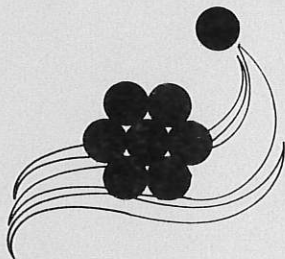


Puget Sound
Air Pollution Control Agency

1981
AIR QUALITY
DATA SUMMARY

Counties Of



King
Kitsap
Pierce
Snohomish

Puget Sound Air Pollution Control Agency

200 West Mercer Street, Room 205, P.O. Box 9863
Seattle, Washington 98109
(206) 344-7330

Serving King, Kitsap, Pierce and Snohomish Counties

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1981
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

1981 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 NOVEMBER, 1982
 TECHNICAL SERVICES DIVISION
 (206) 344-7326

INTRODUCTION

This tenth annual data summary presents air quality and meteorological data measured in the Puget Sound Region during 1981. The format is similar to that of past annual summaries. 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 temperature soundings, wind roses, and stability wind roses.

Last year a new feature was a section summarizing air quality using the nationally uniform Pollutant Standards Index (PSI). The PSI provides a capsule summary of daily air quality using a simple reference scale. This reference scale relates to the short term standard for each of the pollutants set to protect health. In this data summary, the PSI for 1981 is presented for each of the Everett, Seattle and Tacoma areas beginning on page 6. Along with a brief description, the daily PSI values are plotted and tabulated for each area. Each weekday the Agency reports the current PSI to the news media and the public. Interested citizens may obtain the current PSI also from the

Washington Lung Association in Seattle by dialing 322-7110 or by dialing 1-800-732-9339 toll-free from outside Seattle.

It is important that air quality measurements be as precise and accurate as possible. Nationally uniform requirements for auditing and documenting the Precision and Accuracy of air quality data are now in effect. A new section beginning on page 30, titled Quality Assurance, summarizes the program involving these activities. Tables summarizing the Agency's Precision and Accuracy audit data are presented in this section.

All data collected are reported quarterly to the 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 State Department of Ecology conducts air monitoring within the region in addition to that done by the Agency. The Department 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 Air Programs, Support Services Section, Olympia, Washington 98504.

PUGET SOUND AIR POLLUTION CONTROL AGENCY

Atmospheric Sampling Network

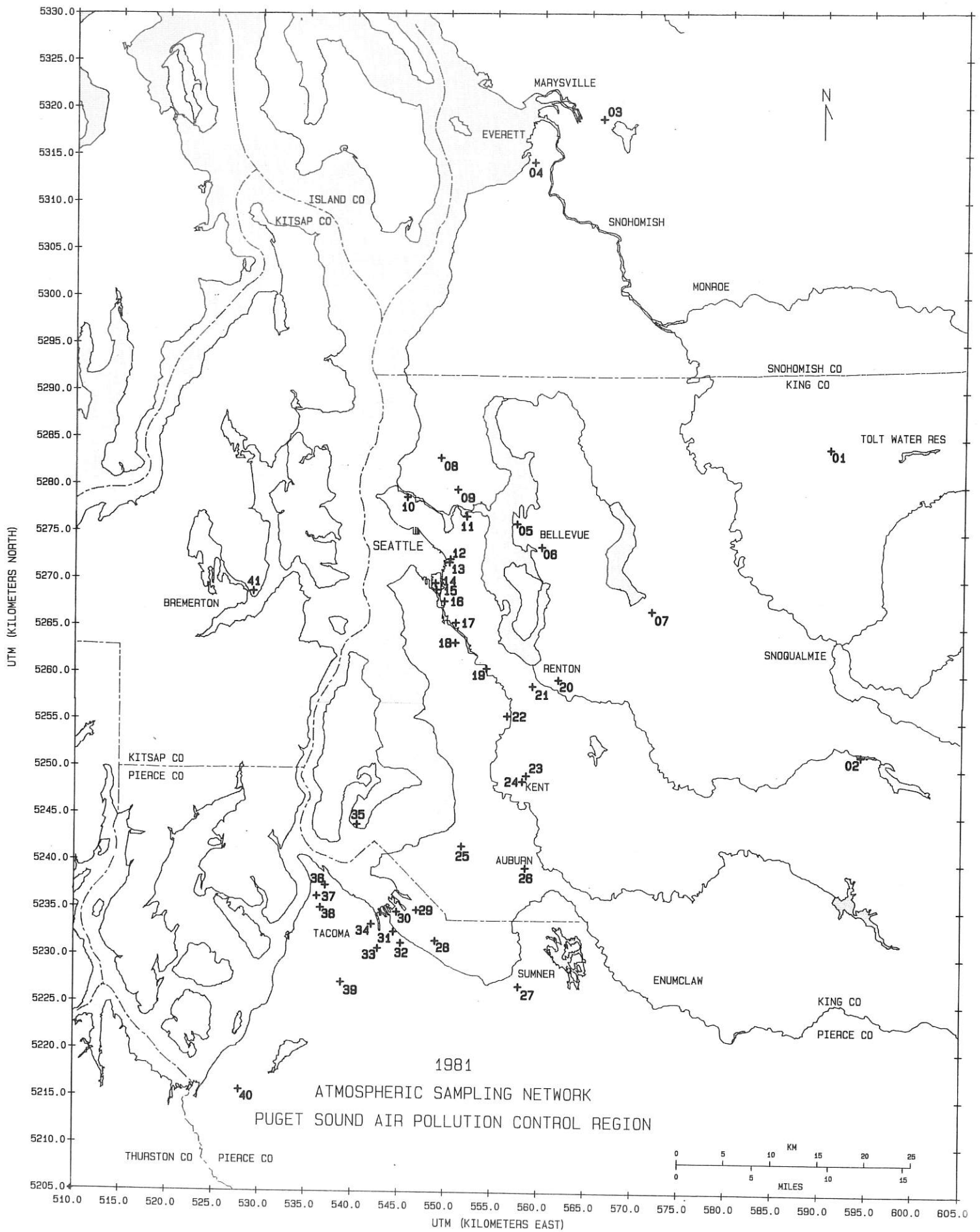
1981

Location	a Type of Sampling									
	A	B	C	D	E	F	G	H	I	J
01 Tolt River Watershed, King County, Wa	A									
02 Cedar River Masonry Dam, King County, Wa	A									
*03 Highway 9 & 28th St NE, Lake Stevens, Wa	A									
04 Medical-Dental Bldg, 2730 Colby, Everett, Wa	A	B	C	D						
*05 Evergreen Point Bridge Toll Plaza, Medina, Wa									I	
*06 504 Bellevue Way NE, Bellevue, Wa	A								I	
*07 20050 SE 56th, Lake Sammamish State Park, Wa	A									J
08 North 98th St & Stone Ave N, Seattle, Wa	A	B	C	D				H	I	J
*09 5701 8th Ave NE, Seattle, Wa	A								I	
10 2700 W Commodore Way, Seattle, Wa	A									
*11 Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	A			D					I	
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								I	
15 Harbor Island, 3400 13th Ave SW, Seattle, Wa	A								I	
16 Duwamish, 4401 E Marginal Way S, Seattle, Wa	A	B	C	D						J
*17 Georgetown, 6431 Corson Ave S, Seattle, Wa	A									J
18 South Park, 723 S Concord St, Seattle, Wa	A									
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 Southcenter, 401 Andover Park E, Tukwila, Wa	A			C	D					
23 22916 86th Ave S, Kent, Wa	A			C	D	E	F	G	H	
24 Memorial Park, 850 N Central Ave, Kent, Wa	A									
25 Federal Way HS, 1401 S 304 St, Federal Way, Wa	A	B		D						
26 115 E Main St, Auburn, Wa	A									
27 Sumner Jr HS, 1508 Willow St, Sumner, Wa	A			D			G			
28 Fife Sr High School, 5616 20th E, Fife, Wa	A									
29 2340 Taylor Way, Tacoma, Wa	A									
30 Fire Station #12, 2316 E 11th St, Tacoma, Wa	A			C	D			H		J
31 Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	A									
32 Cascadia, 2002 E 28th St, Tacoma, Wa	A									
33 Willard School, S 32nd & S 'D' St, Tacoma, Wa	A			C	D					
34 Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	A									
35 SW 283rd & 101st Ave SW, Maury Island, Wa		B		D						
36 4716 North Baltimore St, Tacoma, Wa	A								I	
37 North 37th & Vassault Sts, Tacoma, Wa		B		D						
38 North 26th & Pearl Sts, Tacoma, Wa	A	B		D					I	
*39 Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	A									
*40 City Water Supply Pump House, Dupont, Wa	A									
41 East 16th St & Ironsides Ave, Bremerton, Wa	A									

* Station operated by Washington State Department of Ecology (Additional Ozone and Nitrogen Dioxide sampling and all 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 - TSP	E Nitrogen Dioxide (NO2)	I Lead
B Sulfur Dioxide (SO2)	F Nitric Oxide (NO)	J Suspended Particulates
C Suspended Particulates-COH'S	G Ozone (O3)	(dichotomous sampling)
D Wind Speed & Direction	H Atmospheric Particles	
	(b - Scattering)	

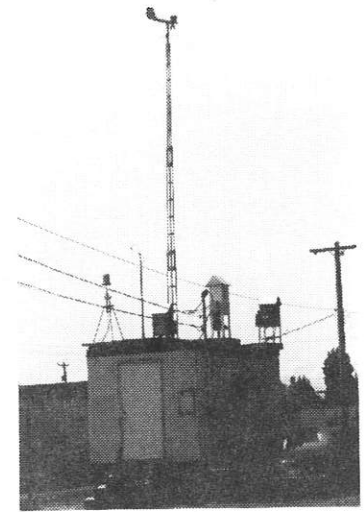


AIR QUALITY AND METEOROLOGICAL SAMPLING SYSTEM

- All remote telemetry stations continuously monitor:
WIND DIRECTION and WIND SPEED
- Each Station continuously measures one or more of these pollutants:
SUSPENDED PARTICULATES (COH's)
ATMOSPHERIC PARTICLES
(b scattering)
SULFUR DIOXIDE
NITROGEN DIOXIDE
NITRIC OXIDE
OZONE



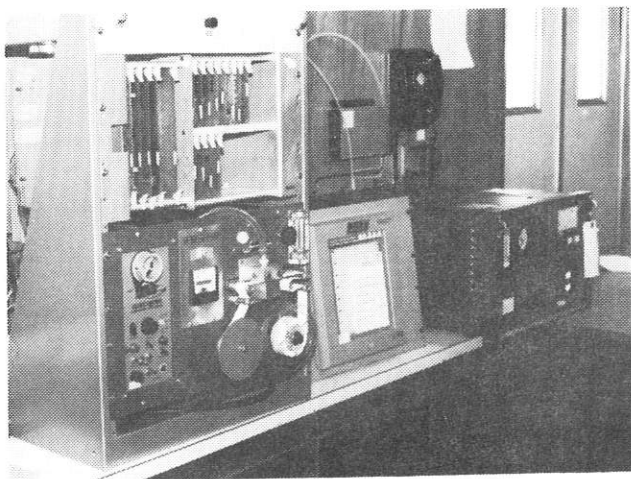
North 37th
and Vassault
Sts., Tacoma



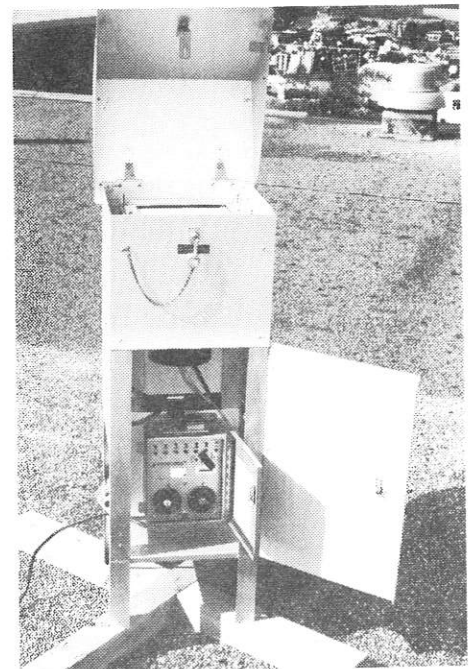
N. 98th St. and
Stone Ave. North,
Seattle

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. Self-contained high volume samplers and a dichotomous sampler are located on the roof.

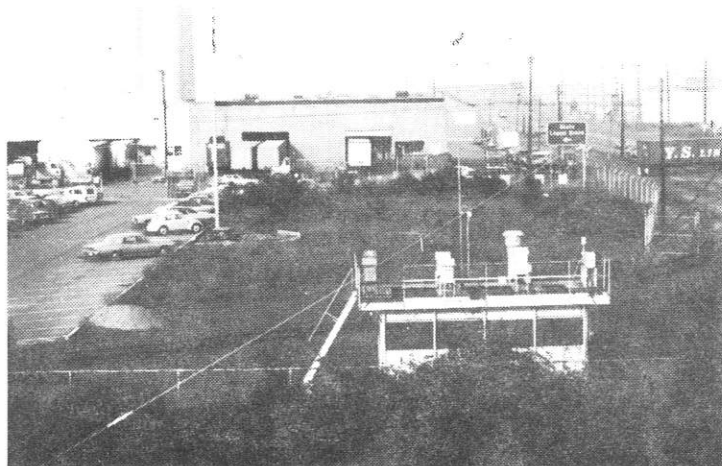
Pictures on this page and one on the following page show sites where sampling is conducted. The monitoring objective and therefore the parameters actually sampled are often different. Actual sampling at each station is documented in the table on page 2.



Inside a station are the telemetry electronics which translate all 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.



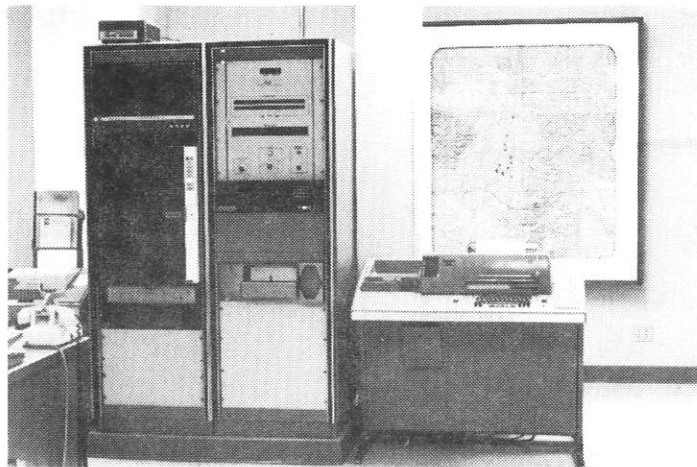
A high volume sampler is the federal reference method for measuring TOTAL SUSPENDED PARTICULATES. The instrument in the picture above is open to show the filter (in frame beneath hinged sampler cover) on which the sample is collected. An electric high flow rate blower pulls air through the filter at about 45 cubic feet per minute. Particulates with diameters from 0.1 micrometer to roughly 100 micrometers are collected on the filter. These samplers normally operate continuously for 24 hours every sixth day.



Station at Duwamish
4401 E Marginal Way S, Seattle

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 from the high volume samplers measuring total suspended particulates are manually computed, stored in computer files, and regularly summarized.
- All data is checked for validity by air quality specialists prior to use.
- 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

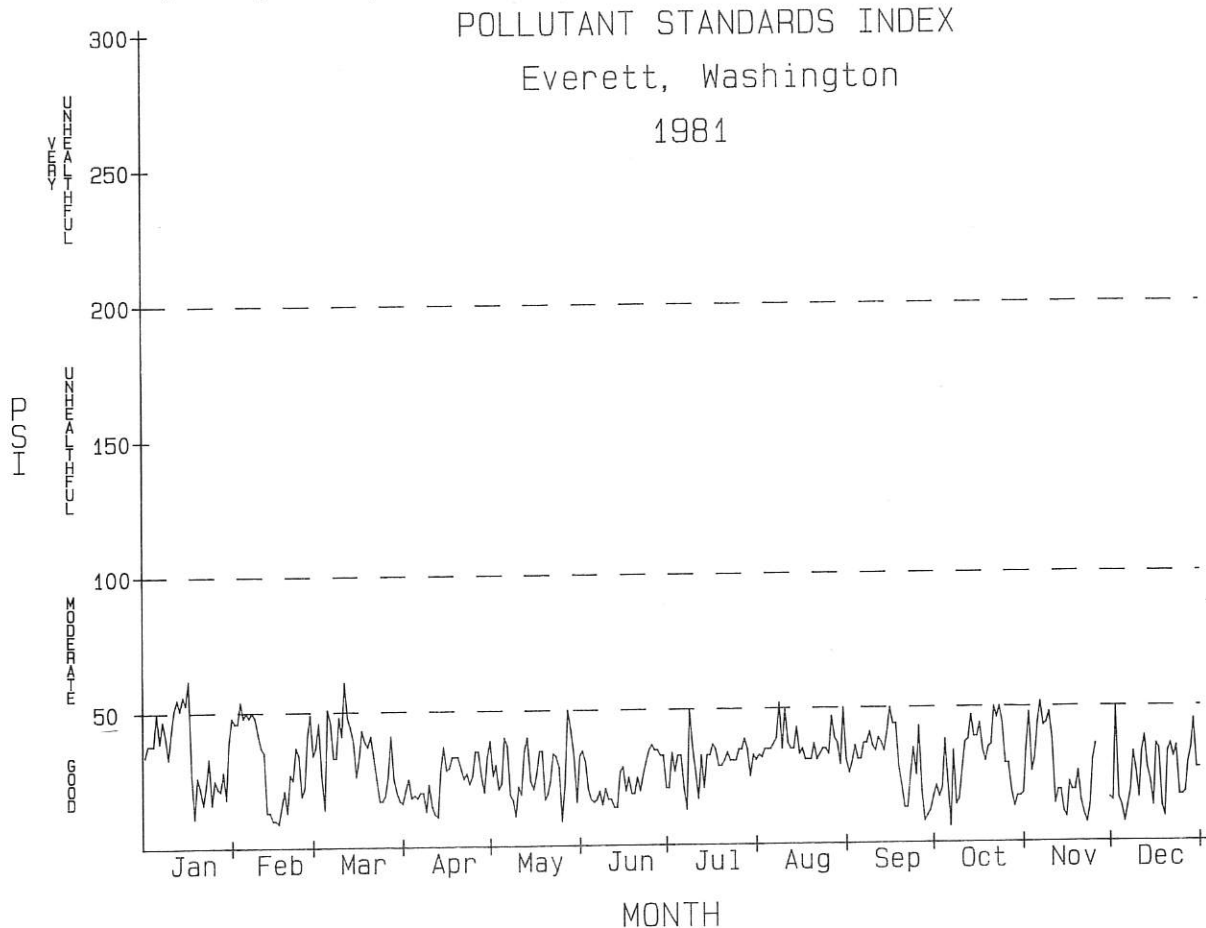
The Pollutant Standards Index (PSI) is a nationally uniform index for daily reporting of air quality. In cooperation with the State Department of Ecology, the Agency began reporting the PSI in 1980 for the Everett, Seattle, and Tacoma areas.

The PSI places maximum emphasis on short term health effects of 24 hours or less. 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 higher than 100, a primary air quality standard has been exceeded. An index value of 200 means the pollutant concentration has reached the "Alert" level listed in the Washington Episode Plan.

The PSI is designed 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 to report the index for Seattle and Tacoma. The index for Everett is based on suspended particulates and sulfur dioxide since carbon monoxide is not available there. The index value for each day in each area is determined by the pollutant with the highest value on the PSI scale.

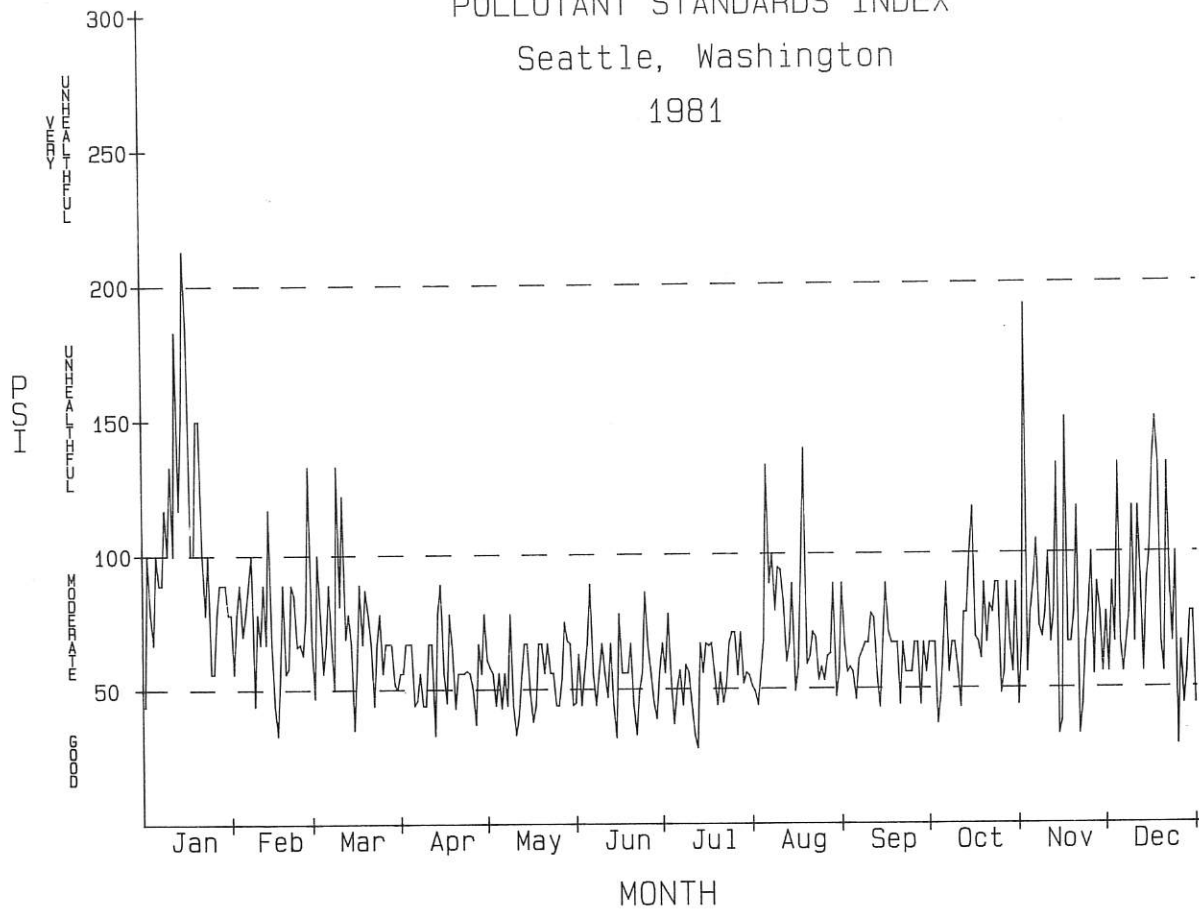
The accompanying graphs plot each daily PSI for Everett, Seattle, and Tacoma during 1981. A summary table shows the number of days in each PSI interval by month and also lists the maximum index for each month, the date of occurrence, and the pollutant causing that index value. The higher PSI values tend to occur during the fall and winter months. These higher PSI values also often coincide with air stagnation periods. During January, 1981, stagnant air conditions persisted from the 12th to the 17th and the highest daily PSI values of the year for all three cities were recorded during that week. The PSI exceeded 100 (air quality was unhealthful or very unhealthful) for five days in a row in Seattle and Tacoma during that week.



