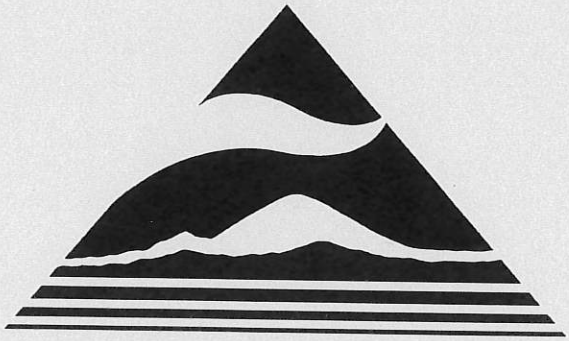
1995 Air Quality Data Summary

for the counties

King
Kitsap
Pierce
Snohomish



PUGET SOUND AIR POLLUTION CONTROL AGENCY
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PUGET SOUND AIR POLLUTION CONTROL AGENCY

Serving King, Kitsap, Pierce and Snohomish Counties

1995 AIR QUALITY DATA SUMMARY

Contents

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(206) 343-8800

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1995 Air Quality Data Summary
Executive Overview

This is our 24th annual data summary which reviews air quality and meteorological data for the Puget Sound Region for the year 1995. This report is beginning to take on a new appearance and we hope that our customers will find it easier to review. We value your comments on how we can continue to enhance the readability of future data summaries and you will find a customer feedback form in the back of the summary.

Air Quality Summary for 1995

During 1995 our region continued to advance an overall trend for improved air quality. No violation of any ambient air quality standard was measured and we continue to demonstrate attainment for all of the criteria pollutants. Control programs and meteorological conditions provided overall good air quality throughout 1995. There were however several periods where air pollution levels were elevated. These "events" are summarized below by pollutant:

Carbon Monoxide

One exceedance of the 8 hour, federal National Ambient Air Quality Standard (NAAQS) was measured at 9.7 ppm in the evening hours on January 4th. The exceedance was detected at the monitoring site located in Bellevue near NE 8th and 108th Ave. NE. All other CO monitoring sites recorded values below the standard. This event did not constitute a violation in accordance with state and federal standards.

Particulate Matter

Three times during 1995, particulate matter (PM) pollution rose to levels above the Washington State trigger for impaired air quality. The first event occurred in January, and resulted in a first stage burn ban being issued for the period January 4 to 7. The second and third periods of elevated PM pollution occurred January 23 to 26 and December 25 to 27. During these events a burn ban was not issued due to PM levels being marginally above the state trigger level, coupled with strong evidence that a major change in the regional weather pattern would occur before the effectiveness of a burn ban would be achieved. None of these events resulted in an exceedance or violation of the PM_{10} NAAQ standard.

Ozone

In July of 1995, there were 2 periods where ozone levels approached the federal standard. The most significant of these events took place on July 1st when elevated levels were monitored at all ozone sites with the highest reading of .104 ppm being recorded at Enumclaw. No exceedance or violation of the Ozone NAAQ standard was recorded.

Sulfur Dioxide

No values exceeding or violating NAAQ standards were monitored, although releases above ambient levels from industrial sources continue to be detected at all PSAPCA SO_2 sites.

Lead

No monitored values approached a level close to the standard.

The charts located at the end of this overview, provide a graphical presentation of air quality values for 1995. For a more detailed examination of 1995 monitored pollution values and regional trends, readers should review the main body of this publication.

This year we are also including in this overview, information regarding key factors that impact our monitoring program and as well as some new approaches that we are implementing to improve our operational programs for wood smoke, ozone and carbon monoxide. Specifically:

- In September of 1995, PSAPCA connected to the meteorological resources available via the Internet. This has resulted in a major upgrade in our ability to forecast weather patterns known to impact air quality.

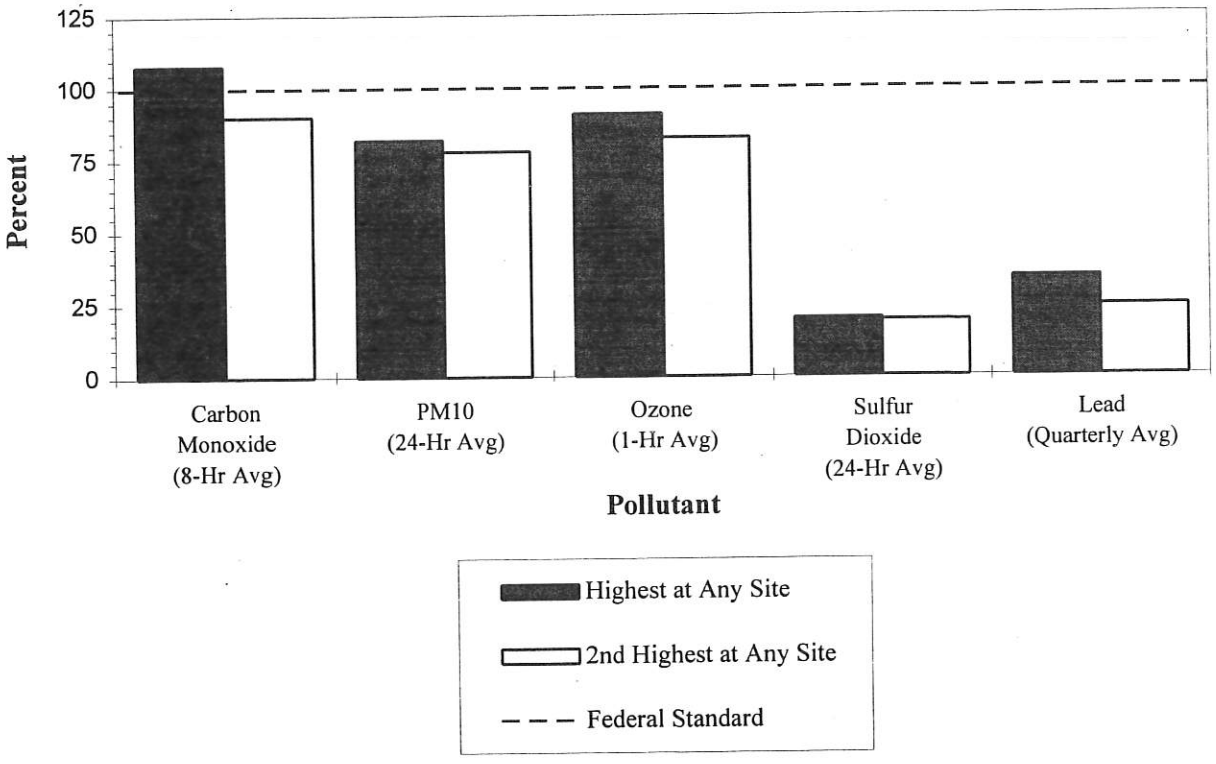
- Liaison with the National Weather Service and local television weather forecasters resulted in greater visibility being given to air quality issues during stagnant weather patterns.

- In anticipation of a new federal particulate matter NAAQS, our Board of Directors authorized the procurement of $PM_{2.5}$ inlet heads for 2 of our continuous air samplers. This decision allows the agency to develop an understanding of the differences in monitoring PM at a smaller fraction size and will insure that we are ready when the new standard is implemented.

- Recognizing the importance that regional visibility holds for our customers and the implications in air quality, the agency has embarked on a new monitoring effort to document the extent of impaired visibility. Our Board of Directors have supported our initiatives and we expect this monitoring program to expand in the coming years.

For 1996 and future years we will endeavor to be more timely in the publication of this data review and readers will see this document on-line with the establishment of our own web site on the Internet in December 1996. For those requiring more detailed air monitoring data packages, please see our new customer service data request form located towards the back of this publication.

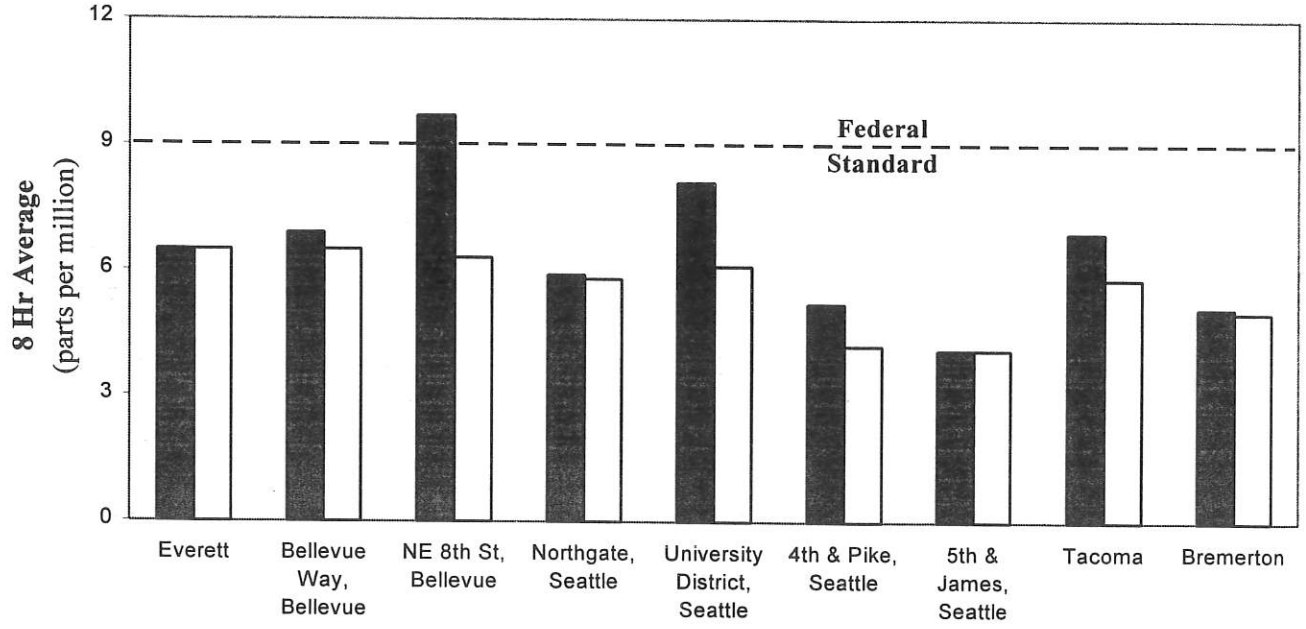
1995 Maximum Pollutant Concentrations
Compared to the Federal Standard



1995 Maximum Pollutant Concentrations

Carbon Monoxide

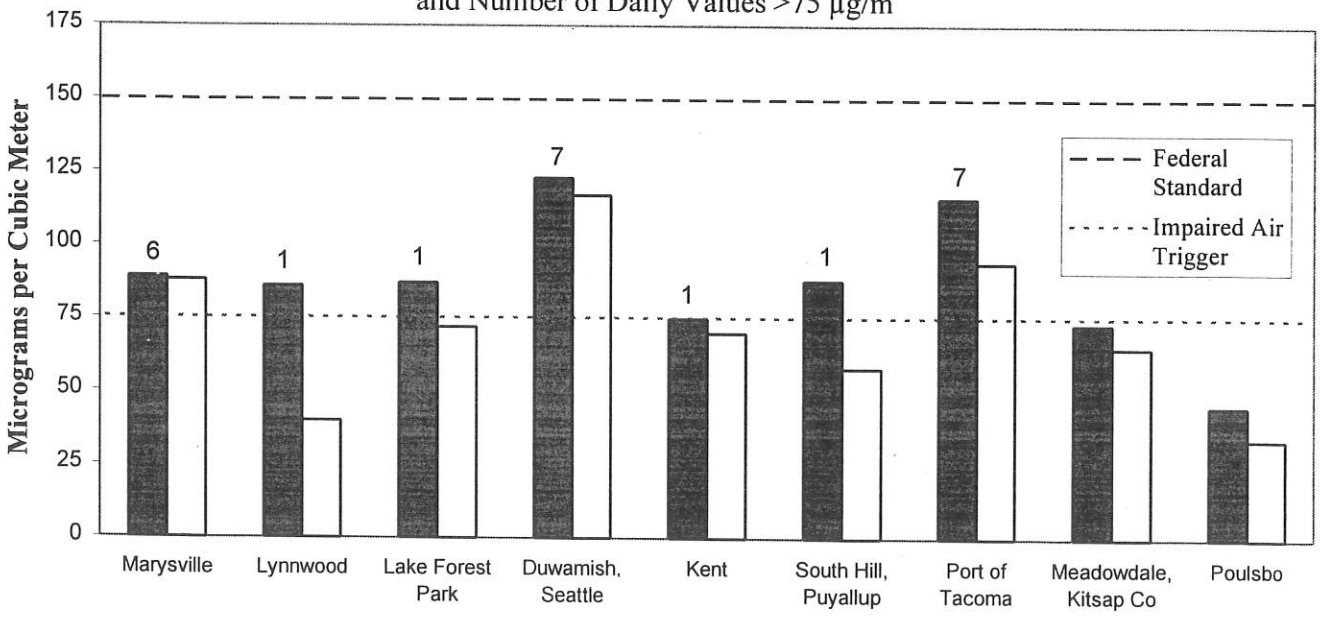
1995 Maximum and 2nd High Concentrations



Particulate (PM10)

1995 Maximum and 2nd High Daily Concentrations

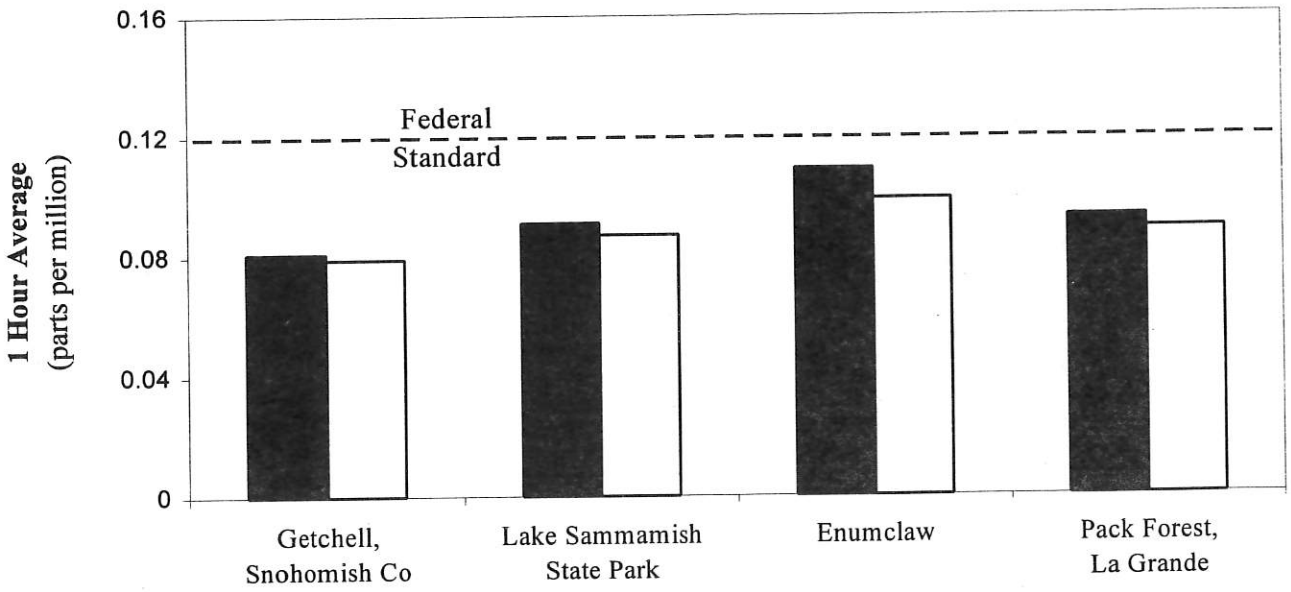
and Number of Daily Values >75 $\mu g/m^3$



