICULATES (Total)
Micrograms per Standard Cubic Meter

Sampled by Standard High Volume Glass Fiber filters

Jan-Apr, 1984

Summary of Observations Greater Than 150

Location	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Apr
	9	16	17	18	19	20	31	1	2	6	7	17	6	7	8	9	27
	Mon	Mon	Tue	Wed	Thu	Fri	Tue	Wed	Thu	Mon	Tue	Fri	Tue	Wed	Thu	Fri	Fri
Medical-Dental Bldg, 2730 Colby, Everett, Wa	--	--	--	--													
Lynnwood HS, 3001 184th St SW, Lynnwood, Wa	--	--	--	--	154	--		--	--			--	--	--	--	--	--
504 Bellevue Way NE, Bellevue, Wa	--	--	--	--	166	--	171	--	--	164	--	--	--	217	--	--	--
20050 SE 56th, Lake Sammamish State Park, Wa	--	--	--	--	164	--		--	--								
North 98th St & Stone Ave N, Seattle, Wa	--	--	--	--				--	--								
Harbor Island, 2555 13th Ave SW, Seattle, Wa	--	--	--	--			159	--	--	165	--	--	--				
Harbor Island, 3400 13th Ave SW, Seattle, Wa	--	--	--	--	189	--	163	--	--	187	--	--	--	176	--	--	--
Duwamish, 4401 E Marginal Way S, Seattle, Wa	217	215	209	262	202	223	182	155		154	258	161	248	168	203		
Georgetown, 6431 Corson Ave S, Seattle, Wa	--	--	--	--	179	--		--	--					168	--	--	--
South Park, 723 S Concord St, Seattle, Wa	--	--	--	--				--	--					157	--	--	--
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	--	--	--	--	211	--		--	--								
Memorial Park, 850 N Central Ave, Kent, Wa	--	--	--	--	191	--		--	--					164	--	--	--
Federal Way HS, 1401 S 304 St, Federal Way, Wa	--	--	--	--				--	--								
Sumner Jr HS, 1508 Willow St, Sumner, Wa	--	--	--	--	163	--		--	--								
Fife Sr High School, 5616 20th E, Fife, Wa	--	--	--	--	167	--		--	--								
2340 Taylor Way, Tacoma, Wa	--	--	--	--	222	--		--	154					180	--	--	--
Fire Station #12, 2316 E 11th St, Tacoma, Wa	--	174	189	--	212	263								209	--	156	201
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	--	--	--	--	202	--		--	--								
Cascadia, 2002 E 28th St, Tacoma, Wa	--	--	--	--	197	--		--	--								
Willard School, S 32nd & S 'D' St, Tacoma, Wa	--	--	--	--	197	--		--	--								
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	--	--	--	--	153	--		--	--								
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	--	--	--	--	269	--		--	--								

-- Indicates no sample on specified day

SUSPENDED PARTICULATES (Total)
Micrograms per Standard Cubic Meter

Sampled by Standard High Volume Glass Fiber filters

May-Dec, 1984

Summary of Observations Greater Than 150

Location	May	May	Jun	Jul	Aug	Aug	Sep	Sep	Sep	Oct	Oct	Nov	Dec	Dec	Dec	Dec
	18	30	23	23	16	25	14	28	30	3	23	16	3	4	5	6
	Fri	Wed	Sat	Mon	Thu	Sat	Fri	Fri	Sun	Wed	Tue	Fri	Mon	Tue	Wed	Thu
Medical-Dental Bldg, 2730 Colby, Everett, Wa							--	--	230	161	191		--	--	--	--
Lynnwood HS, 3001 184th St SW, Lynnwood, Wa							--	--	--	--		--	--	--	--	--
504 Bellevue Way NE, Bellevue, Wa	159						--	--	--	--		--	--	--	--	--
20050 SE 56th, Lake Sammamish State Park, Wa							--	--	--	--		--	--	--	--	--
North 98th St & Stone Ave N, Seattle, Wa							--	--	--	--	159	--	--	--	--	--
Harbor Island, 2555 13th Ave SW, Seattle, Wa							--	--	--	--	178	--	--	--	--	--
Harbor Island, 3400 13th Ave SW, Seattle, Wa							--	--	--	--	165	--	--	--	--	--
Duwamish, 4401 E Marginal Way S, Seattle, Wa					174			184			151	160	169	197	241	263
Georgetown, 6431 Corson Ave S, Seattle, Wa							--	--	--	--		--	--	--	--	--
South Park, 723 S Concord St, Seattle, Wa					--			--	--	--		--	--	--	--	--
Duwamish Valley, 12026 42nd Ave S, King Co, Wa							--	--	--	--		--	--	--	--	--
Memorial Park, 850 N Central Ave, Kent, Wa							--	--	--	--		--	--	--	--	--
Federal Way HS, 1401 S 304 St, Federal Way, Wa							--	--	--	--	162	--	--	--	--	--
Sumner Jr HS, 1508 Willow St, Sumner, Wa							--	--	--	--		--	--	--	--	--
Fife Sr High School, 5616 20th E, Fife, Wa							--	--	--	--		--	--	--	--	--
2340 Taylor Way, Tacoma, Wa					201	176			--	--	185		--	--	--	210
Fire Station #12, 2316 E 11th St, Tacoma, Wa	169	161					151	--	--	170		--	--	--	227	177
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa							--	--	--	--	183	--	--	--	--	--
Cascadia, 2002 E 28th St, Tacoma, Wa							--	--	--	--		--	--	--	--	--
Willard School, S 32nd & S 'D' St, Tacoma, Wa							--	--	--	--		--	--	--	--	--
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa							--	--	--	--		--	--	--	--	--
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa							--	--	--	--		--	--	--	--	--

-- Indicates no sample on specified day

SUSPENDED PARTICULATES (Smaller than 10 micrometers)
Micrograms per Standard Cubic Meter

Sampled by Size Selective Inlet - High Volume Glass Fiber filters

1984

Location	Monthly Arithmetic Averages												No. Of Obs.	Year Arith Mean	Year Geom Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Medical-Dental Bldg, 2730 Colby, Everett, Wa ^a						23	28	29	31	82	27	28	33	36	31
North 98th St & Stone Ave N, Seattle, Wa	52	37	34	20	22	20	27	34	33	69	31	33	60	35	30
Harbor Island, 2555 13th Ave SW, Seattle, Wa	63	49	48	27	29	23	33	33	37	64	41	39	60	41	36
Duwamish, 4401 E Marginal Way S, Seattle, Wa	65	51	50	32	27	30	42	43	42	61	49	48	124	45	40
South Park, 723 S Concord St, Seattle, Wa	65	43	49	21	22	23	34	29	34	59	41	37	60	39	33
Memorial Park, 850 N Central Ave, Kent, Wa	66	37	40	22	24	26	40	33	32	60	41	36	58	38	33
2340 Taylor Way, Tacoma, Wa	67	44	47	24	39	31	53	53	48	62	44	35	61	46	39
Fire Station #12, 2316 E 11th St, Tacoma, Wa	69	49	48	27	47	39	40	53	42	65	45	41	60	47	40

^asampling started 6/17/84

Statistical Summary

Location	No. Of Obs.	Frequency Distribution - Percent										Arith Mean	Geom Mean	Std Dev	Arith Std Dev
		10	20	30	40	50	60	70	80	90	95				
Medical-Dental Bldg, 2730 Colby, Everett, Wa	33	16	20	25	28	30	32	34	39	48	52	36	31	1.69	29.84
North 98th St & Stone Ave N, Seattle, Wa	60	16	19	21	23	27	30	37	43	57	80	35	30	1.69	23.96
Harbor Island, 2555 13th Ave SW, Seattle, Wa	60	20	25	26	30	34	38	43	49	84	98	41	36	1.61	23.24
Duwamish, 4401 E Marginal Way S, Seattle, Wa	124	22	26	29	34	38	44	50	58	82	102	45	40	1.61	24.12
South Park, 723 S Concord St, Seattle, Wa	60	17	20	22	27	29	35	39	55	76	90	39	33	1.74	24.24
Memorial Park, 850 N Central Ave, Kent, Wa	58	18	20	23	27	31	36	39	44	76	89	38	33	1.69	23.73
2340 Taylor Way, Tacoma, Wa	61	17	22	26	31	41	43	49	71	80	96	46	39	1.82	29.53
Fire Station #12, 2316 E 11th St, Tacoma, Wa	60	20	24	27	31	40	45	51	64	84	93	47	40	1.76	30.20

Summary of Maximum and 2nd High Observed Concentrations

Location	Jan 17	Jan 19	Jan 31	Mar 7	Sep 28	Oct 3	Oct 21	Dec 6
	Tue	Thu	Tue	Wed	Fri	Wed	Sun	Thu
Medical-Dental Bldg, 2730 Colby, Everett, Wa	--	--	--	--	165	174	--	--
North 98th St & Stone Ave N, Seattle, Wa	--	--	--	--	--	151	102	--
Harbor Island, 2555 13th Ave SW, Seattle, Wa	--	--	104	--	--	107	--	--
Duwamish, 4401 E Marginal Way S, Seattle, Wa	129	114	--	--	--	--	--	--
South Park, 723 S Concord St, Seattle, Wa	--	115	--	103	--	--	--	--
Memorial Park, 850 N Central Ave, Kent, Wa	--	125	--	--	--	100	--	--
2340 Taylor Way, Tacoma, Wa	--	164	--	--	--	--	149	--
Fire Station #12, 2316 E 11th St, Tacoma, Wa	--	173	--	--	--	--	147	--

-- Indicates no sample on specified day

SUSPENDED PARTICULATES (Smaller than 2.5 micrometers)
Micrograms per Standard Cubic Meter

Sampled by Cyclone Inlet Teflon filters

1984

Location	Monthly Arithmetic Averages												No. Of Obs.	Year Arith Mean	Year Geom Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Harbor Island, 2555 13th Ave SW, Seattle, Wa	34	28	29	19	22	20	25	26	27	44	27	27	61	27	25
Duwamish, 4401 E Marginal Way S, Seattle, Wa	31	25	28	23	18	21	26	27	31	43	30	31	114	28	25
South Park, 723 S Concord St, Seattle, Wa	38	34	32	19		20	28	27	28	53	30	30	55	30	27
2340 Taylor Way, Tacoma, Wa	42	30	29	18	18	19	26	26	27	47	28	27	61	28	24
Fire Station #12, 2316 E 11th St, Tacoma, Wa	44	34	30	21	23	24	30	31	29	49	34	37	58	32	29

Statistical Summary

Location	No. Of Obs.	Frequency Distribution - Percent											Arith Mean	Geom Mean	Geom Std Dev	Arith Std Dev
		10	20	30	40	50	60	70	80	90	95					
Harbor Island, 2555 13th Ave SW, Seattle, Wa	61	16	18	21	23	24	26	28	32	44	52	27	25	1.46	12.33	
Duwamish, 4401 E Marginal Way S, Seattle, Wa	114	15	18	20	22	25	27	31	34	42	52	28	25	1.52	13.39	
South Park, 723 S Concord St, Seattle, Wa	55	14	16	22	24	26	30	34	38	56	59	30	27	1.64	15.03	
2340 Taylor Way, Tacoma, Wa	61	13	14	18	21	23	26	29	36	53	61	28	24	1.69	18.52	
Fire Station #12, 2316 E 11th St, Tacoma, Wa	58	17	20	21	25	26	29	34	39	53	63	32	29	1.59	18.88	

Summary of Maximum and 2nd High Observed Concentrations

Location	Jan Thu	Oct Wed	Oct Sun	Oct Tue	Dec Thu
Harbor Island, 2555 13th Ave SW, Seattle, Wa		70	68	--	--
Duwamish, 4401 E Marginal Way S, Seattle, Wa		79		94	--
South Park, 723 S Concord St, Seattle, Wa		71	66	--	--
2340 Taylor Way, Tacoma, Wa	106				129
Fire Station #12, 2316 E 11th St, Tacoma, Wa	111				138

-- Indicates no sample on specified day

PARTICULATE MATTER RATIOS
(Smaller than 10 micrometers)/(Total)

1984

Particulate Matter Fraction	Method	Filter Medium
Smaller than 10 micrometers	Size Selective Inlet - High Volume	Glass Fiber
DIVIDED BY		
Total	Standard High Volume	Glass Fiber

Location	Average Monthly Ratios												No. of Obs	Year Ratio
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Medical-Dental Bldg, 2730 Colby, Everett, Wa						.70	.60	.67	.80	.86	.81	.79	53	.748
North 98th St & Stone Ave N, Seattle, Wa	.78	.74	.70	.56	.56	.54	.51	.49	.75	.91	.82	.87	60	.685
Harbor Island, 2555 13th Ave SW, Seattle, Wa	.65	.58	.65	.51	.56	.57	.51	.57	.56	.71	.69	.72	60	.606
Duwamish, 4401 E Marginal Way S, Seattle, Wa	.63	.62	.61	.53	.58	.63	.60	.58	.65	.64	.60	.65	123	.610
South Park, 723 S Concord St, Seattle, Wa	.79	.78	.78	.73	.66	.71	.62	.67	.71	.84	.75	.84	59	.740
Memorial Park, 850 N Central Ave, Kent, Wa	.68	.61	.62	.59	.57	.56	.54	.56	.63	.84	.80	.74	61	.643
2340 Taylor Way, Tacoma, Wa	.66	.63	.64	.62	.58	.66	.48	.60	.57	.68	.68	.71	65	.626
Fire Station #12, 2316 E 11th St, Tacoma, Wa	.71	.74	.68	.58	.55	.53	.56	.59	.60	.76	.72	.79	64	.650

PARTICULATE MATTER RATIOS
(Smaller than 2.5 micrometers)/(Smaller than 10 micrometers)

1984

Particulate Matter Fraction	Method	Filter Medium
Smaller than 2.5 micrometers	Cyclone Inlet	Teflon
DIVIDED BY		
Smaller than 10 micrometers	Size Selective Inlet - High Volume	Glass Fiber

Location	Average Monthly Ratios												No. of Obs	Year Ratio
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Harbor Island, 2555 13th Ave SW, Seattle, Wa	.52	.65	.63	.71	.77	.89	.78	.84	.79	.71	.66	.75	60	.723
Duwamish, 4401 E Marginal Way S, Seattle, Wa	.41	.49	.58	.74	.70	.74	.67	.63	.82	.69	.67	.64	113	.649
South Park, 723 S Concord St, Seattle, Wa	.54	.82	.69	.89		.89	.82	.96	.86	.78	.71	.90	52	.805
2340 Taylor Way, Tacoma, Wa	.61	.68	.65	.75	.59	.64	.54	.53	.61	.77	.64	.80	65	.651
Fire Station #12, 2316 E 11th St, Tacoma, Wa	.62	.72	.69	.79	.61	.70	.79	.57	.76	.76	.68	.80	61	.709