POLLUTANT STANDARDS INDEX

Seattle, Washington

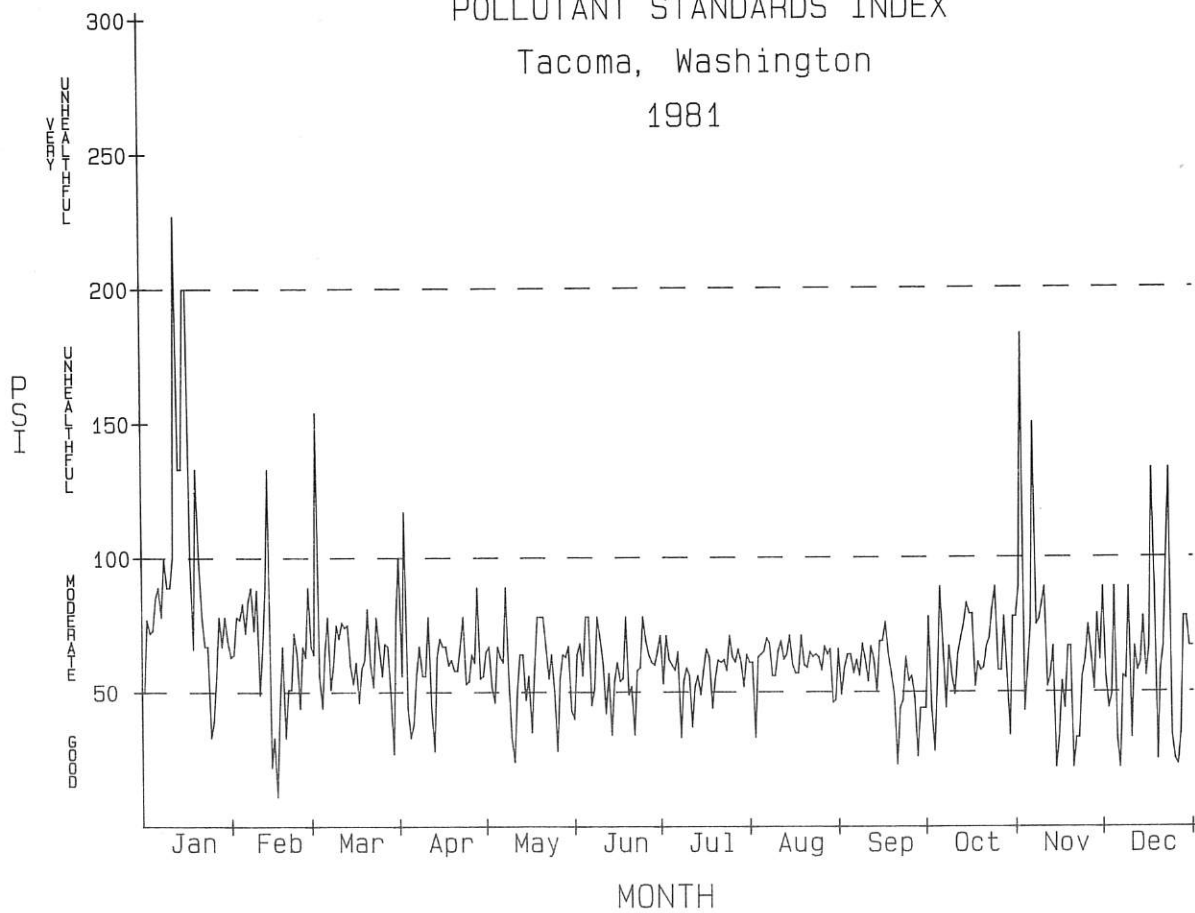
1981



POLLUTANT STANDARDS INDEX

Tacoma, Washington

1981



POLLUTANT STANDARDS INDEX

1981

EVERETT

AIR QUALITY (PSI Interval)	Number of Days in Each PSI Interval during Each Month												ANNUAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
GOOD (0 to 50)	25	27	29	30	31	30	31	30	30	31	25	31	350
MODERATE (51 to 100)	6	1	2	0	0	0	0	1	0	0	1	0	11
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	62	54	61	39	50	37	50	52	50	50	52	50	62
Date	16th	3rd	11th	30th	27th	25th	8th	8th	15th	21st	6th	2nd	Jan 16
Pollutant	TSP	TSP	TSP	TSP	S02	TSP	S02	TSP	S02	S02	TSP	S02	TSP

SEATTLE

AIR QUALITY (PSI Interval)	Number of Days in Each PSI Interval during Each Month												ANNUAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
GOOD (0 to 50)	1	3	5	9	13	10	8	4	4	5	4	3	69
MODERATE (51 to 100)	24	23	24	21	18	20	23	25	26	25	21	21	268
UNHEALTHFUL (101 to 199)	8	2	2	0	0	0	0	2	0	1	5	7	27
VERY UNHEALTHFUL (200 to 299)	1	0	0	0	0	0	0	0	0	0	0	0	1
Maximum PSI each month	213	133	133	89	78	89	78	139	89	117	192	150	213
Date	15th	27th	9th	14th	8th	5th	2nd	18th	15th	15th	2nd	17th	Jan 15
Pollutant	CO	CO	CO	CO	CO	CO	CO	TSP	CO	CO	TSP	CO	CO

TACOMA

AIR QUALITY (PSI Interval)	Number of Days in Each PSI Interval during Each Month												ANNUAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
GOOD (0 to 50)	3	7	4	5	10	5	4	3	11	5	7	10	74
MODERATE (51 to 100)	22	20	26	24	21	25	27	28	19	26	21	19	278
UNHEALTHFUL (101 to 199)	3	1	1	1	0	0	0	0	0	0	2	2	10
VERY UNHEALTHFUL (200 to 299)	3	0	0	0	0	0	0	0	0	0	0	0	3
Maximum PSI each month	227	133	154	117	89	78	71	71	76	89	183	133	227
Date	12th	13th	2nd	2nd	7th	4th	2nd	14th	16th	5th	2nd	17th	Jan 12
Pollutant	CO	CO	TSP	CO	CO	CO	TSP	TSP	TSP	CO	CO	CO	CO

TSP = Total Suspended Particulates; CO = Carbon Monoxide; SO2 = Sulfur Dioxide.

SUSPENDED PARTICULATES

Introduction

Total Suspended Particulates (TSP) is a general term for particles composed of dust, soot, organic matter, and compounds containing sulfur, nitrogen, and metals. These particulates, when sampled by the present high volume federal reference method, range in diameter from 0.1 micrometer to 100 micrometers (the upper diameter range is not very specific; it is often as small as 25 to 30 micrometers).

Some newer instruments specifically collect only the particulates less than 15 micrometers diameter (sometimes called inhalable particulates) or only the particulates less than 2.5 micrometers diameter (often termed fine particulates). Within the last year the newest instruments selectively sample only the particulates less than 10 micrometers diameter. A standard for the particulate size fraction less than 10 micrometers diameter is under discussion but none has yet been established.

Particulate Sources and Measured Levels

Particulates are released from industrial operations, from auto and truck traffic, and from other sources. These emissions change from day to day due to intermittent industrial operations, equipment upset or breakdown and traffic variations.

Once into 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 TSP 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 Suspended Particulate Maps

The maps which follow this page present annual geometric mean TSP values throughout the region for each of calendar years 1980 and 1981. Measured concentrations at each sampling station, together with a particulate emission inventory and information about local winds and topography, were used in developing each map.

The annual concentration of TSP at a location may be determined by interpolating between adjacent isopleths (lines connecting points of equal concentration). Areas which exceed the annual primary standard of 75 micrograms per cubic meter and the annual secondary standard of 60 are clearly outlined. The Tacoma Port area and the Harbor Island-Duwamish Valley area of Seattle continue to exceed these standards.

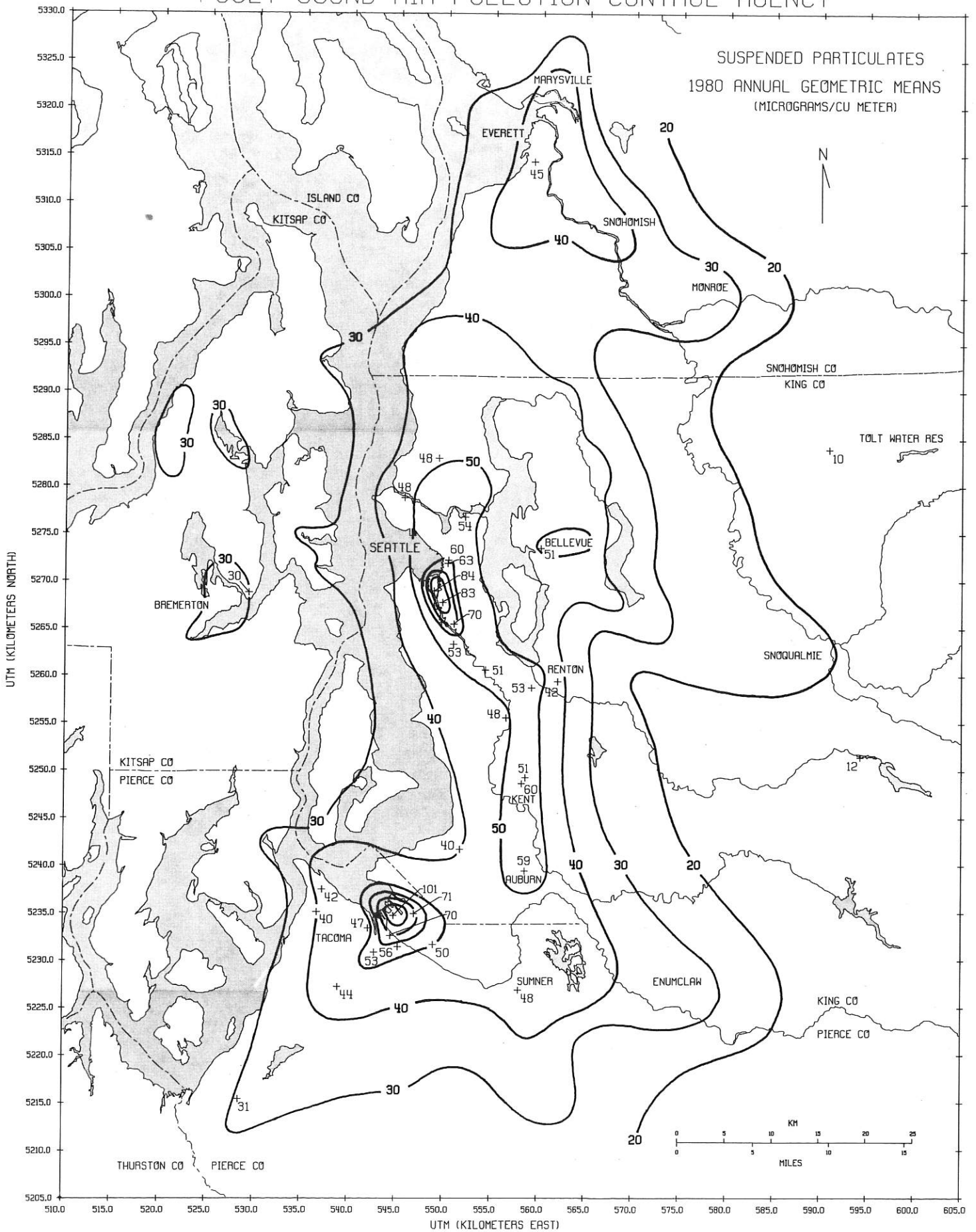
Suspended Particulate Trends

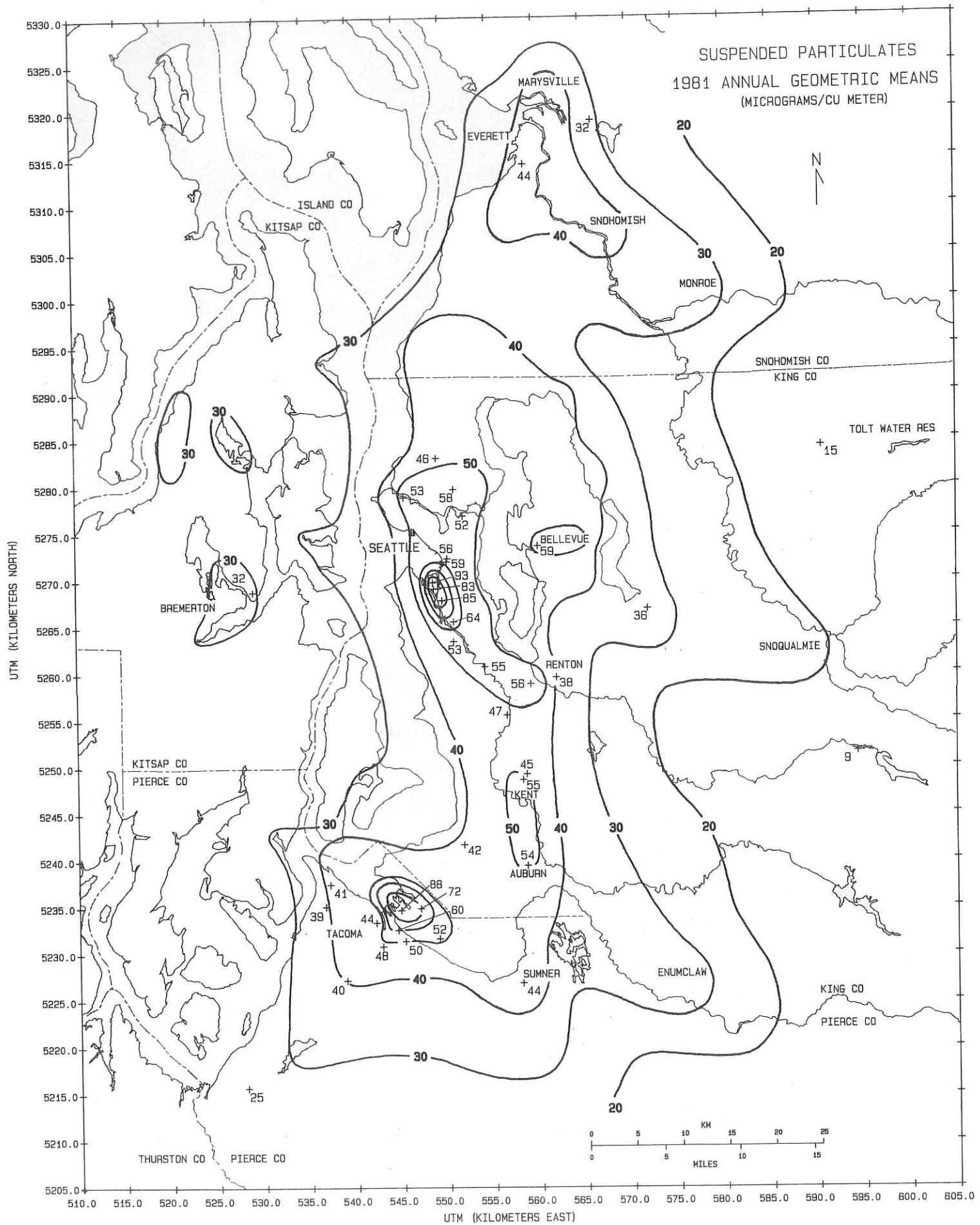
Graphic plots of moving TSP geometric means permit quick visual review of long term trends, but to depict any trend such charts require many years of data. A 12 month moving geometric mean compares directly to the annual primary and secondary standards which are shown by reference lines on these charts.

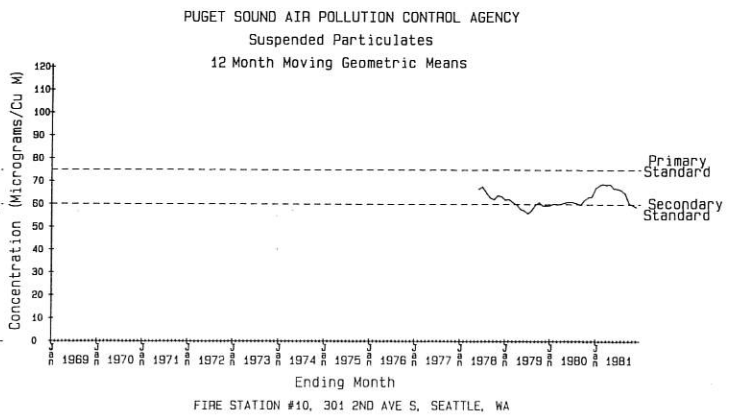
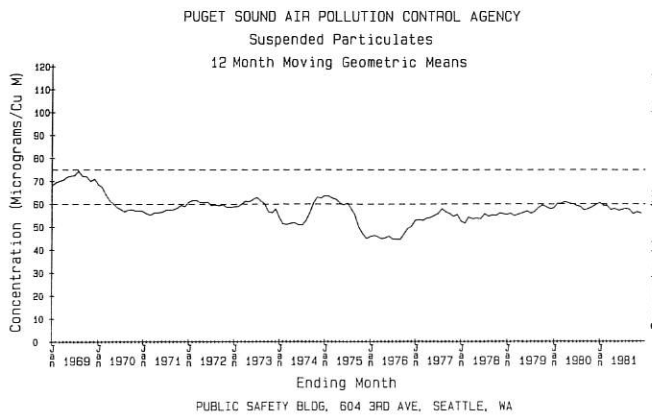
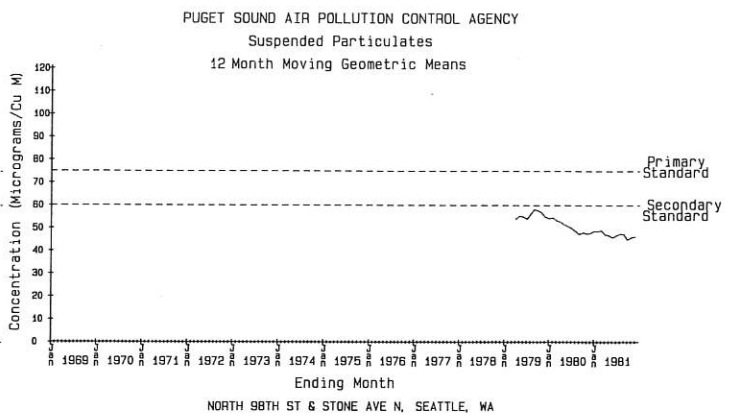
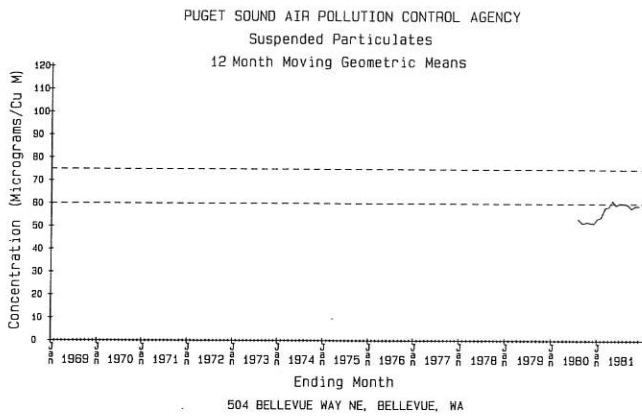
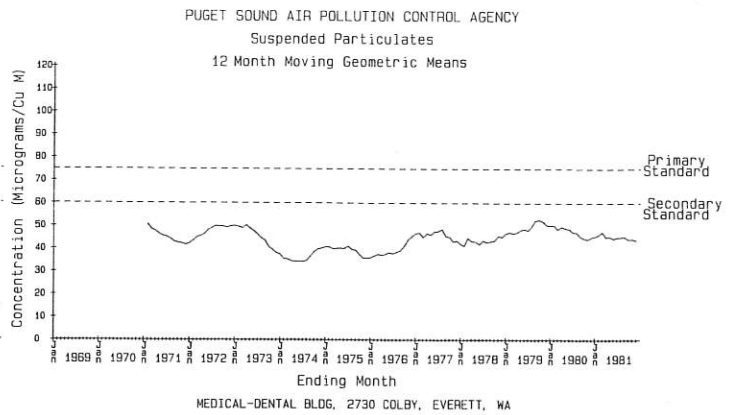
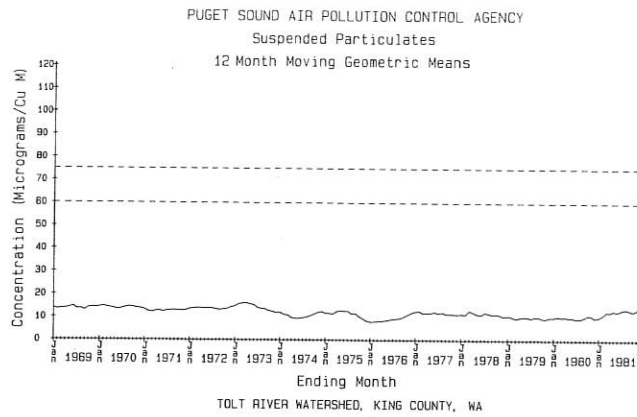
Plotted moving geometric mean charts for several stations are presented in this section. One station near the Tolt Water Reservoir presents a steady unchanging low TSP value apparently unaffected by the urbanized areas. Other stations in the industrialized Seattle Duwamish Valley and Tacoma Port area clearly show values exceeding the annual TSP standards for many years.