1995 Maximum Pollutant Concentrations

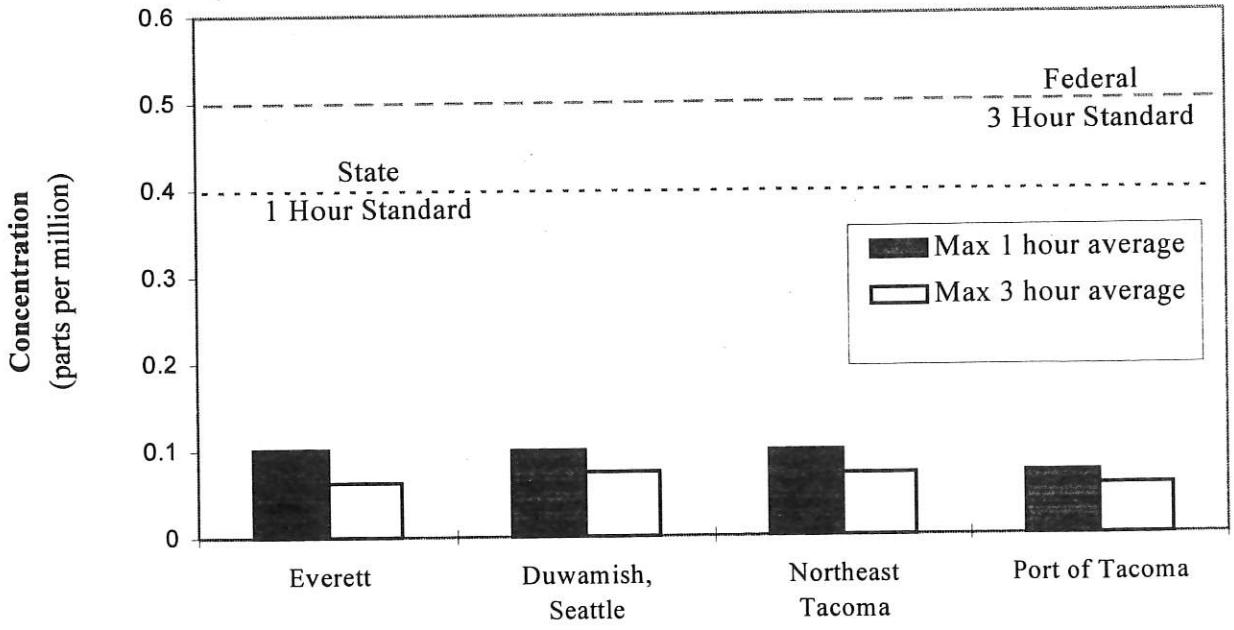
Ozone

1995 Maximum and 2nd High Concentration



Sulfur Dioxide

1995 Maximum Concentrations



CHARACTERISTICS AND EFFECTS OF AMBIENT AIR POLLUTANTS

Carbon Monoxide

Carbon monoxide is a colorless, odorless, toxic gas commonly formed when carbon-containing fuel is not burned completely. The automobile internal combustion engine is a principal source of carbon monoxide. Carbon monoxide chemically combines with the hemoglobin in the red blood cells to decrease the oxygen-carrying capacity of the blood. It also weakens the contractions of the heart, thus reducing the amount of blood pumped throughout the body. Additionally it can affect the functioning of the lungs and brain. People with heart disease and pregnant women are particularly at risk because of the effects of carbon monoxide.

Particulate Matter (PM_{10})

Particulate matter consists of small discrete solid or aerosol particles dispersed in the air. Particulate matter with an aerodynamic diameter of less than or equal to 10 micrometers is referred to as PM_{10}. Transportation, industrial activity and wood burning are major sources of particulate matter. Particulates one micrometer or less in diameter are especially associated with a variety of adverse effects on public health and welfare. The small particles can be breathed deeply into the lungs. Particulate in the respiratory tract may produce injury by itself, or it may act in conjunction with gases to increase the effect on the body. The elderly, those suffering from respiratory illness, and young children are especially prone to the deleterious effects of particulates. Particulate matter causes welfare effects through soiling of buildings and other property and by scattering and absorbing visible light thereby reducing visibility.

Ozone

Ozone is a pungent-smelling, colorless gas produced in the atmosphere when nitrogen oxides and volatile organic compounds chemically react under the effect of strong sunlight. It is a pulmonary irritant that affects lung tissues and respiratory functions. Ozone impairs the normal function of the lung and, at concentrations between 0.15 and 0.25 ppm, causes lung tightness, coughing and wheezing. Other oxidants that often accompany ozone cause eye irritation. Persons with chronic respiratory problems, such as asthma, seem most sensitive to increases in ozone concentration. In contrast, ozone is beneficial when it occurs naturally, very high in the atmosphere, miles above the earth, where it protects us from harmful ultraviolet radiation.

Sulfur Dioxide

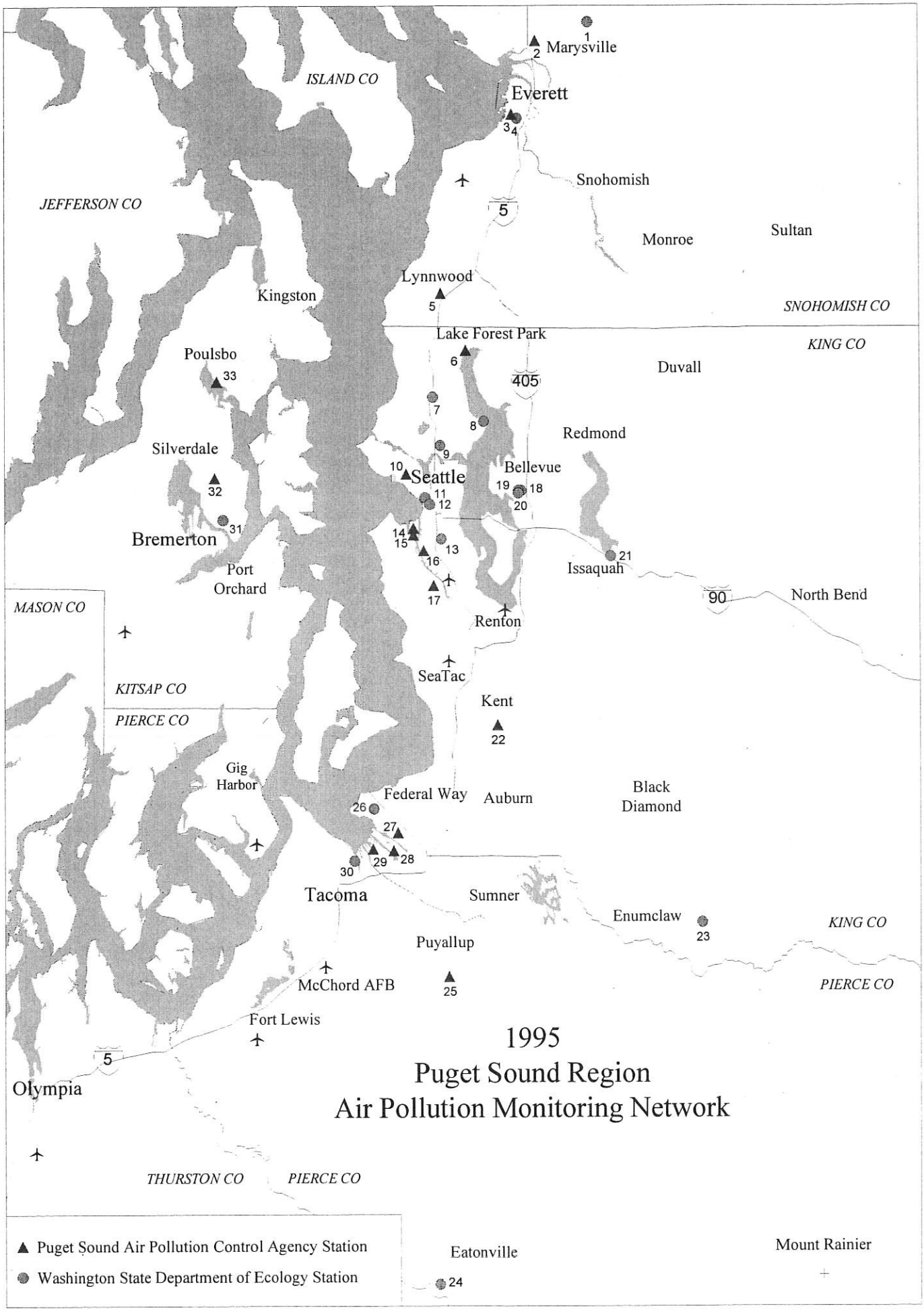
Sulfur dioxide is a colorless, corrosive gas, that has a bitter taste, but no appreciable smell between 0.3 and 1.0 ppm. Industrial sites such as smelters, paper mills, power plants and steel manufacturing plants are the main sources of sulfur dioxide pollution. The presence of sulfur dioxide in the ambient air has been associated with a variety of respiratory diseases and increased mortality rates. When sulfur dioxide is inhaled with small particles, the effect on health is more significant. Inhalation of sulfur dioxide can cause increased airway resistance by constricting lung passages.

Lead

Particles of lead or its compounds enter the air from vehicle exhaust and from industries that smelt or process the metal. Lead affects humans in numerous ways, but the greatest impacts appear to be on the blood-forming system, the nervous system, and the kidneys. It affects some people more than others. Young children from one to five years old 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.

Nitrogen Dioxide

Nitrogen dioxide is a poisonous, brownish gas that, along with being a strong oxidizing agent, quickly reacts with water vapor to form corrosive nitric acid. Nitrogen dioxide is formed as the result of high temperature fuel combustion and subsequent atmospheric reactions. The presence of nitrogen dioxide in ambient air has been connected with a range of respiratory diseases. Further, nitrogen dioxide plays an essential role in the photochemical reactions that produce ozone.


1995
Puget Sound Region
Air Pollution Monitoring Network
Marysville
Everett
Snohomish
Monroe
Sultan
Lynnwood
Kingston
Lake Forest Park
Poulsbo
Duvall
Redmond
Silverdale
Seattle
Bellevue
Bremerton
Port Orchard
Issaquah
North Bend
Renton
SeaTac
Kent
Gig Harbor
Federal Way
Auburn
Black Diamond
Tacoma
Sumner
Enumclaw
Puyallup
McChord AFB
Fort Lewis
Olympia
Eatonville
Mount Rainier
ISLAND CO
JEFFERSON CO
SNOHOMISH CO
KING CO
MASON CO
KITSAP CO
PIERCE CO
THURSTON CO
5
405
90
▲ Puget Sound Air Pollution Control Agency Station
● Washington State Department of Ecology Station

1995 SAMPLING NETWORK

Map ID		Location	Type of Sampling			
*	1	8426 99th Avenue NE, Getchell, Wa				O_3
	2	Marysville JHS, 1605 7th St, Marysville, Wa	PM10	$(PM10)_{eq}$		Wind
	3	Hoyt Ave & 26th St, Everett, Wa	PM10			SO_2, Wind
*	4	Broadway & Hewitt Ave, Everett, Wa			CO	
	5	20935 59th Place West, Lynnwood, Wa	PM10	$(PM10)_{eq}$		Wind
	6	17711 Ballinger Way NE, Lake Forest Park, Wa	PM10	$(PM10)_{eq}$		bsp, Wind
*	7	Northgate, 310 NE Northgate Way, Seattle, Wa			CO	
*	8	Sand Point, 7600 Sand Pt Way NE, Seattle, Wa				Wind, Temp, dT
*	9	University Dist, 1307 NE 45th St, Seattle, Wa			CO	
	10	Queen Anne Hill, 400 W Garfield St, Seattle, Wa				Vsby
*	11	1424 4th Ave, Seattle, Wa			CO	
*	12	5th Ave & James St, Seattle, Wa			CO	
*	13	Beacon Hill, 15th S & Charlestown, Seattle, Wa				NO, NO_2, NO_X, Wind, Temp
	14	Harbor Island, 2555 13th Ave SW, Seattle, Wa				TSP/Pb
	15	Harbor Island, 3400 13th Ave SW, Seattle, Wa	PM10			
	16	Duwamish, 4752 E Marginal Way S, Seattle, Wa	PM10	$(PM10)_{eq}$		PM2.5, bsp, SO_2, Wind
	17	South Park, 723 S Concord St, Seattle, Wa	PM10			
*	18	NE 8th St & 108th Ave NE, Bellevue, Wa			CO	
*	19	622 Bellevue Way NE, Bellevue, Wa			CO	
*	20	504 Bellevue Way NE, Bellevue, Wa	PM10			
*	21	20050 SE 56th, Lake Sammammish State Park, Wa				O_3
	22	James St & Central Ave, Kent, Wa	PM10	$(PM10)_{eq}$		PM2.5, bsp, Wind
*	23	Highway 410, 2 miles east of Enumclaw, Wa				O_3
*	24	Charles L Pack Forest, La Grande, Wa				O_3
	25	South Hill, 9616 128th St E, Puyallup, Wa	PM10	$(PM10)_{eq}$		Wind
*	26	5225 Tower Drive NE, Northeast Tacoma, Wa				Wind, Temp
	27	27th St NE & 54th Ave NE, Northeast Tacoma, Wa	PM10			SO_2, Wind
	28	2301 Alexander Ave, Tacoma, Wa	PM10			SO_2, Wind
	29	Fire Station #12, 2316 E 11th St, Tacoma, Wa	PM10	$(PM10)_{eq}$		PM2.5, bsp, Wind
*	30	1101 Pacific Ave, Tacoma, Wa			CO	
*	31	2909 Wheaton Way, Bremerton, Wa			CO	
	32	Meadowdale, 7252 Blackbird Dr NE, Kitsap Co, Wa	PM10	$(PM10)_{eq}$		Wind
	33	Lions Park, 6th Ave NE & Fjord Dr, Poulsbo, Wa	PM10	$(PM10)_{eq}$		Wind

Notes (1) *Type of Sampling*

PM10	= Particulate Matter ≤ 10 micrometers (reference method)	bsp	= Atmospheric Particles (by nephelometer)
$(PM10)_{eq}$	= Particulate Matter ≤ 10 micrometers (equivalent method)	Temp	= Air Temperature
CO	= Carbon Monoxide	dT	= delta Temperature
O_3	= Ozone	NO	= Nitric Oxide
Wind	= Wind Direction & Speed	NO_2	= Nitrogen Dioxide
SO_2	= Sulfur Dioxide	NO_X	= Nitrogen Oxides
PM2.5	= Particulate Matter ≤ 2.5 micrometers	Vsby	= Visibility
		TSP/Pb	= Total Suspended Particulates and Lead

(2) * Station operated by Washington State Department of Ecology

POLLUTANT STANDARDS INDEX

The Pollutant Standards Index (PSI) provides a nationally uniform method to report daily air quality levels. In cooperation with the Washington State Department of Ecology, the Puget Sound Air Pollution Control Agency began reporting the PSI in 1980 for the Everett, Seattle, and Tacoma areas.

Measured pollutant levels during each day convert to a scale that shows if there are potential health effects. This Index scale, ranging from zero to 500, categorizes air quality by the following descriptions:

from	0	to	50,	Good;
from	51	to	100,	Moderate;
from	101	to	199,	Unhealthful;
from	200	to	299,	Very Unhealthful;
from	300	to	500,	Hazardous.

The table one the following page shows the pollutant concentration and the averaging period associated with each PSI value that is a break-point between Index categories. PSI values for pollutant concentrations between break-points are determined by linear interpolation.

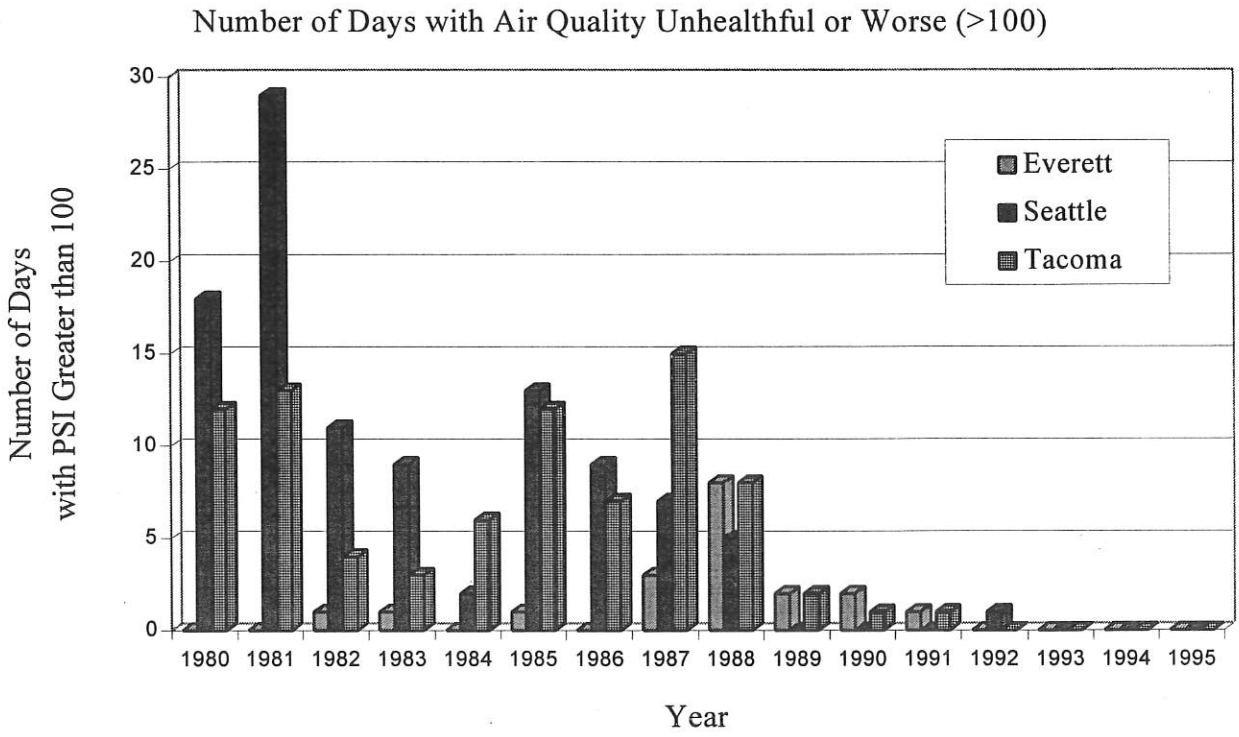
Whenever the PSI is greater than 100, a measured pollutant level has exceeded the national primary air quality standard established to protect health. An index value of 200 means the pollutant concentration has reached the "Alert" level in the Washington Episode Avoidance Plan.