PARTICULATE MATTER RATIOS
(Smaller than 2.5 micrometers)/(Light scattering extinction coefficient)

1984

Particulate Matter Fraction	Method	Filter Medium
Smaller than 2.5 micrometers	Cyclone Inlet	Teflon
DIVIDED BY		
Light scattering extinction coefficient;	Integrating Nephelometer-heated probe;	Units are bsp (X 10 Exp-4)/M

Location	Average Monthly Ratios												No. of Obs	Year Ratio
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Duwamish, 4401 E Marginal Way S, Seattle, Wa	22.1	36.3	38.3	60.3	62.6	81.2	70.3	59.3	60.6	40.4	42.8	39.5	111	51.16
Fire Station #12, 2316 E 11th St, Tacoma, Wa	30.2	34.4	35.5	68.5	81.8	86.1	70.7	69.3	61.0	41.1	31.1	28.9	62	53.22

SUSPENDED PARTICULATES
(COH's/1000 Lin Ft)
1984

Statistical Summary

Location	No. of 1 Hour Samples	Frequency Distribution - Percent												Arith Mean	Geom Mean	Geom Std Dev	Arith Std Dev
		5	10	20	30	40	50	60	70	80	90	95	99				
Medical-Dental Bldg, 2730 Colby, Everett, Wa	8625	.1	.1	.2	.2	.3	.3	.4	.5	.6	.9	1.2	1.8	.44	.31	2.48	.38
Duwamish, 4401 E Marginal Way S, Seattle, Wa	8717	.1	.1	.2	.3	.4	.5	.6	.8	1.1	1.6	2.1	2.9	.69	.45	2.71	.65
Fire Station #12, 2316 E 11th St, Tacoma, Wa	8606	.2	.2	.3	.4	.5	.7	.8	1.1	1.4	2.0	2.7	3.7	.93	.66	2.36	.80

Location	Monthly Arithmetic Averages												No. of 1 Hour Samples	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Medical-Dental Bldg, 2730 Colby, Everett, Wa	.72	.49	.49	.38	.27	.23	.23	.42	.44	.56	.39	.60	8625	.44
Duwamish, 4401 E Marginal Way S, Seattle, Wa	.98	.92	.73	.43	.37	.31	.35	.42	.57	.99	.97	1.30	8717	.69
Fire Station #12, 2316 E 11th St, Tacoma, Wa	1.36	1.24	.94	.59	.55	.51	.57	.70	.86	1.19	1.18	1.47	8606	.93

ATMOSPHERIC PARTICLES
(bsp (X 10 Exp-4)/M)
1984

Statistical Summary

Location	No. of 1 Hour Samples	Frequency Distribution - Percent												Arith Mean	Geom Mean	Geom Std Dev	Arith Std Dev
		5	10	20	30	40	50	60	70	80	90	95	99				
North 98th St & Stone Ave N, Seattle, Wa	8748	.1	.1	.1	.2	.2	.3	.4	.5	.8	1.2	1.9	3.3	.53	.33	2.58	.65
Duwamish, 4401 E Marginal Way S, Seattle, Wa	8696	.1	.2	.2	.3	.3	.4	.5	.7	1.0	1.6	2.3	3.8	.69	.46	2.43	.76
22916 86th Ave S, Kent, Wa	8705	.1	.2	.2	.3	.3	.4	.5	.8	1.1	2.1	3.0	4.8	.81	.48	2.66	.98
Fire Station #12, 2316 E 11th St, Tacoma, Wa	8729	.1	.2	.2	.3	.3	.4	.5	.7	1.2	2.1	3.1	5.8	.84	.48	2.71	1.12

Location	Monthly Arithmetic Averages												No. of 1 Hour Samples	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
North 98th St & Stone Ave N, Seattle, Wa	.94	.67	.55	.32	.23	.22	.28	.29	.41	.90	.59	.95	8748	.53
Duwamish, 4401 E Marginal Way S, Seattle, Wa	1.13	.94	.75	.44	.31	.31	.40	.40	.57	1.11	.75	1.20	8696	.69
22916 86th Ave S, Kent, Wa	1.47	1.05	.81	.45	.33	.34	.48	.44	.57	1.15	.97	1.60	8705	.81
Fire Station #12, 2316 E 11th St, Tacoma, Wa	1.57	1.26	.82	.44	.35	.34	.44	.44	.59	1.21	1.00	1.65	8729	.84

SUSPENDED PARTICULATES
Description of Methods

Coefficient of Haze (COH) is a measure of suspended particulates derived from the decrease in light transmission through a cellulose filter tape as particulates accumulate on the tape. Ambient air is drawn through the cellulose filter tape continuously for 28 minutes; the decrease in light transmission due to particulate loading is measured; the instrument then sequences to a clean section of cellulose tape; and the sampling cycle repeats again and again providing "continuous sampling". The concentration measured by this method is reported in COH-units per thousand linear feet of air.

An instrument called an integrating nephelometer "continuously measures" the light scattering extinction coefficient. A component of the scattering coefficient, (bsp), is a measure of atmospheric particles. This particle scattering coefficient is inversely related to visibility and has shown high correlation to fine particulate mass concentrations. The particulate level measured by this method is reported as a scattering coefficient per meter that must be multiplied by 10 to the exponent -4. The Agency preheats the sample air stream 6 to 10 degrees C above ambient air temperature to dry the particles. A comprehensive description of the integrating

nephelometer method appears in a paper by Michael G. Ruby published in the "Journal of the Air Pollution Control Association", March, 1985.

The Federal reference method using standard high volume sampling measures Total Suspended Particulates (TSP). High volume sampling with a Size Selective Inlet measures the Particulate Matter fraction with particle diameters smaller than or equal to 10 micrometers (PM10). Sampling with a cyclone inlet sampler measures the Fine Particulate fraction with diameters smaller than 2.5 micrometers (FP2.5). These methods "integrate a sample" for the duration of sampling on a filter, usually for 24 hours from midnight to midnight. The particulate concentration measured by these methods is reported in micrograms per standard cubic meter of air.

For stations with collocated sampling the following tables present correlation coefficients calculated between: (1) the "continuous" methods and (2) the "continuous" and "integrated" methods. In general the results are site specific with better correlation between "continuous" and "integrated" sampling for the PM10 and Fine Particulate data than for the TSP data.

Correlation between Continuous Sampling Methods

1984

	Jan	Apr	Jul	Oct	
	Feb	May	Aug	Nov	Annual
	Mar	Jun	Sep	Dec	

Duwamish, 4401 E Marginal Way S, Seattle, Wa					
1 Hour COH Vs 1 Hour bsp					
Correlation Coefficient	.85	.71	.67	.76	.81
Number of 1 Hour Samples	2166	2160	2155	2153	8634
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.92	.75	.76	.78	.86
Number of 24 Hour Samples	91	90	88	89	358

Fire Station #12, 2316 E 11th St, Tacoma, Wa					
1 Hour COH Vs 1 Hour bsp					
Correlation Coefficient	.88	.67	.69	.86	.85
Number of 1 Hour Samples	2121	2167	2124	2144	8556
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.93	.73	.73	.92	.92
Number of 24 Hour Samples	86	91	89	89	355

Note: 24 Hour averages computed for calendar day midnight to midnight time period.

SUSPENDED PARTICULATES

Correlation between Continuous and Integrated Sampling Methods

1984

	Jan	Apr	Jul	Oct	Annual
	Feb	May	Aug	Nov	
	Mar	Jun	Sep	Dec	
Medical-Dental Bldg, 2730 Colby, Everett, Wa 24 Hour COH Vs TSP Corr. Coeff.	.89	.51	.46	.81	.64
Number of Common Samples	15	15	19	30	79
Medical-Dental Bldg, 2730 Colby, Everett, Wa 24 Hour COH Vs PM10 Corr. Coeff.		.78	.56	.86	.72
Number of Common Samples		3	19	29	51
North 98th St & Stone Ave N, Seattle, Wa 24 Hour bsp Vs TSP Corr. Coeff.	.87	.51	.35	.90	.71
Number of Common Samples	16	15	15	15	61
North 98th St & Stone Ave N, Seattle, Wa 24 Hour bsp Vs PM10 Corr. Coeff.	.96	.75	.74	.93	.92
Number of Common Samples	16	14	15	15	60
Duwamish, 4401 E Marginal Way S, Seattle, Wa 24 Hour COH Vs TSP Corr. Coeff.	.89	.67	.72	.79	.78
24 Hour bsp Vs TSP Corr. Coeff.	.86	.63	.53	.82	.79
Number of Common Samples	86	89	87	85	347
Duwamish, 4401 E Marginal Way S, Seattle, Wa 24 Hour COH Vs PM10 Corr. Coeff.	.93	.80	.73	.85	.86
24 Hour bsp Vs PM10 Corr. Coeff.	.91	.85	.60	.91	.88
Number of Common Samples	32	30	28	30	120
Duwamish, 4401 E Marginal Way S, Seattle, Wa 24 Hour COH Vs FP2.5 Corr. Coeff.	.89	.61	.58	.77	.75
24 Hour bsp Vs FP2.5 Corr. Coeff.	.91	.61	.75	.95	.89
Number of Common Samples	27	30	26	27	110
22916 86th Ave S, Kent, Wa 24 Hour bsp Vs TSP Corr. Coeff.	.81	.40	.29	.92	.70
Number of Common Samples	16	15	15	15	61
Fire Station #12, 2316 E 11th St, Tacoma, Wa 24 Hour COH Vs TSP Corr. Coeff.	.92	.52	.52	.86	.71
24 Hour bsp Vs TSP Corr. Coeff.	.86	.51	.41	.88	.71
Number of Common Samples	35	30	29	33	127
Fire Station #12, 2316 E 11th St, Tacoma, Wa 24 Hour COH Vs PM10 Corr. Coeff.	.96	.43	.88	.90	.85
24 Hour bsp Vs PM10 Corr. Coeff.	.94	.45	.73	.98	.89
Number of Common Samples	17	15	13	17	62
Fire Station #12, 2316 E 11th St, Tacoma, Wa 24 Hour COH Vs FP2.5 Corr. Coeff.	.95	.74	.88	.90	.90
24 Hour bsp Vs FP2.5 Corr. Coeff.	.98	.80	.93	.98	.96
Number of Common Samples	17	15	13	16	61

Note: 24 Hour averages computed for calendar day midnight to midnight time period.

LEAD

The ambient air quality standard for lead is 1.5 micrograms per cubic meter averaged over one calendar quarter. About 90 percent of the lead emitted into the air comes from automobile exhaust. The remainder is released from stationary sources such as primary and secondary nonferrous smelters.

The tables below present the results of sampling during 1984. The Harbor Island station at 2555 13th Ave SW shows improving quarterly lead values following closure of the secondary lead smelter just south of the station. Lead concentrations measured at all other stations were lower than the ambient standard.

LEAD
Micrograms per Standard Cubic Meter

Sampled by Standard High Volume Glass Fiber filters

1984

Location	Monthly Arithmetic Averages												No. Of Obs.	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Evergreen Point Bridge Toll Plaza, Medina, Wa	.61	.51	.36	.15	.35	.27	.32	.23	.17	.24	.26	.37	#	.32
504 Bellevue Way NE, Bellevue, Wa	.39	.40	.17	.12	.18	.17	.23	.15	.14	.22	.24	.17	#	.22
North 98th St & Stone Ave N, Seattle, Wa	.40	.32	.19	.10	.14	.10	.11	.14	.15	.25	.23	.21	#	.20
5701 8th Ave NE, Seattle, Wa	.56	.57	.31	.44	.46	.45	.33	.38	.23	.40	.38	.37	#	.41
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	.53	.49	.25	.21	.24	.15	.14	.17	.16	.31	.03	.21	#	.24
Harbor Island, 2555 13th Ave SW, Seattle, Wa	2.29	1.94	.46	1.61	1.51	1.33	.84	1.26	.98	1.80	.78	.61	61	1.28
Harbor Island, 3400 13th Ave SW, Seattle, Wa	.81	.66	.43	.29	.26	.14	.35	.39	.39	.40	.37	1.18	61	.47
South Park, 723 S Concord St, Seattle, Wa					.24	.11	.14	.20	.17	.34	1.18	.27	39	.33
Sumner Jr HS, 1508 Willow St, Sumner, Wa	.22	.28	.22	.11	.14	.17	.14	.12	.10	.17	.14	.16	61	.16
SW 283rd & 101st Ave SW, Maury Island, Wa	.07	.17	.13	.11	.08	.08	.04	.06	.07	.12	.09	.16	84	.10
Ruston School, 5219 N Shirley St, Tacoma, Wa	.39	.31	.25	.11	.11	.11	.17	.11	.20	.28	.31	.11	61	.20
4716 North Baltimore St, Tacoma, Wa	.41	.41	.36	.24	.20	.23	.32	.24	.23	.28	.32	.38	119	.30
North 26th & Pearl Sts, Tacoma, Wa	.43	.36	.33	.05	.17	.16	.28	.15	.13	.19	.15	.22	61	.22
City Water Supply Pump House, Dupont, Wa	.16	.20	.12	.06	.07	.05	.09	.05	.16	.16	.11	.09	60	.11

indicates a composite monthly average was used.