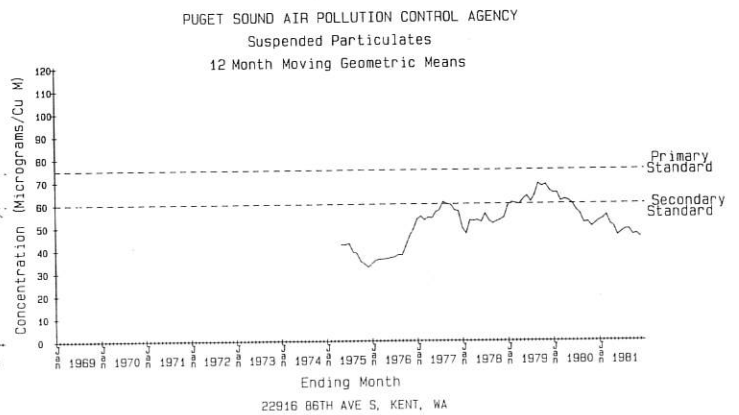
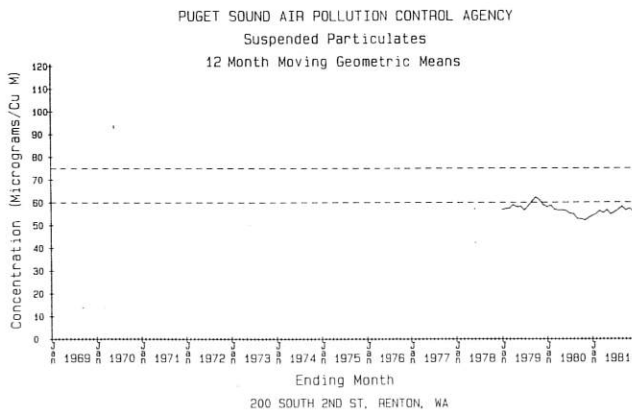
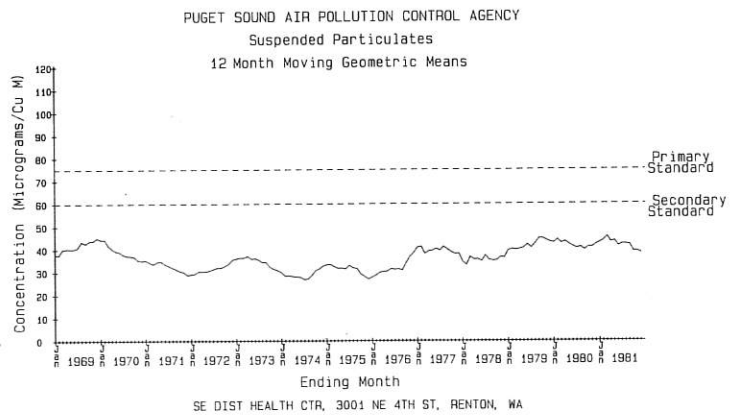
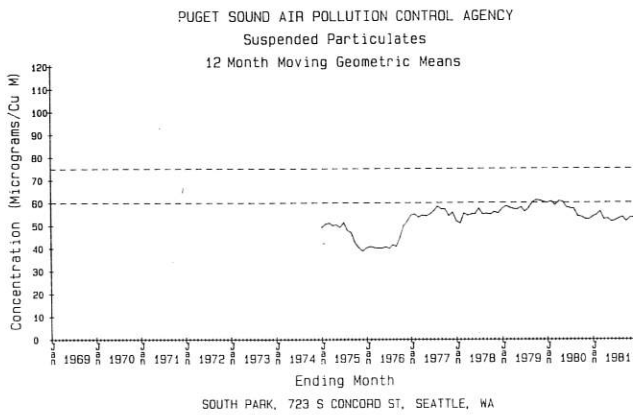
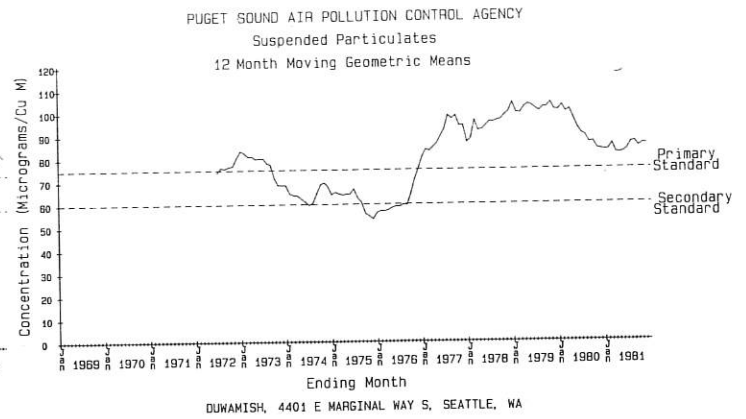
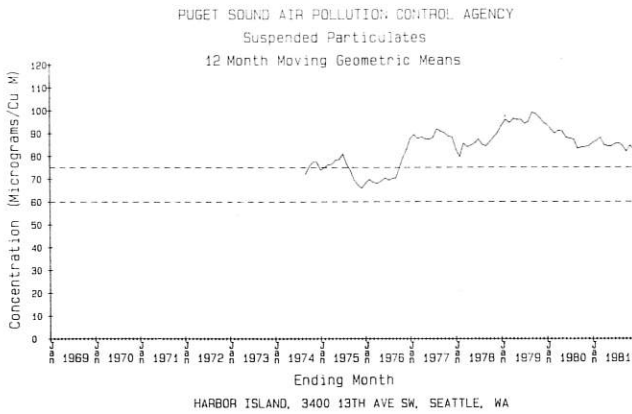
PUGET SOUND AIR POLLUTION CONTROL AGENCY

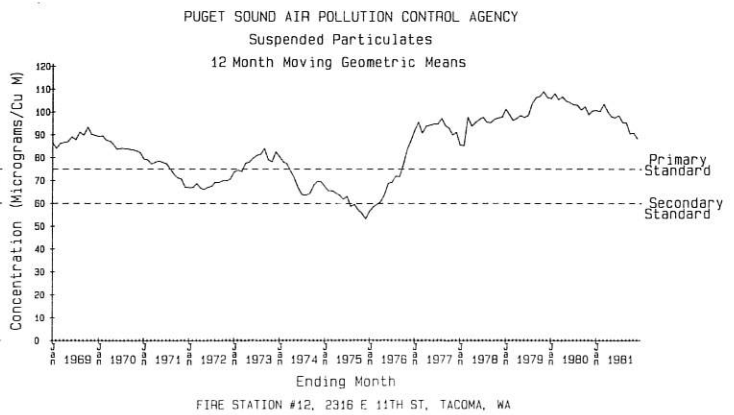
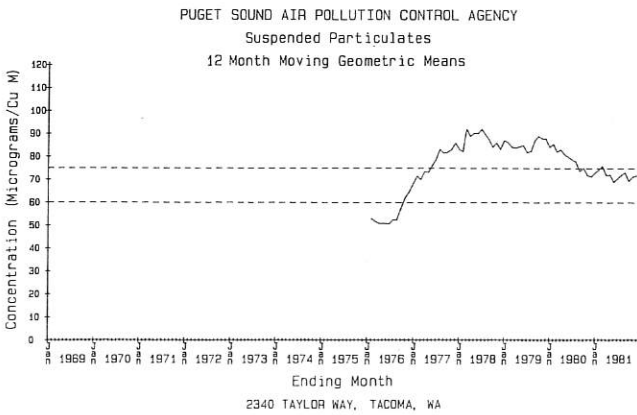
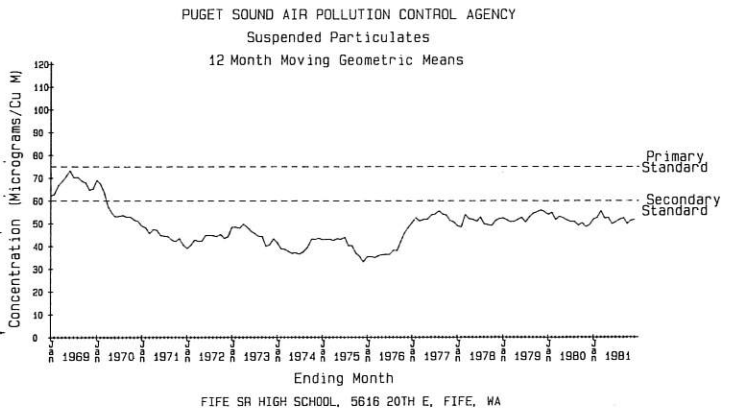
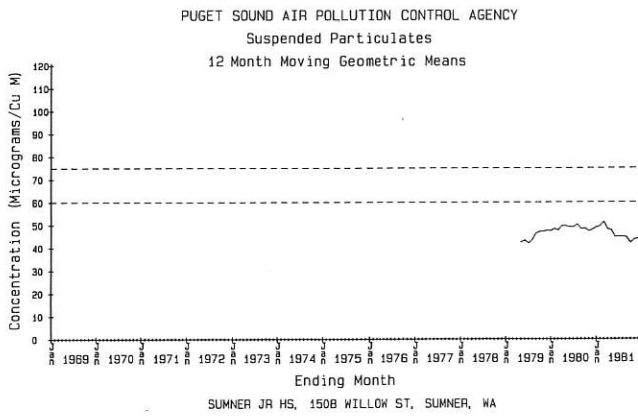
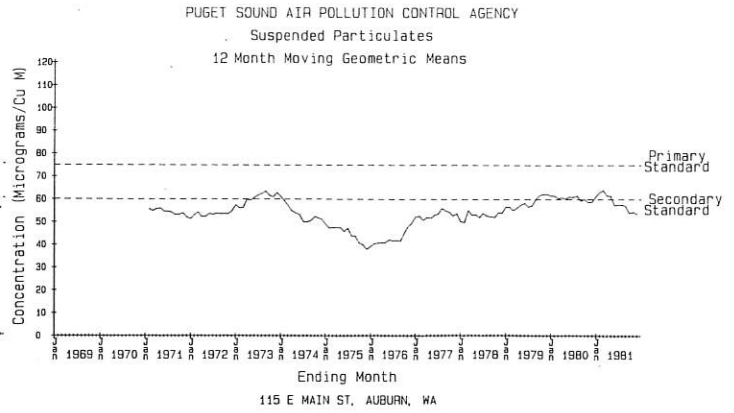
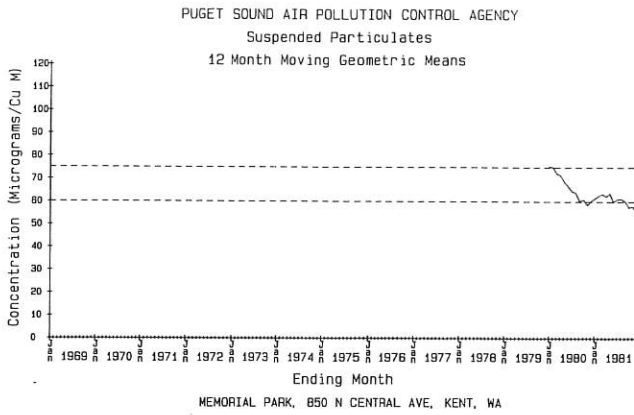
SUSPENDED PARTICULATES
1980 ANNUAL GEOMETRIC MEANS
(MICROGRAMS/CU METER)

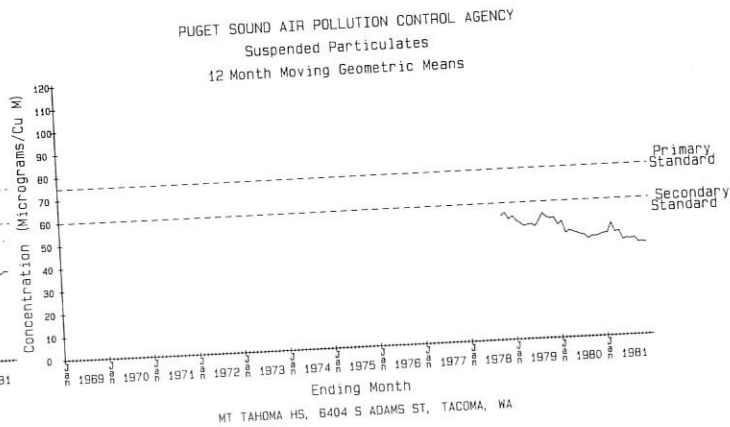
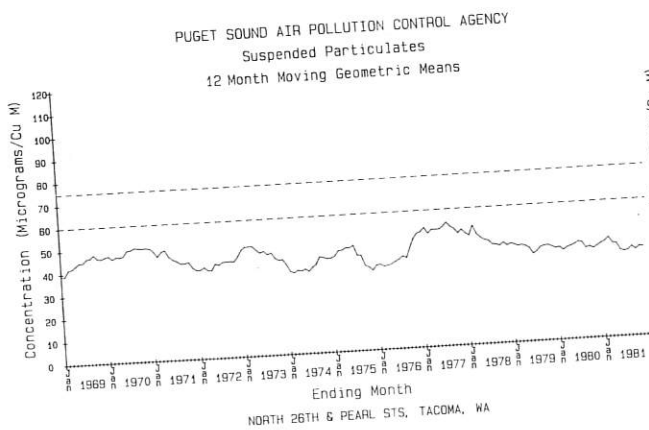
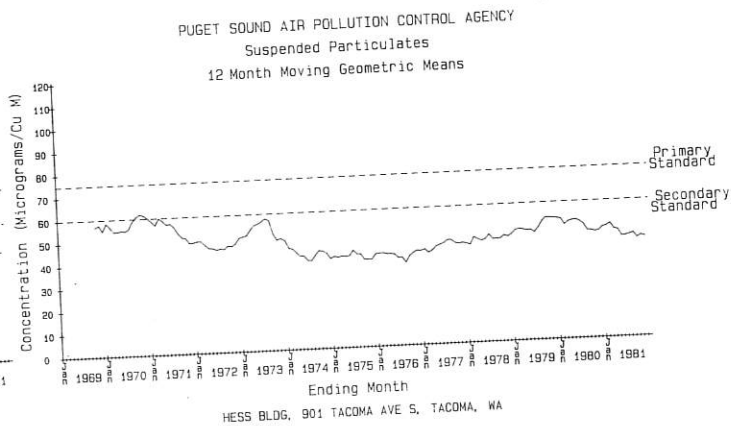
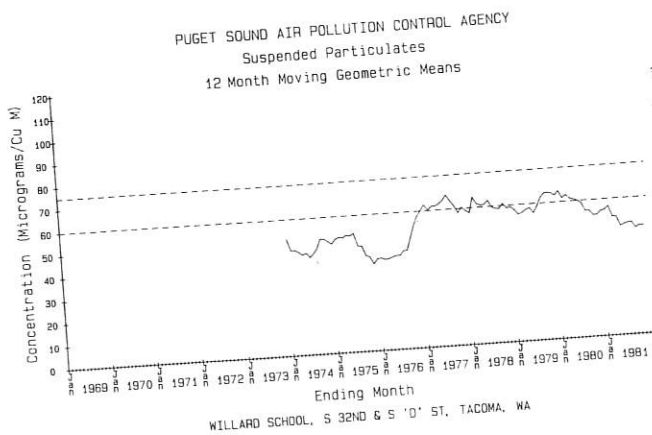
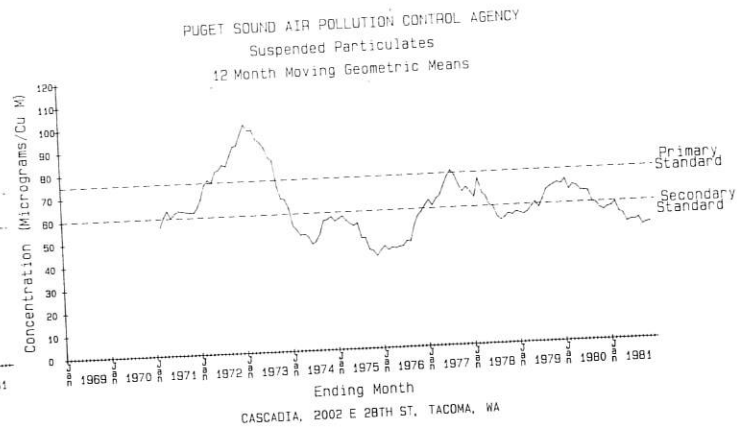
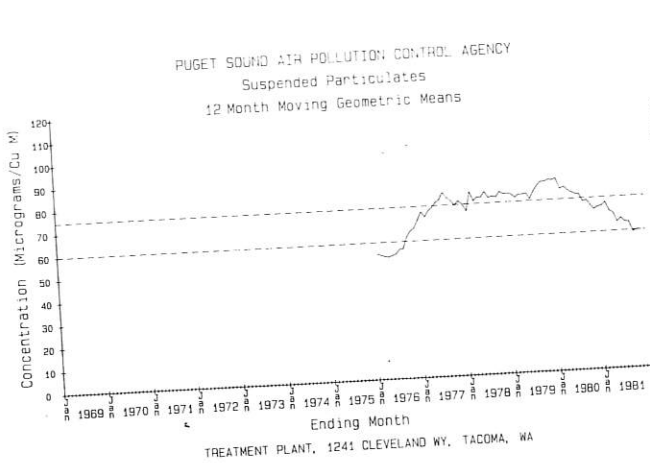












SUSPENDED PARTICULATES
(Micrograms per Cubic Meter)
1981

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			
Tolt River Watershed, King County, Wa	10	17	22	11	20	15	30	49	18	15	11	9			
Cedar River Masonry Dam, King County, Wa	8	6	12	4	18	13	41	44	14	10	6	6	58	19	15
Highway 9 & 28th St NE, Lake Stevens, Wa ^a								56	35	29	35	28	60	15	9
Medical-Dental Bldg, 2730 Colby, Everett, Wa	64	56	62	32	45	39	49	64	48	41	42	33	24	36	32
504 Bellevue Way NE, Bellevue, Wa	143	73	102	49	69	45	65	77	49	52	65	45	59	48	44
20050 SE 56th, Lake Sammamish State Park, Wa ^b						31	51	63	36	39	27	30	54	68	59
North 98th St & Stone Ave N, Seattle, Wa	71	57	56	29	40	39	56	73	47	42	57	42	33	40	36
5701 8th Ave NE, Seattle, Wa	132	96	88	44	53	46	49	56	55	54	53	52	61	51	46
2700 W Commodore Way, Seattle, Wa	72	65	63	42	46	48	51	51	54	65	97	45	54	65	58
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	104	76	64	39	45	43	43	60	41	47	79	55	59	58	53
Public Safety Bldg, 604 3rd Ave, Seattle, Wa	82	68	65	47	55	51	52	63	52	57	77	49	60	57	52
Fire Station #10, 301 2nd Ave S, Seattle, Wa	124	86	75	45	45	50	53	65	52	58	59	53	58	59	56
Harbor Island, 2555 13th Ave SW, Seattle, Wa	128	132	99	77	80	91	80	113	67	122	156	76	52	65	59
Harbor Island, 3400 13th Ave SW, Seattle, Wa	142	112	116	62	71	71	81	93	62	91	133	71	61	102	93
Duwamish, 4401 E Marginal Way S, Seattle, Wa	142	111	127	59	75	76	91	138	81	96	106	74	61	92	83
Georgetown, 6431 Corson Ave S, Seattle, Wa	103	99	104	43	52	51	82	81	53	73	76	49	121	98	85
South Park, 723 S Concord St, Seattle, Wa	107	88	72	27	48	35	59	74	54	56	79	51	51	72	64
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	84	93	77	33	50	36	56	68	58	81	53	53	60	63	53
SE Dist Health Ctr, 3001 NE 4th St, Renton, Wa	68	67	53	22	37	27	49	70	38	37	43	38	59	62	55
200 South 2nd St, Renton, Wa	90	80	70	41	60	40	56	76	65	63	64	47	59	45	38
Southcenter, 401 Andover Park E, Tukwila, Wa	79	68	61	29	51	37	59	59	46	43	53	37	61	63	56
22916 86th Ave S, Kent, Wa	79	69	58	25	48	33	66	86	45	46	48	37	61	52	47
Memorial Park, 850 N Central Ave, Kent, Wa	100	92	76	50	64	39	69	73	44	55	58	44	61	53	45
Federal Way HS, 1401 S 304 St, Federal Way, Wa	71	50	50	27	40	33	46	58	43	43	48	38	61	63	55
115 E Main St, Auburn, Wa	122	89	65	36	48	35	56	67	45	52	63	55	61	46	42
Sumner Jr HS, 1508 Willow St, Sumner, Wa	84	63	52	24	42	29	55	69	42	42	56	55	60	61	54
Fife Sr High School, 5616 20th E, Fife, Wa	102	89	69	25	52	32	63	83	57	57	65	56	59	51	44
2340 Taylor Way, Tacoma, Wa	132	107	77	38	69	52	90	104	75	80	98	66	60	62	52
Fire Station #12, 2316 E 11th St, Tacoma, Wa	126	123	138	77	80	95	114	111	90	93	92	66	58	81	72
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	126	84	67	37	55	46	86	98	66	56	71	57	119	100	88
Cascadia, 2002 E 28th St, Tacoma, Wa	99	83	60	25	56	32	85	82	63	50	61	51	58	69	60
Willard School, S 32nd & S 'D' St, Tacoma, Wa	108	133	56	20	44	27	60	64	53	60	72	51	61	62	50
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	100	75	50	23	35	28	38	50	47	51	77	42	57	59	48
4716 North Baltimore St, Tacoma, Wa	75	70	22	19	44	22	52	64	61	47	57	42	61	51	44
North 26th & Pearl Sts, Tacoma, Wa	72	62	49	20	40	20	46	55	47	49	59	37	57	49	41
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	71	76	69	18	44	24	53	54	50	62	65	34	61	46	39
City Water Supply Pump House, Dupont, Wa	44	36	28	14	23	15	33	39	32	35	25	26	58	51	40
East 16th St & Ironsides Ave, Bremerton, Wa ^c	84	48	54	19	28	20	29	34	35	36			58	30	25