Every day the concentration of each pollutant within the areas of Everett, Seattle and Tacoma determines an Index value. For each area, the pollutant with the highest Index value determines the PSI on that day. Highest values for these areas usually occur in the vicinity of heavy traffic or an industrial area.

Since high ozone levels occur some distance downwind of Everett, Seattle or Tacoma on hot summer afternoons, the Agency reports the ozone PSI value in a downwind area during the months from May through September. For 1995, the maximum ozone PSI value of 91 occurred on July 1 near Enumclaw.

Graphs and tables in the back summarize the daily PSI values for Everett, Seattle, and Tacoma. The 1995 summary table shows for each month: the number of days in each PSI interval, the maximum Index, the date of the maximum and the pollutant determining the maximum value.

A 1980 through 1995 summary table shows for each year the number of days in each air quality category and the number of days each pollutant determined the PSI. The right-hand columns list the highest PSI value for each year. The number of Unhealthful days each year (Index values greater than 100), is also displayed in a chart.



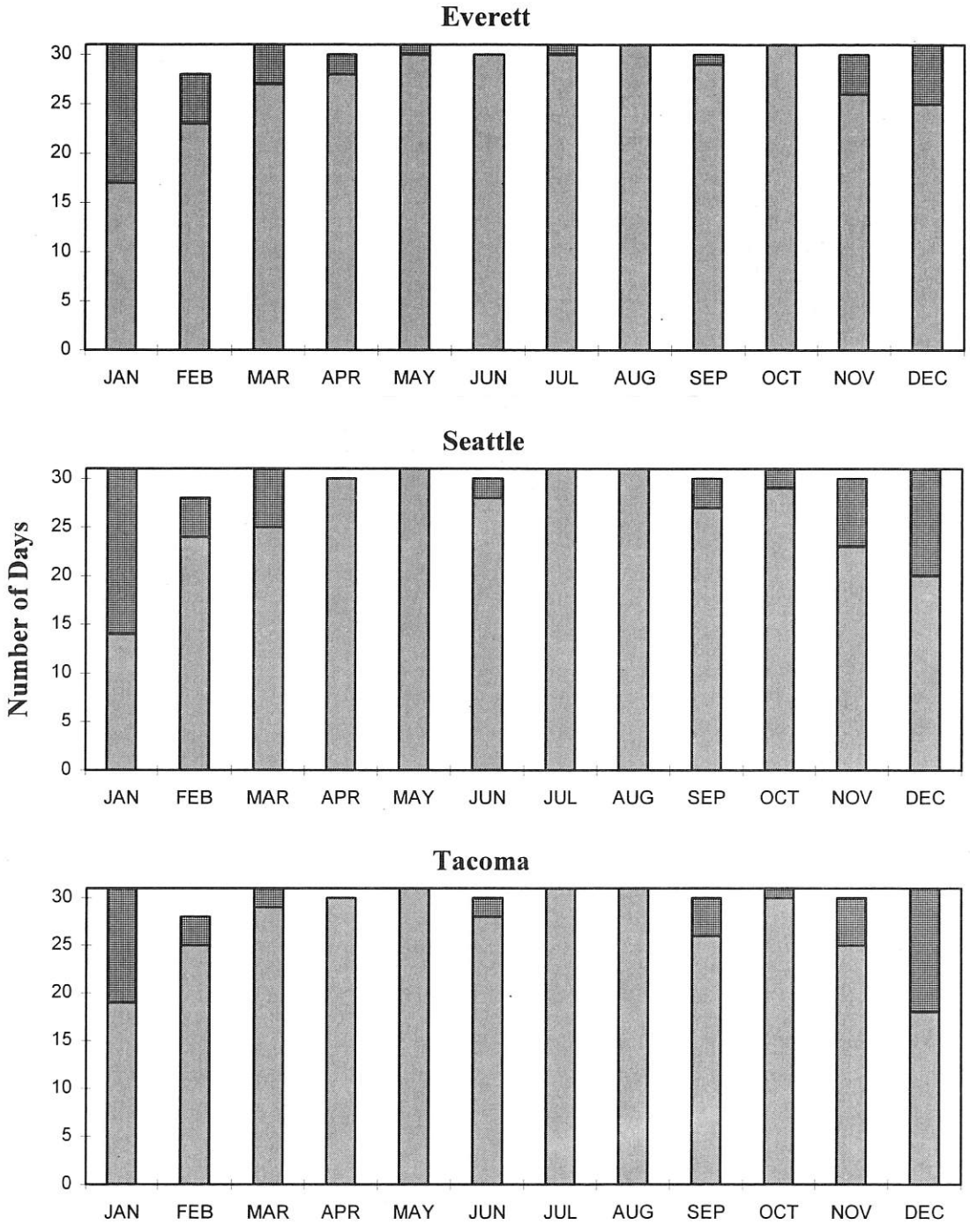
Pollutant Concentration for Each PSI Break-point Value

PSI Value	CO *8 hr Avg* (*ppm*)	PM10 *24 hr Avg* ($\mu g/m^3$)	SO_2 *24 hr Avg* (*ppm*)	O_3 *1 hr Avg* (*ppm*)
50	4.5	50	0.03	0.06
100	9.0	150	0.14	0.12
200	15.0	350	0.30	0.20
300	30.0	420	0.60	0.40
400	40.0	500	0.80	0.50
500	50.0	600	1.00	0.60

Pollutant Standards Index

Number of Days in Each PSI Category

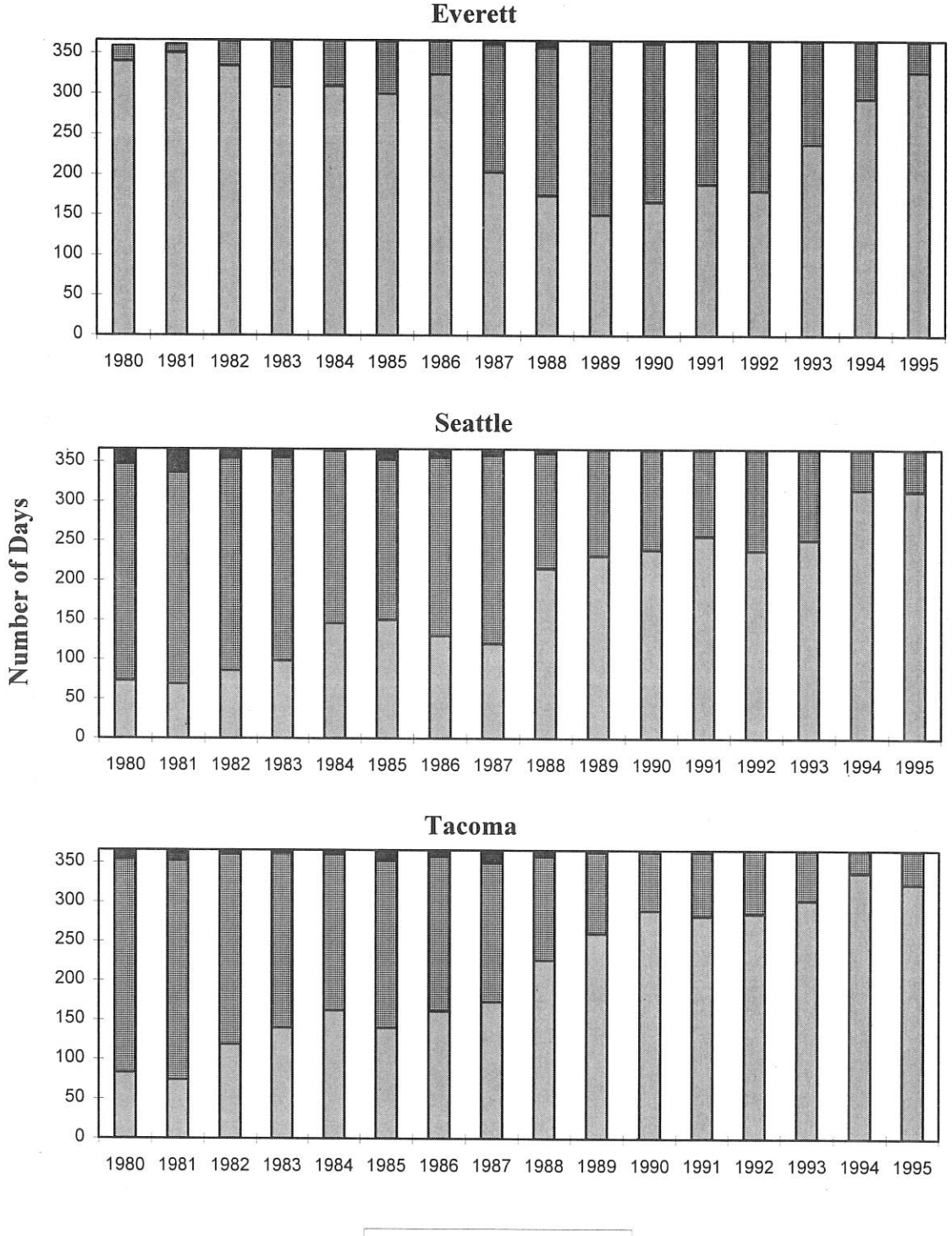
1995



Pollutant Standards Index

Number of Days in Each PSI Category

1980 - 1995



POLLUTANT STANDARDS INDEX

1995

EVERETT

Number of Days in Each PSI Interval during Each Month

AIR QUALITY	PSI Interval	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
GOOD	(0 to 50)	17	23	27	28	30	30	30	31	29	31	26	25	327
MODERATE	(51 to 100)	14	5	4	2	1	0	1	0	1	0	4	6	38
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		77	56	56	56	56	44	78	44	56	45	67	67	78
Date		3rd	8th#	10th#	3rd#	1st	1st#	7th	4th#	22nd	30th	14th	22nd	Jul 7
Pollutant		CO	CO	CO	CO	CO	CO	CO	CO	CO	PM	CO	CO	CO

SEATTLE

Number of Days in Each PSI Interval during Each Month

AIR QUALITY	PSI Interval	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
GOOD	(0 to 50)	14	24	25	30	31	28	31	31	27	29	23	20	313
MODERATE	(51 to 100)	17	4	6	0	0	2	0	0	3	2	7	11	52
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		89	71	67	44	44	56	43	44	56	67	67	69	89
Date		3rd	9th	17th#	3rd#	26th	6th	19th	7th#	23rd	19th	14th	22nd	Jan 3
Pollutant		CO	PM	CO	CO	CO	CO	PM	CO	CO	CO	CO	PM	CO

TACOMA

Number of Days in Each PSI Interval during Each Month

AIR QUALITY	PSI Interval	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
GOOD	(0 to 50)	19	25	29	30	31	28	31	31	26	30	25	18	323
MODERATE	(51 to 100)	12	3	2	0	0	2	0	0	4	1	5	13	42
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		83	67	58	45	41	60	42	35	56	56	58	67	83
Date		3rd	23rd	31st	27th	24th	29th	20th	25th	21st#	19th	21st	19th#	Jan 3
Pollutant		PM	CO	PM	PM	PM	PM	PM	PM	PM	CO	PM	CO	PM

PM = Particulate Matter; CO = Carbon Monoxide; SO2 = Sulfur Dioxide

Earliest date of occurrence

POLLUTANT STANDARDS INDEX

1980 - 1995

EVERETT

	Days in Each Air Quality Category				Pollutant Determining the PSI						Highest Value		
					All Days			Unhealthful Days					
	Good	Moderate	Unhealthful	Very Unhealthful	PM	CO	SO2	PM	CO	SO2	PSI	Date	Pollutant
1980	340	19	0	0	356	-	3	0	-	0	60	Jan 23	PM
1981	350	11	0	0	340	-	21	0	-	0	62	Jan 16	PM
1982	334	30	1	0	277	70	18	0	1	0	117	Dec 30	CO
1983	308	56	1	0	191	150	24	0	1	0	117	Nov 30	CO
1984	309	57	0	0	105	217	44	0	0	0	92	Sep 28	PM
1985	300	64	1	0	152	166	47	0	1	0	117	Dec 11	CO
1986	324	41	0	0	169	148	48	0	0	0	89	Jan 25	CO
1987	203	158	3	0	96	250	18	0	3	0	117	Jun 26#	CO
1988	174	184	8	0	15	345	6	0	8	0	133	Sep 13#	CO
1989	150	213	2	0	26	338	1	0	2	0	133	Feb 10	CO
1990	166	197	2	0	29	335	1	0	2	0	117	Mar 2#	CO
1991	188	176	1	0	32	333	0	0	1	0	117	Dec 16	CO
1992	180	186	0	0	34	332	0	0	0	0	100	Feb 4#	CO
1993	238	127	0	0	56	309	0	0	0	0	79	Jan 11	PM
1994	294	71	0	0	28	336	1	0	0	0	78	Dec 30	CO
1995	327	38	0	0	59	305	1	0	0	0	78	Jul 7	CO
Totals	4185	1628	19	0	1965	3634	233	0	19	0			

SEATTLE

	Days in Each Air Quality Category				Pollutant Determining the PSI						Highest Value		
					All Days			Unhealthful Days					
	Good	Moderate	Unhealthful	Very Unhealthful	PM	CO	SO2	PM	CO	SO2	PSI	Date	Pollutant
1980	73	275	18	0	95	270	1	1	17	0	194	Jan 23	PM
1981	69	267	28	1	109	254	2	5	24	0	213	Jan 15	CO
1982	86	268	10	1	96	264	5	1	10	0	214	Feb 6	PM
1983	98	258	9	0	101	261	3	0	9	0	183	Jan 28	CO
1984	146	218	2	0	111	242	13	2	0	0	103	Dec 6	PM
1985	150	202	10	3	156	206	3	6	7	0	204	Dec 12	PM
1986	130	226	8	1	113	246	6	1	8	0	206	Jan 7	PM
1987	120	238	7	0	119	246	0	3	4	0	184	Feb 6	PM
1988	215	146	5	0	67	298	1	2	3	0	150	Dec 3	CO
1989	231	134	0	0	129	233	3	0	0	0	100	Jan 19#	CO
1990	239	126	0	0	141	218	6	0	0	0	100	Jan 18	CO
1991	256	109	0	0	141	216	8	0	0	0	100	Dec 15#	CO
1992	238	127	1	0	105	260	1	0	1	0	167	Feb 3	CO
1993	251	114	0	0	119	245	1	0	0	0	88	Jan 11	PM
1994	315	50	0	0	72	292	1	0	0	0	89	Dec 23	CO
1995	313	52	0	0	100	260	5	0	0	0	89	Jan 3	CO
Totals	2930	2810	98	6	1774	4011	59	21	83	0			

TACOMA

	Days in Each Air Quality Category				Pollutant Determining the PSI						Highest Value		
					All Days			Unhealthful Days					
	Good	Moderate	Unhealthful	Very Unhealthful	PM	CO	SO2	PM	CO	SO2	PSI	Date	Pollutant
1980	83	271	12	0	256	107	3	4	8	0	160	Apr 12	PM
1981	74	278	10	3	222	137	6	1	12	0	227	Jan 12	CO
1982	119	242	4	0	255	101	9	0	4	0	167	Dec 30	CO
1983	140	222	3	0	228	128	9	1	2	0	137	Dec 23	PM
1984	162	198	6	0	207	149	10	0	6	0	117	Jan 19#	CO
1985	140	213	12	0	252	109	4	1	11	0	165	Dec 13	PM
1986	161	197	7	0	247	114	4	2	5	0	167	Oct 23	CO
1987	173	177	13	2	227	136	2	5	10	0	220	Feb 5	CO
1988	226	132	8	0	184	175	7	3	5	0	183	Jan 27	CO
1989	260	103	2	0	217	121	27	0	2	0	117	Nov 30#	CO
1990	289	75	1	0	237	87	41	1	0	0	118	May 5	PM
1991	282	82	1	0	268	85	12	0	1	0	117	Jan 31	CO
1992	285	81	0	0	256	83	27	0	0	0	100	Feb 3#	CO
1993	302	63	0	0	260	82	23	0	0	0	89	Feb 1	CO
1994	337	28	0	0	259	75	31	0	0	0	89	Dec 23	CO
1995	323	42	0	0	255	97	13	0	0	0	83	Jan 3	PM
Totals	3356	2404	79	5	3830	1786	228	18	66	0			

Earliest date of occurrence

PARTICULATE MATTER

Introduction

Particulate matter as a general term includes small particles of dust, soot, organic matter and compounds containing sulfur, nitrogen, and metals. In July 1987, the U. S. EPA changed the national particulate matter standards from Total Suspended Particulates (TSP) to only that portion of particulate matter with particle diameters smaller than or equal to 10 micrometers (PM_{10}). The levels for both the national primary and secondary standards are: 150 $\mu g/m^3$ for a 24 hour average and 50 $\mu g/m^3$ annual arithmetic mean. The PM_{10} standards also include calculation formulas to statistically determine if the standards are attained (40 CFR Part 50, Appendix K).