Location	Quarterly Arithmetic Averages			
	1st	2nd	3rd	4th
Evergreen Point Bridge Toll Plaza, Medina, Wa	.49	.26	.24	.29
504 Bellevue Way NE, Bellevue, Wa	.32	.16	.17	.21
North 98th St & Stone Ave N, Seattle, Wa	.30	.11	.13	.23
5701 8th Ave NE, Seattle, Wa	.48	.45	.31	.38
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	.42	.20	.16	.18
Harbor Island, 2555 13th Ave SW, Seattle, Wa	1.56	1.48	1.03	1.06
Harbor Island, 3400 13th Ave SW, Seattle, Wa	.63	.23	.38	.65
South Park, 723 S Concord St, Seattle, Wa		.18	.17	.60
Sumner Jr HS, 1508 Willow St, Sumner, Wa	.24	.14	.12	.16
SW 283rd & 101st Ave SW, Maury Island, Wa	.12	.09	.06	.12
Ruston School, 5219 N Shirley St, Tacoma, Wa	.32	.11	.16	.23
4716 North Baltimore St, Tacoma, Wa	.39	.22	.26	.33
North 26th & Pearl Sts, Tacoma, Wa	.37	.13	.19	.19
City Water Supply Pump House, Dupont, Wa	.16	.06	.10	.12

ARSENIC
Micrograms per Standard Cubic Meter

Sampled by Standard High Volume Glass Fiber filters

1984

Location	Monthly Arithmetic Averages												No. Of	Year
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Obs.	Mean
Harbor Island, 2555 13th Ave SW, Seattle, Wa	.02	.03	.01	.02	.01	.01	.01	.02	.02	.04	.02	.01	61	.02
Harbor Island, 3400 13th Ave SW, Seattle, Wa	.02	.02	.02	.02	.01	.01	.01	.02	.02	.05	.01	.02	61	.02
South Park, 723 S Concord St, Seattle, Wa					.01	.02	.01	.04	.03	.02	.06	.02	39	.03
Sumner Jr HS, 1508 Willow St, Sumner, Wa	<.01	.01	.01	<.01	<.01	<.01	.01	.01	<.01	.02	.01	<.01	61	.01
SW 283rd & 101st Ave SW, Maury Island, Wa	.07	.04	.06	.05	.06	.04	.02	.07	.08	.07	.07	.12	84	.06
Ruston School, 5219 N Shirley St, Tacoma, Wa	1.02	.27	.26	.20	.10	.10	.40	.16	.21	.22	.83	.13	61	.32
4716 North Baltimore St, Tacoma, Wa	.54	.15	.39	.24	.16	.36	.67	.45	.54	.24	.35	.31	119	.37
North 26th & Pearl Sts, Tacoma, Wa	.26	.05	.12	.01	.06	.13	.38	.17	.16	.05	.09	.06	61	.13
City Water Supply Pump House, Dupont, Wa	.02	<.01	.02	<.01	.01	.01	.04	.04	.02	.03	.34	.02	60	.05

Yearly arithmetic mean calculated using .0025 as a substitute for each <.01 value.

Summary of Individual 24 Hour Average Arsenic Values				
Location	Highest Value		Values Higher than .99	
	Value	Date	Value	Date
Harbor Island, 2555 13th Ave SW, Seattle, Wa	.08	27 Oct		
Harbor Island, 3400 13th Ave SW, Seattle, Wa	.12	15 Oct		
South Park, 723 S Concord St, Seattle, Wa	.20	14 Nov		
Sumner Jr HS, 1508 Willow St, Sumner, Wa	.06	3 Oct		
SW 283rd & 101st Ave SW, Maury Island, Wa	.42	15 Sep		
Ruston School, 5219 N Shirley St, Tacoma, Wa	2.40	19 Jan	2.40	19 Jan
			1.78	1 Jan
			1.61	23 Jul
			1.60	20 Nov
			1.44	31 Jan
4716 North Baltimore St, Tacoma, Wa	3.26	27 Sep	3.26	27 Sep
			3.23	13 Jan
			2.73	23 Jul
			2.42	7 Mar
			1.23	22 Jun
			1.14	2 Dec
			1.07	23 Jun
			1.03	15 Aug
			1.00	14 Jul
			1.00	21 Aug
North 26th & Pearl Sts, Tacoma, Wa	1.10	17 Jul	1.10	17 Jul
City Water Supply Pump House, Dupont, Wa	1.68	20 Nov	1.68	20 Nov

Under the federal Clean Air Act the U.S. EPA has designated inorganic arsenic as a hazardous air pollutant. The principal source emitting arsenic in the Puget Sound area is the Tacoma Smelter. The Washington Department of Ecology has adopted community exposure standards for arsenic as follows:

Maximum 24 hour Concentration - 2.0 micrograms per cubic meter

Maximum annual arithmetic mean - 0.3 micrograms per cubic meter

The adjacent tables summarize arsenic measurements during 1984 from nine stations. The Ruston School and North Baltimore stations are less than one mile from the Tacoma Smelter.

QUALITY ASSURANCE

Introduction

Quality Assurance (QA) includes all the activities which focus attention on obtaining valid data and documenting the quality of the data. The QA process is an integral part of all monitoring activities. Some specific QA activities are: selection of methods and analyzers; installation of equipment; calibration; zero and span checks and adjustments; control checks, limits, and corrective actions; maintenance; recording and validating data; and documentation of quality control information.

Independent Audits

The Agency participates in audit programs conducted independently by the U.S. Environmental Protection Agency and the Washington State Department of Ecology. For the EPA, this consists of (1) an annual onsite audit of some Agency instruments by EPA or their designated representative, and (2) Agency participation in EPA's national performance audits as they are announced. The Department of Ecology also independently selects and audits Agency instruments onsite such that a part of the network is audited each quarter.

Precision and Accuracy Audits

The documentation for the QA program is established in Title 40, Code of Federal Regulations, Part 58, published May 10, 1979, and amended November 9, 1979, and September 3, 1981. The important QA characteristics which the regulations require to be developed and reported are PRECISION and ACCURACY. In simple terms, PRECISION means the ability to repeat a measurement of the same, known sample at a different time; ACCURACY means the agreement between a measurement and the true value.

Each pollutant measuring instrument must be audited for precision at least every two weeks and for accuracy at least once per year. For each audit the percentage difference between the instrument indicated concentration and the true concentration of the reference sample is

calculated. At the end of a calendar quarter the average and the standard deviation of the percentage differences for each instrument are calculated. These two statistics are then pooled for all instruments monitoring the same pollutant.

Probability Limits for Precision and Accuracy

The Federal Regulation requires summary of the precision and accuracy audit results by computing the 95 Percent Probability Limits for each pollutant from the pooled average percent differences, D , and the pooled standard deviation, S_a , as follows.

$$\text{Upper 95 Percent Probability Limit} = D + 1.96(S_a)$$

$$\text{Lower 95 Percent Probability Limit} = D - 1.96(S_a)$$

These calculated limits signify that with 95 percent probability all air quality data compiled during the audit period are within the limits. As an example, if the average of the percent differences is zero and the standard deviation of the percent differences is 4.1 percent, the upper and lower 95 percent probability limits are respectively +8 and -8 percent.

Agency Precision and Accuracy

For many Agency instruments precision audits are performed each week and accuracy audits are completed each six months or each quarter. The tables on the following page summarize the Precision and Accuracy statistics from these audits for all air quality data which the Agency originated in 1984.

Audits for the integrating nephelometer, which measures atmospheric particles, are presented only in the Precision table since separate accuracy audits are not applicable for the nephelometer measurement. Also added to the Precision table this year are the audit results for duplicate samples of fine particulates measured using the cyclone inlet samplers. Attention to the fine particulate measurement method improved the precision of these data during the year.

PRECISION OF AIR QUALITY DATA
1984

Upper and Lower 95 Percent Probability Limits
of Percent Differences

Pollutant	Probability Limit	Quarter				Annual Average
		1st	2nd	3rd	4th	
Suspended Particulates (Total, Hi Vol)	Upper	+19.6	+11.3	+7.8	+5.3	+11.0
	Lower	-4.8	-5.1	-5.0	-9.1	-6.0
Suspended Particulates (PM10, SSI Hi Vol)	Upper	+6.6	+9.4	+5.9	+4.9	+6.7
	Lower	-5.0	-9.2	-9.9	-9.3	-8.4
Suspended Particulates (Fine, Cyclone Inlet)	Upper	+21.9	+7.8	+12.5	+11.4	+13.4
	Lower	-21.1	-18.0	-14.9	-11.8	-16.4
Sulfur Dioxide	Upper	+8.7	+7.9	+9.5	+9.7	+9.0
	Lower	-9.7	-6.9	-8.1	-7.1	-8.0
Ozone	Upper	+12.3	+12.4	+13.3	+11.5	+12.4
	Lower	+0.5	+5.0	+5.9	-0.7	+2.7
Atmospheric Particles (Nephelometer)	Upper	+2.8	+3.6	+4.7	+4.7	+4.0
	Lower	-3.4	-4.6	-4.3	-4.7	-4.2

ACCURACY OF AIR QUALITY DATA
1984

Upper and Lower 95 Percent Probability Limits
of Percent Differences

Pollutant	Probability Limit	Quarter				Annual Average
		1st	2nd	3rd	4th	
Suspended Particulates (Total, Hi Vol)	Upper	+3.2	+6.2	+5.3	+3.7	+4.6
	Lower	-7.0	-6.4	-4.5	-4.9	-5.7
Suspended Particulates (PM10, SSI Hi Vol)	Upper	+1.3	+1.5	+0.4	+3.5	+1.7
	Lower	-4.5	-4.7	-5.8	-5.9	-5.2
Sulfur Dioxide	Upper	+4.8	+7.9	+8.8	+14.0	+8.9
	Lower	-11.0	-6.1	-9.7	-6.0	-8.2
Ozone	Upper	-0.3		+4.3		+2.0
	Lower	-2.4		-8.7		-5.6

SULFUR DIOXIDE

Sulfur dioxide is a common air pollutant for which standards have been established nationwide. Sulfur dioxide enters the air primarily from industrial processes or from the combustion of sulfur-containing fuels such as coal and oil. In the Puget Sound area about 85 percent of the sulfur dioxide released into the air during 1984 came from the Tacoma Smelter. Once emitted into the air, reactions occur to partially convert it to other sulfur compounds such as sulfuric acid and various sulfate salts. Local sulfur

dioxide standards have been in effect since 1968. The tables below summarize sulfur dioxide data collected during 1984. There were no violations of the national standards, but there were several incidents where measured 5 minute averages exceeded 1.00 ppm and where measured 1 hour averages exceeded 0.25 ppm and in one case 0.40 ppm. The tables do not specifically enumerate which of these occurrences were violations of the local standards, but do suggest how often and at what locations such sulfur dioxide incidents occur.

SULFUR DIOXIDE
(Parts per Million)
1984

Location	Monthly Arithmetic Averages												No. of 1 Hour Samples	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Medical-Dental Bldg, 2730 Colby, Everett, Wa	.007	.006	.006	.008	.009	.012	.016	.016	.014	.013	.010	.010	8259	.010
North 98th St & Stone Ave N, Seattle, Wa	.009	.007	.006	.006	.004			.006	.006	.007	.009	.009	8120	.007
Duwamish, 4401 E Marginal Way S, Seattle, Wa	.013	.012	.012	.011	.008	.009	.007		.012	.017	.016	.012	8304	.012
Federal Way HS, 1401 S 304 St, Federal Way, Wa	.005	.005	.004	.005	.012	.009	.008	.011	.009	.008	.008	.008	8656	.008
SW 283rd & 101st Ave SW, Maury Island, Wa	.009	.008	.007	.007	.008	.007	.007	.009	.010	.015	.012	.012	8380	.009
North 37th & Vassault Sts, Tacoma, Wa	.015	.010	.007	.008	.010	.010	.011	.013	.013		.008	.010	8340	.010
North 26th & Pearl Sts, Tacoma, Wa	.011	.006	.007	.006	.012	.012	.014	.013	.015	.014	.011	.014	8511	.011

Number of Concentrations Exceeding Selected Values
for Various Averaging Periods

Location	5 Minute Average	1 Hour Average		3 Hour Average	24 Hour Average	
	1.00 ppm	0.40 ppm	0.25 ppm	0.50 ppm	0.10 ppm	0.14 ppm
Medical-Dental Bldg, 2730 Colby, Everett, Wa	4	0	1	0	0	0
North 98th St & Stone Ave N, Seattle, Wa	0	0	0	0	0	0
Duwamish, 4401 E Marginal Way S, Seattle, Wa	0	0	0	0	0	0
Federal Way HS, 1401 S 304 St, Federal Way, Wa	0	0	0	0	0	0
SW 283rd & 101st Ave SW, Maury Island, Wa	0	0	2	0	0	0
North 37th & Vassault Sts, Tacoma, Wa	5	0	3	0	0	0
North 26th & Pearl Sts, Tacoma, Wa	1	1	2	0	0	0

SULFUR DIOXIDE
(Parts per Million)
1984

Summary of Maximum and Second Highest Concentrations
for Various Averaging Periods

Location	5 Minute Average			1 Hour Average			3 Hour Average			24 Hour Average		
	Value	Date	End Time	Value	Date	End Time	Value	Date	End Time	Value	Date	End Time
Medical-Dental Bldg, 2730 Colby, Everett, Wa	1.54	25 Apr	1149	.32	29 Sep	0416	.163	29 Sep	0500	.059	30 Sep	0200
	1.30	5 Aug	1758	.24	29 Sep	0800	.147	7 Jul	2000	.050	8 Jul	1100
North 98th St & Stone Ave N, Seattle, Wa				.12	24 Sep	1200	.067	24 Sep	1300	.026	7 Dec	1200
				.07	11 Feb	1700	.053	22 Nov	2200	.025	7 Nov	1700
Duwamish, 4401 E Marginal Way S, Seattle, Wa				.13	26 Jun	1500	.120	11 Oct	1700	.052	11 Oct	1800
				.13	11 Oct	1700	.097	11 Oct	1200	.051	13 Oct	1200
Federal Way HS, 1401 S 304 St, Federal Way, Wa				.21	10 Aug	1800	.133	9 Jul	1200	.035	10 Jul	0600
				.19	9 Jul	1100	.097	16 May	1900	.032	11 Aug	1400
SW 283rd & 101st Ave SW, Maury Island, Wa				.30	11 Oct	1130	.170	25 Oct	0400	.051	25 Oct	0800
				.28	25 Oct	0400	.163	23 Jan	1600	.049	24 Jan	1300
North 37th & Vassault Sts, Tacoma, Wa	1.89	22 Jul	0105	.33	13 Jan	0953	.150	25 Sep	1300	.041	28 Sep	0700
	1.33	22 Jul	0933	.28	27 Sep	2308	.120	13 Jan	1100	.040	13 Jan	1000
North 26th & Pearl Sts, Tacoma, Wa	1.10	27 Sep	0631	.48	31 Jan	0930	.237	31 Jan	1100	.055	31 Jan	1600
				.25	26 Sep	2000	.117	25 Sep	1400	.042	27 Sep	0900

Notes

- (1) 5 minute average reported only for concentrations exceeding 1.00 ppm.
- (2) Ending times are reported in Pacific Standard Time.
- (3) For equal concentration values the reported date and time refer to the earliest occurrences during the year.
- (4) At all stations sulfur dioxide was continuously measured using the method of ultraviolet fluorescence.