^a Sampling started 8/08/81

^b Sampling started 6/09/81

^c Sampling ended 10/31/81

SUSPENDED PARTICULATES
(Micrograms per Cubic Meter)
1981

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	58	7	9	11	13	15	17	22	27	32	43	19	15	1.96	14.35
Cedar River Masonry Dam, King County, Wa	60	2	3	4	6	8	10	18	27	36	51	15	9	3.12	16.22
Highway 9 & 28th St NE, Lake Stevens, Wa	24	16	18	22	24	35	38	45	52	59	68	36	32	1.66	17.73
Medical-Dental Bldg, 2730 Colby, Everett, Wa	59	24	29	32	39	44	51	59	64	74	83	48	44	1.58	22.39
504 Bellevue Way NE, Bellevue, Wa	54	33	38	44	51	58	63	69	81	114	121	68	59	1.68	44.48
20050 SE 56th, Lake Sammamish State Park, Wa	33	15	22	25	31	39	43	52	54	59	68	40	36	1.67	19.61
North 98th St & Stone Ave N, Seattle, Wa	61	28	30	33	37	45	52	65	69	84	90	51	46	1.53	22.36
5701 8th Ave NE, Seattle, Wa	54	30	40	46	50	54	58	64	76	110	139	65	58	1.58	36.86
2700 W Commodore Way, Seattle, Wa	59	34	36	44	50	53	54	63	68	82	91	58	53	1.48	29.68
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	60	35	38	39	44	49	52	60	73	87	115	57	52	1.51	28.90
Public Safety Bldg, 604 3rd Ave, Seattle, Wa	58	38	43	46	50	53	58	64	69	89	104	59	56	1.38	21.58
Fire Station #10, 301 2nd Ave S, Seattle, Wa	52	37	38	45	48	53	60	66	76	106	123	65	59	1.54	34.90
Harbor Island, 2555 13th Ave SW, Seattle, Wa	61	58	65	77	84	93	98	112	124	147	195	102	93	1.53	49.33
Harbor Island, 3400 13th Ave SW, Seattle, Wa	61	47	57	66	71	80	88	99	113	137	179	92	83	1.56	50.09
Duwamish, 4401 E Marginal Way S, Seattle, Wa	121	46	55	62	68	79	95	109	143	166	210	98	85	1.69	57.28
Georgetown, 6431 Corson Ave S, Seattle, Wa	51	36	40	44	50	67	71	77	112	125	133	72	64	1.62	35.16
South Park, 723 S Concord St, Seattle, Wa	60	26	32	36	41	49	62	70	89	109	133	63	53	1.75	38.09
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	59	29	34	39	45	56	61	69	89	100	133	62	55	1.63	31.95
SE Dist Health Ctr, 3001 NE 4th St, Renton, Wa	59	18	25	28	33	39	46	49	63	91	100	45	38	1.83	26.54
200 South 2nd St, Renton, Wa	61	29	36	41	48	53	64	75	88	104	118	63	56	1.61	30.71
Southcenter, 401 Andover Park E, Tukwila, Wa	61	25	29	32	41	49	55	60	69	78	91	52	47	1.59	24.55
22916 86th Ave S, Kent, Wa	61	19	25	33	39	49	55	61	76	96	110	53	45	1.82	29.97
Memorial Park, 850 N Central Ave, Kent, Wa	61	24	36	42	53	59	66	70	87	103	116	63	55	1.73	32.94
Federal Way HS, 1401 S 304 St, Federal Way, Wa	61	24	27	32	37	45	48	51	59	72	76	46	42	1.55	19.45
115 E Main St, Auburn, Wa	60	30	36	39	42	49	57	67	82	107	109	61	54	1.64	37.47
Sumner Jr HS, 1508 Willow St, Sumner, Wa	59	18	30	34	38	48	50	57	71	87	104	51	44	1.74	27.60
Fife Sr High School, 5616 20th E, Fife, Wa	60	20	29	38	44	52	63	73	95	115	134	62	52	1.87	36.49
2340 Taylor Way, Tacoma, Wa	58	38	44	51	57	74	82	93	113	139	149	81	72	1.64	42.39
Fire Station #12, 2316 E 11th St, Tacoma, Wa	119	46	57	66	75	91	104	123	138	170	189	100	88	1.68	50.30
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	58	27	34	43	50	56	71	79	97	112	140	69	60	1.71	39.06
Cascadia, 2002 E 28th St, Tacoma, Wa	61	19	26	35	41	51	57	76	96	111	134	62	50	1.92	39.84
Willard School, S 32nd & S 'D' St, Tacoma, Wa	57	18	25	29	36	46	59	72	83	110	133	59	48	1.93	39.29
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	61	21	25	30	36	40	47	56	71	98	118	51	44	1.75	33.15
4716 North Baltimore St, Tacoma, Wa	57	16	25	29	35	41	45	56	74	96	105	49	41	1.83	29.16
North 26th & Pearl Sts, Tacoma, Wa	61	17	20	25	32	38	48	61	74	84	99	46	39	1.83	27.19
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	58	16	21	29	35	44	49	57	64	93	125	51	40	2.02	37.76
City Water Supply Pump House, Dupont, Wa	58	12	15	19	21	26	34	38	45	50	59	30	25	1.81	16.34
East 16th St & Ironsides Ave, Bremerton, Wa	44	17	20	23	28	31	33	44	47	63	75	36	32	1.64	19.24

SUSPENDED PARTICULATES
(Micrograms per Cubic Meter)

Jul-Dec, 1981

Summary of Observations Greater Than 150

Location	Jul	Jul	Jul	Jul	Aug	Aug	Aug	Aug	Aug	Aug	Aug	Aug	Aug	Aug	Aug	Sep	Sep	Sep
	3	24	25	27	5	6	8	9	10	11	14	17	18	21	28	11	15	16
	Fri	Fri	Sat	Mon	Wed	Thu	Sat	Sun	Mon	Tue	Fri	Mon	Tue	Fri	Fri	Fri	Tue	Wed
504 Bellevue Way NE, Bellevue, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5701 8th Ave NE, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2700 W Commodore Way, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fire Station #10, 301 2nd Ave S, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Harbor Island, 2555 13th Ave SW, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Harbor Island, 3400 13th Ave SW, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Duwamish, 4401 E Marginal Way S, Seattle, Wa	153	153	152	154	151	181	154	239	193	166	235	305	154	215	172	186	151	
Georgetown, 6431 Corson Ave S, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
South Park, 723 S Concord St, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
200 South 2nd St, Renton, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Memorial Park, 850 N Central Ave, Kent, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
115 E Main St, Auburn, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fife Sr High School, 5616 20th E, Fife, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2340 Taylor Way, Tacoma, Wa	--	--	--	--	--	--	--	--	--	159	--	--	--	--	--	--	--	--
Fire Station #12, 2316 E 11th St, Tacoma, Wa	154	--	--	--	--	--	--	--	--	151	--	--	--	--	--	--	--	170
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cascadia, 2002 E 28th St, Tacoma, Wa	179	--	--	--	--	152	--	--	--	--	--	--	--	--	--	--	--	--
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	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Location	Oct	Oct	Oct	Oct	Oct	Oct	Oct	Oct	Oct	Oct	Nov	Nov	Nov	Nov	Nov	Nov	Nov	Nov	Dec
	12	13	14	15	16	21	22	23	24	24	2	5	6	7	9	10	24	28	17
	Mon	Tue	Wed	Thu	Fri	Wed	Thu	Fri	Sat	Sat	Mon	Thu	Fri	Sat	Mon	Tue	Tue	Sat	Thu
504 Bellevue Way NE, Bellevue, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5701 8th Ave NE, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2700 W Commodore Way, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	222	--	--	--	--	--	--
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fire Station #10, 301 2nd Ave S, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	174	--	--	--	--
Harbor Island, 2555 13th Ave SW, Seattle, Wa	--	195	--	--	--	--	--	--	--	--	--	--	329	--	--	--	153	--	--
Harbor Island, 3400 13th Ave SW, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	268	--	--	--	--	--	--
Duwamish, 4401 E Marginal Way S, Seattle, Wa	153	--	209	205	--	189	173	165	156	366	174	266	161	154	168	--	161	204	
Georgetown, 6431 Corson Ave S, Seattle, Wa	--	--	230	160	152	--	--	--	--	--	--	--	--	--	158	--	--	--	--
South Park, 723 S Concord St, Seattle, Wa	--	--	--	--	--	--	--	--	--	--	--	--	155	--	--	--	--	--	--
Duwamish Valley, 12026 42nd Ave S, King Co, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
200 South 2nd St, Renton, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Memorial Park, 850 N Central Ave, Kent, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
115 E Main St, Auburn, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fife Sr High School, 5616 20th E, Fife, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2340 Taylor Way, Tacoma, Wa	--	--	--	--	--	--	--	--	--	--	--	180	--	--	--	--	--	--	--
Fire Station #12, 2316 E 11th St, Tacoma, Wa	--	168	196	183	182	--	--	--	--	--	--	167	--	196	162	--	--	--	--
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cascadia, 2002 E 28th St, Tacoma, Wa	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Willard School, S 32nd & S 'D' St, Tacoma, Wa	--	--	--	--	--	--	--	--	--	--	--	166	--	--	--	--	--	--	--
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa	--	--	--	--	--	--	--	--	--	--	--	153	--	--	--	--	--	--	--
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	--	--	152	--	174	--	--	179	--	--	--	194	--	--	--	--	--	--	--

-- Indicates no sample on specified day

SUSPENDED PARTICULATES
(Micrograms per Cubic Meter)
1981

Summary of Maximum and 2nd High Observed Concentrations

Location	Jan	Jan	Jan	Jan	Feb	Feb	Mar	Mar	Jul	Jul	Aug	Aug	Aug	Aug	Sep	Oct	Oct	Nov	Nov
	4	10	12	16	3	9	2	11	3	16	6	8	14	26	7	14	23	2	6
	Sun	Sat	Mon	Fri	Tue	Mon	Mon	Wed	Fri	Thu	Thu	Sat	Fri	Wed	Mon	Wed	Fri	Mon	Fri
Tolt River Watershed, King County, Wa			--				--			--	--		85	62		--	--	--	
Cedar River Masonry Dam, King County, Wa	--									75	89								
Highway 9 & 28th St NE, Lake Stevens, Wa	--	--	--	--	--	--	--	--	--	--	--	68							75
Medical-Dental Bldg, 2730 Colby, Everett, Wa				121				115											
504 Bellevue Way NE, Bellevue, Wa	--	190	--	283										--					
20050 SE 56th, Lake Sammamish State Park, Wa	--	--	--	--	--	--	--	--				85	92						
North 98th St & Stone Ave N, Seattle, Wa				112															112
5701 8th Ave NE, Seattle, Wa		157	--	227										--					
2700 W Commodore Way, Seattle, Wa			--	137															222
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa			--	187															128
Public Safety Bldg, 604 3rd Ave, Seattle, Wa		115	--	--		--	--												136
Fire Station #10, 301 2nd Ave S, Seattle, Wa				258	224									--					--
Harbor Island, 2555 13th Ave SW, Seattle, Wa				--	244														329
Harbor Island, 3400 13th Ave SW, Seattle, Wa				--	317														268
Duwamish, 4401 E Marginal Way S, Seattle, Wa					355														366
Georgetown, 6431 Corson Ave S, Seattle, Wa			--				--	165		--	--					230	--	--	--
South Park, 723 S Concord St, Seattle, Wa			--	201			--			--	--								155
Duwamish Valley, 12026 42nd Ave S, King Co, Wa			--	--	158		--			--	--								145
SE Dist Health Ctr, 3001 NE 4th St, Renton, Wa	106		--	--	113		--			--	--								
200 South 2nd St, Renton, Wa			--	169	127		--			--	--								
Southcenter, 401 Andover Park E, Tukwila, Wa			--	131	120		--			--	--								
22916 86th Ave S, Kent, Wa			--	130			--			--	--			137					
Memorial Park, 850 N Central Ave, Kent, Wa			--	181	154		--			--	--								
Federal Way HS, 1401 S 304 St, Federal Way, Wa	88		--	114			--			--	--								
115 E Main St, Auburn, Wa		163	--	241			--			--	--								
Sumner Jr HS, 1508 Willow St, Sumner, Wa			--	148			--			--	--		113						
Fife Sr High School, 5616 20th E, Fife, Wa			--	135	156		--			--	--								
2340 Taylor Way, Tacoma, Wa	--		--	230			--			--	--								180
Fire Station #12, 2316 E 11th St, Tacoma, Wa			--			217	322			--	--								
Treatment Plant, 1241 Cleveland Wy, Tacoma, Wa	--		--	222			--			--	--	--	145						
Cascadia, 2002 E 28th St, Tacoma, Wa			--	163			--		179	--	--								
Willard School, S 32nd & S 'D' St, Tacoma, Wa			--	177			--			--	--								166
Hess Bldg, 901 Tacoma Ave S, Tacoma, Wa			--	169			--			--	--								153
4716 North Baltimore St, Tacoma, Wa			--		--		--	--		--	--	123			115				
North 26th & Pearl Sts, Tacoma, Wa			--				--	--		--	--	110							111
Mt Tahoma HS, 6404 S Adams St, Tacoma, Wa	--		--	--			--	--		--	--					179	--	--	194
City Water Supply Pump House, Dupont, Wa			--	79	62		--	--		--	--	62							
East 16th St & Ironsides Ave, Bremerton, Wa		83	--	95			--	--		--	--								--

-- Indicates no sample on specified day.

SUSPENDED PARTICULATES
(COH's/1000 Lin Ft)
1981

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	8569	.1	.1	.1	.2	.2	.3	.3	.4	.5	.7	1.0	1.5	.37	.28	2.13	.31	
North 98th St & Stone Ave N, Seattle, Wa	8531	.1	.2	.2	.3	.3	.4	.5	.7	.9	1.4	1.8	2.5	.61	.44	2.27	.53	
Duwamish, 4401 E Marginal Way S, Seattle, Wa	8598	.1	.2	.2	.4	.5	.6	.8	1.0	1.3	1.8	2.3	3.0	.82	.56	2.60	.70	
Southcenter, 401 Andover Park E, Tukwila, Wa	8389	.1	.1	.2	.3	.4	.5	.6	.8	1.0	1.4	1.8	2.4	.64	.44	2.56	.55	
22916 86th Ave S, Kent, Wa	8700	.1	.1	.1	.2	.3	.3	.5	.6	.9	1.4	1.8	2.4	.56	.34	2.90	.55	
Fire Station #12, 2316 E 11th St, Tacoma, Wa	8166	.2	.3	.4	.5	.7	.8	1.0	1.4	1.8	2.6	3.2	4.5	1.16	.82	2.38	.99	
Willard School, S 32nd & S 'D' St, Tacoma, Wa	8206	.1	.2	.3	.3	.4	.5	.7	.9	1.3	1.8	2.4	3.4	.80	.55	2.42	.74	

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	.67	.52	.42	.21	.31	.17	.18	.25	.37	.40	.44	.49	8569	.37
North 98th St & Stone Ave N, Seattle, Wa	1.21	.89	.65	.38	.40	.32	.28	.36	.47	.58	.86	.89	8531	.61
Duwamish, 4401 E Marginal Way S, Seattle, Wa	1.41	1.08	.85	.44	.47	.41	.40	.63	.68	1.09	1.18	1.21	8598	.82
Southcenter, 401 Andover Park E, Tukwila, Wa	.95	.66	.53	.36	.43	.31	.41	.61	.62	.98	1.04	.87	8389	.64
22916 86th Ave S, Kent, Wa	1.09	.74	.53	.28	.34	.21	.31	.46	.42	.80	.83	.66	8700	.56
Fire Station #12, 2316 E 11th St, Tacoma, Wa	2.41	1.58	1.01	.67	.71	.71	.65	.84	.93	1.34	1.59	1.58	8166	1.16
Willard School, S 32nd & S 'D' St, Tacoma, Wa	1.75	1.16	.81	.52	.49	.26	.32	.61	.76	.99	1.17	.92	8206	.80

ATMOSPHERIC PARTICLES
(bsp (X 10 Exp-4)/M)
1981

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	8566	.1	.1	.2	.3	.3	.4	.5	.7	1.0	1.7	2.6	4.7	.74	.46	2.57	.90	
22916 86th Ave S, Kent, Wa	8491	.1	.1	.2	.3	.4	.5	.6	.8	1.2	2.1	2.9	5.1	.83	.50	2.73	1.00	
Fire Station #12, 2316 E 11th St, Tacoma, Wa	6611	.1	.2	.3	.4	.4	.6	.7	.9	1.4	2.4	3.5	5.5	.99	.61	2.65	1.15	

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	1.50	1.14	.59	.29	.37	.26	.34	.55	.51	1.12	1.29	.88	8566	.74
22916 86th Ave S, Kent, Wa	1.88	1.22	.70	.33	.42	.26	.47	.81	.58	1.14	1.32	.95	8491	.83
Fire Station #12, 2316 E 11th St, Tacoma, Wa				.39	.49	.41		.88	.69	1.38	1.59	1.23	6611	.99

SUSPENDED PARTICULATES
Description of Methods

Coefficient of Haze (COH) represents 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 calculated concentration measured by this method is reported in COH-units per thousand linear feet of sampled air.

The light scattering extinction coefficient (bsp) represents a measure of

atmospheric particles. The light scattering extinction coefficient is inversely related to visibility and has been shown highly correlated to fine particle mass concentration. Values of bsp summarized here were continuously measured using an integrating nephelometer. The sample air stream was heated 6 to 12 degrees C above ambient air temperature to dry the particles. The particulate concentration measured by this method is reported as a scattering coefficient per meter that must be multiplied by 10 to the exponent, -4.

The Federal reference method of high volume sampling measures Total Suspended Particulates (TSP). The TSP concentration is reported in micrograms per cubic meter of air.

SUSPENDED PARTICULATES
1981

Correlation between Continuous Sampling Methods

	Jan	Apr	Jul	Oct	
	Feb	May	Aug	Nov	Annual
	Mar	Jun	Sep	Dec	
North 98th St & Stone Ave N, Seattle, Wa					
1 Hour COH Vs 1 Hour bsp					
Correlation Coefficient	.88	.79	.59	.79	.84
Number of 1 Hour Samples	2129	2133	2072	2081	8415
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.92	.80	.65	.79	.86
Number of 24 Hour Samples	89	89	83	86	347
22916 86th Ave S, Kent, Wa					
1 Hour COH Vs 1 Hour bsp					
Correlation Coefficient	.90	.80	.68	.90	.89
Number of 1 Hour Samples	2047	2102	2171	2167	8487
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.94	.86	.75	.93	.93
Number of 24 Hour Samples	84	88	91	90	353
Fire Station #12, 2316 E 11th St, Tacoma, Wa					
1 Hour COH Vs 1 Hour bsp					
Correlation Coefficient	.89	.63	.62	.80	.83
Number of 1 Hour Samples	651	2136	1540	2047	6374
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.95	.69	.61	.86	.90
Number of 24 Hour Samples	25	90	60	85	260

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

SUSPENDED PARTICULATES
1981

Correlation between Methods on TSP Sampling Days

	Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov Dec	Annual
Medical-Dental Bldg, 2730 Colby, Everett, Wa					
24 Hour COH Vs 24 Hour TSP					
Correlation Coefficient	.87	.30	.45	.83	.69
Number of Common 24 Hour Samples	15	13	14	14	56
North 98th St & Stone Ave N, Seattle, Wa					
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.91	.49	.79	.81	.91
24 Hour COH Vs 24 Hour TSP					
Correlation Coefficient	.88	.38	.14	.86	.71
24 Hour bsp Vs 24 Hour TSP					
Correlation Coefficient	.84	.74	.35	.96	.75
Number of Common 24 Hour Samples	26	15	13	15	69
Duwamish, 4401 E Marginal Way S, Seattle, Wa					
24 Hour COH Vs 24 Hour TSP					
Correlation Coefficient	.72	.36	.65	.78	.67
Number of Common 24 Hour Samples	83	84	87	87	341
Southcenter, 401 Andover Park E, Tukwila, Wa					
24 Hour COH Vs 24 Hour TSP					
Correlation Coefficient	.87	.65	.69	.94	.69
Number of Common 24 Hour Samples	14	13	14	16	57
22916 86th Ave S, Kent, Wa					
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.97	.63	.70	.96	.96
24 Hour COH Vs 24 Hour TSP					
Correlation Coefficient	.90	.75	.47	.98	.73
24 Hour bsp Vs 24 Hour TSP					
Correlation Coefficient	.89	.80	.42	.92	.71
Number of Common 24 Hour Samples	14	15	14	15	58
Fire Station #12, 2316 E 11th St, Tacoma, Wa					
24 Hour COH Vs 24 Hour bsp					
Correlation Coefficient	.96	.61	.76	.91	.93
24 Hour COH Vs 24 Hour TSP					
Correlation Coefficient	.53	.52	.62	.89	.65
24 Hour bsp Vs 24 Hour TSP					
Correlation Coefficient	.46	.47	.61	.90	.65
Number of Common 24 Hour Samples	11	29	24	33	97
Willard School, S 32nd & S 'D' St, Tacoma, Wa					
24 Hour COH Vs 24 Hour TSP					
Correlation Coefficient	.92	.34	.59	.99	.88
Number of Common 24 Hour Samples	11	15	12	12	50

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

SULFUR DIOXIDE
(Parts per Million)
1981

Location	Monthly Arithmetic Averages												No. of 1 Hour Arith Samples	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Medical-Dental Bldg, 2730 Colby, Everett, Wa	.009	.008	.009	.008	.008	.008	.011	.014	.007	.009	.006		8431	.009
North 98th St & Stone Ave N, Seattle, Wa	.008	.007	.008	.008	.005	.006	.005	.006	.006		.008	.006	8056	.007
Duwamish, 4401 E Marginal Way S, Seattle, Wa		.018	.018	.014	.012	.011	.015	.027	.018	.015	.013	.009	8242	.016
Federal Way HS, 1401 S 304 St, Federal Way, Wa					.007	.008	.008	.010	.008	.006	.009	.005	5895	.008
SW 283rd & 101st Ave SW, Maury Island, Wa	.010	.011	.010	.009	.010	.007	.007	.008	.008	.008	.017	.012	8590	.010
North 37th & Vassault Sts, Tacoma, Wa	.016		.012	.009	.011	.008	.010	.014	.013	.011	.014	.011	7963	.012
North 26th & Pearl Sts, Tacoma, Wa		.011	.013	.008	.011	.007	.011	.013	.011	.010	.011	.009	8100	.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	0	0	2	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	3	12	0	1	0
Federal Way HS, 1401 S 304 St, Federal Way, Wa	0	0	1	0	0	0
SW 283rd & 101st Ave SW, Maury Island, Wa	6	4	11	0	0	0
North 37th & Vassault Sts, Tacoma, Wa	5	2	7	0	0	0
North 26th & Pearl Sts, Tacoma, Wa	6	3	13	0	0	0

At all stations, Sulfur Dioxide was continuously measured using the method of ultraviolet fluorescence.