Particulate Sources and Air Quality

Particulates directly enter the air from industrial operations, from auto, bus and truck traffic, from fuel combustion including wood stoves and fireplaces, from construction, and from other sources. These emissions into the air change daily due to intermittent industrial operations, equipment upset or breakdown, traffic cycles and building heating requirements. Gaseous transformation products in the air like sulfates, nitrates, and some organics are also components of particulate matter. The wind acts to disperse and transport airborne particulate matter. Ambient particulate levels change from day to day in response both to what enters the air and to the variations in weather.

Sampling Methods

Reference methods designated by the U. S. EPA to measure PM_{10} all draw outside air first through an inlet that removes particulates larger than 10 micrometers and then through a filter that collects the remaining particulate matter (PM_{10}). Sampling for a single measurement continues for 24 hours under time clock control and the required sampling period occurs from midnight to midnight.

After the sampling has been completed, the pre-weighed, sampled filter must be manually removed. Following conditioning in a controlled environment for 24 hours to remove moisture effects, the sampled filter is weighed again on a precision balance and the weight of particulate matter collected during the sample period is calculated. The volume of air sampled, corrected to standard temperature and pressure conditions, is calculated from the flow rate and sampling time. The ambient PM_{10} concentration for the specific location and sampling time is calculated by dividing the weight (mass) of collected particulate by the volume of air sampled. The PM_{10} concentration is reported in micrograms per standard cubic meter.

The U. S. EPA has designated three methods as *equivalent methods* for the measurement of PM_{10}; two use a measurement principle based on beta-ray attenuation; one uses a Tapered Element Oscillating Microbalance (TEOM). All three equivalent methods are automated and continuous so that PM_{10} values may be immediately determined and transmitted to a central computer. These methods also measure consecutive daily values without the need for manual servicing after each sampling day.

During 1995, the Puget Sound Air Pollution Control Agency had five equivalent method PM_{10} beta attenuation instruments and five TEOM instruments in operation. Three beta instruments and all five TEOM instruments were placed at wood smoke sites. Two of the beta attenuation instruments were located at industrial sites. A TEOM was installed at Lynnwood that began operation in mid October. Each beta attenuation and each TEOM instrument is collocated with one or more manual, reference method instrument(s) to enable data comparison. The Marysville station featured collocation of both a beta attenuation instrument and TEOM along with the reference method.

The dichotomous sampler is one of the manual samplers designated as a *reference method* for the measurement of PM_{10}. This sampler is different from the more commonly used high volume sampler in that it further separates the PM_{10} at a particle diameter of 2.5 micrometers. The dichotomous sampler collects the small size particulates known as $PM_{2.5}$ on one filter and the coarse fraction containing particulates of size 2.5 to 10 micrometers

on another filter. The Agency has collocated dichotomous samplers with other particulate matter sampling at the Duwamish and Tacoma port industrial sites and also at the Kent station.

Summary of Data

During 1995, PM_{10} data in the Puget Sound Region was measured at fifteen locations, but six of these sites were equipped only with a single manual reference method sampler. PM_{10} sampling usually occurred each sixth day at these six locations for a total of about sixty PM_{10} values during the year at each of those sites.

Continuous PM_{10} data was obtained at nine locations that were equipped with additional reference method samplers and/or equivalent method monitors. Two of these continuous sites are industrial locations and seven of the sites are primarily wood smoke monitoring locations. The industrial locations have operated since the PM_{10} standard was adopted and the wood smoke area monitoring began more recently.

Since adoption of the PM_{10} standard in 1987, none of the annual PM_{10} values have exceeded the annual PM_{10} standard. This means the Puget Sound Region is in compliance with the annual PM_{10} standard.

Under the Federal regulation, (40 CFR Part 50, Appendix K), the last three years of data must be used to determine compliance with the 24 hour average (daily) PM_{10} standard. This regulation requires attainment to be determined by statistically adjusting for days without data and then calculating the average number of days per year exceeding the standard at a particular location for the last three years. If this "expected" number of days above the standard exceeds one, then the PM_{10} standard has not been attained; the location is out of compliance with the 24 hour average PM_{10} standard.

The 24 hour average PM_{10} standard has been met everywhere in the Puget Sound Region for the last seven calendar years. A single daily value at a Tacoma port area station during 1990 exceeded the level of the 150 $\mu g/m^3$ daily standard, but this was not a violation of the standard because measurements occur each day at this site and none of the other values exceeded the level of the standard. With respect to the daily (24 hour average) PM_{10} standard, the last three years of data establish the Region is in compliance with this standard.

Charts on the following pages summarize PM_{10} data beginning in the first year following the PM_{10} standard adoption. Column graphs for the nine stations with continuous data present a PM_{10} history starting either in 1988 or with the beginning of data at each site.

Separate charts for industrial sites and wood smoke sites show the annual arithmetic averages and maximum daily values. These charts show compliance with both the annual and 24 hour average PM_{10} standards for both types of monitoring locations. One can see the PM_{10} levels in the industrial areas have been and continue to be higher than those in the wood smoke areas.

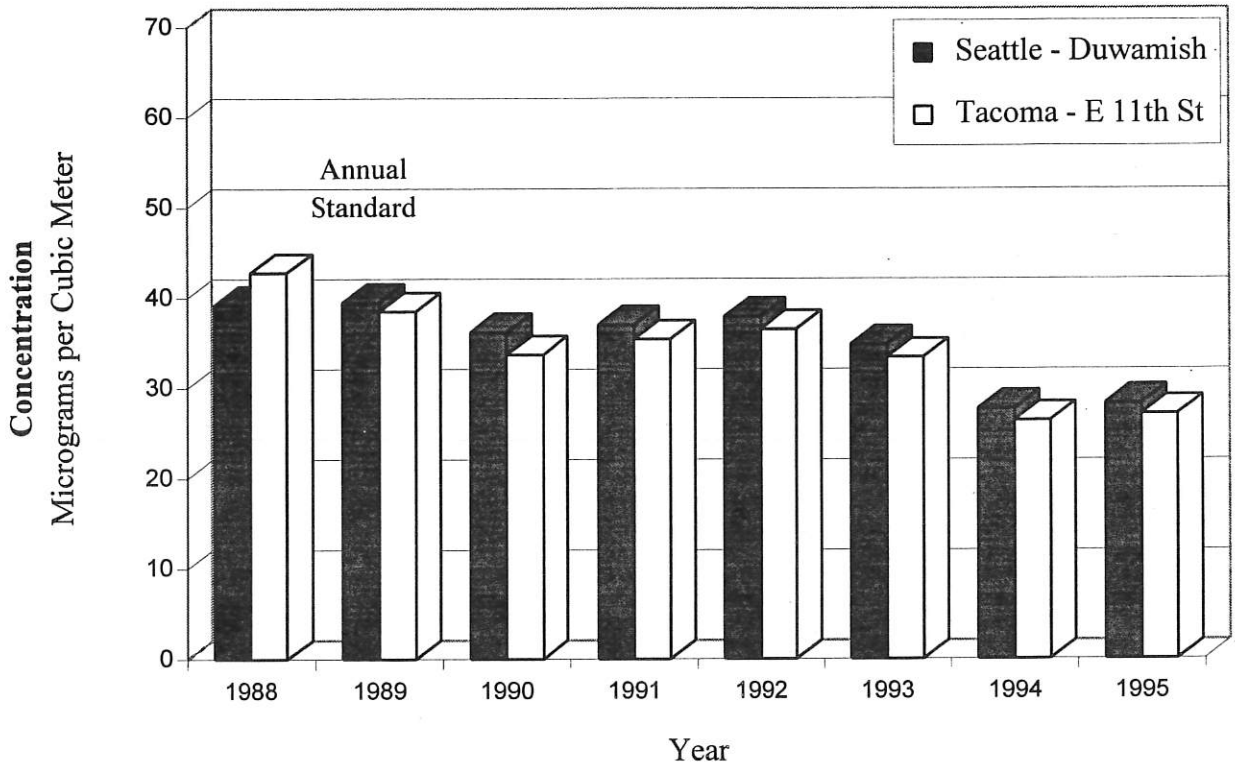
An additional set of charts shows the number of days when each of these stations exceeded the 75 $\mu g/m^3$ "impaired air quality" trigger level established in Washington State law. During the heating season beginning the last part of October and continuing into March, certain indoor burning in fireplaces and wood stoves is prohibited upon formal declaration that a period of "impaired air quality" is in effect.

Tables following the charts summarize for each station the 1995 PM_{10} data from both reference and equivalent methods and $PM_{2.5}$ data from dichotomous samplers.