Photochemical Oxidants

The oxidant found in largest amounts in photochemical smog is ozone, a very reactive form of oxygen. Most oxidants are not emitted directly into the atmosphere but instead result from a series of chemical reactions between nitrogen oxides and reactive hydrocarbons in the presence of sunlight. These "photochemical" reactions proceed for several hours and generally produce maximum ozone levels between noon and early evening at locations several miles away from the sources of nitrogen oxides and reactive hydrocarbons.

In the Puget Sound region the highest ozone levels occur during summer months. These high values develop when urban area emissions are trapped beneath a nighttime and morning temperature inversion followed by very high temperatures. Light northerly winds often develop on these hot days. As a result, the highest ozone values normally occur 5 to 15 miles south to southeast of the major cities.

Ozone Standard and Pollutant Standards Index

The level of the ozone standard is 0.12 ppm. The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than one.

If an "exceedence" is defined to be a day on which the maximum 1 hour average is higher than 0.12 ppm, the standard is attained when the expected number of exceedences is equal to or less than one. In the case of a complete data set, the expected number of exceedences is simply

the average number of observed exceedences at a particular location during the most recent 3 years.

When the data set for a given year is incomplete, the number of exceedences in that year must be adjusted to estimate the true number. This estimate is based upon the observed number of exceedences, the number of required monitoring days, the number of days upon which a valid maximum was recorded, and the number of days assumed to be less than the standard level.

The estimated number of exceedences is always equal to or greater than the observed number of exceedences. However, for stations where no exceedences are observed, the estimate is zero. The expected number of exceedences is then the three year average of the estimated number of exceedences.

An hourly average ozone level of 0.12 ppm is equivalent to 100 on the Pollutant Standards Index scale. Since high ozone levels occur some distance downwind of major cities, ozone never determines the Index for Everett, Seattle or Tacoma, but may occasionally be reported for places such as Lake Sammamish, Sumner or Graham.

1984 Ozone Summary

The 1984 ozone table summarizes the four highest daily maximum 1 hour ozone averages and shows that for the three year period ending with 1984 the ozone standard was attained. Accordingly, the Agency Board of Directors and the Washington Department of Ecology requested the U.S. Environmental Protection Agency to reclassify the Puget Sound area as in attainment of the ozone standard.

NITROGEN OXIDES

Nitric oxide (NO) and nitrogen dioxide (NO₂) are released to the atmosphere as the result of high temperature fuel combustion. Motor vehicles and power plants are the most common fuel combustion sources emitting oxides of nitrogen. Nitric oxide oxidizes rather quickly to

nitrogen dioxide. Nitrogen dioxide plays an important role in the photochemical reactions which produce ozone. The nitrogen dioxide standard is an annual arithmetic average of 0.05 ppm. Nitrogen dioxide levels exceeding this annual standard are considered unhealthful.

OZONE
(Parts per Million)
1984

Location / Period of Sampling	Four Highest Daily Maximum 1 Hour Averages			Estimated No. of Days Daily Maximum 1 Hour Average Exceeded .12 ppm			No. of Days Daily Maximum 1 Hour Average Exceeded To Exceed .12 ppm
	Value	Date	End Time	1982	1983	1984	
Snohomish FD #22, 9921 84th NE, Arlington, Wa* 1 May - 22 Jul; 3 Aug - 15 Nov	.07	23 Jun	1400	0.0	0.0	0.0	0.0
	.07	25 Jun	1800				
	.07	15 Jul	1500				
	.07	7 Aug	1600				
20050 SE 56th, Lake Sammamish State Park, Wa* 1 Jan - 31 Dec	.09	16 Jul	1400	0.0	0.0	0.0	0.0
	.09	24 Jul	1600				
	.08	28 May	1500				
	.08	23 Jul	1500				
22916 86th Ave S, Kent, Wa 1 Jan - 31 Dec	.08	24 Jul	1600	0.0	0.0	0.0	0.0
	.07	15 Jul	1500				
	.07	23 Jul	1400				
	.06	28 May	1500				
Sumner Jr HS, 1508 Willow St, Sumner, Wa 1 Jan - 31 Dec	.09	24 Jul	1700	0.0	0.0	0.0	0.0
	.08	15 Jul	1500				
	.08	16 Jul	1400				
	.08	15 Aug	1400				
Firwood Fire Sta, 4418 Freeman Rd, Fife, Wa* 1 Jan - 22 Jul; 31 Jul - 31 Dec	.07	29 May	1600	0.0	0.0	0.0	0.0
	.07	15 Jul	1500				
	.07	15 Aug	1300				
	.06	28 May	1400				
Pierce Co Fire D #21, 8102 304th, Graham, Wa* 4 May - 5 Sep; 10 Oct - 31 Oct	.11	24 Jul	1600	0.0	0.0	0.0	0.0
	.09	23 Jul	1700				
	.08	15 Jul	1600				
	.07	16 Jul	1500				

Notes

- (1) * Station operated by the Washington State Department of Ecology.
- (2) Ending times are reported in Pacific Standard Time.
- (3) For equal concentration values the reported date and time refer to the earliest occurrences during the year.
- (4) At all stations ozone was continuously measured using ultraviolet photometric detection.

NITROGEN DIOXIDE
(Parts per Million)
1984

Location	Monthly Arithmetic Averages												No. of Year 1 Hour Arith Samples	Year Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
4th Ave South & Jackson St, Seattle, Wa*		.036	.040	.038	.033	.029	.030	.032	.033	.033	.030	.031	8081	.033
15th Ave S & Charlestown St, Seattle, Wa*		.013	.015	.015	.011	.010	.011	.011	.011	.013		.014	7596	.012

Notes

- (1) * Station operated by the Washington State Department of Ecology.
- (2) Monthly averages are shown only for months with 75 percent or higher data completeness.
- (3) Year averages are calculated from all valid samples; the number of samples shows how completely the year mean represents the full year.
- (4) At all stations nitrogen dioxide was continuously measured using gas phase chemiluminescence.

CARBON MONOXIDE

Introduction

The Washington State Department of Ecology has statewide jurisdiction over motor vehicle emissions. As a group, motor vehicles emit more carbon monoxide than any other source. For the cities of the Puget Sound area, motor vehicle traffic is the principal contributor to the carbon monoxide levels which exceed ambient air quality standards.

The high ambient levels of carbon monoxide occur most often near congested, slow-moving motor vehicle traffic when low level winds are light and stable meteorological conditions exist. The highest hour average concentrations frequently coincide with the weekday evening traffic peaks. The lower hour average values normally occur during low traffic periods after midnight and on many hours of the weekends.

Pollutant Standards Index and Washington State Episode Levels

The level of the 8 hour average standard is 9 parts per million (ppm), and this is equivalent to 100 on the Pollutant Standards Index scale. PSI values exceeding 100 are considered "Unhealthful". An 8 hour average of 15 ppm equals 200 on the PSI scale. Pollutant Standards Index values of 200 to 299 are termed "Very Unhealthful".

Episode criteria are specified in the Washington Episode Plan (Washington Administrative Code 173-435). The Alert stage is reached when the ambient carbon monoxide concentration reaches 15 ppm for an 8 hour average, and meteorological conditions are such that the carbon monoxide concentration can be expected to remain at or above that level for 12 or more hours, or to recur unless control actions are taken. Correspondingly, the carbon monoxide concentration for the Warning stage is 30 ppm for an 8 hour

average, and for the Emergency stage is 40 ppm for an 8 hour average.

Summary

The tables on the next two pages summarize the six highest 1 hour and 8 hour average carbon monoxide levels at each station during 1984. These data were obtained from Department of Ecology data summaries. Three additional stations have been added to the carbon monoxide tables this year; they are: 1016 1st Ave, Seattle; Courthouse, 4th Ave & James St, Seattle; and 1103 Pacific Ave, Tacoma. The Seattle station at 2nd Ave & University St discontinued operation after September 30th.

Review of the data shows that two of the fifteen stations exceeded an 8 hour average of 9 ppm at least twice. Therefore these two stations, one located in Bellevue and one in Tacoma, violated the 8 hour average carbon monoxide standard. Since the maximum 1 hour average recorded at any of the stations was 21 ppm, the 1 hour carbon monoxide standard of 35 ppm was not exceeded.

The results of carbon monoxide monitoring from the 70's to date clearly show improvement in the levels of this pollutant. As recently as 1979 several Seattle area stations recorded carbon monoxide 8 hour averages which exceeded the standard on 26 to 39 days. In 1984 none of the Seattle stations measured values exceeding the standard although several locations recorded levels equal to the standard on seven different days.

During January, 1985, carbon monoxide measurements at one Seattle station exceeded the standard on five days. This indicates the Puget Sound area has not yet attained the carbon monoxide standard and further suggests a vigilant effort will be needed to maintain the standard when attainment is achieved.

CARBON MONOXIDE
(Parts per Million)
1984

Location / Period of Sampling	Six Highest Concentrations						Number of 8 Hour Averages Exceeding 9 ppm	Number of Days 8 Hour Average Exceeded 9 ppm
	1 Hour Average			8 Hour Average				
	Value	Date	End Time	Value	Date	End Time		
2005 Hewitt Avenue, Everett, Wa 1 Jan - 31 Dec	15	18 Dec	1800	8	18 Dec	2000	0	0
	15	18 Dec	1900	8	21 Dec	1800		
	14	17 Jan	1900	7	17 Jan	2400		
	12	9 Nov	1700	7	19 Oct	2400		
	11	16 Jan	1900	7	9 Nov	2300		
	11	9 Nov	1800	6	9 Jan	1400		
622 Bellevue Way NE, Bellevue, Wa 1 Jan - 31 Dec	15	9 Jan	1800	11	4 Dec	2300	2	2
	15	4 Dec	1800	10	9 Jan	2100		
	14	4 Dec	1900	9	5 Dec	2300		
	13	9 Jan	1900	8	19 Jan	2200		
	13	19 Jan	1800	8	4 Feb	2400		
	12	17 Jan	1800	8	16 Nov	2200		
Northgate, 310 NE Northgate Way, Seattle, Wa 1 Jan - 31 Dec	20	5 Dec	900	9	30 Nov	2300	0	0
	17	8 Nov	900	9	5 Dec	1100		
	16	5 Dec	800	9	5 Dec	2100		
	15	5 Dec	1800	8	9 Jan	1900		
	14	9 Jan	1800	8	15 Jan	100		
	14	7 Feb	800	7	7 Feb	1300		
4511 University Way NE, Seattle, Wa 1 Jan - 31 Dec	17	9 Jan	1800	9	9 Jan	1800	0	0
	13	16 Nov	2200	9	16 Nov	2200		
	12	21 Nov	1900	9	5 Dec	2400		
	12	5 Dec	1800	8	7 Feb	1900		
	11	9 Jan	1900	8	14 Sep	2400		
	11	14 Jan	2000	8	21 Nov	2100		
3921 Linden Ave N, Seattle, Wa 1 Jan - 30 Jun; 21 Jul - 31 Dec	10	5 Dec	900	6	17 Nov	300	0	0
	9	8 Nov	900	5	9 Jan	1400		
	8	17 Jan	900	5	5 Dec	2400		
	7	9 Jan	900	4	9 Jan	2200		
	7	9 Jan	1700	4	15 Jan	100		
	7	16 Nov	900	4	17 Jan	1100		
1424 4th Ave, Seattle, Wa 1 Jan - 31 Dec	18	20 Jan	1700	9	6 Jan	1800	0	0
	13	6 Jan	1700	8	9 Jan	1500		
	12	6 Jan	1600	8	20 Jan	1800		
	11	9 Jan	1200	8	24 Feb	1800		
	11	11 Jan	1800	8	9 Apr	1700		
	11	7 May	1600	8	7 Dec	1800		
2nd Ave & University St, Seattle, Wa 1 Jan - 30 Sep	9	7 Feb	1000	6	7 Feb	1200	0	0
	9	16 Mar	1800	5	17 Jan	1400		
	9	19 Mar	1800	5	20 Jan	1600		
	9	2 Apr	1800	5	31 Jan	1800		
	9	4 Sep	1000	5	5 Feb	300		
	8	20 Jan	1800	5	7 Feb	2000		
1016 1st Ave, Seattle, Wa 1 Jan - 8 Jan; 25 Jan - 31 Dec	13	14 Apr	2400	7	16 Nov	2200	0	0
	12	5 Dec	900	7	6 Dec	1400		
	11	6 Dec	900	6	25 Jan	1700		
	9	6 Mar	1800	6	4 Feb	2300		
	9	14 Sep	1700	6	14 Apr	2400		
	9	12 Nov	2300	6	14 Sep	1900		