SULFUR DIOXIDE
(Parts per Million)
1981

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				.37	30 Aug	1855	.150	30 Aug	2000	.034	2 Dec	1900
				.30	1 Mar	1248	.143	15 Sep	1500	.032	21 Oct	2200
North 98th St & Stone Ave N, Seattle, Wa				.16	14 Jun	0900	.107	14 Jun	1000	.026	28 Apr	1300
				.14	27 Apr	2200	.077	17 Sep	1200	.022	30 Sep	2200
Duwamish, 4401 E Marginal Way S, Seattle, Wa				.60	9 Aug	2019	.420	9 Aug	2100	.135	10 Aug	0100
				.47	9 Aug	0700	.350	9 Aug	0900	.080	8 Aug	1400
Federal Way HS, 1401 S 304 St, Federal Way, Wa				.28	2 Nov	1336	.150	13 Aug	1300	.044	3 Nov	0300
				.23	16 Aug	1800	.140	2 Nov	1500	.032	24 Sep	0900
SW 283rd & 101st Ave SW, Maury Island, Wa	1.72	14 Jul	1004	.60	14 Jul	1040	.273	14 Jul	1200	.082	25 Nov	0600
	1.54	5 Mar	1020	.59	11 Dec	0934	.230	11 Dec	1100	.060	17 Feb	0600
North 37th & Vassault Sts, Tacoma, Wa	1.59	26 Apr	0822	.53	26 Apr	0908	.270	2 Jan	0400	.095	2 Jan	2400
	1.48	24 Jun	0145	.43	2 Jan	0242	.223	26 Apr	1100	.060	9 Nov	2000
North 26th & Pearl Sts, Tacoma, Wa	1.63	1 Jun	1024	.54	1 Jun	1102	.283	2 Mar	1200	.058	9 Nov	2400
	1.22	1 Jun	1029	.49	11 Mar	2019	.217	1 Jun	1200	.055	17 Apr	2100

25

- (1) 5 minute average reported only for concentrations exceeding 1.00 ppm.
- (2) Ending times are reported in Pacific Standard Time.
- (3) For equal, high concentration values, the reported date and time refer to the earliest occurrences during the year.

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. This series of "photochemical" reactions proceeds for several hours generally producing maximum ozone levels between noon and early evening.

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

Ozone Standard

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 with the maximum 1 hour average greater 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 during the most recent 3 years.

An incomplete data set for a given year requires an estimate of the number of exceedences in that year. 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 calculated as the three year average of the estimated number of exceedences. A shorter sampling period may shorten the averaging period to a minimum of one year.

Using the Ozone Table to Assess Attainment

The 1981 ozone table summarizes the four highest daily maximum 1 hour ozone averages and shows whether the standard was attained in 1981. The rightmost column documents that 2 of 6 stations had a value for expected number of exceedences greater than 1.0, and thus exceeded the ozone standard for the three year period ending in 1981.

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.

OZONE
(Parts per Million)
1981

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 Expected To Exceed .12 ppm
	Value	Date	End Time	1979	1980	1981	
Snohomish FD#22, 9921 84th NE, Arlington, Wa* 1 May - 19 Oct	.09	16 Sep	1500	0.0	0.0	0.0	0.0
	.08	10 Aug	1700				
	.08	11 Aug	1400				
	.08	18 Aug	1800				
20050 SE 56th, Lake Sammamish State Park, Wa* 1 May - 31 Dec	.15	11 Aug	1500	2.1	0.0	1.0	1.0
	.12	10 Aug	1400				
	.10	3 Jul	1400				
	.10	14 Aug	1600				
22916 86th Ave S, Kent, Wa 1 Jan - 31 Dec	.11	10 Aug	1400	0.0	0.0	0.0	0.0
	.10	9 Aug	1400				
	.10	11 Aug	1600				
	.09	7 Aug	1400				
Sumner Jr HS, 1508 Willow St, Sumner, Wa 1 Jan - 31 Dec	.15	10 Aug	1500	1.1	0.0	3.1	1.4
	.13	7 Aug	1600				
	.13	11 Aug	1400				
	.11	8 Aug	1400				
Pierce Co Firwood FS, 4418 Freemn Rd, Fife, Wa* 1 May - 31 Dec	.13	10 Aug	1400	-	0.0	1.2	0.6
	.11	7 Aug	1500				
	.11	11 Aug	1400				
	.10	8 Aug	1300				
Pierce Co, Fire D #21, 8102 304th, Graham, Wa* 1 May - 14 Oct	.14	7 Aug	1700	1.6	0.0	4.0	1.9
	.14	8 Aug	1600				
	.14	10 Aug	1500				
	.14	11 Aug	1500				

- (1) * Station operated by Washington State Department of Ecology.
- (2) - Indicates no Ozone sampling for given year.
- (3) Ending times are reported in Pacific Standard Time.
- (4) For equal, high concentration values, the reported date and time refer to the earliest occurrences during the year.
- (5) At all stations, Ozone was continuously measured using ultraviolet photometric detection.

NITROGEN DIOXIDE
(Parts per Million)
1981

Location	Monthly Arithmetic Averages												No. of 1 Hour Samples	Year Arith Mean	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
4th Ave South & Jackson St, Seattle, Wa*	(Station began operation 8/01/81)							.031					.079	2319	.045
551 South Dearborn Street, Seattle, Wa*	.023	.030	.023					(Station discontinued 5/29/81)					2946	.027	
15th Ave S & Charlestown St, Seattle, Wa*	.012			.020	.018	.021			.030	.031	.030			6107	.022
22916 86th Ave S, Kent, Wa	.015	.014	.016	.014	.017	.014	.014	.017	.019	.020	.026	.026	8640	.018	

- (1) * Station operated by 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 Department of Ecology has statewide jurisdiction over motor vehicle emissions. Motor vehicles are the largest source of carbon monoxide and are the principal contributor to the carbon monoxide levels which exceed standards in the cities of the Puget Sound area.

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 normally coincide with the weekday morning and evening traffic peaks. The lower values normally occur after midnight and on many hours of the weekends.

Pollutant Standards Index and 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 PSI scale. PSI values exceeding 100 are considered "Unhealthful". An 8 hour average of 15 ppm equals 200 on the PSI scale. PSI values of 200 to 299 are termed "Very Unhealthful".

Episode criteria are specified in the Washington Episode Plan. 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 that level for 12 or more hours or increase 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.

Data Summary

The following tables summarize the six highest 1 hour and 8 hour average carbon monoxide levels at each station. These data were obtained from the Department of Ecology monthly data summaries and from the Department publication, "Washington State Air Monitoring Data for 1981". Nine of the twelve stations for which data is presented were in operation during several previous years.

Review of the data shows that 10 of the 12 stations exceeded an 8 hour average of 9 ppm at least twice. Therefore all of these 10 stations violated the 8 hour average standard. The maximum 1 hour average recorded at any of the stations was 34 ppm. Therefore the 1 hour standard of 35 ppm was not exceeded.

CARBON MONOXIDE (Parts Per Million) 1981

Location / Period of Sampling	Six Highest Concentrations						Number of Days	
	1 Hour Average			8 Hour Average			8 Hour	8 Hour
	Value	Date	End Time	Value	Date	End Time	Averages Exceeding 9 ppm	Averages Exceeded 9 ppm
622 Bellevue Way NE, Bellevue, Wa 1 Jan - 22 Jul	23	15 Jan	1800	18	15 Jan	2300	9	8
	22	16 Jan	1800	12	16 Jan	2400		
	21	15 Jan	1900	11	10 Jan	2300		
	21	15 Jan	2100	11	12 Jan	2300		
	18	15 Jan	1700	10	5 Jan	2300		
	18	15 Jan	2200	10	13 Jan	2100		
Northgate, 310 NE Northgate Way, Seattle, Wa 4 May - 31 Dec	19	2 Nov	1900	11	2 Nov	2200	5	4
	17	17 Dec	1000	11	6 Nov	2400		
	16	6 Nov	1900	10	24 Oct	2300		
	16	17 Dec	1800	10	17 Dec	1300		
	15	17 Dec	800	10	17 Dec	2100		
	15	17 Dec	900	9	8 Nov	200		

CARBON MONOXIDE
(Parts Per Million)
1981

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		
4511 University Way NE, Seattle, Wa 1 Jan - 30 Sep; 21 Nov - 31 Dec	22	12 Jan	2000	17	15 Jan	2300	17	13
	21	15 Jan	1900	14	12 Jan	2200		
	21	15 Jan	2000	12	14 Jan	2100		
	19	18 Jan	1800	12	16 Jan	1500		
	18	9 Mar	2400	12	17 Dec	2000		
	17	21 Jan	2100	11	10 Jan	2000		
3921 Linden Ave N, Seattle, Wa 1 Jan - 31 Dec	15	14 Jan	1000	7	12 Jan	300	0	0
	13	5 Jan	900	7	12 Jan	1300		
	11	14 Jan	900	7	12 Jan	2400		
	10	19 Jan	1000	7	8 Feb	300		
	10	7 Feb	2300	7	2 Nov	2300		
	10	17 Dec	800	6	9 Jan	2300		
6th Ave & Pike St, Seattle, Wa 19 May - 16 Dec	16	2 Nov	1700	12	2 Nov	2100	2	2
	13	24 Oct	1700	10	24 Oct	2100		
	13	24 Oct	2000	9	5 Nov	2200		
	13	24 Oct	2100	9	8 Nov	300		
	13	2 Nov	1600	9	13 Nov	2000		
	13	4 Dec	1800	9	4 Dec	1900		
1424 4th Ave, Seattle, Wa 1 Jan - 31 Dec	19	27 Feb	1800	13	15 Jan	2400	17	15
	18	15 Jan	2000	11	16 Jan	2000		
	18	27 Feb	1700	11	27 Feb	2200		
	18	6 Mar	1800	11	13 Nov	1800		
	16	13 Feb	1600	11	4 Dec	1900		
	16	18 Dec	1600	11	16 Dec	2200		
2nd Ave & University St, Seattle, Wa 1 Jan - 31 Dec	19	14 Jan	900	13	14 Jan	1200	5	4
	18	14 Jan	1000	11	12 Jan	1500		
	16	12 Jan	900	10	12 Jan	2400		
	16	14 Jan	1100	10	13 Jan	1100		
	15	13 Jan	1000	10	16 Jan	1900		
	15	16 Jan	1800	9	12 Jan	1000		
5th Ave & James St, Seattle, Wa 1 Jan - 31 Dec	23	16 Nov	1800	14	2 Nov	1800	20	14
	22	14 Jan	1800	12	14 Jan	1100		
	22	16 Nov	1700	12	15 Jan	1900		
	19	7 Aug	1700	12	16 Jan	1300		
	19	28 Aug	1800	12	19 Jan	1300		
	18	14 Jan	1100	12	20 Jan	2000		
Fire Station #10, 301 2nd Ave S, Seattle, Wa 1 Jan - 31 Dec	24	16 Jan	2300	13	16 Jan	2400	5	5
	18	14 Jan	1800	11	14 Jan	1100		
	16	14 Jan	1100	10	12 Jan	200		
	16	16 Jan	2200	10	2 Nov	2100		
	16	15 Oct	2100	10	17 Dec	1700		
	16	2 Nov	1900	9	12 Jan	1200		
2809 26th Ave S, Seattle, Wa 1 Jan - 31 Dec	20	12 Jan	1000	12	12 Jan	1400	6	5
	20	17 Dec	1000	12	17 Dec	1400		
	17	12 Jan	900	11	13 Jan	100		
	16	14 Jan	1800	11	19 Jan	1500		
	16	16 Jan	900	10	16 Jan	1100		
	16	28 Jan	900	10	2 Nov	2200		
15th Ave S & Charlestown St, Seattle, Wa 6 Feb - 31 Dec	8	2 Nov	1000	5	2 Nov	1300	0	0
	7	9 Mar	1000	4	9 Mar	1100		
	7	2 Nov	900	4	8 Nov	300		
	6	2 Nov	800	4	9 Nov	1400		
	6	2 Nov	1700	4	9 Nov	2200		
	6	6 Nov	1700	4	10 Nov	600		
942 Pacific Ave, Tacoma, Wa 1 Jan - 31 Dec	34	12 Jan	1800	19	12 Jan	2300	19	13
	29	2 Apr	1800	15	15 Jan	1900		
	26	15 Jan	1800	15	16 Jan	1900		
	24	16 Jan	1800	14	2 Nov	2200		
	23	12 Jan	1900	12	6 Nov	2200		
	23	16 Jan	1700	11	12 Jan	1400		

- (1) Ending times are reported in Pacific Standard Time.
- (2) For equal, high concentration values, the reported date and time refer to the earliest occurrences during the year.
- (3) At all stations, Carbon Monoxide was continuously measured using the nondispersive infrared method.

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 State Department of Ecology. For the EPA, this consists of (1) an annual onsite audit of some Agency analyzers 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 analyzers 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 analyzers 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, Sa, as follows.

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

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

These calculated limits mean that with 95 percent probability all air quality data compiled during the audit period agree with the true value by a percentage 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

The following two tables summarize the Precision and Accuracy statistics for all air quality data which the Agency originated in 1981. Precision audits for the integrating nephelometer, which measures atmospheric particles, were begun after the 2nd quarter. Separate accuracy audits are not applicable for the nephelometer measurement. In some cases the number of analyzers for a particular pollutant is small, and the accuracy audits over two quarters are combined.

PRECISION OF AIR QUALITY DATA
1981

Upper and Lower 95 Percent Probability Limits
of Percent Differences

Pollutant	Probability Limit	Quarter				Annual Average
		1st	2nd	3rd	4th	
Suspended Particulates (High Volume)	Upper	+19.0	+8.2	+13.0	+12.7	+13.2
	Lower	-16.0	-11.2	-15.8	-8.3	-12.8
Sulfur Dioxide	Upper	+1.6	+9.8	+7.1	+9.6	+7.0
	Lower	-12.2	-7.4	-8.9	-7.6	-9.0
Ozone	Upper	+11.1	+11.5	+10.0	+14.0	+11.7
	Lower	-5.7	-7.3	+1.4	-5.2	-4.2
Atmospheric Particles (Nephelometer)	Upper			+8.3	+5.8	+7.0
	Lower			-6.9	-3.6	-5.2

ACCURACY OF AIR QUALITY DATA
1981

Upper and Lower 95 Percent Probability Limits
of Percent Differences

Pollutant	Probability Limit	Quarter				Annual Average
		1st	2nd	3rd	4th	
Suspended Particulates (High Volume)	Upper	+4.1	+7.7	+8.4	+6.9	+6.8
	Lower	-9.3	-5.7	-10.0	-11.9	-9.2
Sulfur Dioxide	Upper		-5.6	+7.2	+9.0	+3.5
	Lower		-11.0	+0.7	-9.6	-6.6
Ozone	Upper				+1.8	
	Lower				-6.0	

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 comes from stationary sources such as primary and secondary nonferrous smelters.

Data from a coordinated network operated by the Department of Ecology and the Agency has previously identified two areas

in the Puget Sound region which exceed the lead standard. These are both in Seattle. One area is a strip bordering Interstate 5 from Spokane Street to Northgate. The other area is the Harbor Island industrial region.

The table below presents the results of sampling during 1981. A single station on Harbor Island located near a secondary lead smelter continues to record quarterly averages exceeding the lead standard.

LEAD
(Micrograms per cubic meter)
1981

Quarterly Arithmetic Averages

Location	1st	2nd	3rd	4th
Evergreen Point Bridge Toll Plaza, Medina, Wa	0.97	0.31	0.65	0.53
504 Bellevue Way NE, Bellevue, Wa	0.83	0.34	0.38	0.60
North 98th St & Stone Ave N, Seattle, Wa	0.46	0.21	0.25	0.41
5701 8th Ave NE, Seattle, Wa	1.31	0.87	0.82	0.93
Portage Bay, 2725 Montlake Blvd E, Seattle, Wa	0.85	0.51	0.44	0.81
Harbor Island, 2555 13th Ave SW, Seattle, Wa	6.90	10.6	6.85	5.33
Harbor Island, 3400 13th Ave SW, Seattle, Wa	1.16	0.40	0.76	0.68
4716 North Baltimore St, Tacoma, Wa	0.48	0.20	0.64	0.58
North 26th & Pearl Sts, Tacoma, Wa	0.54	0.14	0.39	0.43

LOWER ATMOSPHERE TEMPERATURE SOUNDINGS

A lower atmosphere sounding unit began operating on the east shore of Portage Bay in Seattle during 1971. The Department of Ecology operates the station. Normal operation provides one slow ascent sounding to 700 millibars about 0700 local time each Monday through Friday except on holidays. This sounding is the primary source of lower atmosphere data in the Puget Sound Basin and is an essential basis for many forecasts including air stagnation forecasts. Each sounding is reasonably representative of the lower atmosphere in the entire Puget Sound area. The Agency makes regular use of the sounding in evaluating and interpreting 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 simply 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.

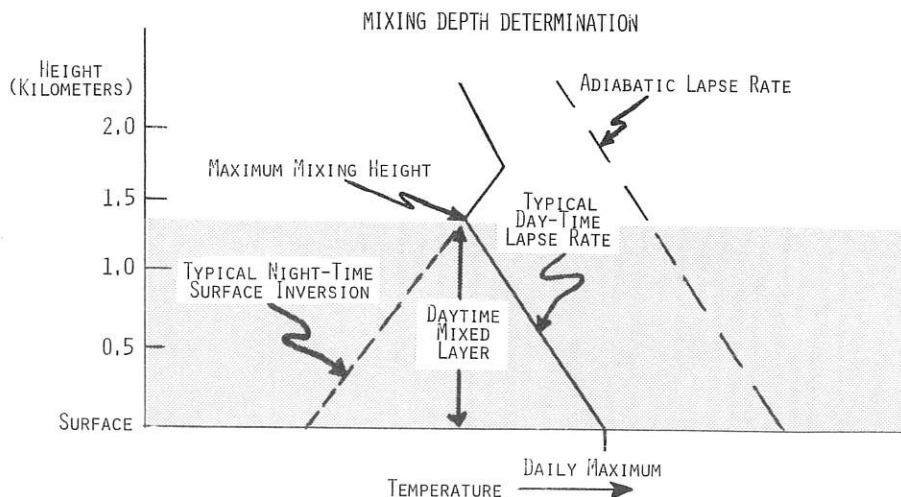
Eight soundings from 1981 are presented on the following pages. Temperature is represented by a solid line connecting actual data values enclosed by circles. The dewpoint temperature is represented by a dashed line connecting actual data values enclosed by triangles. Winds above ground are plotted and printed in degrees/knots to the right of the sounding.

These soundings provide a meteorological picture of seven days when TSP and Carbon Monoxide levels reached high values exceeding standards at several stations. Another sounding represents a summer day when Ozone levels exceeded the standard. The TSP, Carbon Monoxide and Ozone summaries outline the values and dates; dates of soundings and the significant pollutants are listed below.