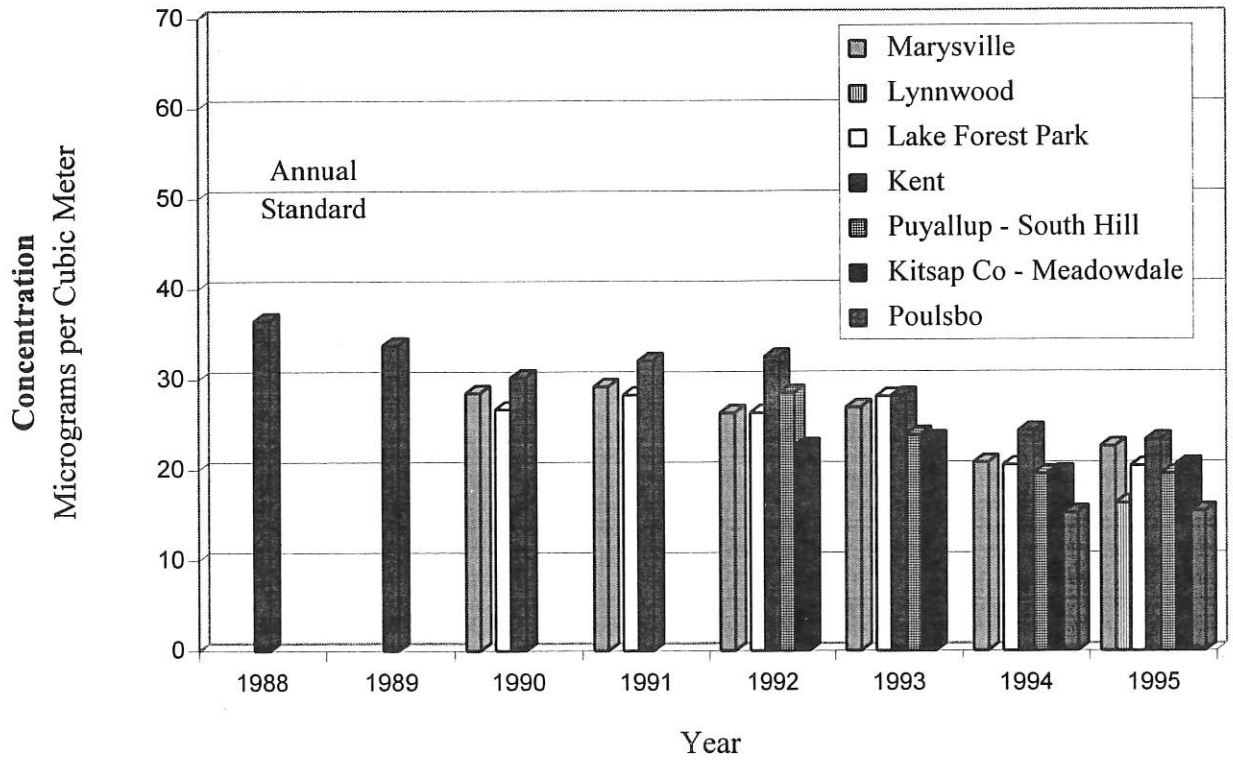
PM10

Annual Arithmetic Averages

Industrial Sites



Wood Smoke Sites

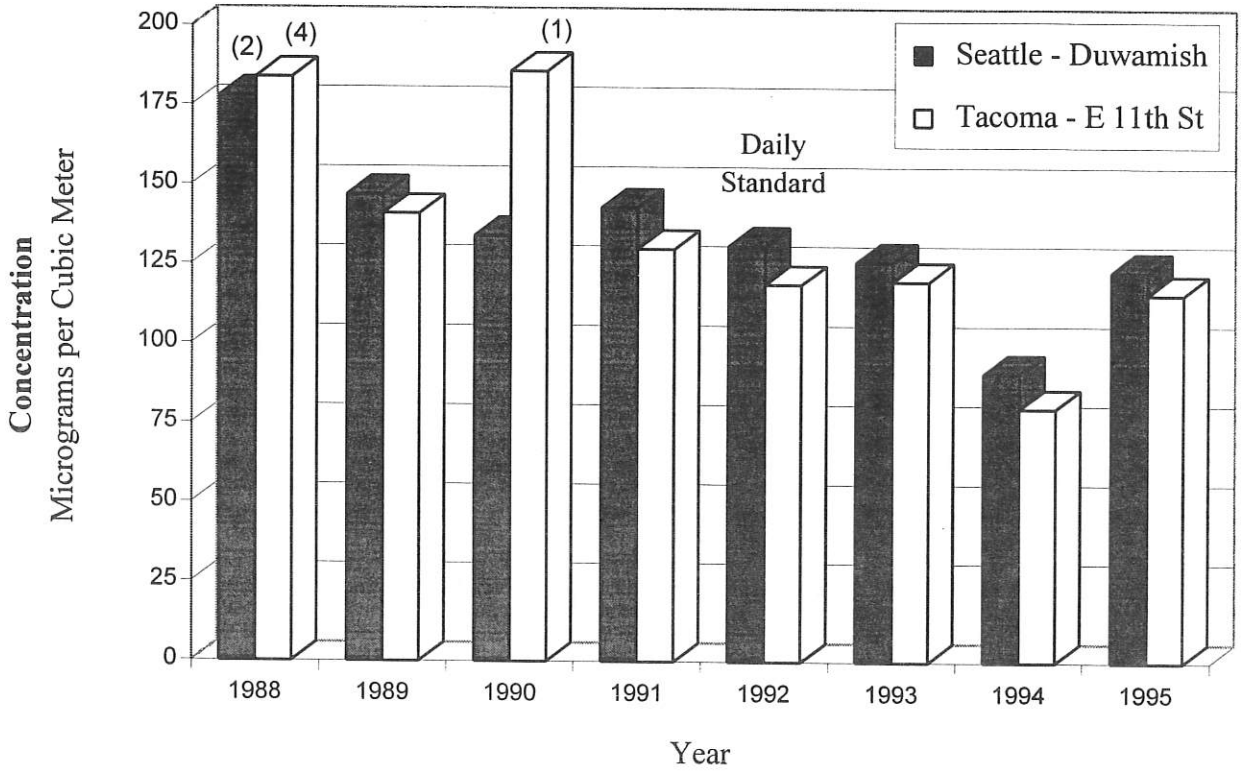


PM10

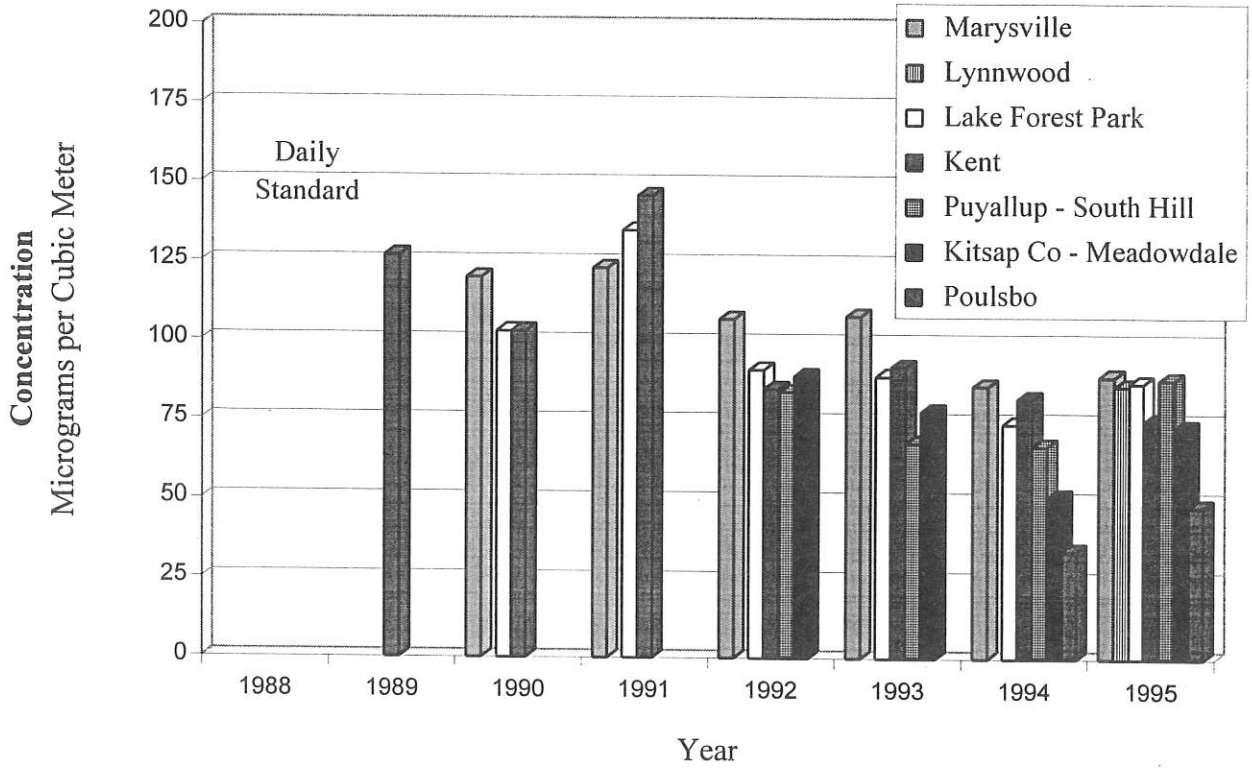
Maximum Daily Values

Industrial Sites

(Number of Daily Values greater than 150 $\mu g/m^3$ shown in parenthesis)



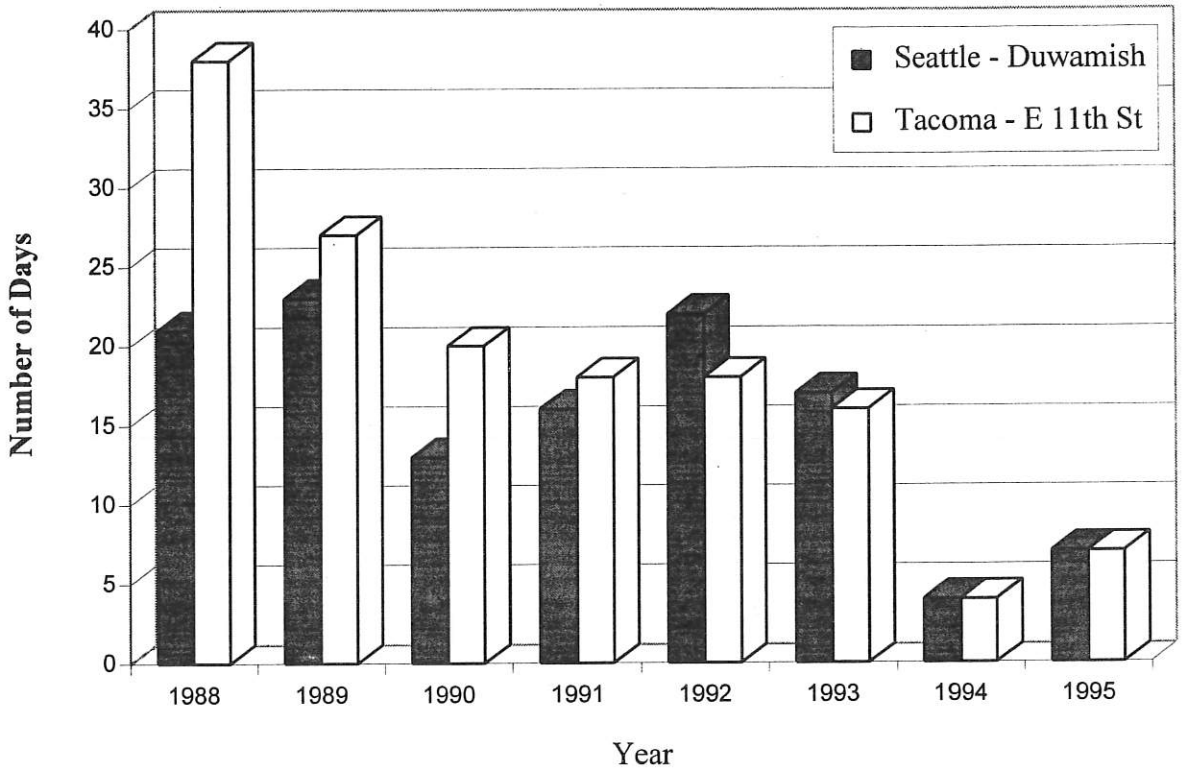
Wood Smoke Sites



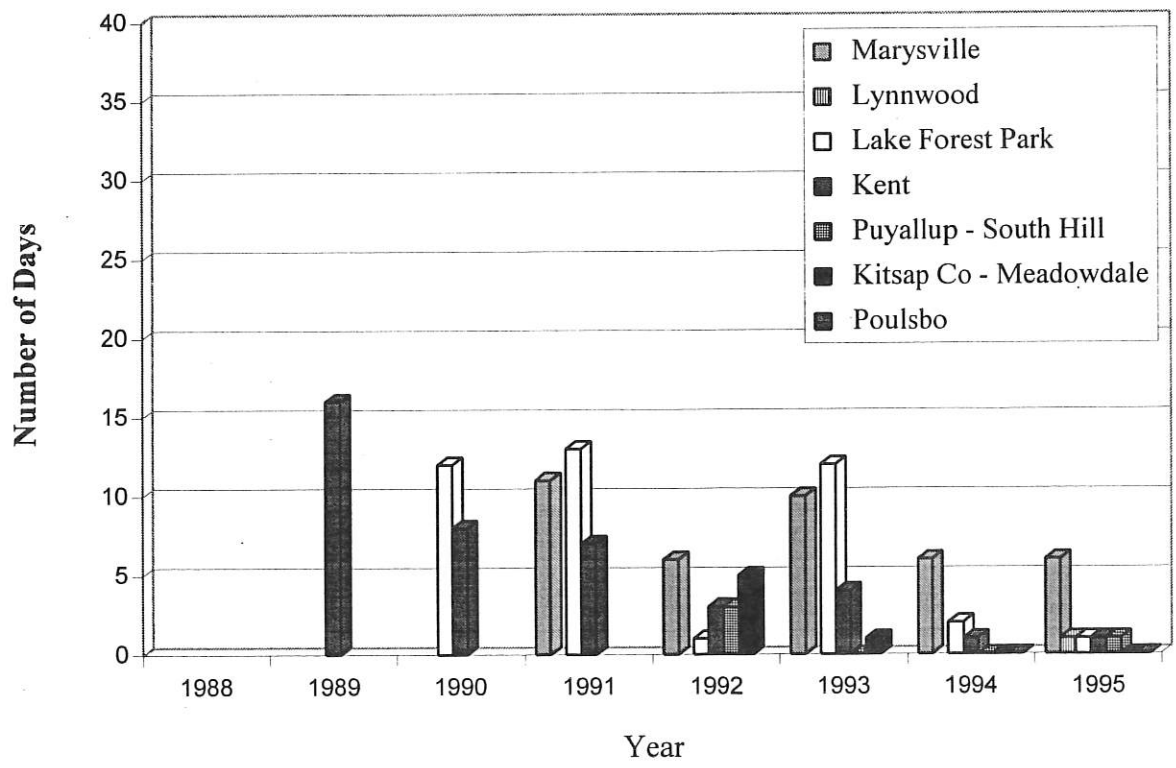
PM10

Number of Daily Values Greater than or Equal to 75 micrograms per cubic meter
(Washington State "Impaired Air Quality" Trigger Level = 75 $\mu g/m^3$)

Industrial Sites



Wood Smoke Sites



PARTICULATE MATTER (PM_{10})

Micrograms per Standard Cubic Meter

Sampling Method: Reference - **Hi Vol ANDERSEN/GMW 1200** Quartz Fiber filters

1995

Location	Number of Values	Quarterly Arithmetic Averages				Year Arith Mean
		1st	2nd	3rd	4th	
Marysville JHS, 1605 7th St, Marysville, Wa	201	31.1	17.4	17.6	22.0	22.0
Hoyt Ave & 26th St, Everett, Wa	59	18.1	17.7	16.2	15.3	16.8
20935 59th Place West, Lynnwood, Wa	61	22.7	12.5	12.9	16.7	16.2
504 Bellevue Way NE, Bellevue, Wa	61	19.0	14.8	14.7	15.2	15.9
17711 Ballinger Way NE, Lake Forest Park, Wa	298	26.8	15.9	15.6	23.2	20.4
Harbor Island, 3400 13th Ave SW, Seattle, Wa	58	33.0	22.2	23.0	24.9	25.8
Duwamish, 4752 E Marginal Way S, Seattle, Wa	354	37.5	22.1	23.8	29.9	28.3
South Park, 723 S Concord St, Seattle, Wa	59	28.3	19.5	18.5	19.4	21.4
James St & Central Ave, Kent, Wa	300	25.4	21.1	23.4	23.4	23.3
South Hill, 9616 128th St E, Puyallup, Wa	61	25.7	16.3	16.4	19.6	19.5
27th St NE & 54th Ave NE, Northeast Tacoma, Wa	59	16.9	19.5	18.7	17.2	18.1
2301 Alexander Ave, Tacoma, Wa	121	30.9	21.7	25.8	24.9	25.8
Fire Station #12, 2316 E 11th St, Tacoma, Wa	354	34.3	22.5	23.4	28.2	27.1
Meadowdale, 7252 Blackbird Dr NE, KitsapCo, Wa	61	27.8	15.6	14.6	24.1	20.5
Lions Park, 6th Ave NE & Fjord Dr, Poulsbo, Wa	61	18.7	14.7	12.5	14.4	15.1

Notes

(1) Nationally scheduled particulate matter sampling occurs each sixth day. Quarterly averages are shown only when at least one data value exists for 75 percent or more of the six day intervals.

(2) Annual averages are shown only if there are at least three quarterly averages.

Summary of Maximum and 2nd High Observed Concentrations

Location	Jan 3 Tue	Jan 5 Thu	Jan 6 Fri	Jan 25 Wed	Jan 27 Fri	Feb 8 Wed	Mar 28 Tue	May 15 Mon	Sep 12 Tue	Sep 24 Sun	Dec 6 Wed	Dec 23 Sat	Dec 25 Mon	Dec 26 Tue
Marysville JHS, 1605 7th St, Marysville, Wa	88	-	89	-										
Hoyt Ave & 26th St, Everett, Wa	-	-	-	-			36			33	-		-	-
20935 59th Place West, Lynnwood, Wa	86	-	-	-							-	40	-	-
504 Bellevue Way NE, Bellevue, Wa	47	-	-	-		36					-		-	-
17711 Ballinger Way NE, Lake Forest Park, Wa	72												87	-
Harbor Island, 3400 13th Ave SW, Seattle, Wa	77	-	-	-	45						-		-	-
Duwamish, 4752 E Marginal Way S, Seattle, Wa	123	117												-
South Park, 723 S Concord St, Seattle, Wa	75	-	-	-			52				-		-	-
James St & Central Ave, Kent, Wa				75							70		70	-
South Hill, 9616 128th St E, Puyallup, Wa	88	-	-	-							-	58	-	-
27th St NE & 54th Ave NE, Northeast Tacoma, Wa		-	-	-				33	34	33	-		-	-
2301 Alexander Ave, Tacoma, Wa	92	-		-							-		-	76
Fire Station #12, 2316 E 11th St, Tacoma, Wa	116	94												-
Meadowdale, 7252 Blackbird Dr NE, KitsapCo, Wa	73	-	-	-							-	65	-	-
Lions Park, 6th Ave NE & Fjord Dr, Poulsbo, Wa	45	-	-	-	34						-		-	-

- Indicates no sample on specified day

Summary of Observations Equal To or Greater Than 75

Location	Jan 3 Tue	Jan 4 Wed	Jan 5 Thu	Jan 6 Fri	Jan 23 Mon	Jan 24 Tue	Jan 25 Wed	Feb 9 Thu	Mar 30 Thu	Dec 6 Wed	Dec 25 Mon	Dec 26 Tue	Dec 27 Wed
Marysville JHS, 1605 7th St, Marysville, Wa	88	75	-	89	76	80	-	-	-			81	-
20935 59th Place W, Lynnwood, Wa	86	-	-	-	-	-	-	-	-	-	-	-	-
17711 Ballinger Way NE, Lake Forest Park, Wa											87	-	
Harbor Island, 3400 13th Ave SW, Seattle, Wa	77	-	-	-	-	-	-	-	-	-	-	-	-
Duwamish, 4752 E Marginal Way S, Seattle, Wa	123	115	117	84			86	91	80			-	
South Park, 723 S Concord St, Seattle, Wa	75	-	-	-	-	-	-	-	-	-	-	-	-
James St & Central Ave, Kent, Wa							75		-			-	
South Hill, 9616 128th St E, Puyallup, Wa	88	-	-	-	-	-	-	-	-	-	-	-	-
2301 Alexander Ave, Tacoma, Wa	92	-	-		-		-	-	-	-	-	76	-
Fire Station #12, 2316 E 11th St, Tacoma, Wa	116	87	94		78		90			82		-	78

- Indicates no sample on specified day

PARTICULATE MATTER (PM_{10})

Micrograms per Standard Cubic Meter

Sampling Method: Equivalent - **BetaAtten ANDERSEN FH62I-N** Glass Fiber strip

1995

Location	Number of Values	Quarterly Arithmetic Averages				Year Arith Mean
		1st	2nd	3rd	4th	
Marysville JHS, 1605 7th St, Marysville, Wa	359	29.5	18.9	19.9	22.0	22.6
17711 Ballinger Way NE, Lake Forest Park, Wa	360	23.6	14.9	15.0	19.9	18.4
Duwamish, 4752 E Marginal Way S, Seattle, Wa	365	36.3	24.8	25.6	29.6	29.1
James St & Central Ave, Kent, Wa	361	21.5	20.9	22.3	21.0	21.4
Fire Station #12, 2316 E 11th St, Tacoma, Wa	362	32.3	22.3	23.5	25.9	26.0

Notes

(1) At all stations PM_{10} was measured using the continuous 'beta ray attenuation' method.