CARBON MONOXIDE
(Parts per Million)
1984

Location / Period of Sampling	Six Highest Concentrations						Number of 8 Hour Averages Exceeding 9 ppm	Number of Days 8 Hour Average Exceeded 9 ppm
	1 Hour Average			8 Hour Average				
	Value	Date	End Time	Value	Date	End Time		
5th Ave & James St, Seattle, Wa 1 Jan - 6 Jan; 28 Jan - 31 Dec	14	7 Feb	1700	9	7 Feb	1800	0	0
	14	9 Nov	1700	9	16 Nov	2200		
	14	16 Nov	1800	8	6 Jan	1600		
	14	5 Dec	900	8	24 Feb	1700		
	14	12 Dec	1800	8	6 Mar	1800		
	14	18 Dec	1800	8	20 Mar	1400		
Courthouse, 4th Ave & James St, Seattle, Wa 1 Jan - 11 Oct; 29 Oct - 31 Dec	11	3 Sep	1600	8	9 Jan	1800	0	0
	11	12 Nov	1800	7	7 Feb	1300		
	11	5 Dec	900	6	6 Jan	1700		
	11	21 Dec	1600	6	5 Feb	300		
	11	21 Dec	1700	6	7 Feb	2100		
	11	22 Dec	1700	6	6 Mar	1700		
Fire Station #10, 301 2nd Ave S, Seattle, Wa 1 Jan - 31 Dec	12	4 Dec	1800	8	16 Nov	2400	0	0
	11	3 Dec	900	8	4 Dec	2400		
	11	5 Dec	900	7	5 Dec	2400		
	11	6 Dec	900	6	9 Jan	1500		
	10	16 Nov	2200	6	5 Feb	100		
	10	5 Dec	1800	6	5 Dec	1100		
2809 26th Ave S, Seattle, Wa 1 Jan - 31 Dec	21	3 Dec	900	9	3 Dec	1000	0	0
	15	3 Dec	1000	8	16 Nov	2400		
	15	5 Dec	900	8	4 Dec	2400		
	14	8 Nov	900	8	6 Dec	1400		
	14	3 Dec	800	7	5 Feb	100		
	11	8 Nov	800	7	8 Nov	1200		
942 Pacific Ave, Tacoma, Wa 1 Jan - 31 Dec	19	20 Dec	1800	10	19 Jan	2400	5	5
	17	24 Oct	1600	10	5 Dec	2000		
	17	12 Dec	1700	10	6 Dec	1400		
	16	7 Feb	1800	10	19 Dec	2000		
	16	11 Dec	1700	10	20 Dec	1800		
	16	19 Dec	1900	9	20 Jan	1500		
South 11th & A Streets, Tacoma, Wa 1 Jan - 31 Dec	15	6 Jan	1700	10	20 Jan	1500	1	1
	14	6 Jan	800	9	19 Jan	2400		
	14	18 Jan	800	9	7 Feb	1400		
	14	19 Jan	800	9	17 Feb	1900		
	13	7 Feb	1800	8	18 Jan	1400		
	13	17 Feb	1800	8	7 Feb	2200		
1103 Pacific Ave, Tacoma, Wa 1 Jan - 12 Mar; 30 Mar - 31 Dec	14	6 Jan	1700	9	6 Jan	1800	0	0
	14	18 Dec	1700	9	16 Nov	2200		
	13	5 Dec	1800	9	5 Dec	1900		
	12	17 Feb	1700	9	18 Dec	2100		
	12	16 Nov	1900	8	19 Jan	2300		
	12	3 Dec	900	8	20 Jan	1500		

Notes

- (1) Ending times are reported in Pacific Standard Time.
- (2) For equal concentration values the reported date and time refer to the earliest occurrences during the year.
- (3) A block of data missing for more than 15 consecutive days is shown by dates beneath the location of each station.
- (4) At all stations carbon monoxide was continuously measured using the nondispersive infrared method.

LOWER ATMOSPHERE TEMPERATURE SOUNDINGS

A lower atmosphere sounding unit began operating on the east shore of Portage Bay in Seattle during 1971. The Washington State Department of Ecology operates the station. Normal operation provides one sounding to 700 millibars about 0700 local time each Monday through Friday except holidays. This sounding provides the primary lower atmosphere data in the Puget Sound region and is an essential basis for many forecasts including air stagnation forecasts. Each sounding is reasonably representative of the lower atmosphere throughout the Puget Sound area. The Agency regularly uses the sounding to evaluate and interpret air quality data and also enters the sounding in a computerized data base.

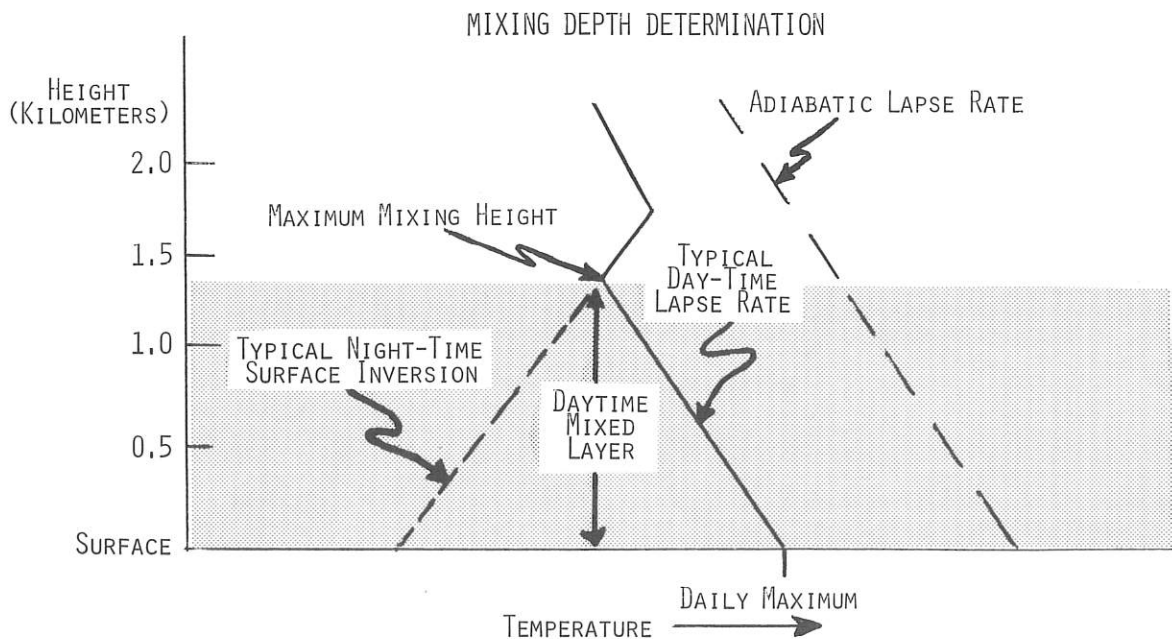
The figure below illustrates some key concepts. Temperature increasing with height is termed a TEMPERATURE INVERSION. A temperature inversion limits the height to which pollutants are mixed or dispersed vertically. The MIXING DEPTH is the height from the surface to the temperature inversion base. The mixing depth continuously changes in response to diurnal surface temperature changes and to other processes.

On days with no temperature inversion the mixing depth is unlimited, and this

contributes to rapid pollutant dispersion and good air quality. In contrast a temperature inversion near the surface, thick enough so that the daytime mixing depth will not exceed the depth of the inversion, significantly restricts vertical dispersion. This stable condition is associated with higher pollutant levels.

Two soundings from 1984 are presented on the following page. Temperature is represented by a solid line connecting actual data values enclosed by circles. The dewpoint temperature is represented by a dashed line connecting actual data values enclosed by triangles. The wind at regular altitude intervals is plotted and also printed in degrees/knots to the right of the temperature sounding. Wind data above the surface is not always available.

The soundings for JANUARY 19 and DECEMBER 5 provide a meteorological picture on two mornings during periods when Suspended Particulate and Carbon Monoxide levels reached high values exceeding standards at several stations. The Suspended Particulate, Carbon Monoxide, and Pollutant Standards Index summaries on the preceding pages of this report present the actual values. For some locations the highest levels for the year were measured on one of these two days.

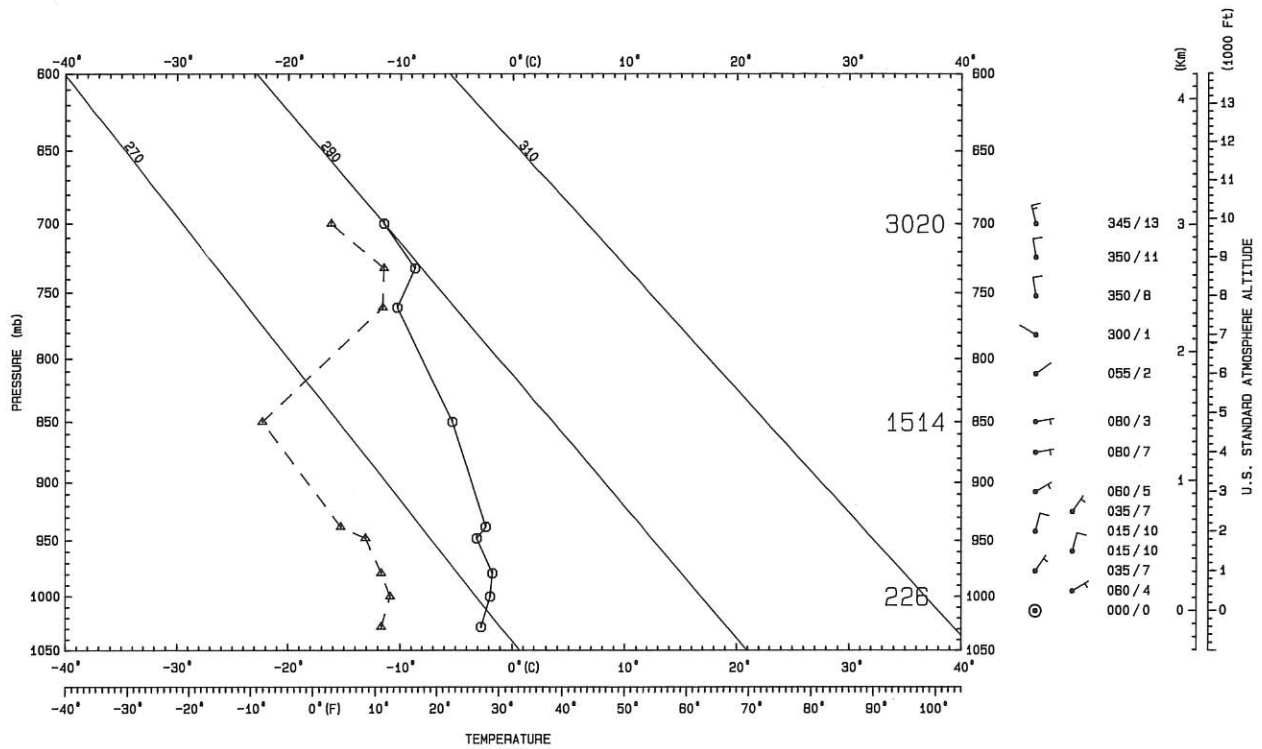


PUGET SOUND AIR POLLUTION CONTROL AGENCY

PSEUDO-ADIABATIC CHART

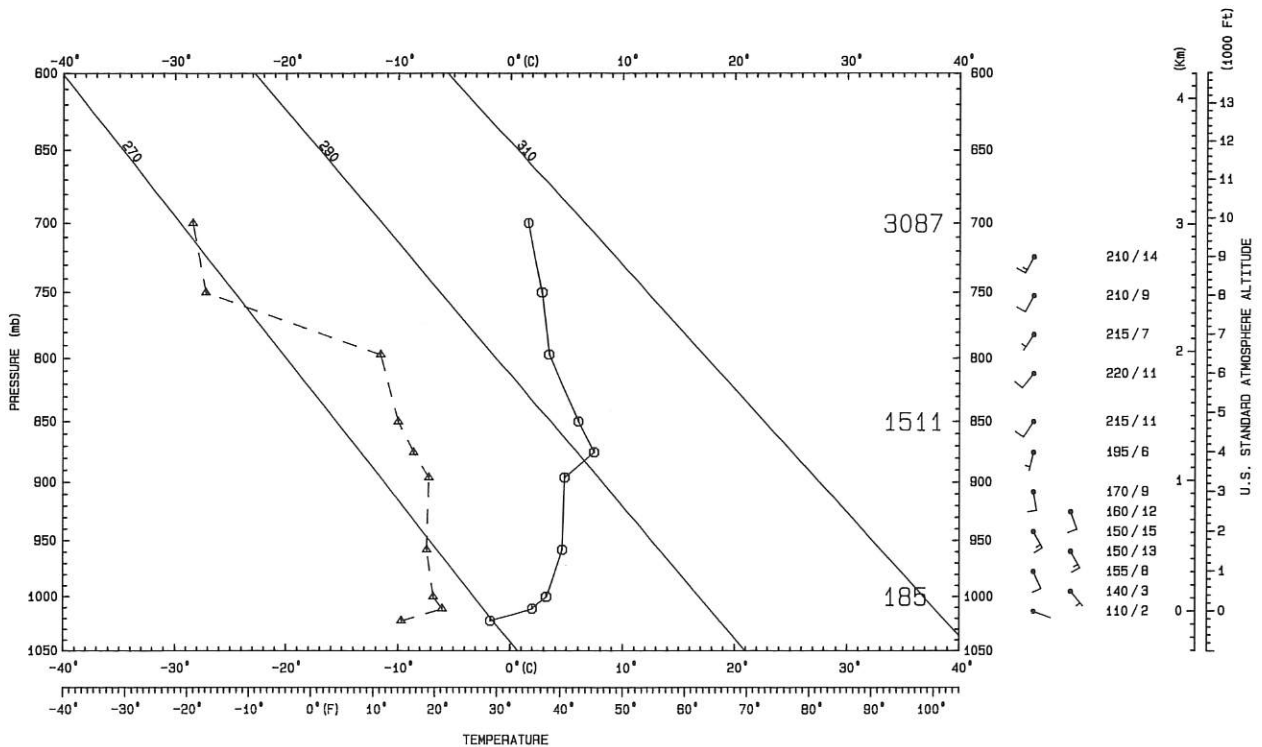
0700 PST Jan 19, 1984

Portage Bay, 2725 Montlake Blvd E, Seattle, WA



0700 PST Dec 5, 1984

Portage Bay, 2725 Montlake Blvd E, Seattle, WA



AIR STAGNATION ADVISORY AND
WASHINGTON EPISODE PLAN FORECAST STAGE

An "Air Stagnation Advisory" is issued by the National Weather Service when poor atmospheric dispersion conditions exist and these conditions are forecast to persist for 24 hours or more. The Washington State Department of Ecology may at the same time declare the "First or Forecast" stage of the Washington Episode Plan (Washington Administrative Code

173-435). Declaration of the Forecast stage indicates the presence of meteorological conditions conducive to the accumulation of air contaminants. Outdoor fires are prohibited during any declared stage of the Washington Episode Plan.

No Air Stagnation Advisory nor any stage of the Washington Episode Plan were in effect during 1984.