JAN 12 - 16: Air Stagnation Advisory
TSP, Carbon Monoxide

AUG 10: Ozone

NOV 2 & 6: single stagnant days
TSP, Carbon Monoxide

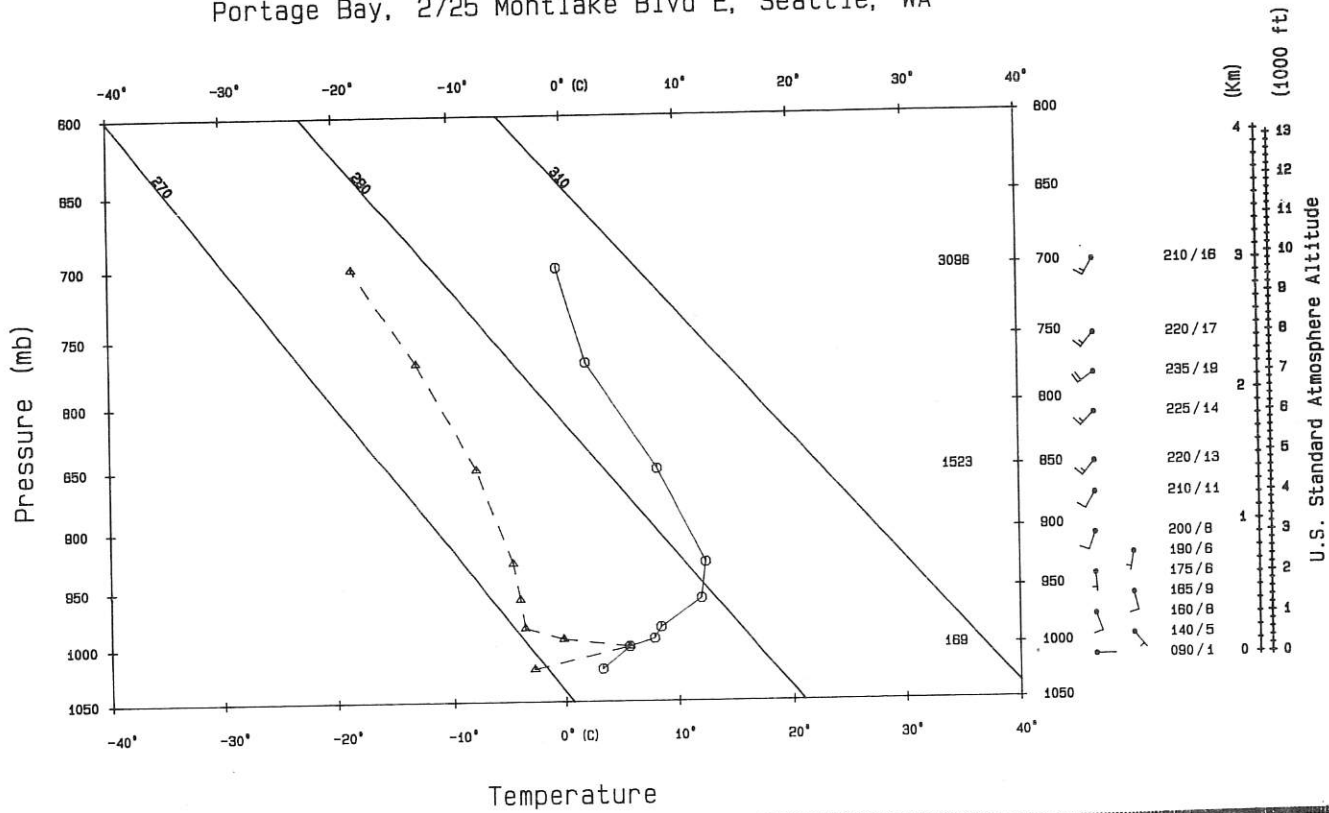


PUGET SOUND AIR POLLUTION CONTROL AGENCY

PSEUDO-ADIABATIC CHART

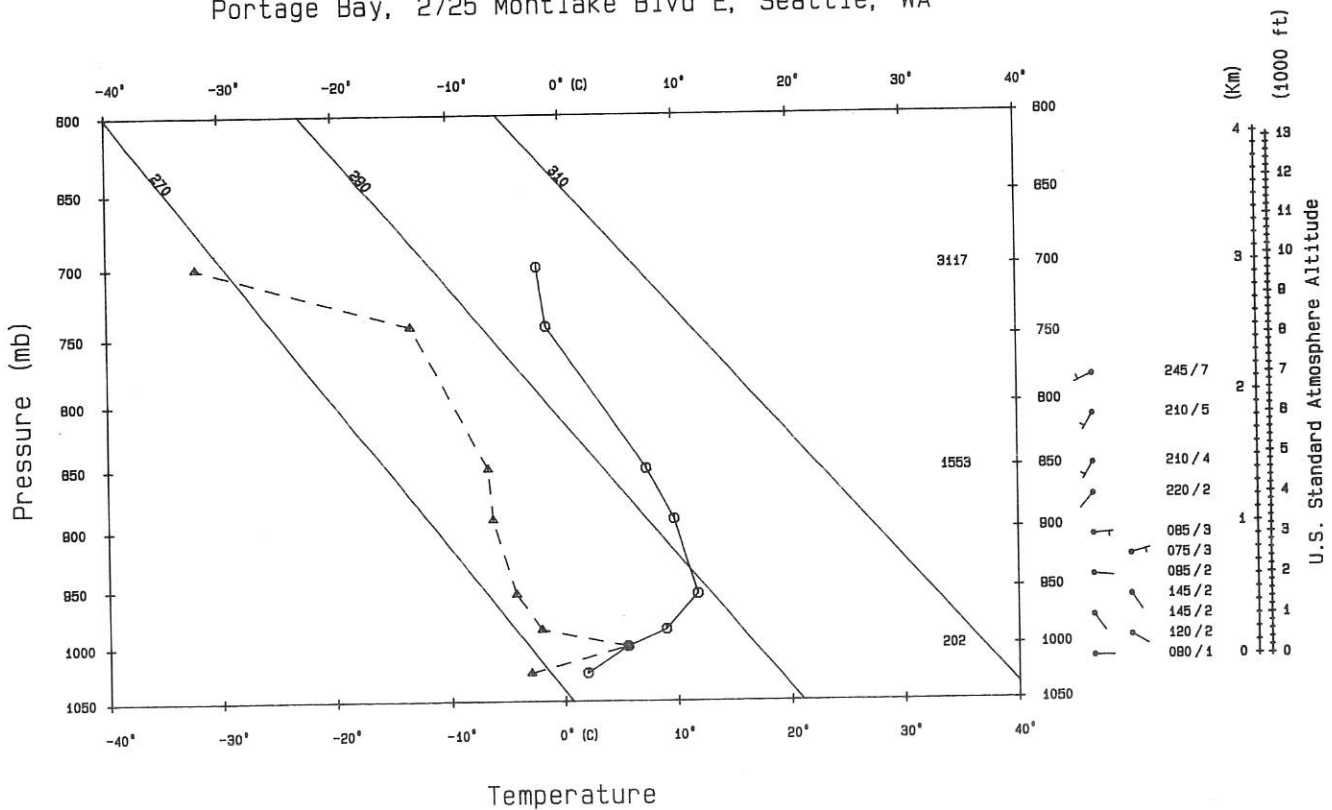
0700 PST 12 Jan 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA



0700 PST 13 Jan 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA

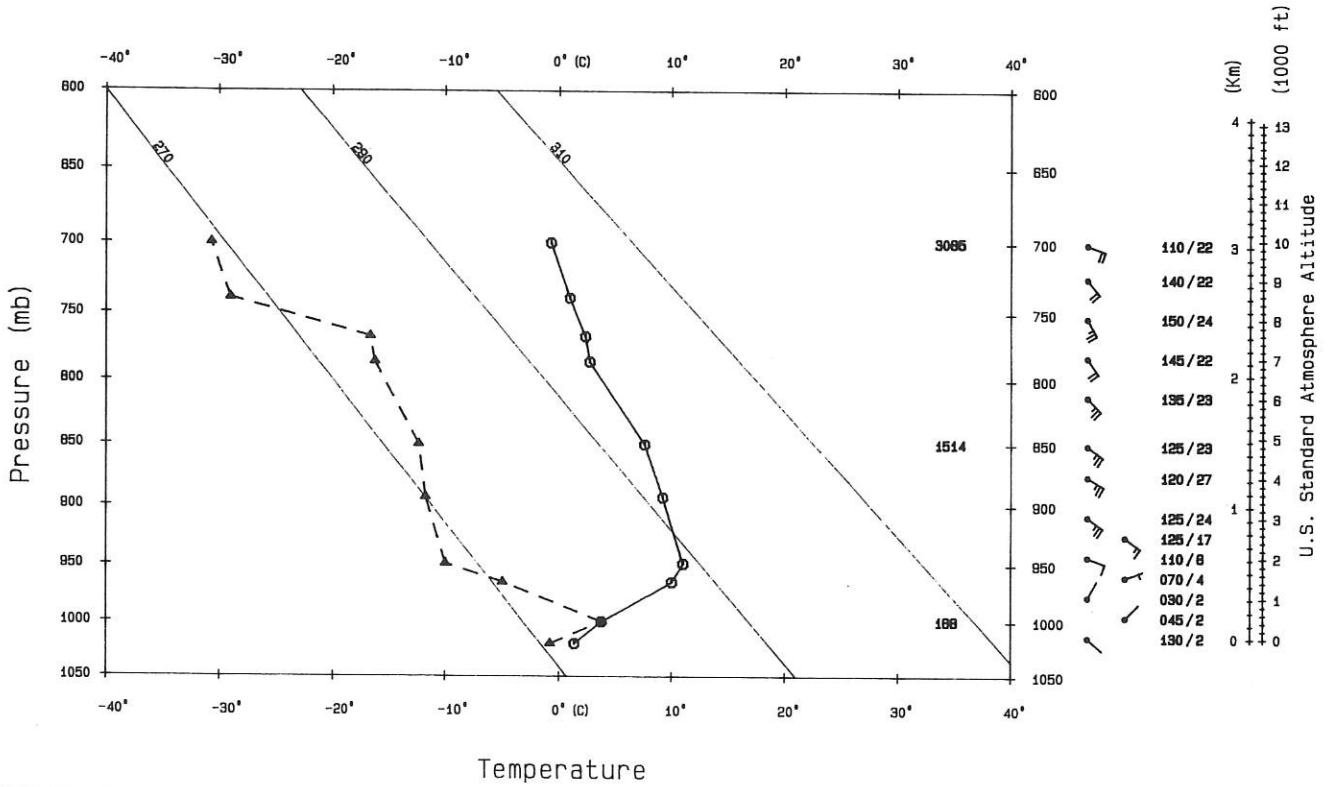


PUGET SOUND AIR POLLUTION CONTROL AGENCY

PSEUDO-ADIABATIC CHART

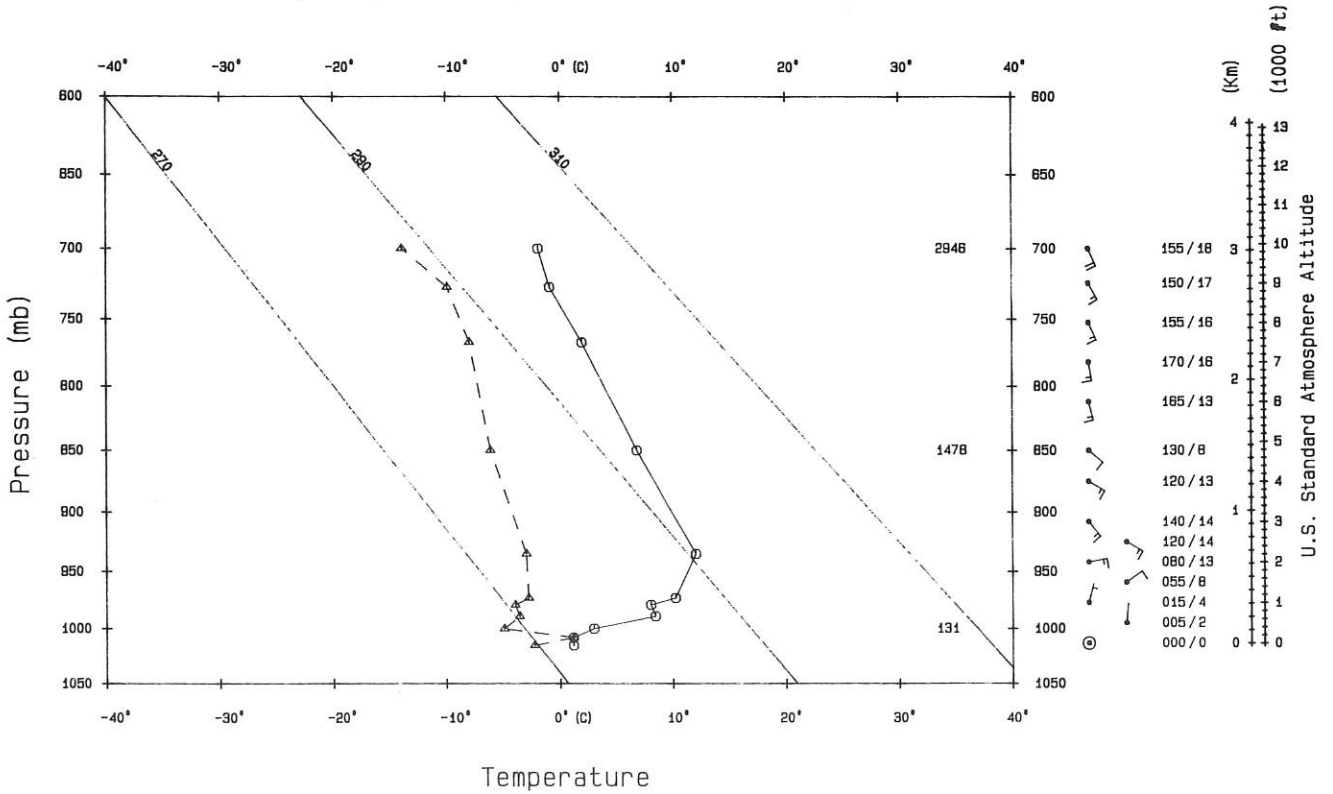
0700 PST 14 Jan 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA



0700 PST 15 Jan 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA

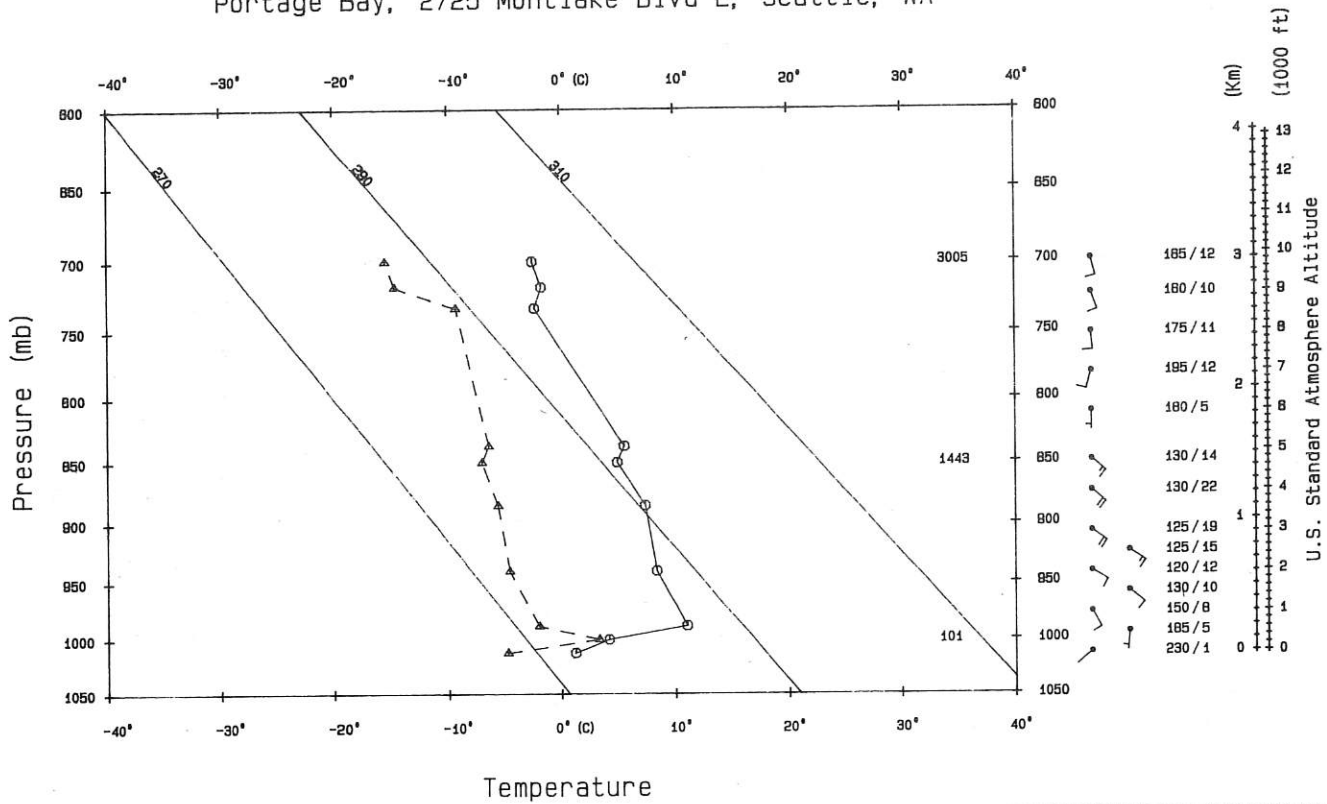


PUGET SOUND AIR POLLUTION CONTROL AGENCY

PSEUDO-ADIABATIC CHART

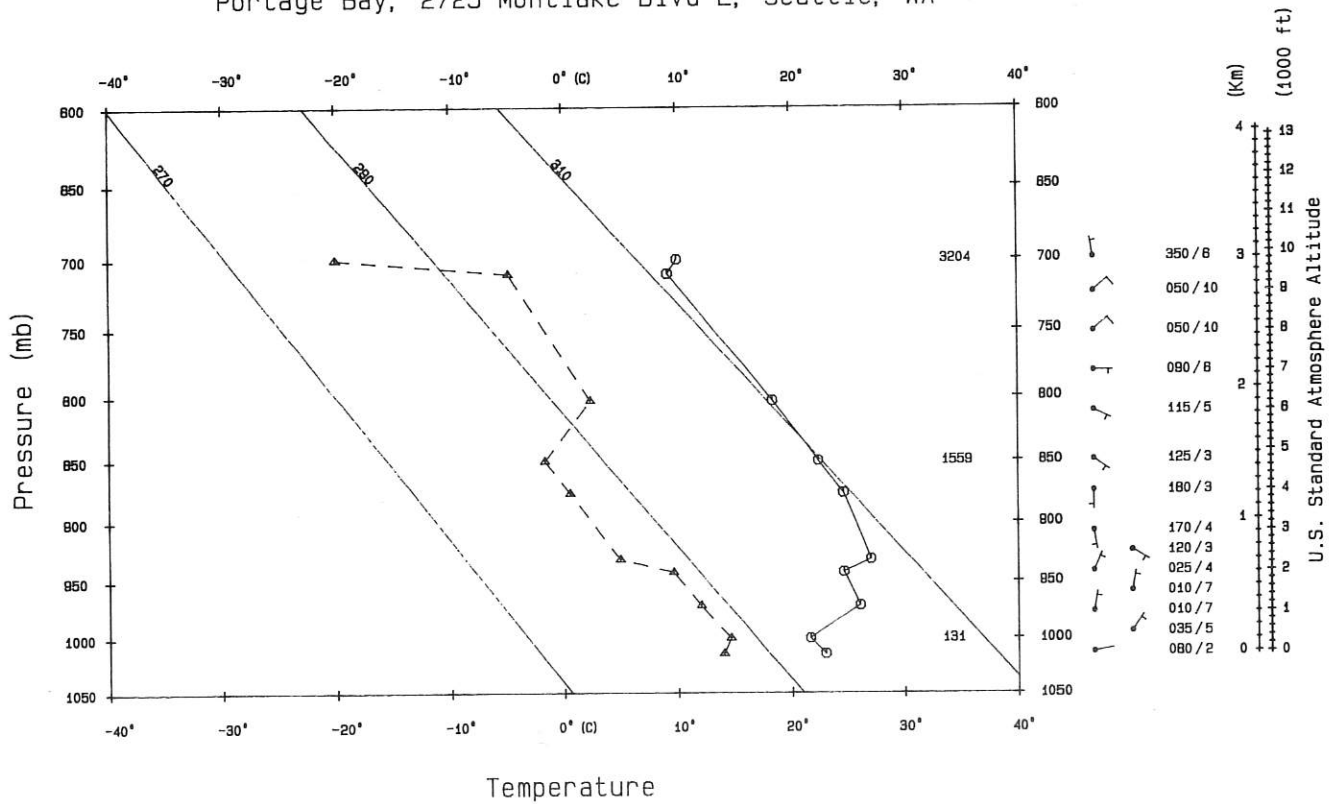
0700 PST 16 Jan 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA



0600 PST 10 Aug 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA

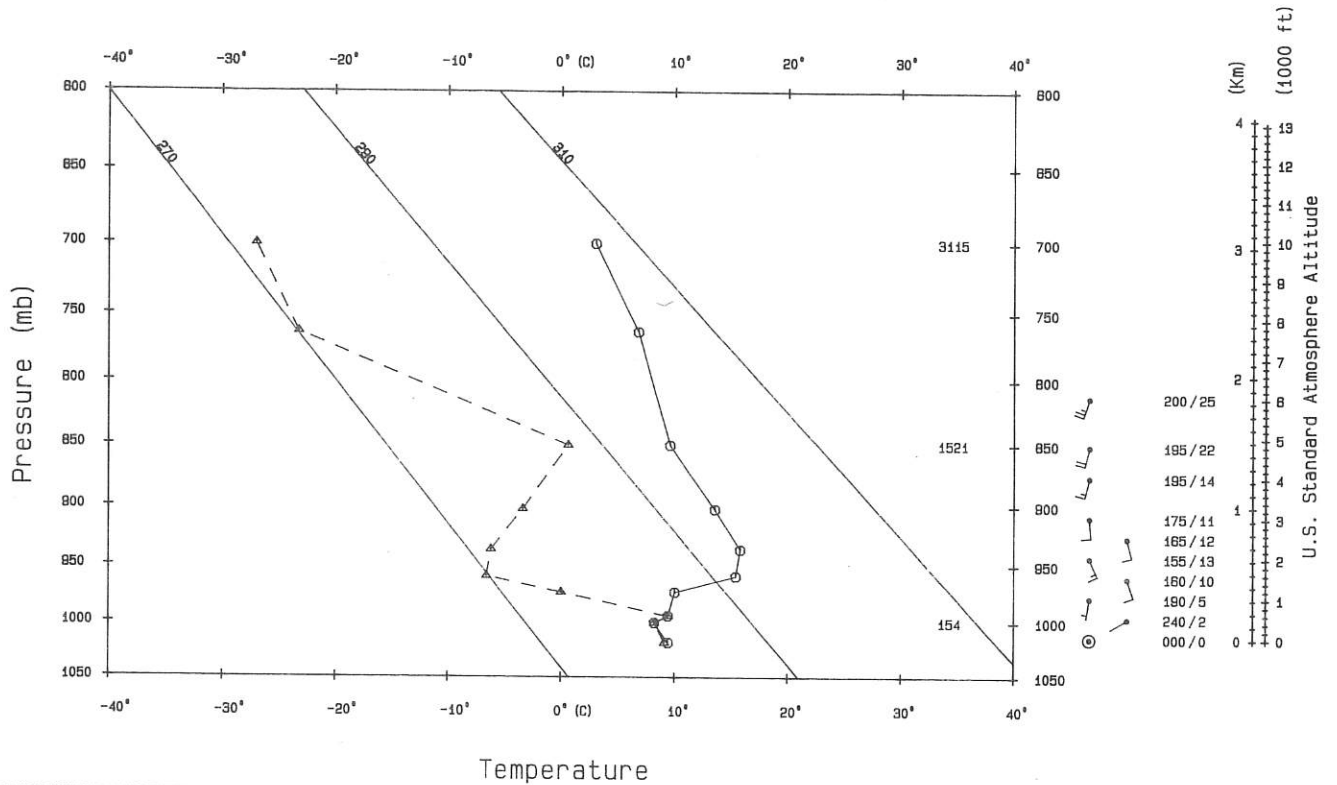


PUGET SOUND AIR POLLUTION CONTROL AGENCY

PSEUDO-ADIABATIC CHART

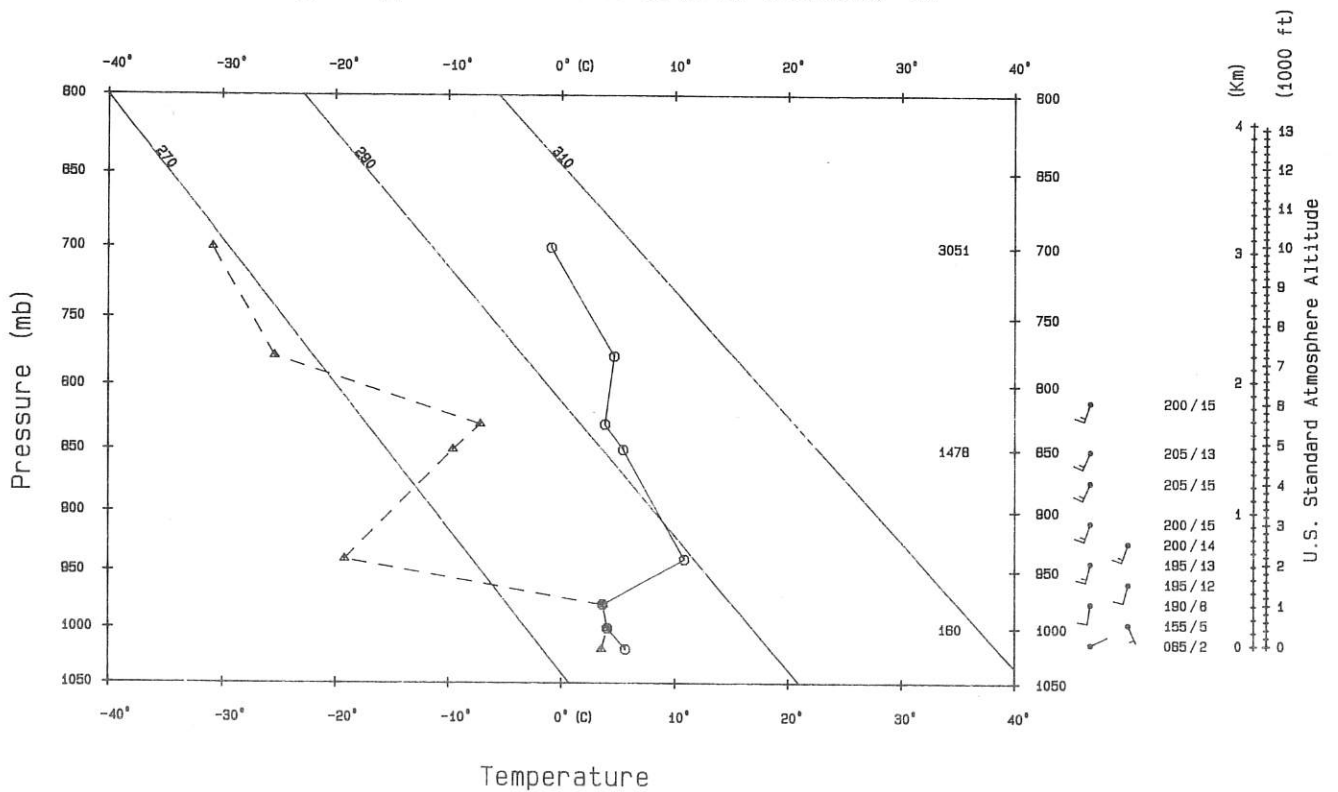
0700 PST 2 Nov 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA



0700 PST 6 Nov 1981

Portage Bay, 2725 Montlake Blvd E, Seattle, WA



LOWER ATMOSPHERE TEMPERATURE SOUNDING CLIMATOLOGY

The Agency has developed a lower atmosphere climatology from the sounding data base. Each individual temperature sounding is analyzed to determine the vertical lapse rate of temperature, (-DT/DZ), between significant levels. These "significant level" layers are then grouped into sounding layers by the following four stability categories:

- 1) Temperature inversion (a stable condition)
- 2) Stable (no inversion)
- 3) Conditionally stable
- 4) Unstable

Two types of summary tables of these

sounding layers are presented below. On the right the tables present a distribution of TEMPERATURE INVERSION LAYERS showing the number of inversions of a given thickness (or depth) by height of the inversion base. Tables on the left present the distribution of the four mutually exclusive SOUNDING LAYERS by height of the base of each layer.

This analysis includes tables summarizing ten years of data (1972 through 1981) as well as tables for calendar year 1981 alone. Seasonal variations are shown by monthly tables presented in the Air Quality Data Summary for 1977.

FREQUENCY DISTRIBUTION OF SOUNDING LAYERS
(Within Given Lapse Rate Interval Based At or Below Given Height)

Portage Bay, 2725 Montlake Blvd E, Seattle, Wa

ALL MONTHS 1981
Morning Soundings (0600 to 0800 PST)

Height of Base (GPM) At or Below	LAPSE RATE CATEGORIES (DEGREES C/KM)				Total No. Sounding Layers
	Stable		Cond Stable	Unstable	
	< 0.0 to 5.0	0.0 to 5.1	5.1 to 10.0	> 10.0	
SFC	35	33	49	135	252
150	58	51	115	138	362
300	92	81	162	140	475
500	117	116	201	140	574
1000	145	210	283	142	780
1500	187	282	381	145	995
2000	218	342	442	150	1152
2500	250	395	521	155	1321
3000	275	438	572	158	1443
700 MB	276	438	573	158	1445

Number of Soundings: 252

ALL MONTHS 1972-81
Morning Soundings (0600 to 0800 PST)

Height of Base (GPM) At or Below	LAPSE RATE CATEGORIES (DEGREES C/KM)				Total No. Sounding Layers
	Stable		Cond Stable	Unstable	
	< 0.0 to 5.0	0.0 to 5.1	5.1 to 10.0	> 10.0	
SFC	348	389	690	1072	2499
150	591	609	1281	1112	3593
300	917	853	1726	1151	4647
500	1198	1232	2058	1163	5651
1000	1580	2051	2888	1215	7734
1500	2011	2857	3755	1301	9924
2000	2438	3541	4535	1379	11893
2500	2843	4183	5271	1460	13757
3000	3139	4662	5800	1519	15120
700 MB	3149	4665	5805	1521	15140

Number of Soundings: 2499

NOTES:

- (1) All Heights are measured in Geopotential Meters above Mean Sea Level.
- (2) Sounding terminates at 700 MB (3010 GPM - U.S. Standard Atmosphere).
- (3) Because the Numbers in each Column are cumulative, Totals may be read Directly from the last Row (Height of Base At or Below 700 MB).

FREQUENCY DISTRIBUTION OF TEMPERATURE INVERSION LAYERS
(Within Given Thickness Interval Based At or Below Given Height)

Portage Bay, 2725 Montlake Blvd E, Seattle, Wa (Elevation 8 M Above MSL)

ALL MONTHS 1981
Morning Soundings (0600 to 0800 PST)

Height of Base (GPM) At or Below	Thickness (GPM)							Total No. Temperature Inversions	Total No. Sounding Layers
	0 to 150	151 to 300	301 to 450	451 to 600	601 to 750	751 to 900	> 900		
	SFC	8	9	8	4	1	4		
150	10	16	12	5	4	8	3	58	362
300	22	22	18	7	8	8	7	92	475
500	27	30	22	12	11	8	7	117	574
1000	34	44	26	14	11	8	8	145	780
1500	52	61	30	16	12	8	8	187	995
2000	62	68	36	18	16	10	8	218	1152
2500	71	83	40	20	17	11	8	250	1321
3000	77	99	43	20	17	11	8	275	1443
700 MB	78	99	43	20	17	11	8	276	1445

Number of Soundings: 252

ALL MONTHS 1972-81
Morning Soundings (0600 to 0800 PST)

Height of Base (GPM) At or Below	Thickness (GPM)							Total No. Temperature Inversions	Total No. Sounding Layers
	0 to 150	151 to 300	301 to 450	451 to 600	601 to 750	751 to 900	> 900		
	SFC	85	91	67	36	25	21		
150	125	153	108	76	48	37	44	591	3593
300	221	223	162	108	73	56	74	917	4647
500	316	308	198	137	88	65	86	1198	5651
1000	470	429	244	168	99	69	101	1580	7734
1500	664	580	285	195	106	75	106	2011	9924
2000	835	728	353	215	123	77	107	2438	11893
2500	1005	863	415	237	135	80	108	2843	13757
3000	1139	981	454	242	135	80	108	3139	15120
700 MB	1149	981	454	242	135	80	108	3149	15140

Number of Soundings: 2499

- (4) The Lapse Rate is defined as -DT/DZ where DT is Temperature Difference and DZ is Height Difference (or Thickness) between consecutive Sounding Layers. Thus an Inversion is defined by a negative Lapse Rate.

AIR STAGNATION ADVISORIES

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. An Air Stagnation Advisory was in effect in the Puget Sound region for the following periods during 1981:

Valid From:	To:
10 AM, Monday, January 12	12 noon, Saturday, January 17
10 AM, Wednesday, October 14	10 AM, Tuesday, October 20
10 AM, Friday, October 23	10 AM, Sunday, October 25
10 AM, Monday, November 9	1 PM, Tuesday, November 10

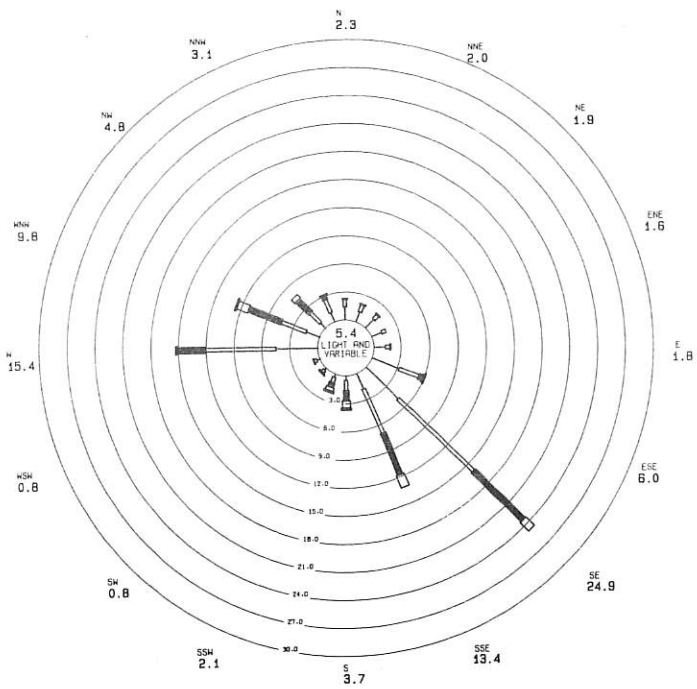
WIND ROSES

The measurement of local area wind speed and direction is important in the evaluation of air pollution. Low wind speeds contribute to higher air pollutant concentrations, particularly near major urban or industrialized areas. Wind direction data suggests which sources or source areas affect a specific location.

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 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.

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 shown in the center of the rose.



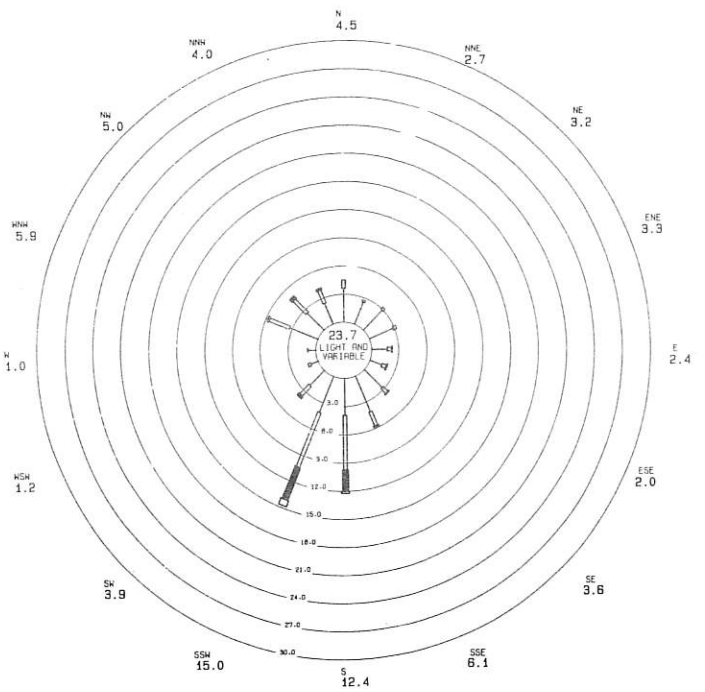
HOOR AVERAGE SURFACE WINDS
PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,599

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



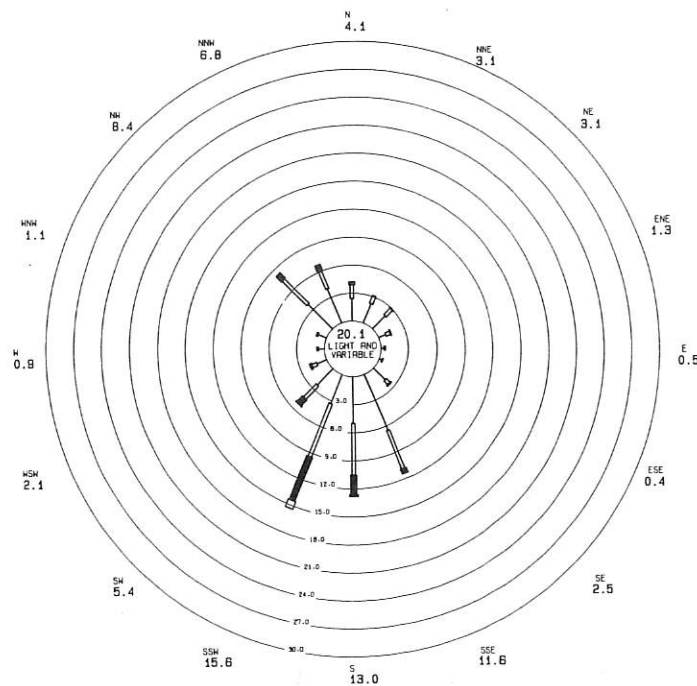
HOOR AVERAGE SURFACE WINDS
PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,674

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



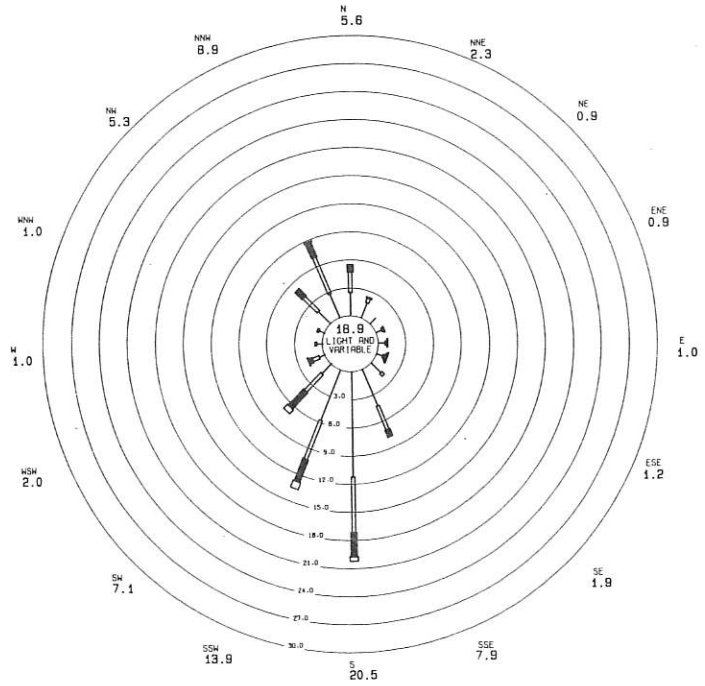
HOOR AVERAGE SURFACE WINDS
PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,639

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



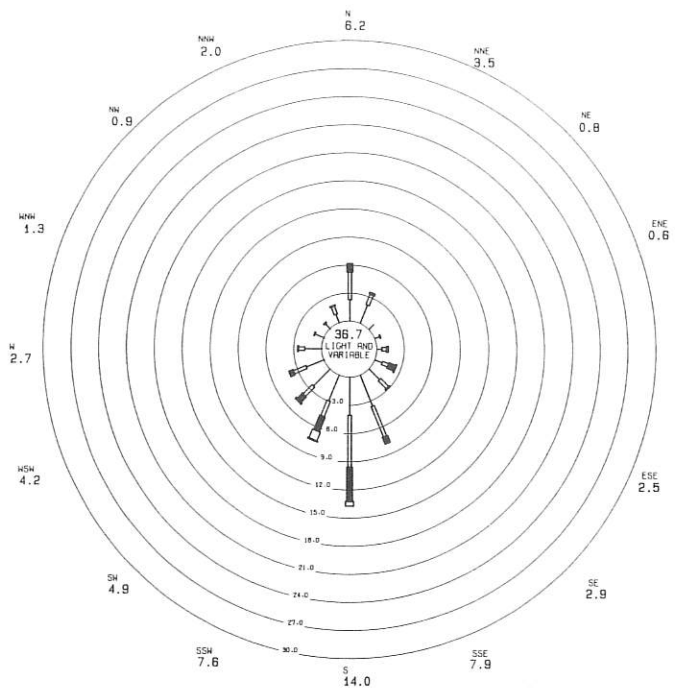
HOOR AVERAGE SURFACE WINDS
PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Southcenter, 401 Andover Park E, Tukwila, Wa

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,588

0.0 3.0 6.0 9.0 12.0 15.0
PERCENT



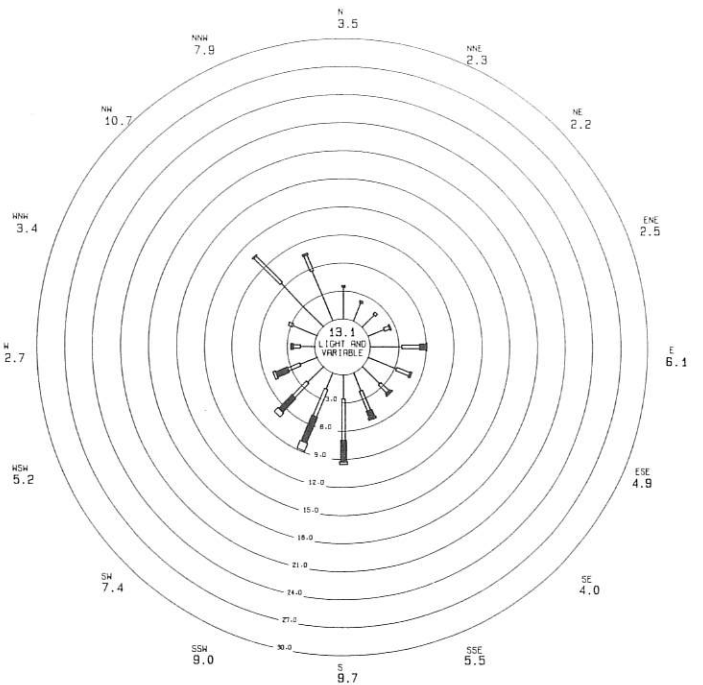
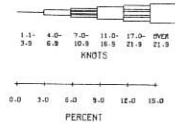
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
22916 86th Ave S, Kent, Wa

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,697



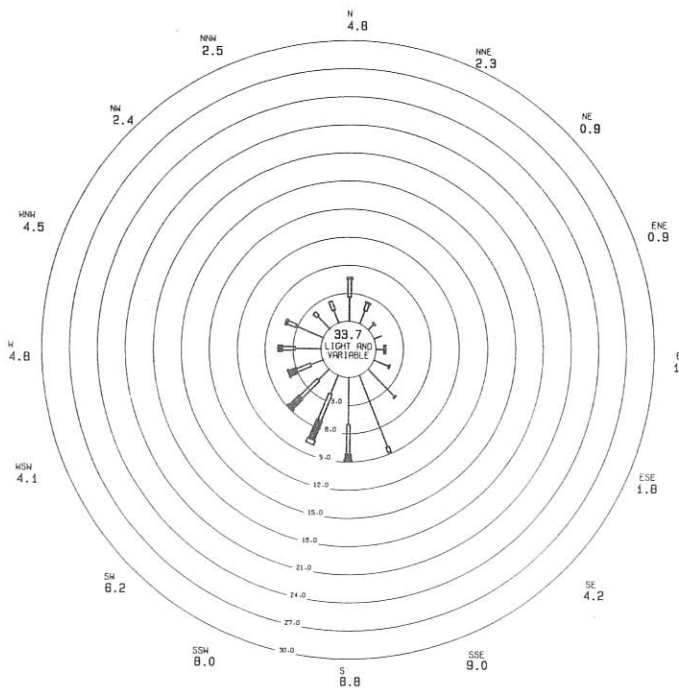
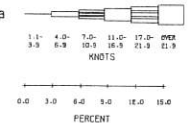
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- JAN-FEB, APR-DEC, 1981

TOTAL OBSERVATIONS- 7,219



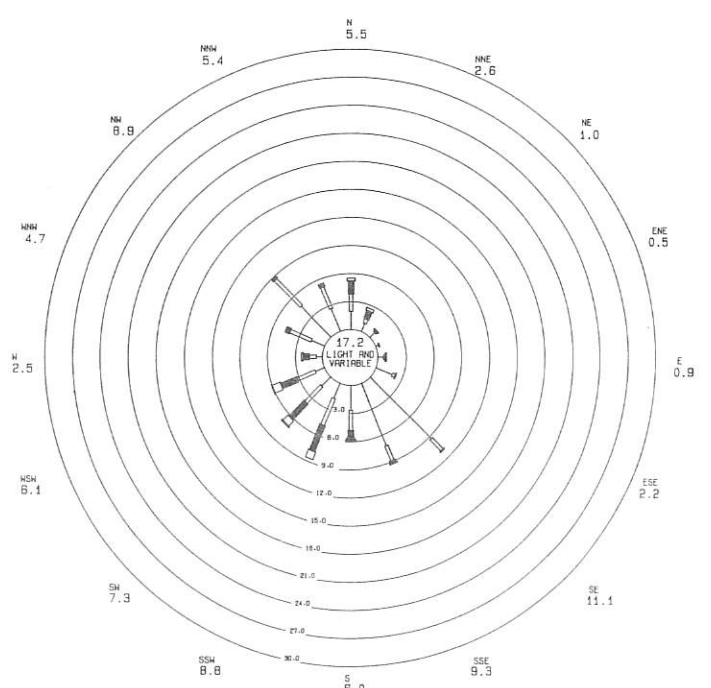
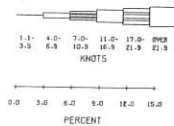
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,593