Summary of Maximum and 2nd Highest Observed Concentrations

Location	Jan 3 Tue	Jan 4 Wed	Jan 5 Thu	Jan 6 Fri	Jan 25 Wed	Dec 25 Mon	Dec 26 Tue
Marysville JHS, 1605 7th St, Marysville, Wa	80			79			
17711 Ballinger Way NE, Lake Forest Park, Wa	62					71	
Duwamish, 4752 E Marginal Way S, Seattle, Wa	102	101	101				
James St & Central Ave, Kent, Wa					61		62
Fire Station #12, 2316 E 11th St, Tacoma, Wa	95		85				

Summary of Observations Equal To or Greater Than 75 Micrograms per Standard Cubic Meter

Location	Jan 3 Tue	Jan 4 Wed	Jan 5 Thu	Jan 6 Fri	Jan 23 Mon	Jan 24 Tue	Jan 25 Wed	Feb 9 Thu	Mar 30 Thu	Dec 26 Tue
Marysville JHS, 1605 7th St, Marysville, Wa	80			79		76	75			
Duwamish, 4752 E Marginal Way S, Seattle, Wa	102	101	101				77	81	82	83
Fire Station #12, 2316 E 11th St, Tacoma, Wa	95	75	85		76		78			

PARTICULATE MATTER (PM_{10})

Micrograms per Standard Cubic Meter

Sampling Method: Equiv - **Mass Transducer R&P TEOM 1400a** Tef-coat Glass Fiber

1995

Location	Number of Values	Quarterly Arithmetic Averages				Year Arith Mean
		1st	2nd	3rd	4th	
Marysville JHS, 1605 7th St, Marysville, Wa	362	27.7	15.9	17.6	19.0	20.1
20935 59th Pl W, Lynnwood, Wa	350	21.2	13.3	13.5	17.2	16.3
South Hill, 9616 128th St E, Puyallup, Wa	363	21.1	14.3	17.0	18.6	17.8
Meadowdale, 7252 Blackbird Dr NE, KitsapCo, Wa	358	20.6	12.8	14.2	18.0	16.4
Lions Park, 6th Ave NE & Fjord Dr, Poulsbo, Wa	356	17.8	14.1	14.1	15.5	15.4

Notes

(1) At all stations PM_{10} was measured using the continuous 'tapered element oscillating microbalance' method.

Summary of Maximum and 2nd Highest Observed Concentrations

Location	Jan 1 Sun	Jan 3 Tue	Jan 6 Fri	Jan 24 Tue	Jan 25 Wed	Dec 26 Tue
Marysville JHS, 1605 7th St, Marysville, Wa			80	79		
20935 59th Pl W, Lynnwood, Wa		77			73	
South Hill, 9616 128th St E, Puyallup, Wa		74				65
Meadowdale, 7252 Blackbird Dr NE, KitsapCo, Wa	63	56				-
Lions Park, 6th Ave NE & Fjord Dr, Poulsbo, Wa			42			48

- Indicates no sample on specified day

Summary of Observations Equal To or Greater Than 75 Micrograms per Standard Cubic Meter

Location	Jan 3 Tue	Jan 6 Fri	Jan 24 Tue
Marysville JHS, 1605 7th St, Marysville, Wa		80	79
20935 59th Place W, Lynnwood, Wa	77		

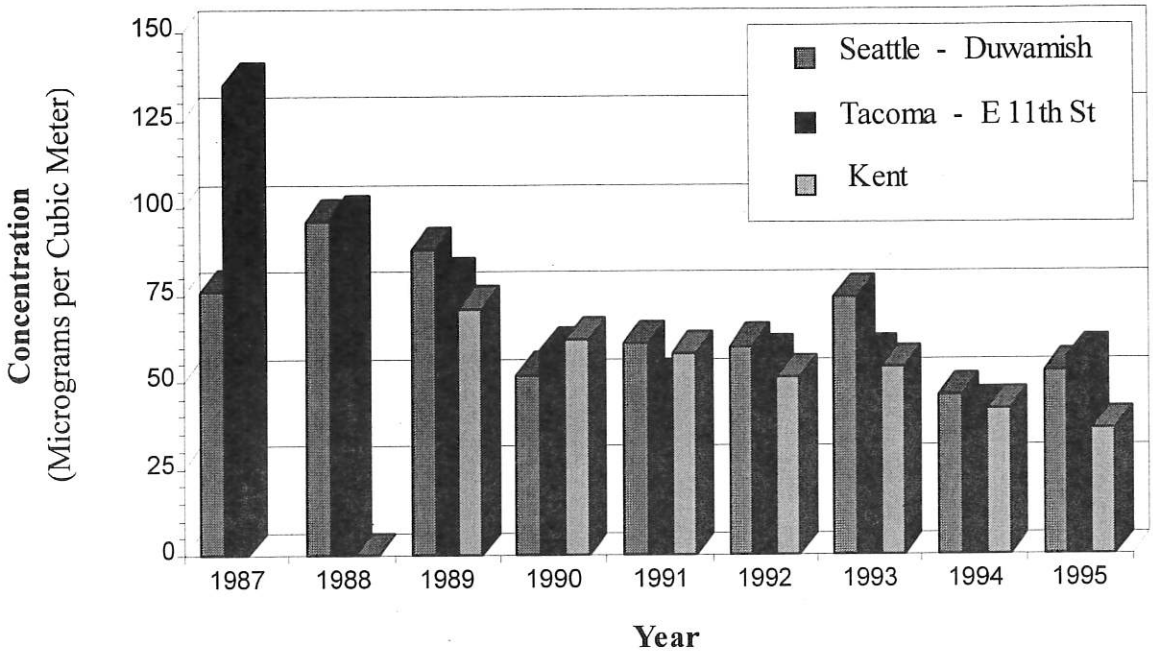
PM2.5

Particulate Matter $\leq$ 2.5 Micrometers

Sampling Method: Dichotomous Sampler - SA244e Teflon Filters

PM2.5

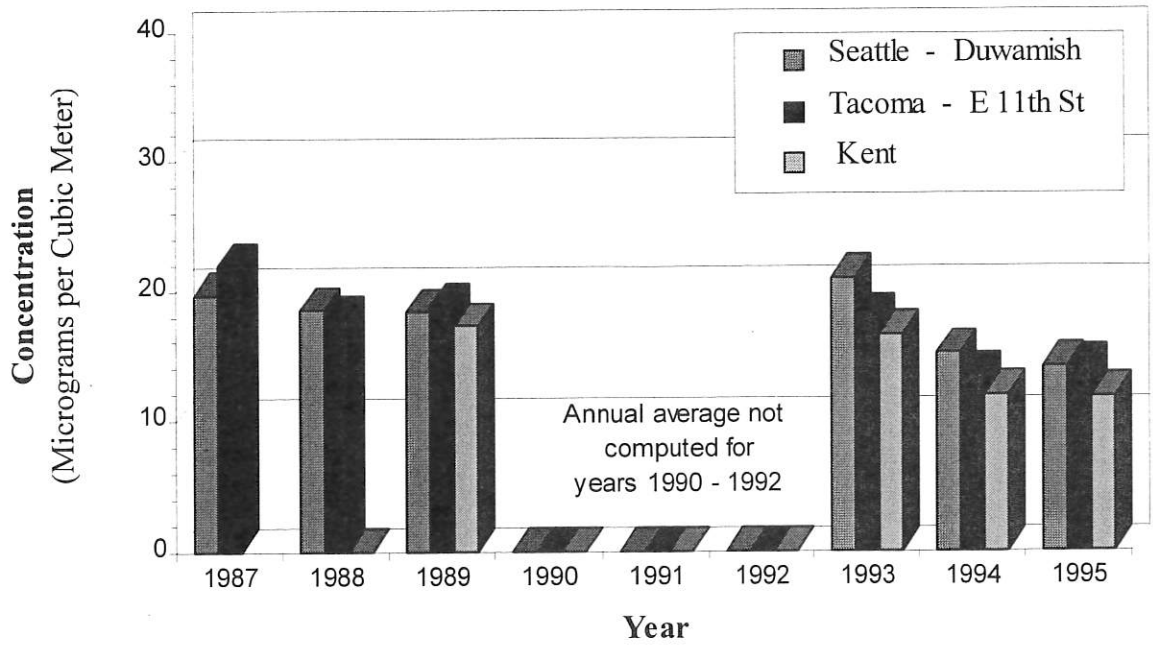
Maximum Daily Values



Note: In years 1990 - 1992 no sampling occurred during months April through September

PM2.5

Annual Arithmetic Averages



PARTICULATE MATTER (PM2.5)

Micrograms per Standard Cubic Meter

Sampling Method: **Dichotomous Sampler - SA244E** Teflon filters

1995

Location	Number of Values	Quarterly Arithmetic Averages				Year Arith Mean
		1st	2nd	3rd	4th	
Duwamish, 4752 E Marginal Way S, Seattle, Wa	121	17.9	11.3	11.1	15.9	14.1
James St & Central Ave, Kent, Wa	121	14.2	9.5	10.3	13.0	11.8
Fire Station #12, 2316 E 11th St, Tacoma, Wa	123	18.2	9.9	11.5	16.3	14.0

Notes

(1) Nationally scheduled particulate matter sampling occurs each sixth day. Quarterly averages are shown only when at least one data value exists for 75 percent or more of the six day intervals.

(2) Annual averages are shown only if there are at least three quarterly averages.

Summary of Maximum and 2nd Highest Observed Concentrations

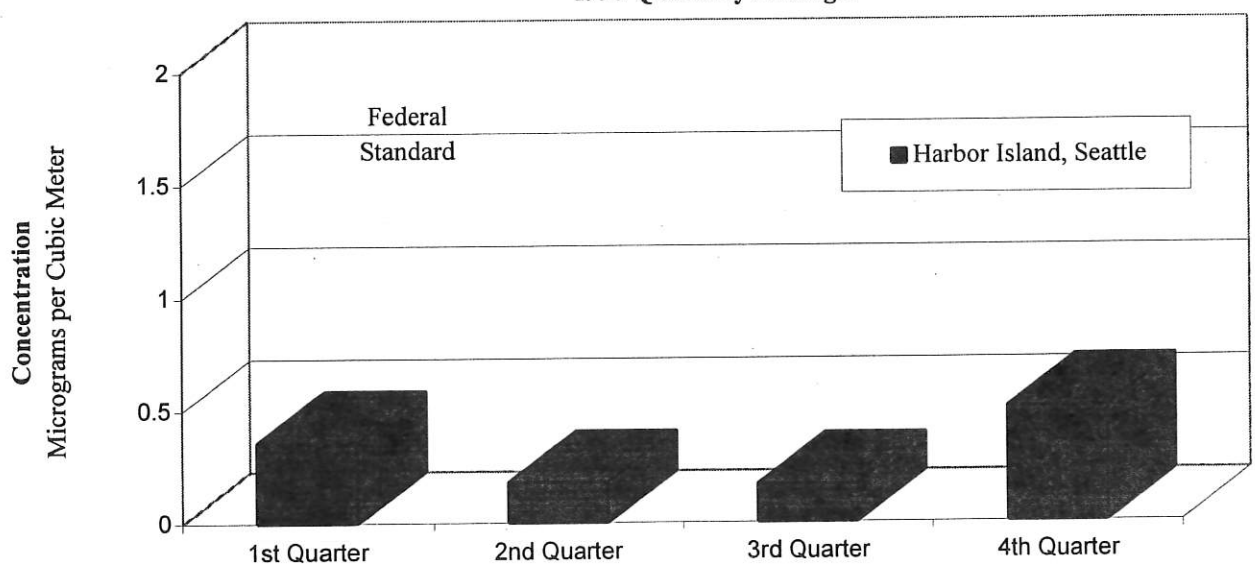
Location	Jan 3 Tue	Jan 5 Thu	Dec 7 Thu
Duwamish, 4752 E Marginal Way S, Seattle, Wa	53	52	
James St & Central Ave, Kent, Wa		36	34
Fire Station #12, 2316 E 11th St, Tacoma, Wa	57		53

Summary of Observations Equal To or Greater Than 35 Micrograms per Standard Cubic Meter

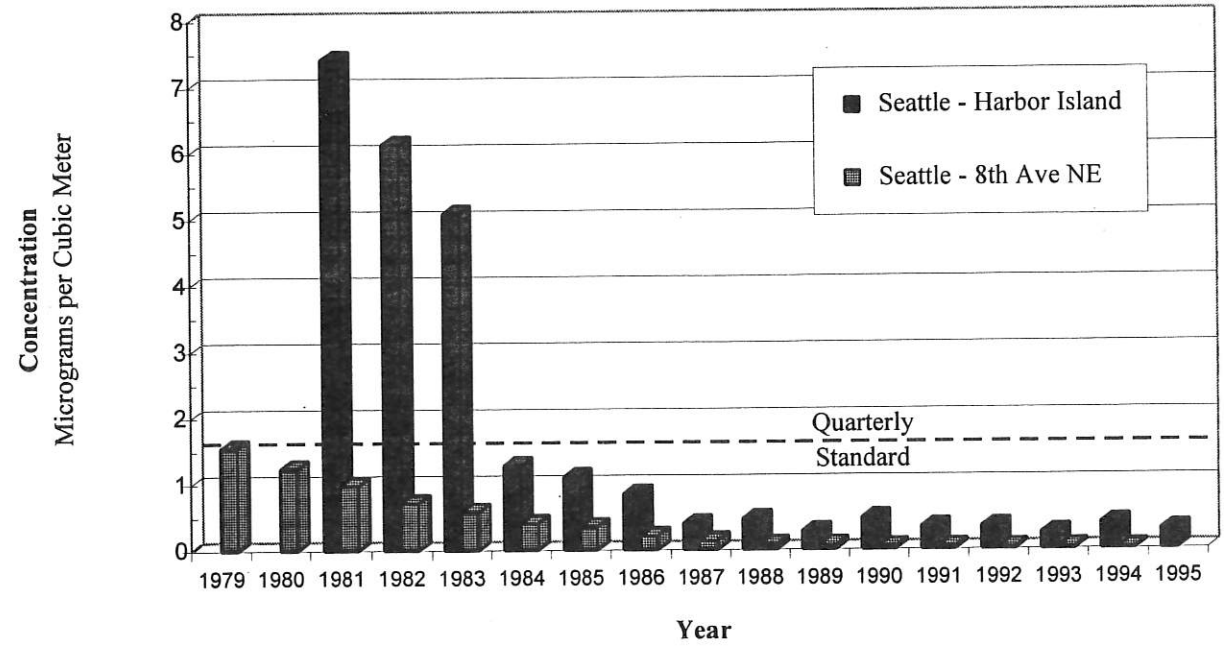
Location	Jan 3 Tue	Jan 5 Thu	Jan 24 Tue	Nov 21 Tue	Dec 7 Thu	Dec 23 Sat
Duwamish, 4752 E Marginal Way S, Seattle, Wa	53	52				
James St & Central Ave, Kent, Wa		36				
Fire Station #12, 2316 E 11th St, Tacoma, Wa	57	47	38	35	53	40

The ambient air quality standard for lead is 1.5 $\mu g/m^3$ averaged over one calendar quarter. The Puget Sound Region fully complies with this standard as shown by 1995 data in the chart below. In the past, urban area lead levels violated the standard near high traffic roadways due principally to automobile exhaust. However, the current ambient lead levels near these roadways are now significantly lower as a result of the reduced amount of lead in gasoline. This is shown below for the Puget Sound Region where the freeway site at 5701 8th Ave NE (site discontinued July 1994) documented that the lead concentration was about 2 percent of the standard in 1994. This compares to a level that was 116 percent of the standard at this site in 1979. Lead emissions come also from stationary industrial sources such as primary and secondary nonferrous smelters. The Harbor Island station in the table below is located just across the street from the site of a secondary lead smelter. The lead levels at this station reached 34 percent of the standard in 1995 and continue to document some effect of past emissions from this lead smelter.