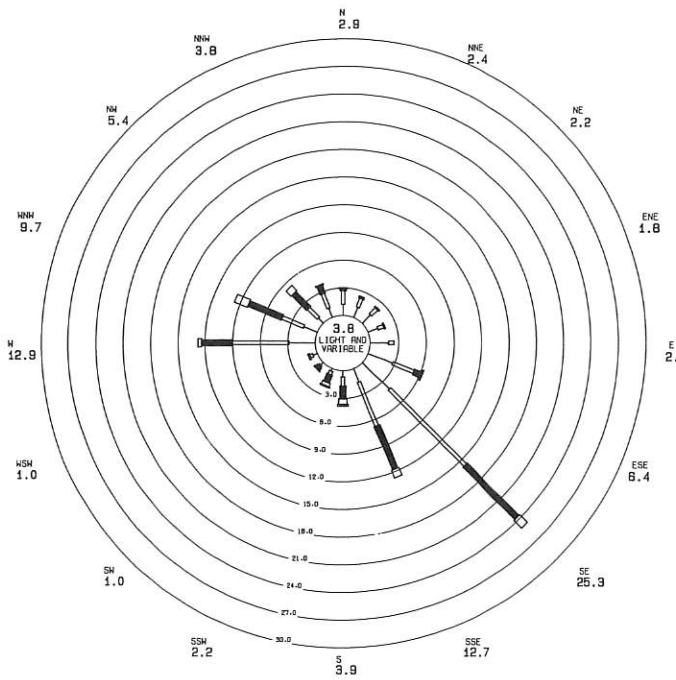
WIND ROSES

The measurement of local area wind speed and direction is important in the evaluation of air pollution. Low wind speed results in slowing the dispersion of pollutants and is therefore associated with higher air pollutant concentrations, particularly near major urban or industrialized areas. Wind direction data suggests which sources or source areas affect a specific location.

The wind rose spokes or arms represent 16 points of the compass, each pointing to a wind direction compass point. The percentage frequency of winds FROM a given direction (without regard to speed) is expressed numerically beneath that direction on the perimeter of each rose.

A wind rose is a graphical means of summarizing the winds for a given time period. It is essentially a count, expressed on the following graphs as a percentage frequency, of the number of observations or hours which had a particular direction and speed during the summary period.

The length of each segment of a spoke represents the frequency of winds within each speed category. Using the percent scale located to the lower right of each rose, these lengths may be converted to the number of observations or hours during which a wind speed within the category occurred. The percentage frequency of light and variable winds (winds less than 1.5 knots) is printed in the center of the rose.



HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

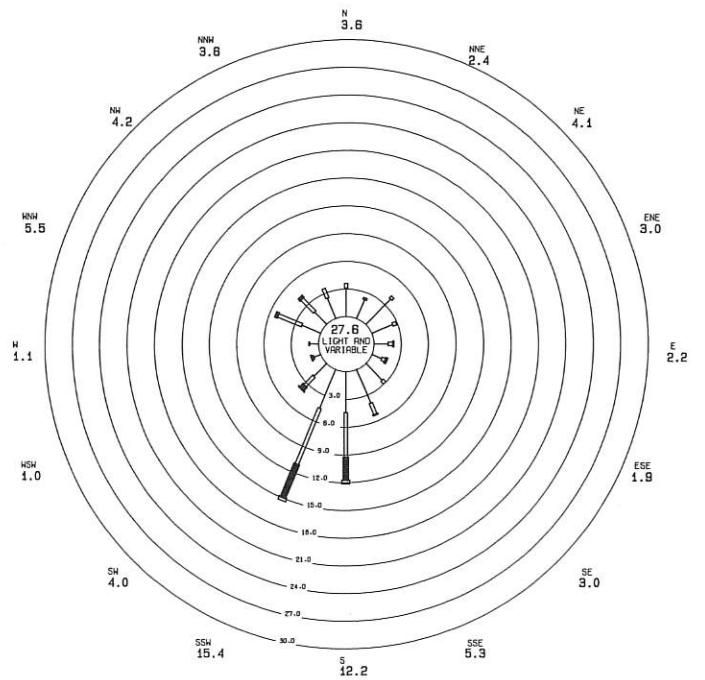
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Medical-Dental Bldg, 2730 Colby, Everett, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,773

1.1- 4.0- 7.0- 11.0- 17.0- OVER
3.0 6.0 10.0 15.0 21.0 27.0
KNOTS

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

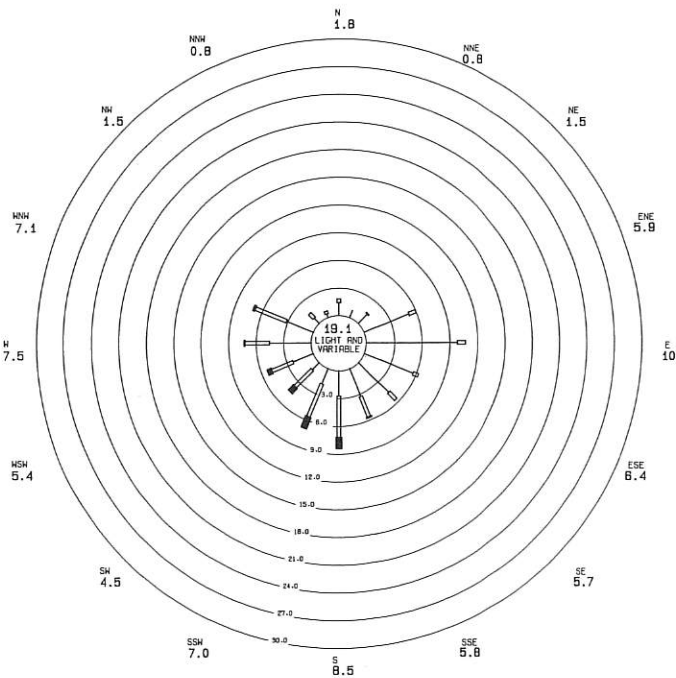
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
North 98th St & Stone Ave N, Seattle, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,779

1.1- 4.0- 7.0- 11.0- 17.0- OVER
3.0 6.0 10.0 15.0 21.0 27.0
KNOTS

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

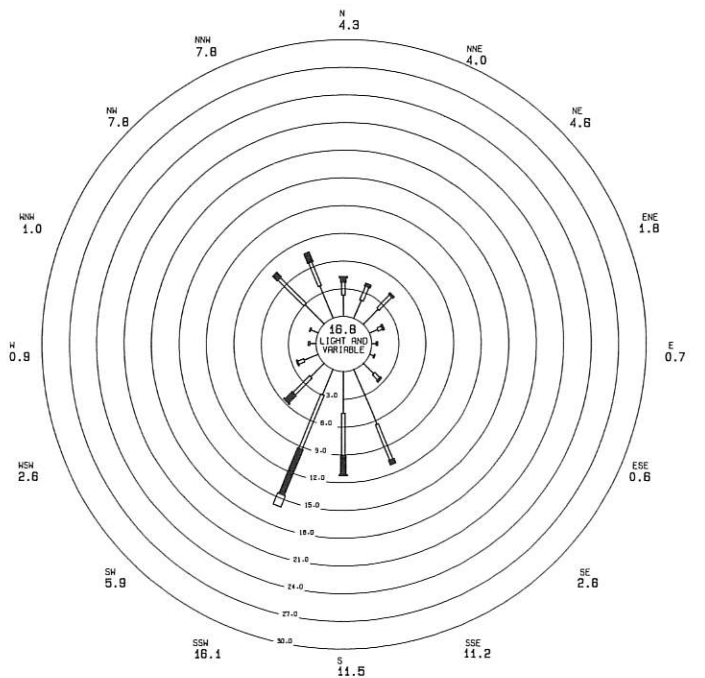
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,100

1.1- 4.0- 7.0- 11.0- 17.0- OVER
3.0 6.0 10.0 15.0 21.0 27.0
KNOTS

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

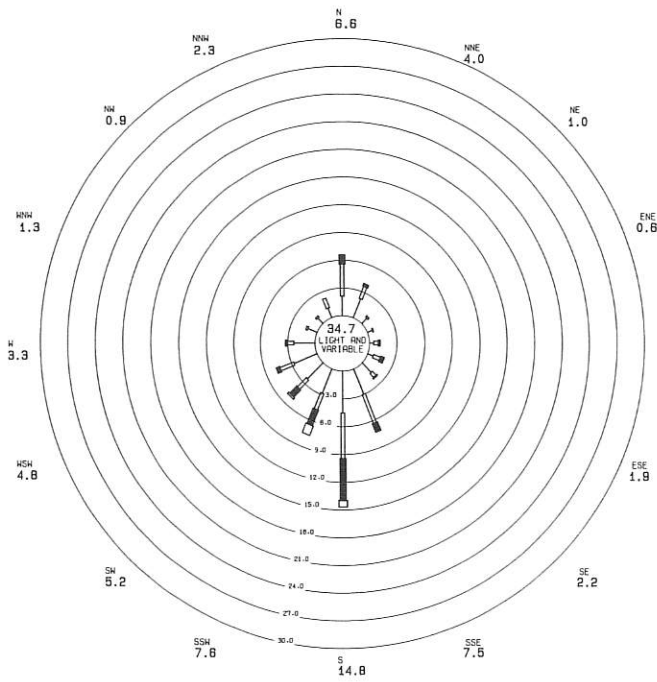
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Duwamish, 4401 E Marginal Way S, Seattle, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,768

1.1- 4.0- 7.0- 11.0- 17.0- OVER
3.0 6.0 10.0 15.0 21.0 27.0
KNOTS

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



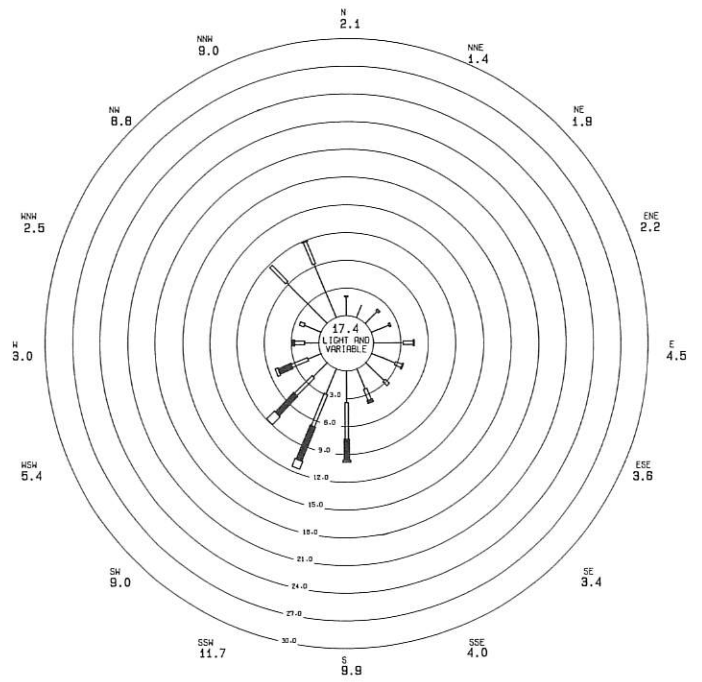
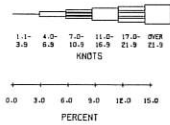
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
22818 86th Ave S, Kent, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,642



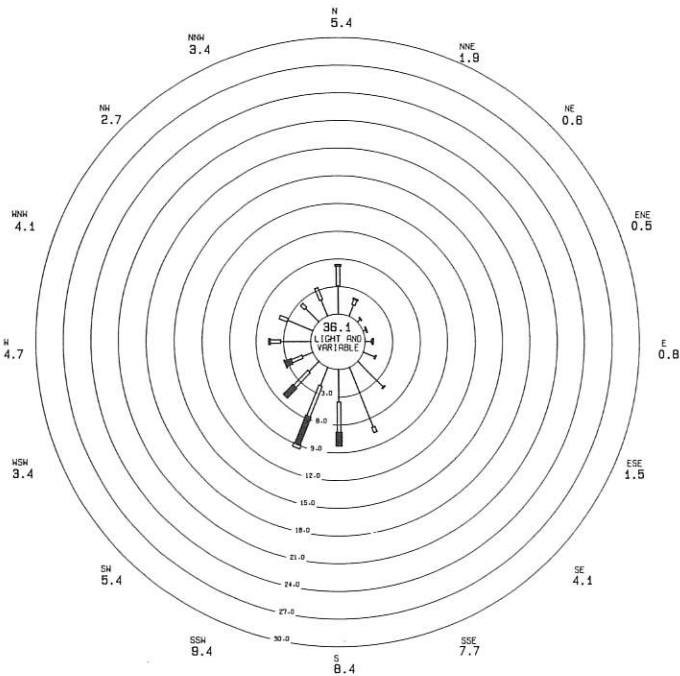
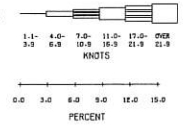
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Federal Way HS, 1401 S 304 St, Federal Way, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,697



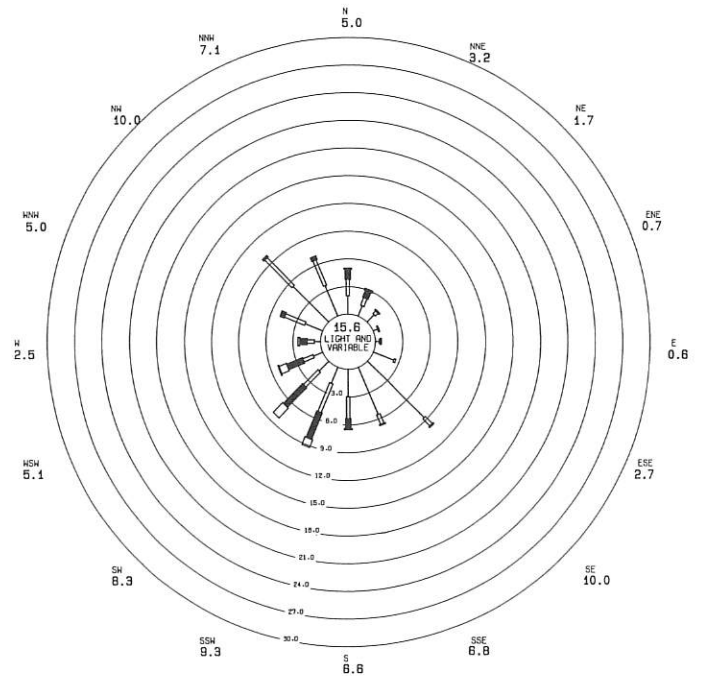
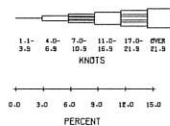
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Summer Jr HS, 1508 Willow St, Sumner, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,778