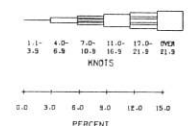
HOUR AVERAGE SURFACE WINDS

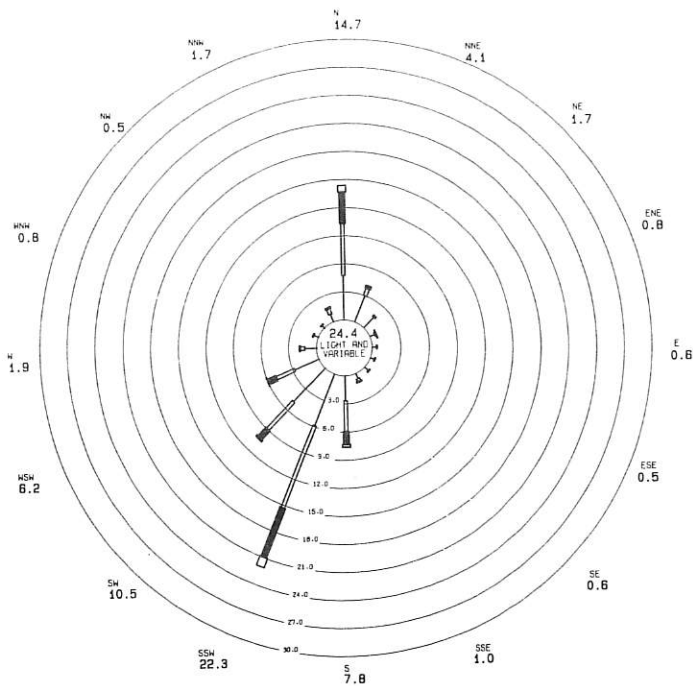
PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,641





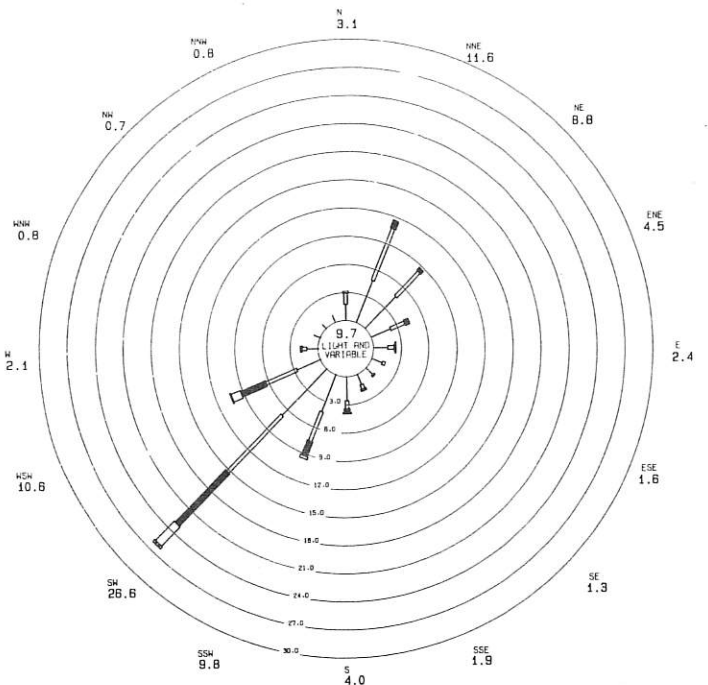
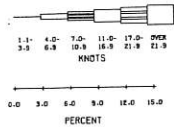
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,491



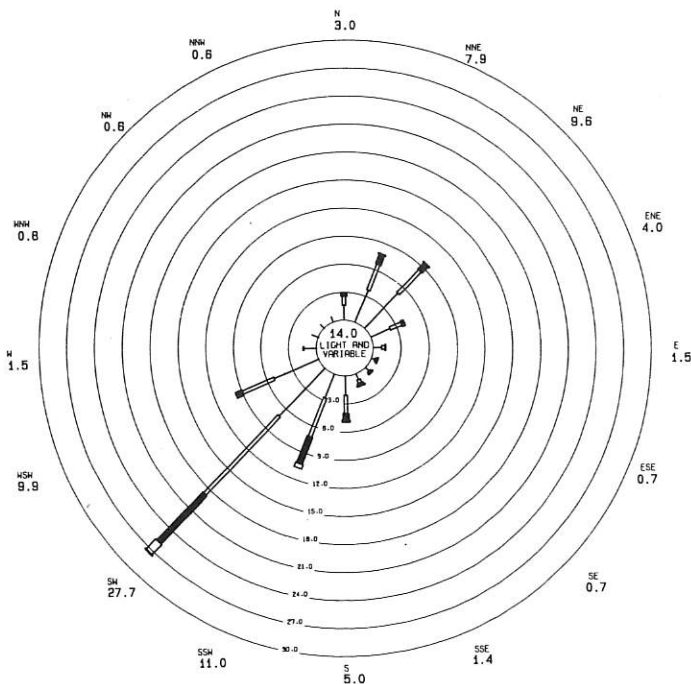
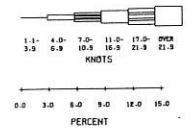
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,614



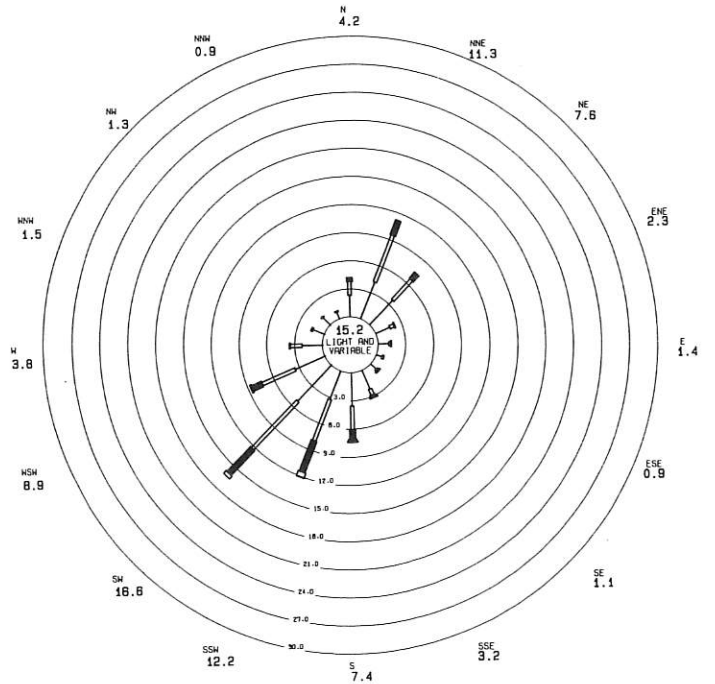
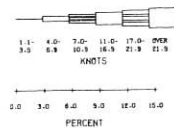
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,395



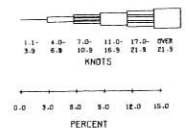
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1981

TOTAL OBSERVATIONS- 8,642



STABILITY WIND ROSES

Introduction

The stability wind rose summarizes individual observations of wind direction and wind speed plus an objective calculation of low level stability existing at the same time. 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. The graphical presentation is similar to the wind rose except that separate wind roses are constructed for each 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

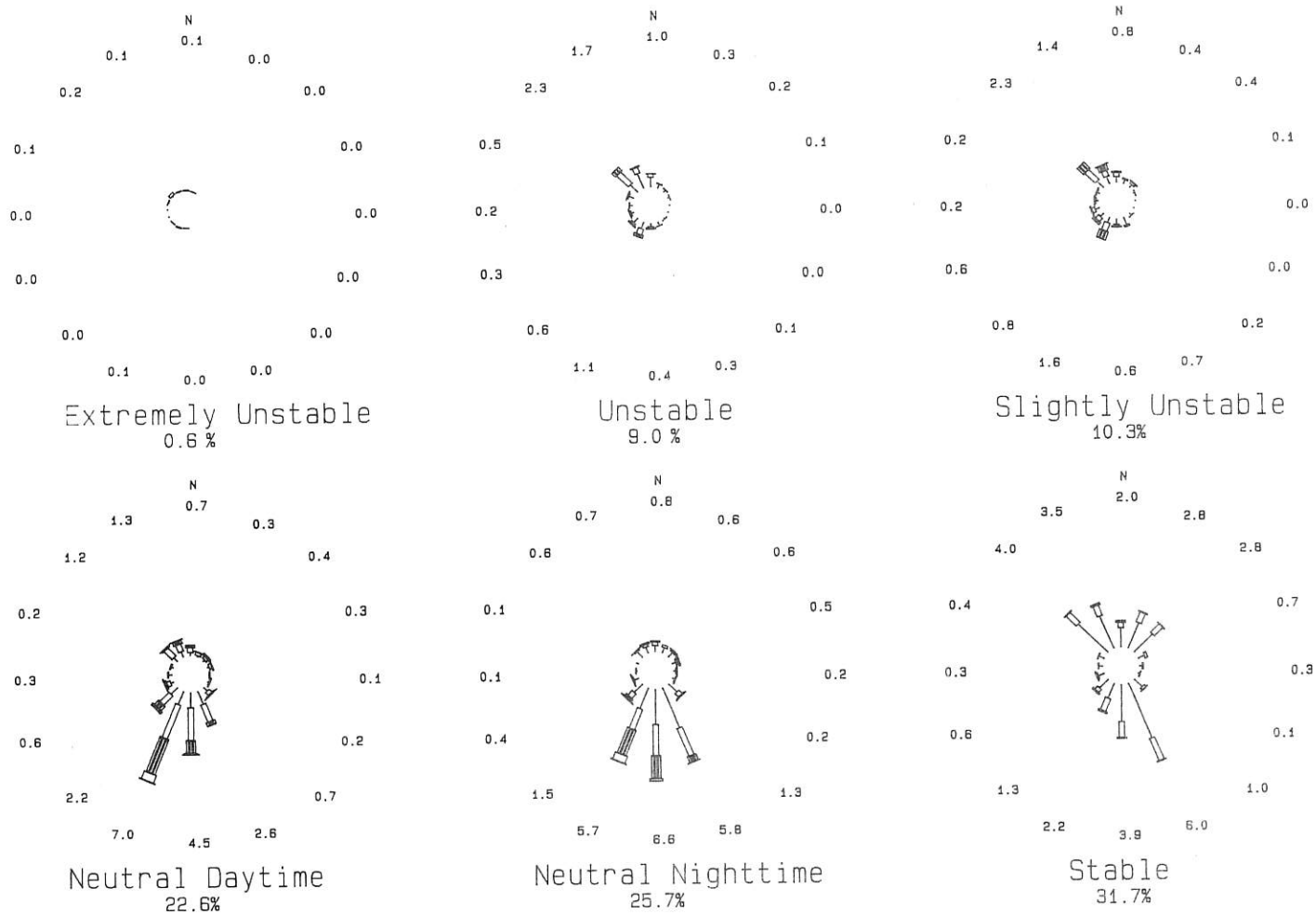
The local area stability wind roses are developed using 3 hour interval cloud data recorded for Seattle Tacoma International Airport. Persistence in cloud data is assumed for the hour preceding and the hour following the observation. This cloud data extended to 1 hour intervals is then used with the 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, percent 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 frequency tables from which the accompanying stability wind roses were plotted.

Clearly the distribution of wind represents the most significant difference between locations. The frequency of hours in each stability class is about the same at each location. Neutral stability exists about 49 percent of the time. Stable nighttime conditions occur about 31 percent of the time. The wind rose associated with these stable conditions is probably the most important in describing poor pollutant dispersion and is generally different than that occurring during any other stability class.

PUGET SOUND AIR POLLUTION CONTROL AGENCY



STABILITY WIND ROSES

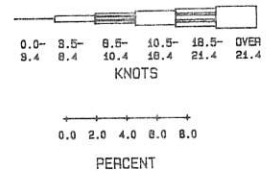
DUWAMISH, 4401 E MARGINAL WAY S, SEATTLE, WA

Period of Record: JAN - DEC, 1981

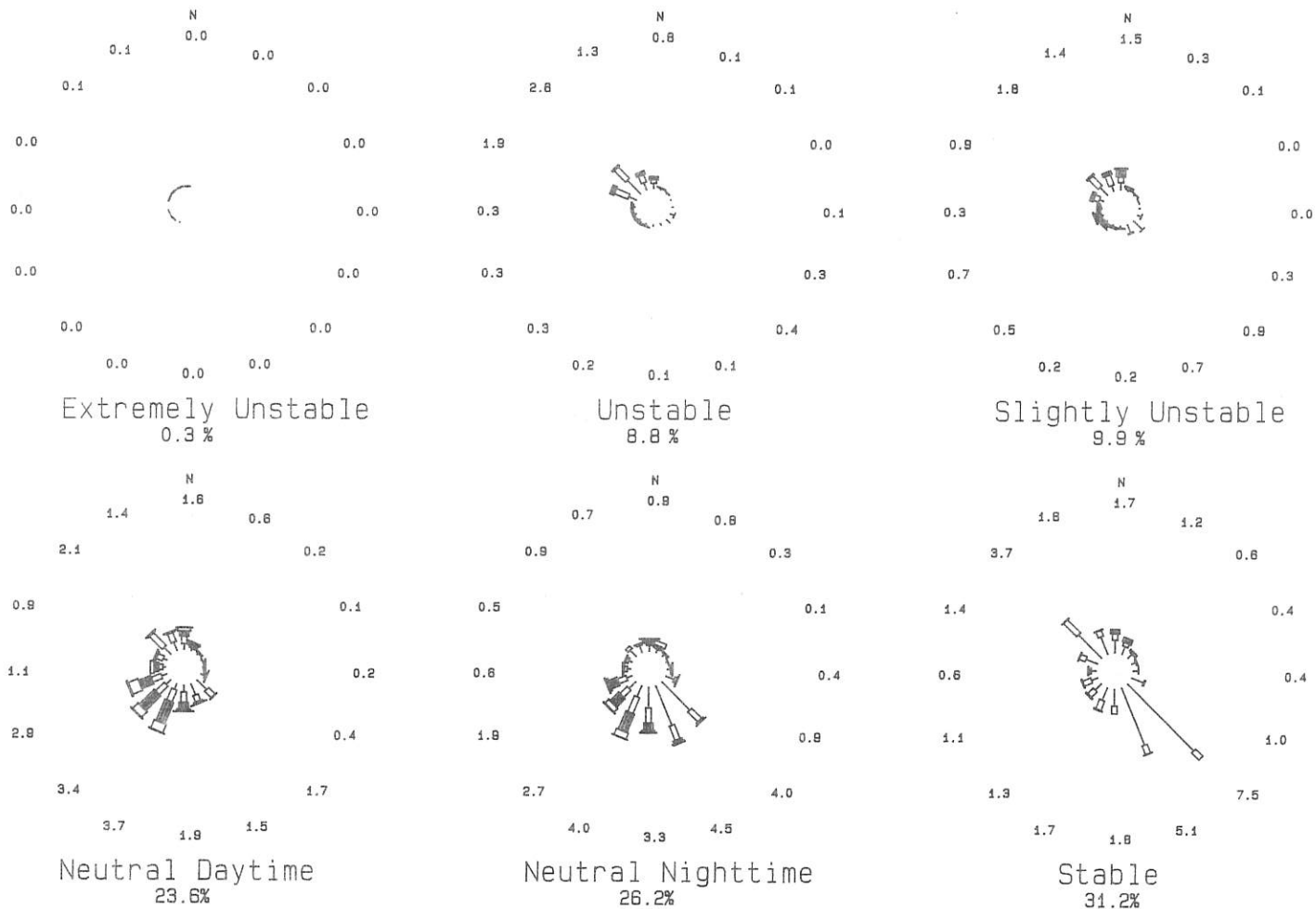
1 Hr Wind Location: DUWAMISH, 4401 E MARGINAL WAY S, SEATTLE, WA

Percentage Frequency of Occurrence

3 Hr Cloud Location: SEATTLE TACOMA INTERNATIONAL AIRPORT, WA



PUGET SOUND AIR POLLUTION CONTROL AGENCY



STABILITY WIND ROSES

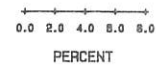
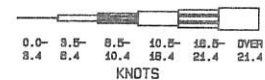
FIRE STATION #12, 2316 E 11TH ST, TACOMA, WA

Period of Record: JAN - DEC, 1981

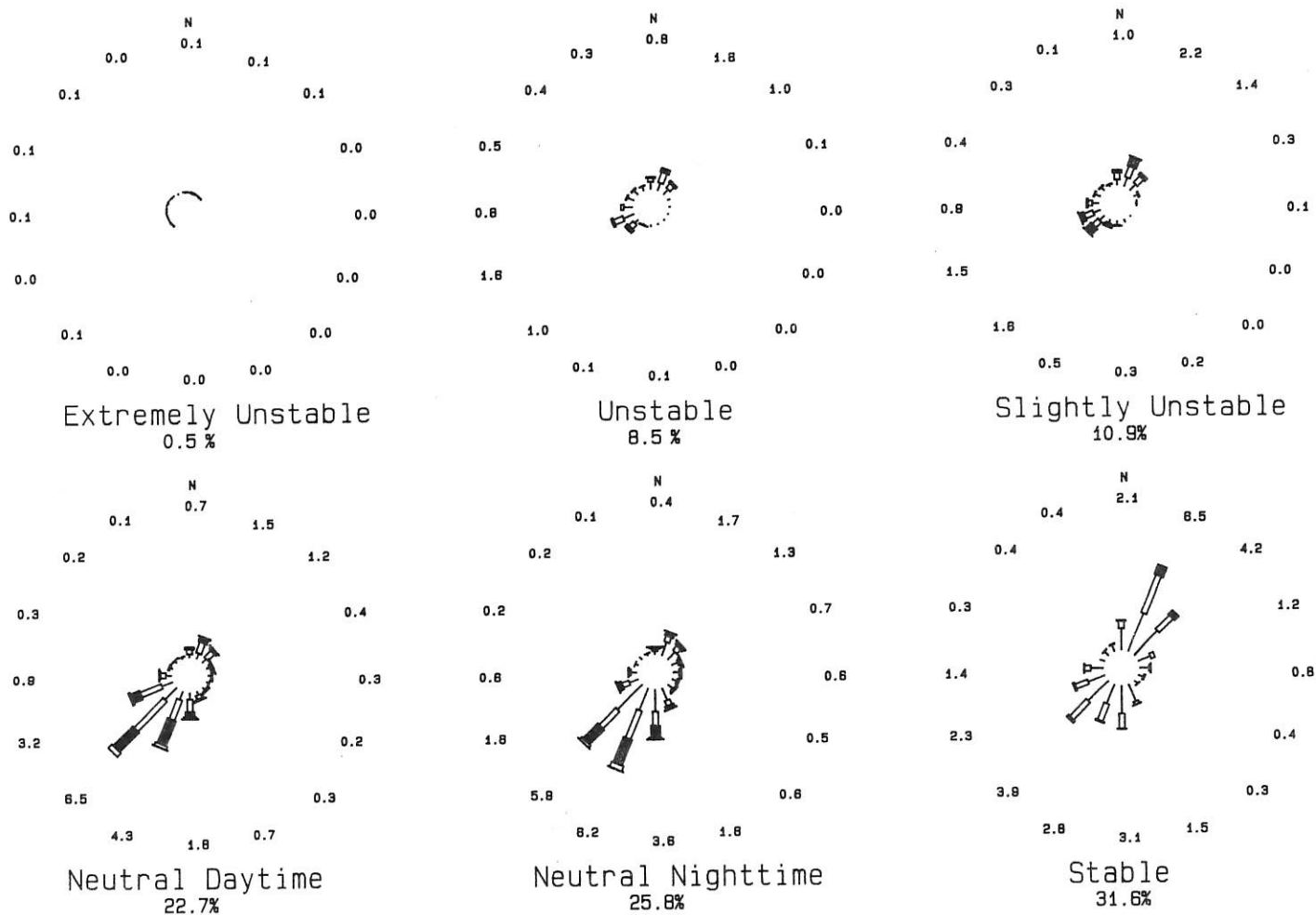
1 Hr Wind Location: FIRE STATION #12, 2316 E 11TH ST, TACOMA, WA

Percentage Frequency of Occurrence

3 Hr Cloud Location: SEATTLE TACOMA INTERNATIONAL AIRPORT, WA



PUGET SOUND AIR POLLUTION CONTROL AGENCY



STABILITY WIND ROSES

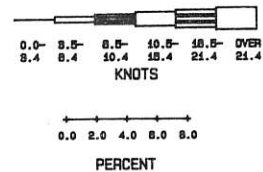
NORTH 26TH & PEARL STS, TACOMA, WA

Period of Record: JAN - DEC, 1981

1 Hr Wind Location: NORTH 26TH & PEARL STS, 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 (μg) 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 of our readers who wish to interpret our results in terms of $\mu\text{g}/\text{m}^3$ or mg/m^3 . Conversion factors, extracted from the Federal Register, assume a pressure of 760 mm Hg and a temperature of 25°C .

<u>Pollutant</u>	<u>Multiply PPM by</u>	<u>To Obtain</u>
CO	1.145	mg/m^3
NO ₂	1880	$\mu\text{g}/\text{m}^3$
O ₃	1961	$\mu\text{g}/\text{m}^3$
SO ₂	2619	$\mu\text{g}/\text{m}^3$

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%. Note: Smoking up to 2 packs of cigarettes a day raises carboxyhemoglobin levels to about 5%. This is equivalent to exposure for 8 or more hours to 30 ppm of carbon monoxide.

	NATIONAL			WASHINGTON STATE		PUGET SOUND REGION	
	PRIMARY	SECONDARY	Notes		Notes		Notes
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	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$		$\mu\text{g}/\text{m}^3$		$\mu\text{g}/\text{m}^3$	
Annual Geo. Mean	75	60	a	60	a	60	a
24-hour Average	260	150	b	150	b	150	b
CARBON MONOXIDE	ppm						
8-hour Average	9	same	b	same		same	
1-hour Average	35		b				
OZONE	ppm						
1-hour Average	0.12	same	e	same		same	
NITROGEN DIOXIDE	ppm						
Annual Average	0.05	same	a	same		same	
HYDROCARBONS (Less Methane)	ppm						
3-hour Average	0.24	same	b f				
LEAD	$\mu\text{g}/\text{m}^3$						
Calendar Quarter Average	1.5	same	a			same as National	

- 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
- f Applies 6 a.m. to 9 a.m. daily

ppm = parts per million

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

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 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.

HYDROCARBONS

Defined as organic compounds composed exclusively of carbon and hydrogen, hydrocarbons are primarily associated with the use of petroleum products. They are the main components of photochemical smog. Hydrocarbons alone have no known effect on human health; therefore the sole purpose of prescribing a hydrocarbon standard is to control photochemical oxidants.

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.