1995 Quarterly Averages



Long Term Trend



LEAD

Micrograms per Standard Cubic Meter
Sampling Method: Standard High Volume Quartz Fiber filters

1995

Location	Monthly Arithmetic Averages												No. of Obs	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Harbor Island, 2555 13th Ave SW, Seattle, Wa	.60	.43	.06	.11	.21	.22	.22	.22	.06	.47	.62	.44	59	.30

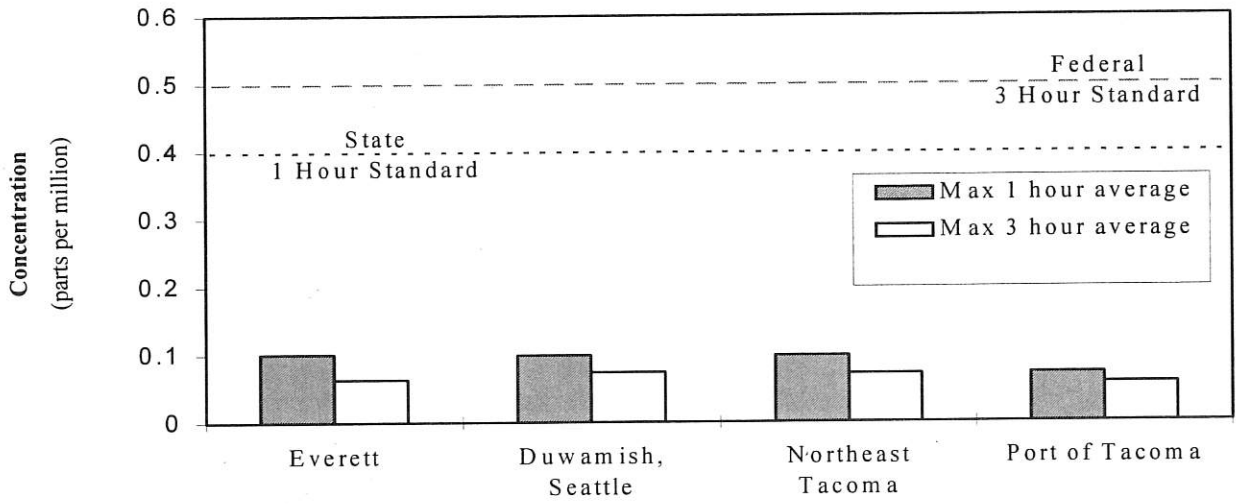
Location	Quarterly Arithmetic Averages			
	1st	2nd	3rd	4th
Harbor Island, 2555 13th Ave SW, Seattle, Wa	.36	.18	.17	.51

Summary of Individual 24 Hour Average Lead Values				
Location	Highest Value		Values Higher than .50	
	Value	Date	Value	Date
Harbor Island, 2555 13th Ave SW, Seattle, Wa	1.67	3 Jan	1.67	3 Jan
			1.40	29 Nov
			1.30	29 Dec
			1.20	14 Feb
			1.10	11 Nov
			.80	12 Oct
			.77	9 Jan
			.76	6 Oct
			.73	20 Jun
			.69	2 Feb
			.68	7 Aug
			.53	24 Oct
			.51	26 Jul

Sulfur dioxide is a common air pollutant regulated under a national standard. Local sulfur dioxide standards have been in effect since 1968. The national, state and local sulfur dioxide standards are summarized in the back of the summary.. Sulfur dioxide enters the air mainly from industrial processes and from the combustion of sulfur-containing fuels such as coal and oil. In the Puget Sound Region, the four main industrial areas with sulfur dioxide point sources are the Everett Port area, Seattle Harbor Island-Duwamish Valley area, Tacoma Port area and the Bremerton Naval Shipyard. Reactions in the air partially convert sulfur dioxide to other sulfur compounds such as sulfuric acid and various sulfate salts. In the Puget Sound area the ASARCO smelter at Point Defiance was the principal sulfur dioxide source, but the smelter permanently ceased copper smelting in March, 1985. During the last eight years, only one high sulfur dioxide concentration (measured in 1994 at the Everett station) exceeded the State 0.40 ppm hour average standard. There is no federal one hour standard. This case of high ambient sulfur dioxide was caused by emissions from the paper company located on the waterfront just to the west of the monitoring station. The charts below summarize sulfur dioxide data collected during 1995 and show that the Puget Sound Region continues to comply with all federal sulfur dioxide standards.

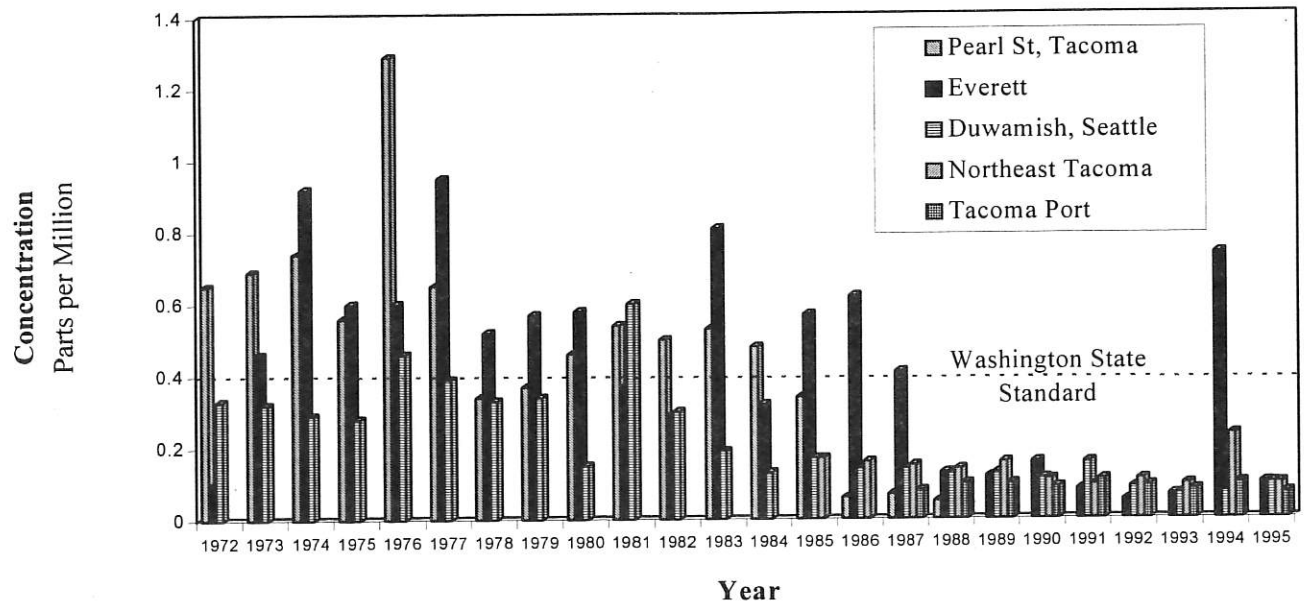
Sulfur Dioxide

1995 Maximum Concentrations



Long Term Trend

Maximum 1 Hour Concentration



SULFUR DIOXIDE
(Parts per Million)
1995

Monthly and Annual Arithmetic Averages

Location	Monthly Arithmetic Averages												No of 1 Hour Samples	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hoyt Ave & 26th St, Everett, Wa	.005	.005	.005	.006	.005	.005	.006	.004	.004	.003	.003	.002	8397	.004
Duwamish, 4752 E Marginal Way S, Seattle, Wa	.008	.005	.006	.006	.005	.008	.007	.005	.006	.007	.008	.006	8645	.006
27th St NE & 54th Ave NE, Northeast Tacoma, Wa	.007	.006	.006	.004	.003	.004	.004	.005	.007	.007	.008	.008	8589	.006
2301 Alexander Ave, Tacoma, Wa	.008	.006	.002	.004	.005	.005	.006	.005	.007	.006	.006	.007	8594	.006

Maximum and 2nd High Concentration for Various Averaging Periods

Location / Continuous Sampling Periods(s)	1 Hour Average			3 Hour Average			24 Hour Average		
	Value	Date	End Time	Value	Date	End Time	Value	Date	End Time
Hoyt Ave & 26th St, Everett, Wa	.101	15 May	1400	.063	25 Apr	2000	.017	26 Apr	1400
1 Jan-31 Dec	.080	25 Apr	1800	.050	22 Apr	1500	.016	23 Apr	1200
Duwamish, 4752 E Marginal Way S, Seattle, Wa	.099	18 Jun	1700	.074	16 Jun	2100	.021	16 May	2400
1 Jan-31 Dec	.090	16 Jun	1900	.066	24 Jul	0100	.021	4 Jan	1000
27th St NE & 54th Ave NE, Northeast Tacoma, Wa	.098	15 Sep	0300	.071	15 Sep	0500	.028	24 Sep	0200
1 Jan-31 Dec	.092	24 Dec	0400	.068	30 Mar	0500	.027	6 Jan	0900
2301 Alexander Ave, Tacoma, Wa	.072	1 Jan	1500	.057	1 Jan	1500	.021	2 Jan	1100
1 Jan-31 Dec	.072	4 Jan	1300	.052	4 Jan	1300	.019	25 Dec	2400

Notes
(1) Ending times are reported in Pacific Standard Time.
(2) For equal concentration values the date and time refer to the earliest occurrences.
(3) Continuous sampling periods are those with fewer than 10 consecutive days of missing data.
(4) At all stations sulfur dioxide was measured using the continuous ultraviolet fluorescence method.

CARBON MONOXIDE

Introduction

As a group, motor vehicles emit more carbon monoxide than any other source. For Puget Sound Region cities, motor vehicles contribute significantly in all cases of high carbon monoxide ambient levels.

The occasions with high ambient levels of carbon monoxide occur mainly during autumn and winter months near congested motor vehicle traffic. Traffic congestion occurs with afternoon commuting and increased shopping during holidays. Stable weather and light wind often exist during periods when levels are high. This weather condition temporarily reduces the means to disperse carbon monoxide that is emitted into the air.

Summary of 1995 Data

The table in this section summarizes the six highest 1 hour and 8 hour average carbon monoxide levels at each station during 1995 as obtained from Department of Ecology data summaries. The Federal regulation, (40 CFR Part 50), directs that comparison of the data with the standards (in ppm) be made in terms of integers with fractional parts of 0.5 or greater rounding up. Further, the ambient concentration at a site shall not exceed the level of the standard more than once per year.

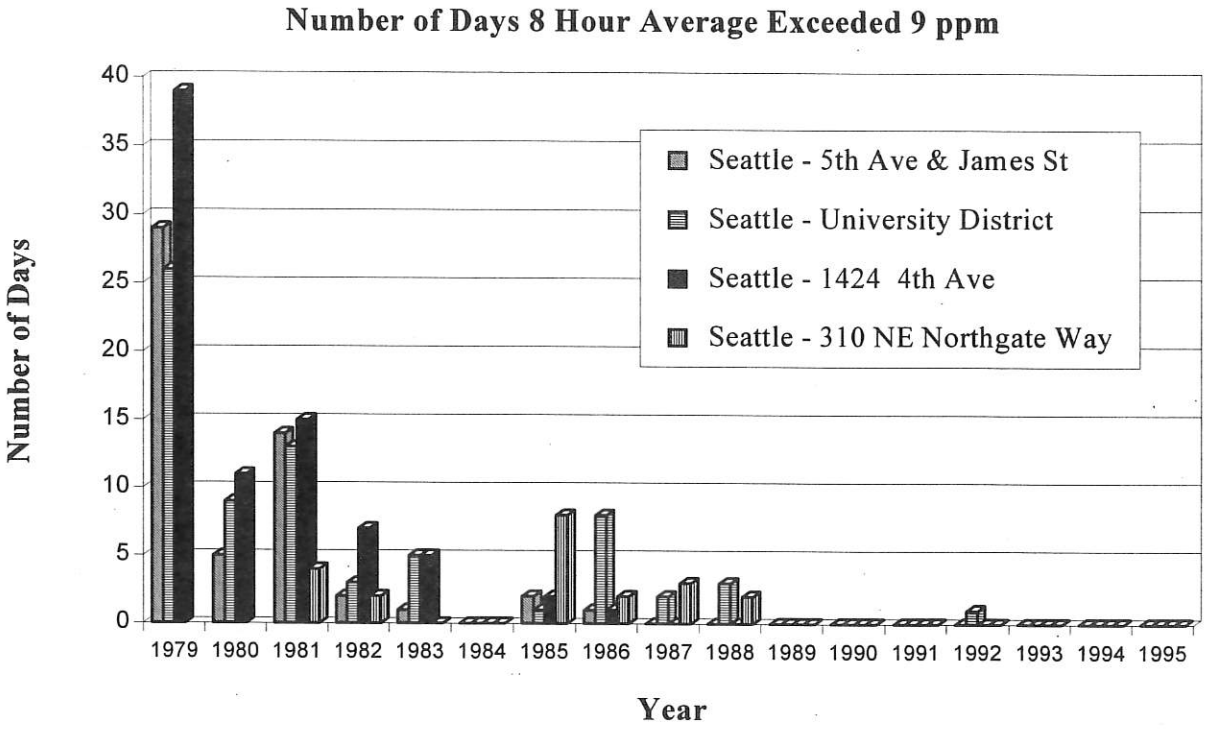
The only station to exceed the level of the 8 hour average standard was the Bellevue NE 8th Street location where a value of 9.7 ppm was measured the evening of January 4. Since this occurred only once at this location during the year, none of the stations in the Puget Sound Region violated the 8 hour average standard during 1995. The 1 hour standard continues to be easily achieved everywhere.

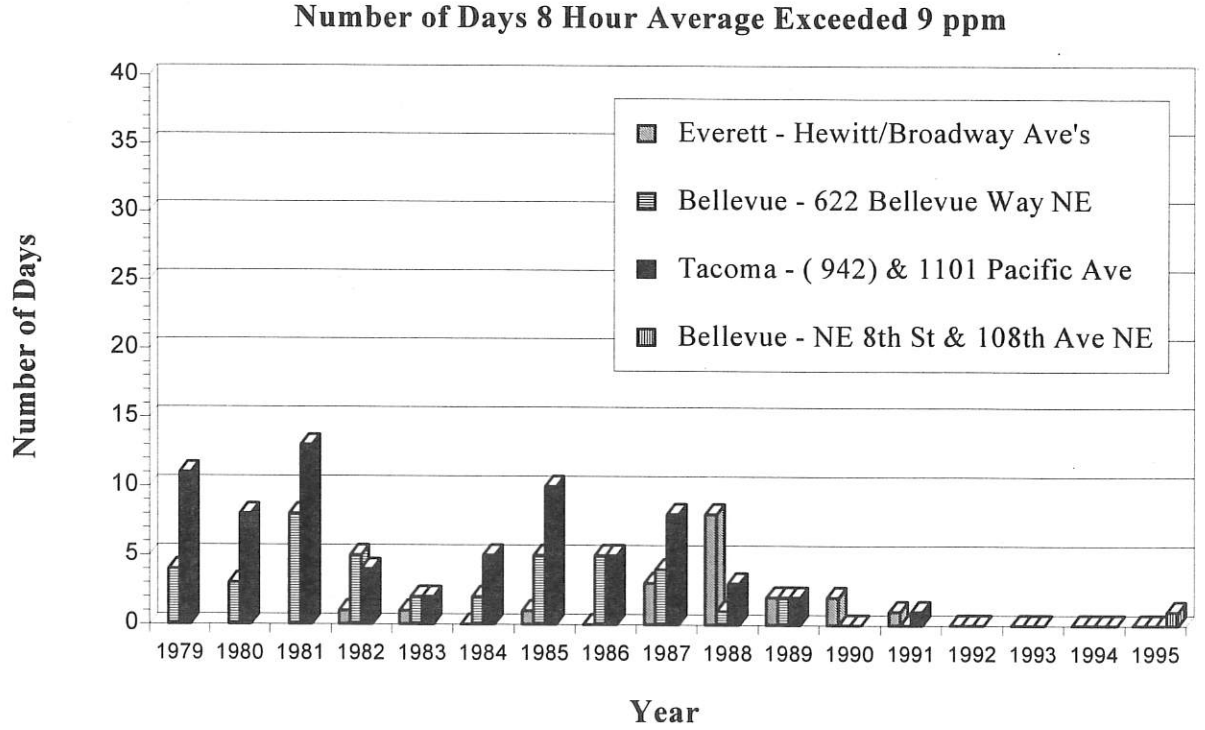
Multi-Year Summary

Multi-year graphs for carbon monoxide present column charts to show the historical trend. For the longest term sampling sites in the cities of Seattle, Everett, Bellevue and Tacoma, one chart shows the number of days on which the 8 hour average exceeded 9 ppm for each year from 1979 to 1995. A companion chart graphs the value that was the second highest 8 hour average for each of those years. If the second highest 8 hour average equals or exceeds 9.5 ppm, this violates the standard.

For all cities, the data acquired since 1979 shows that carbon monoxide values have improved, though there is some variability from year to year. As documented in previous annual data summaries, the first complete year of carbon monoxide data for the Seattle 5th Avenue and James Street station was 1972. The results at this station have improved from exceeding the primary standard 112 days in 1972 and 130 days in 1973, to zero exceedances during 1987 through 1995. The charts show that for the last five years, 1991 through 1995, the carbon monoxide levels throughout the Puget Sound Region have achieved the standards.