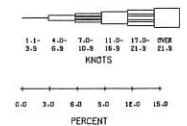
HOUR AVERAGE SURFACE WINDS

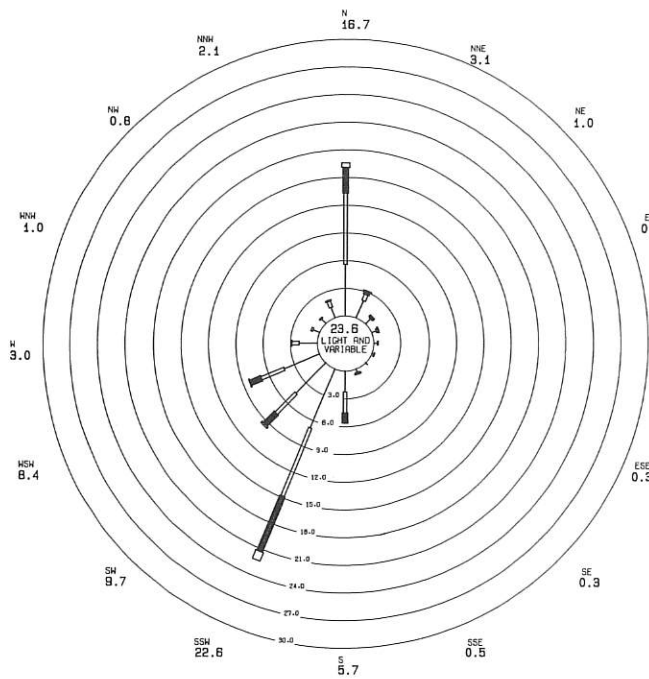
PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Fire Station #12, 2316 E 11th St, Tacoma, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,736





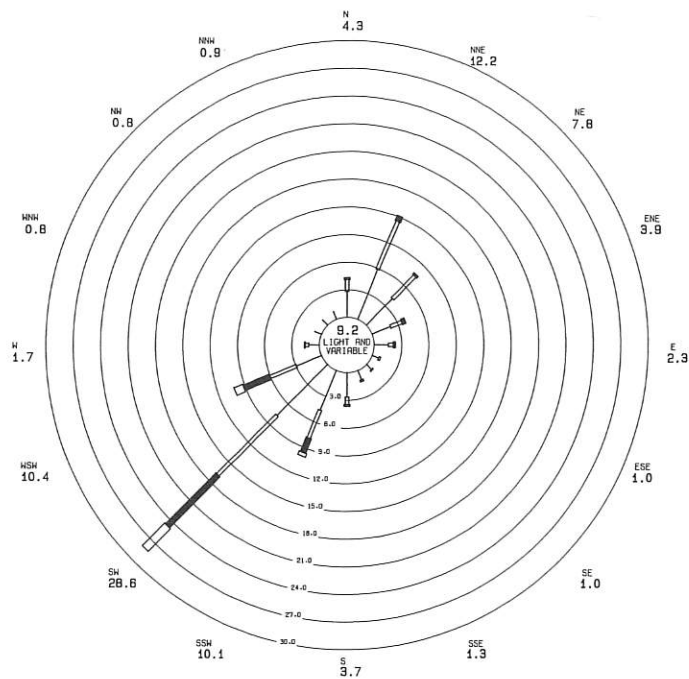
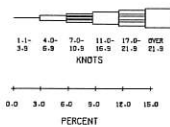
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Willard School, S 32nd & S 'D' St, Tacoma, Wa

INCLUSIVE DATES- JAN - AUG, 1984

TOTAL OBSERVATIONS- 5,832



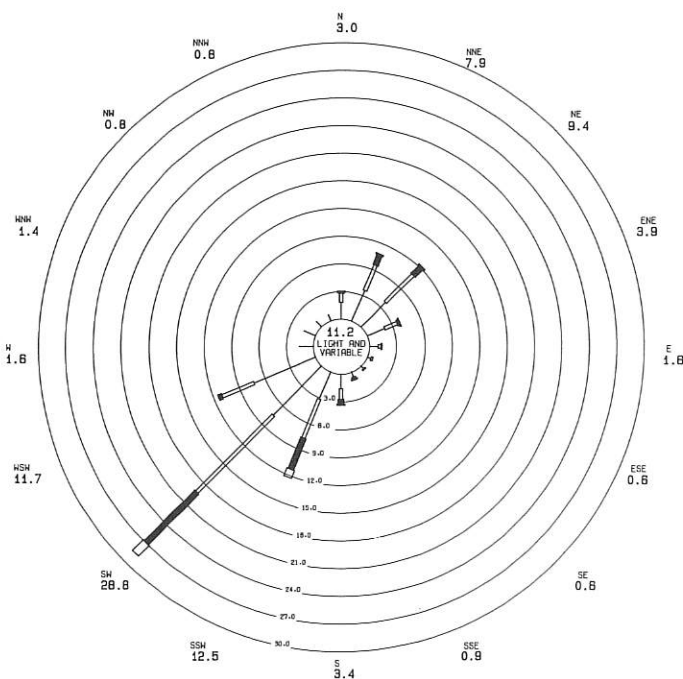
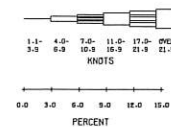
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
SW 283rd & 101st Ave SW, Maury Island, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,765



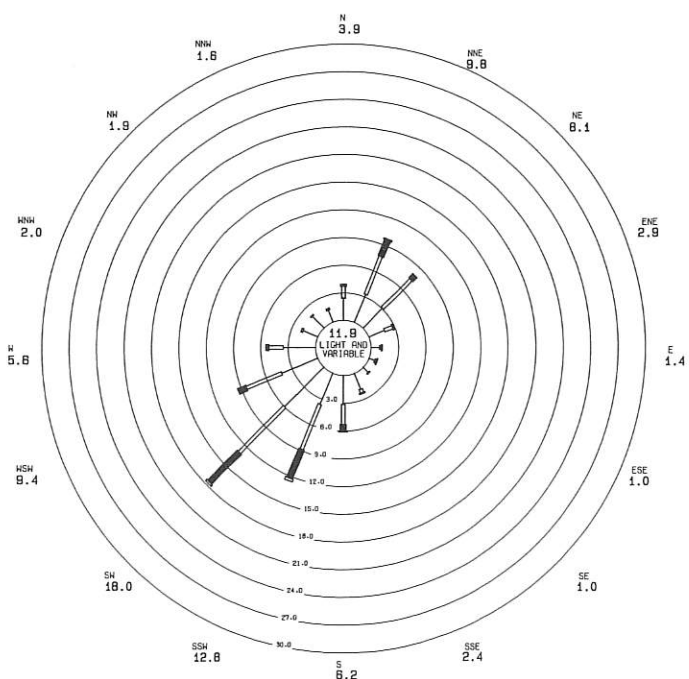
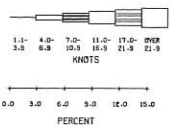
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
North 37th & Vassault Sts, Tacoma, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,770



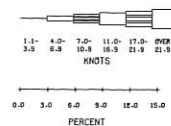
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
North 26th & Pearl Sts, Tacoma, Wa

INCLUSIVE DATES- ALL MONTHS 1984

TOTAL OBSERVATIONS- 8,753



STABILITY WIND ROSES

Introduction

The stability wind rose summarizes concurrent observations of wind direction, wind speed and an objective calculation of low level stability. Each hourly observation is added to a three dimensional table at the position indicated by the wind direction assigned to the nearest of 16 compass points, by the wind speed assigned to one of 6 separate intervals, and by the low level stability category.

Determination of Stability

The low level stability is calculated following an objective procedure documented by D. Bruce Turner in the "Journal of Applied Meteorology", February, 1964. Low level stability depends primarily upon net radiation and wind speed. In this technique the estimate of daytime incoming radiation is developed from solar altitude for time of day and time of year at the particular location. Incoming radiation is then decreased for increased cloud cover and lower cloud ceiling height. The estimate of nighttime outgoing radiation is also decreased for increased total cloud cover.

Stability Classes

- A. EXTREMELY UNSTABLE. Daytime occurrence with high positive net radiation and wind speed 5 knots or less.
- B. UNSTABLE. Daytime occurrence with wind speed less than 10 knots.
- C. SLIGHTLY UNSTABLE. Daytime occurrence.
- D. NEUTRAL. Characterized by low or zero net radiation. Separated into daytime or nighttime occurrence by local daily sunrise and sunset times.
- E. STABLE. Nighttime occurrence in conjunction with lighter wind speeds. All stable conditions are combined within this class since urban areas do not become as stable in the lower layers as rural areas.

Discussion of Local Stability Wind Roses

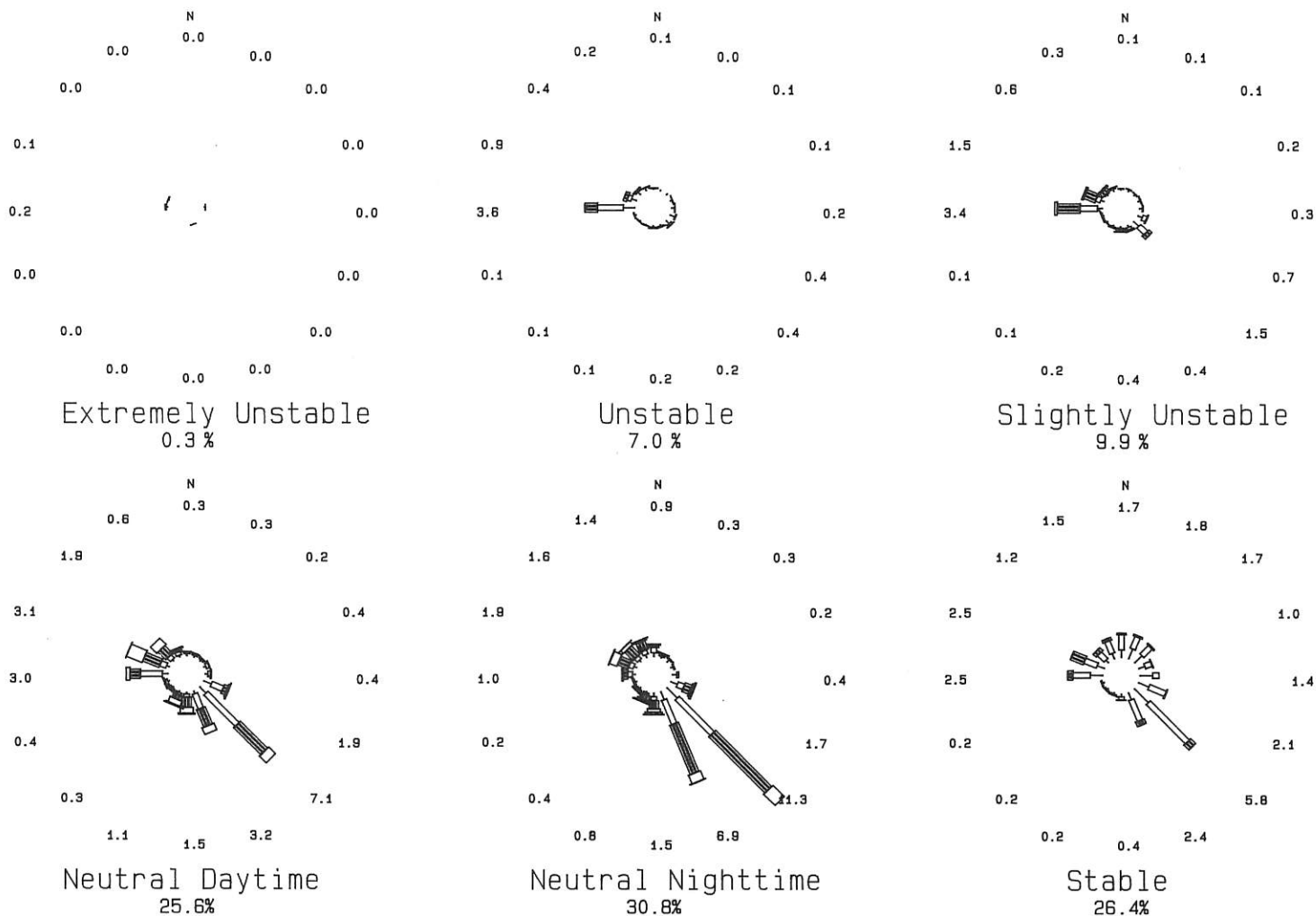
The local area stability wind roses are developed using 3 hour interval cloud data recorded for Seattle Tacoma International Airport. Persistence in cloud data is assumed for the hour preceding and the hour following the observation. This cloud data extended to 1 hour intervals is then used with the 1 hour average wind data measured at the location for which the stability wind rose is constructed.

Stability wind roses for three locations in the Puget Sound region follow this discussion. The wind rose for each stability class may be interpreted by reviewing the discussion in the preceding section on wind roses. There are two main differences. First, each wind rose includes only the observations for that stability class, but the percentage frequencies refer to the total of all observations. Thus the sum of the frequency of winds from 16 compass points displayed around each wind rose equals the frequency of occurrence for that stability class. Second, light and variable wind cases are distributed within the lowest wind speed class based upon actual occurrences in the lowest two wind speed classes.

The stability wind rose summaries are required for air quality modeling. The Climatological Dispersion Model uses the same frequency tables used here to plot the stability wind roses.

The wind pattern represents the most significant difference between locations. Each stability class occurs a similar percentage of time at each station. Neutral stability existed about one-half of the time and stable nighttime conditions occurred about 30 percent of the time. The Everett stability wind rose, presented for the first time this year, shows about an eight percent greater frequency in the neutral category, probably due to stronger wind speeds measured at this top of a multi-story building location. At each station the wind rose for the stable conditions probably best documents the conditions of poor pollutant dispersion.

PUGET SOUND AIR POLLUTION CONTROL AGENCY



STABILITY WIND ROSES

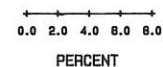
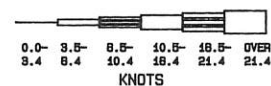
MEDICAL-DENTAL BLDG, 2730 COLBY, EVERETT, WA

Period of Record: JAN - DEC, 1984

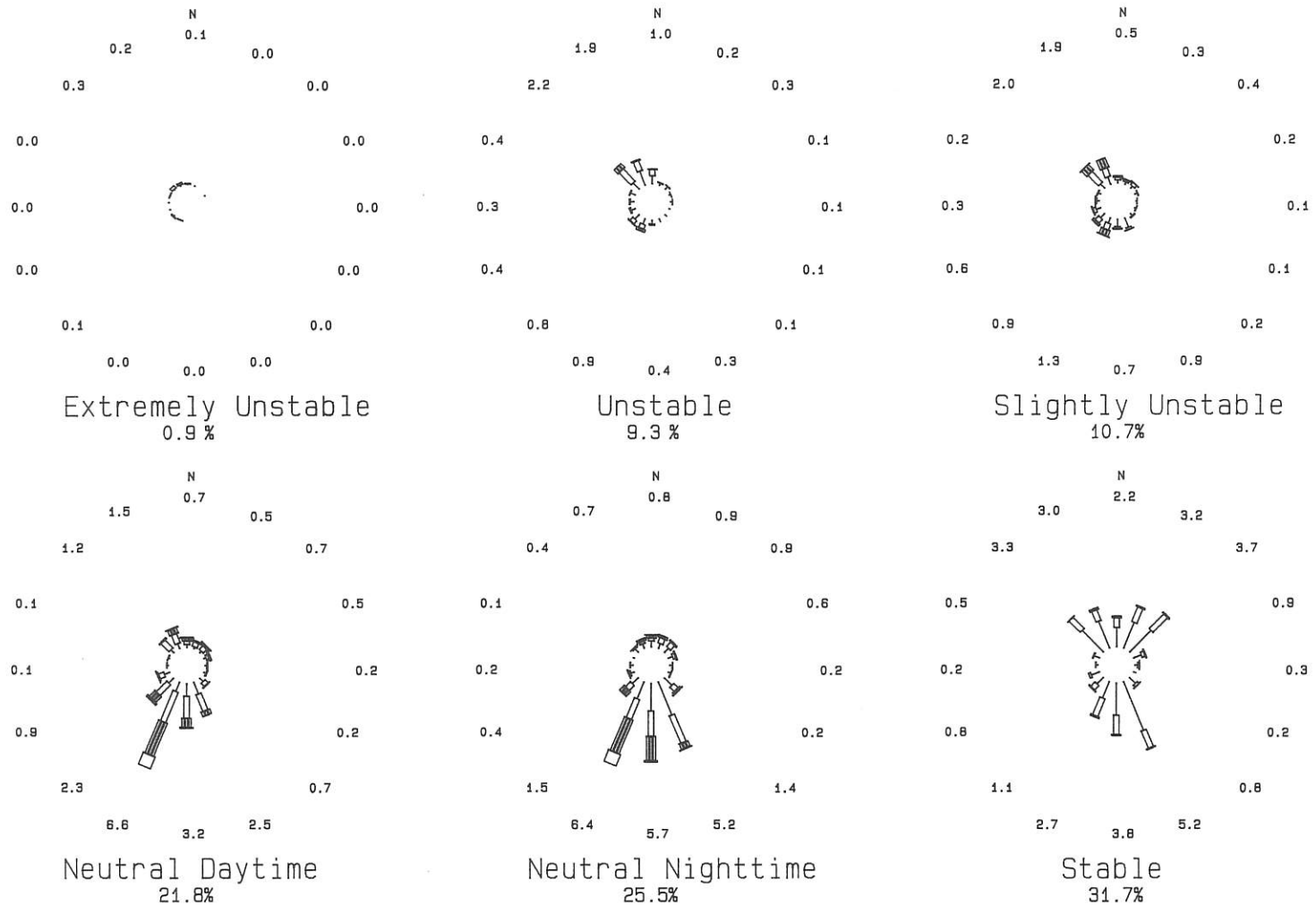
1 Hr Wind Location: MEDICAL-DENTAL BLDG, 2730 COLBY, EVERETT, WA

Percentage Frequency of Occurrence

3 Hr Cloud Location: SEATTLE TACOMA INTERNATIONAL AIRPORT, WA



PUGET SOUND AIR POLLUTION CONTROL AGENCY



STABILITY WIND ROSES

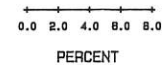
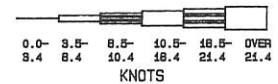
DUWAMISH, 4401 E MARGINAL WAY S, SEATTLE, WA

Period of Record: JAN - DEC, 1984

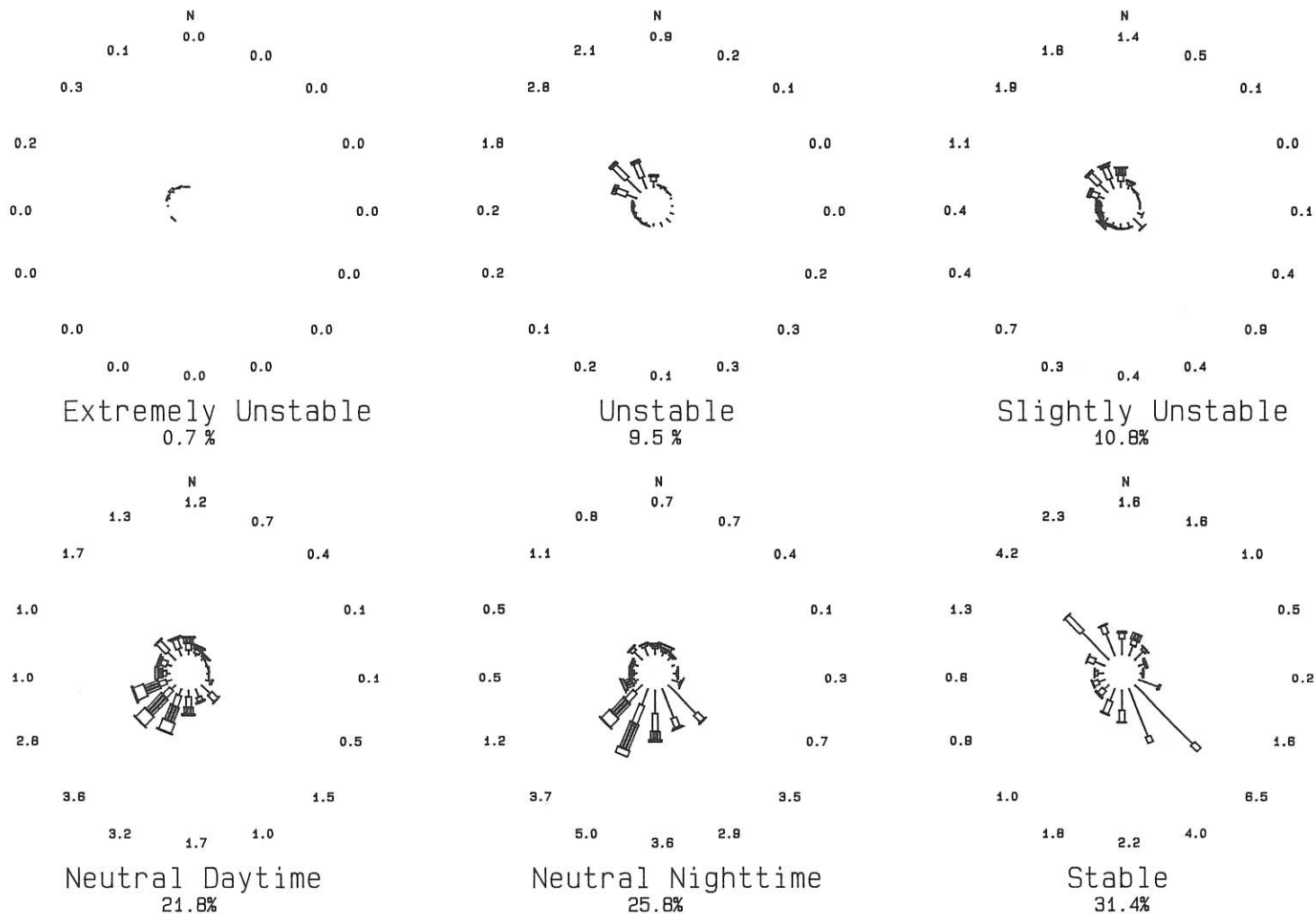
1 Hr Wind Location: DUWAMISH, 4401 E MARGINAL WAY S, SEATTLE, WA

Percentage Frequency of Occurrence

3 Hr Cloud Location: SEATTLE TACOMA INTERNATIONAL AIRPORT, WA



PUGET SOUND AIR POLLUTION CONTROL AGENCY



STABILITY WIND ROSES

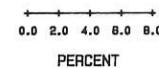
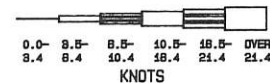
FIRE STATION #12, 2316 E 11TH ST, TACOMA, WA

Period of Record: JAN - DEC, 1984

1 Hr Wind Location: FIRE STATION #12, 2316 E 11TH ST, TACOMA, WA

Percentage Frequency of Occurrence

3 Hr Cloud Location: SEATTLE TACOMA INTERNATIONAL AIRPORT, WA



AIR QUALITY UNITS CONVERSION TABLE

Air quality standards for gases are defined in terms of micrograms (ug) or milligrams (mg) per cubic meter as well as in parts per million (ppm). As this data summary expresses measurements for gaseous pollutants in terms of ppm, the following conversion table is for the convenience of those who wish to interpret our results in terms of ug/cubic meter or mg/cubic meter. These conversion factors from the Federal Register assume a pressure of 760 mm Hg and a temperature of 25 degrees C.

<u>Pollutant</u>	<u>Multiply ppm by</u>	<u>To Obtain</u>
Carbon Monoxide	1.145	mg/cubic meter
Nitrogen Dioxide	1880	ug/cubic meter
Ozone	1961	ug/cubic meter
Sulfur Dioxide	2619	ug/cubic meter

POLLUTANT STANDARDS INDEX

The Pollutant Standards Index values are derived from the measured concentrations of pollutants for which a national primary standard has been set. The following table shows the averaging period and the pollutant concentration associated with the breakpoints of the Index. Values between breakpoints may be determined by linear interpolation.

<u>Pollutant</u>	<u>Concentration</u>
Carbon Monoxide (CO)	8 hour average in parts per million
Total Suspended Particulates (TSP)	24 hour average in micrograms per cubic meter
Sulfur Dioxide (SO ₂)	24 hour average in parts per million
Ozone (O ₃)	1 hour average in parts per million

PSI Interval Breakpoints and Pollutant Concentrations

<u>PSI value</u>	<u>CO (8 hrs)</u>	<u>TSP (24 hrs)</u>	<u>SO₂ (24 hrs)</u>	<u>O₃ (1 hr)</u>
50	4.5	75	0.03	0.06
100	9.0	260	0.14	0.12
200	15.0	375	0.30	0.20
300	30.0	625	0.60	0.40
400	40.0	875	0.80	0.50
500	50.0	1000	1.00	0.60

AMBIENT AIR QUALITY STANDARDS

SULFUR OXIDES

The presence of sulfur oxides in the ambient air has been associated with a variety of respiratory diseases and increased mortality rates. They represent a significant economic burden and have a nuisance impact. When sulfur oxides are inhaled with small particles, the effect on health is increased. Inhalation of sulfur dioxide can cause increased airway resistance by constricting lung passages.

PARTICULATES

Small discrete masses of solid or liquid matter dispersed in the atmosphere, especially those of one micron or less in diameter, are associated with a variety of adverse effects on public health and welfare. Particulate matter in the respiratory tract may produce injury by itself, or it may act in conjunction with gases to increase the effect on the body. Small particles suspended in the air are chiefly responsible for reduced visibility in the Puget Sound area. Soiling of buildings and other property is a common effect of high particulate levels.

CARBON MONOXIDE

Carbon monoxide reacts with the hemoglobin in red blood cells to decrease the oxygen-carrying capacity of the blood. The national primary standard for carbon monoxide was based on evidence that levels of carboxyhemoglobin in human blood as low as 2.5% may be associated with impairment of ability to discriminate time intervals. The national ambient air quality standards for carbon monoxide are intended to protect against the occurrence of carboxyhemoglobin levels above 2%. Smoking 2 packs of cigarettes a day raises carboxyhemoglobin levels to 5%.

	NATIONAL		*	WASHINGTON	*	PUGET SOUND	*
	PRIMARY	SECONDARY		STATE		REGION	
SULFUR OXIDES	ppm	ppm		ppm		ppm	
Annual Average	0.03		a	0.02	a	0.02	a
30 day Average						0.04	a
24 hour Average	0.14		b	0.10	b	0.10	a
3 hour Average		0.50	b				
1 hour Average				0.25	c	0.25	c
1 hour Average				0.40	b	0.40	a
5 min Average						1.00	d
SUSPENDED PARTICULATES	ug/cubic meter	ug/cubic meter		ug/cubic meter		ug/cubic meter	
Annual Geometric Mean	75	60	a	60	a	60	a
24 hour Average	260	150	b	150	b	150	b
CARBON MONOXIDE	ppm	ppm		ppm		ppm	
8 hour Average	9	9	b	9	b	9	b
1 hour Average	35	35	b	35	b	35	b
OZONE	ppm	ppm		ppm		ppm	
1 hour Average	0.12	0.12	e	0.12	e	0.12	e
NITROGEN DIOXIDE	ppm	ppm		ppm		ppm	
Annual Average	0.05	0.05	a	0.05	a	0.05	a
LEAD	ug/cubic meter	ug/cubic meter				ug/cubic meter	
Calendar Quarter Average	1.5	1.5	a			1.5	a

ppm = parts per million

ug/cubic = micrograms per meter cubic meter

*

- a Never to be exceeded
- b Not to be exceeded more than once per year
- c Not to be exceeded more than twice in seven days
- d Not to be exceeded more than once in eight hours
- e Standard attained when expected number of days per year with maximum hourly average above 0.12 ppm is equal to or less than one

OZONE

Oxidants are produced in the atmosphere when nitrogen oxides and some hydrocarbons are exposed to sunlight. Ozone is the oxidant found in largest amounts. It is a pulmonary irritant that affects lung tissues and respiratory functions. Ozone impairs the normal function of the lung and, at concentrations between 0.15 and 0.25 ppm, causes lung tightness, coughing, and wheezing. Other oxidants, produced in smaller amounts than ozone, cause eye irritation. Persons with chronic respiratory problems such as asthma seem most sensitive to changes in ozone concentration.

NITROGEN DIOXIDE

Nitric oxide results from the fixation of nitrogen and oxygen at high temperatures as in fuel combustion. There are several atmospheric reactions which lead to the oxidation of nitric oxide to nitrogen dioxide, and the presence of nitrogen dioxide in ambient air is essential to the production of photochemical oxidants. The presence of nitrogen dioxide in ambient air has been associated with a variety of respiratory diseases.

LEAD

Lead affects humans in numerous ways, but the greatest effects appear to be on the blood-forming system, the nervous system, and the kidneys. It affects some persons more than others. Young children (ages 1-5) are particularly sensitive to lead exposure. The standard for lead in air is intended to prevent most children from exceeding blood lead levels of 30 micrograms per deciliter of blood.