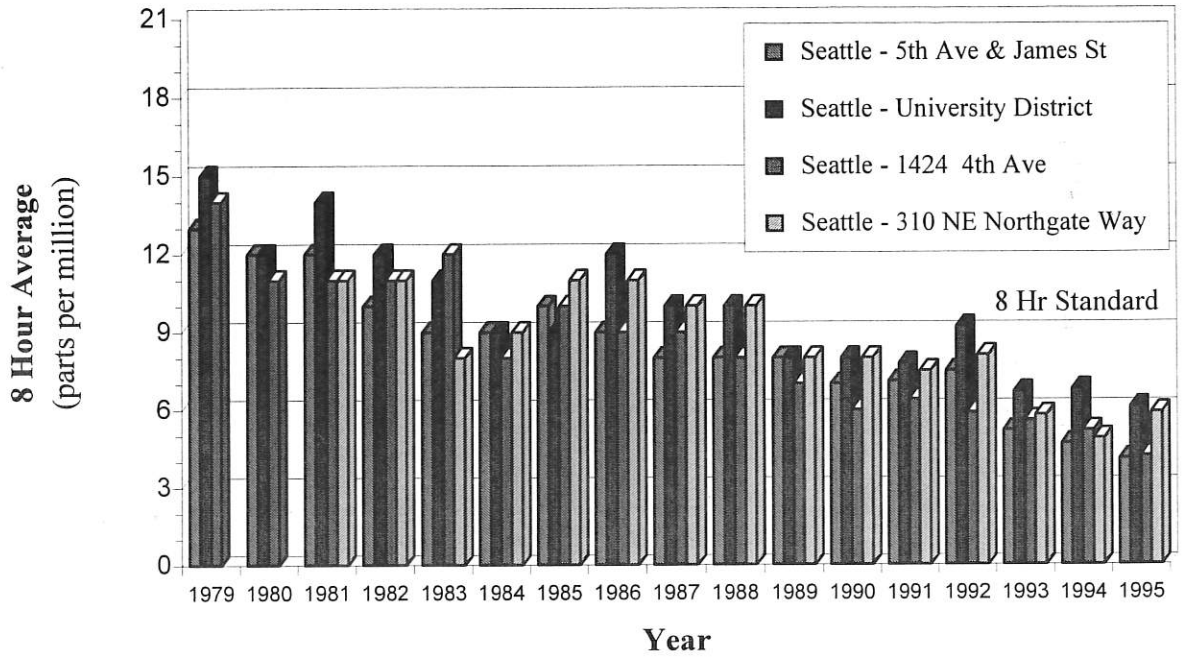
The significant improvement from levels in the mid 1970's is due mainly to the Federal emission standards for new motor vehicles and to the program requiring regular testing of vehicle emissions to assure compliance with these standards. Since November 1992, the requirement that only oxygenated gasoline be dispensed during the four months from November through February has also reduced carbon monoxide emissions.


Number of Days 8 Hour Average Exceeded 9 ppm
Number of Days
40
35
30
25
20
15
10
5
0
Seattle - 5th Ave & James St
Seattle - University District
Seattle - 1424 4th Ave
Seattle - 310 NE Northgate Way
1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995
Year

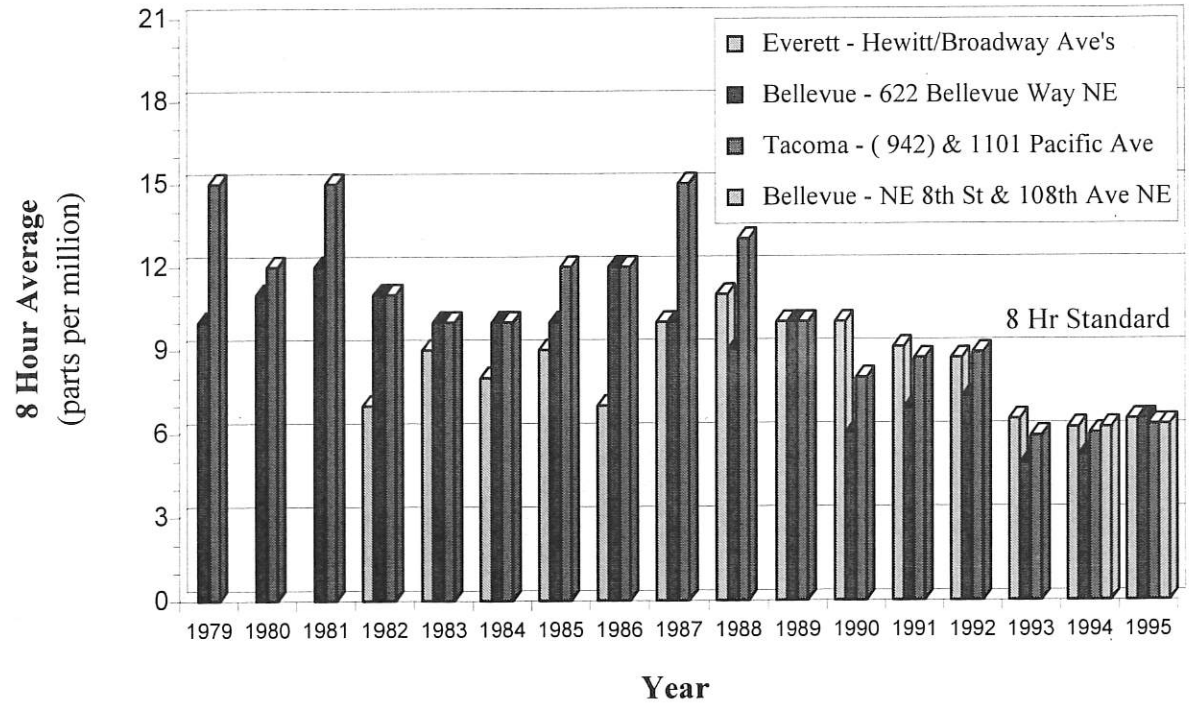

Number of Days 8 Hour Average Exceeded 9 ppm
Number of Days
40
35
30
25
20
15
10
5
0
Everett - Hewitt/Broadway Ave's
Bellevue - 622 Bellevue Way NE
Tacoma - (942) & 1101 Pacific Ave
Bellevue - NE 8th St & 108th Ave NE
1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995
Year

CARBON MONOXIDE

Second High 8 Hour Average



Second High 8 Hour Average



CARBON MONOXIDE

(Parts per Million)

1995

Location / Continuous Sampling Period(s)	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		
Broadway & Hewitt Ave, Everett, Wa	13.2	3 Jan	1800	6.5	3 Jan	2100	0	0
1 Jan-31 Dec	11.7	5 Jan	1900	6.5	7 Jul	1700		
	11.2	27 Jan	1800	6.0	22 Dec	2000		
	10.5	7 Jul	1400	5.7	6 Jan	1800		
	10.1	25 Jan	0900	5.5	25 Jan	1400		
	10.0	6 Jan	1800	5.5	14 Nov	2200		
622 Bellevue Way NE, Bellevue, Wa	10.4	4 Jan	1900	6.9	4 Jan	2400	0	0
1 Jan-31 Dec	10.3	3 Jan	1900	6.5	5 Jan	2400		
	9.3	5 Jan	2000	6.0	26 Dec	2400		
	9.2	5 Jan	1900	5.8	3 Jan	2400		
	8.3	5 Jan	2100	5.1	23 Dec	0100		
	8.0	4 Jan	1800	5.1	24 Dec	0100		
NE 8th St & 108th Ave NE	12.2	4 Jan	1800	9.7	4 Jan	2400	1	1
Bellevue, Wa	11.6	4 Jan	1900	6.3	3 Jan	2400		
1 Jan-31 Dec	11.2	4 Jan	2100	6.2	22 Dec	0200		
	10.9	4 Jan	2000	5.9	5 Jan	2300		
	10.4	5 Jan	1900	5.7	4 Jan	1400		
	9.7	4 Jan	2200	5.7	23 Dec	0100		
Northgate, 310 NE Northgate Way	11.0	25 Jan	0900	6.1	26 Dec	2400	0	0
Seattle, Wa	10.3	4 Jan	0800	5.9	5 Jan	2400		
1 Jan-31 Dec	10.3	4 Jan	0900	5.8	25 Jan	1400		
	9.9	4 Jan	1000	5.7	4 Jan	1200		
	9.6	20 Nov	0900	5.3	25 Dec	2400		
	9.3	25 Jan	1000	5.2	25 Dec	0100		
University District, 1307 NE 45th St	12.7	6 Jun	0800	8.1	3 Jan	2400	0	0
Seattle, Wa	10.2	3 Jan	1800	6.1	17 Mar	1500		
1 Jan-31 Dec	10.0	3 Jan	2100	6.0	14 Nov	2400		
	9.7	14 Nov	2100	5.9	4 Jan	1500		
	9.6	1 Jan	0200	5.9	29 Mar	2400		
	9.5	21 Jan	2000	5.8	5 Jan	2400		
1424 4th Ave, Seattle, Wa	6.2	3 Jan	1800	5.2	3 Jan	2400	0	0
1 Jan-31 Dec	6.0	3 Jan	2100	4.2	21 Jan	2400		
	5.8	25 Jan	0900	4.0	22 Dec	1700		
	5.7	1 Jan	0400	3.9	6 Jan	2000		
	5.7	3 Jan	2000	3.9	10 Mar	2000		
	5.6	25 Jan	1800	3.9	20 Nov	1800		
5th Ave & James St, Seattle, Wa	6.6	6 Dec	1800	4.1	10 Mar	2000	0	0
1 Feb-31 Dec	6.3	8 Dec	1800	4.1	23 Sep	2300		
	6.2	21 Nov	1800	4.0	23 Feb	2100		
	5.9	10 Mar	1700	4.0	12 Apr	1800		
	5.9	29 Mar	1800	4.0	14 Nov	2400		
	5.9	5 Oct	1600	4.0	20 Nov	1900		
1101 Pacific Ave, Tacoma, Wa	10.6	23 Feb	1800	6.9	6 Jan	0100	0	0
1 Jan-31 Dec	10.5	21 Nov	1800	6.3	19 Dec	2400		
	9.8	19 Dec	1900	6.0	20 Dec	2300		
	9.6	5 Jan	1900	5.8	3 Jan	1300		
	8.9	19 Dec	1800	5.5	23 Feb	2300		
	8.8	20 Dec	1900	5.3	4 Jan	1300		
2909 Wheaton Way, Bremerton, Wa	9.2	3 Jan	1700	5.1	5 Jan	2300	0	0
1 Jan-31 Dec	8.1	6 Jan	1600	5.0	3 Jan	2300		
	7.9	3 Jan	1800	4.4	25 Jan	1400		
	7.5	5 Jan	1700	4.4	14 Nov	2300		
	6.7	25 Jan	0900	4.3	9 Jan	1800		
	6.4	9 Jan	1700	4.3	25 Jan	2300		

Notes

(1) All carbon monoxide stations operated by the Washington State Department of Ecology.
(2) Ending times are reported in Pacific Standard Time.
(3) For equal concentration values the date and time refer to the earliest occurrences.
(4) Continuous sampling periods are those with fewer than 10 consecutive days of missing data.
(5) At all stations carbon monoxide was measured using the continuous nondispersive infrared method.

Introduction

The principal oxidant found in photochemical smog is ozone, a very reactive form of oxygen. Most photochemical oxidants result from chemical reactions in the ambient air between nitrogen oxides and volatile organic compounds (VOC) that take place under intense sunlight. The highest ozone levels occur on hot summer afternoons, since this is the period of most intense radiant energy from sunlight. However, even with strong sunlight, ozone levels would be low without the precursor nitrogen oxide and VOC pollutants emitted from human activities.

On any given day the photochemical reactions continue for several hours and generally produce maximum ozone levels between noon and early evening at locations miles away from the sources of nitrogen oxides and VOC. Each day after nightfall the high ozone levels diminish because the photochemical effect ends.

In the Puget Sound Region the highest ozone levels occur from mid May to mid September on the few hot days favorable for significant photochemical activity. These high values develop when urban area emissions are trapped beneath a nighttime and morning temperature inversion followed during the day by very high temperatures. Light northerly winds often develop on these hot days. As a result, the highest ozone values normally occur south to southeast of the major cities or source areas.

The Ozone Standard and Pollutant Standards Index

The U. S. EPA has set the level of the ozone standard at a value of 0.12 ppm. A 1 hour average ozone value of 0.12 ppm is equivalent to 100 on the Pollutant Standards Index scale. According to the Federal regulation (40 CFR Part 50, Appendix H), the standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above 0.12 ppm is one day or less. Compliance is established for a monitoring site by averaging the number of days with an hour average above 0.12 ppm over the past three years to determine if this is less than or equal to one day.

The required ozone monitoring season in Washington state is the period from April 1 through October 31. If any data at a site during this season are missing and there are any days where the maximum hour average exceeds 0.12 ppm, the number of exceedance days must be increased by a fraction using the procedure in Appendix H.

As indicated, the higher ozone levels occur some distance downwind rather than in Everett, Seattle or Tacoma. For 1995, the maximum ozone Index value of 91, described as "moderate" on the Index, occurred July 1 at Enumclaw.

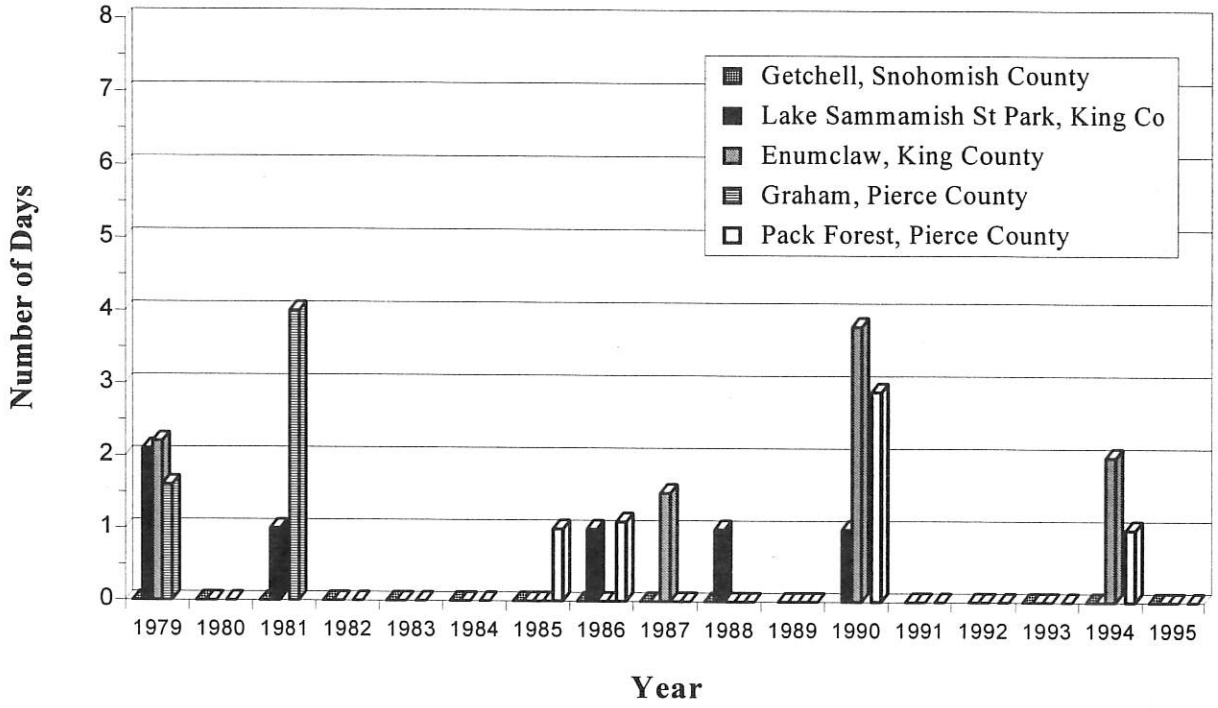
Summary of Data

The 1995 ozone summary table on the following page lists the six highest daily maximum 1 hour averages for each monitoring location. There were no exceedances of the ozone standard at any site during 1995. In 1994 there were two exceedances of the ozone standard at Enumclaw and one exceedance at La Grande. During 1993 there were no exceedances of the standard. The exceedances of the past three years combine to maintain these locations in compliance with the ozone standard. Therefore, all sites in the Puget Sound Region complied with the ozone standard at the end of 1995.

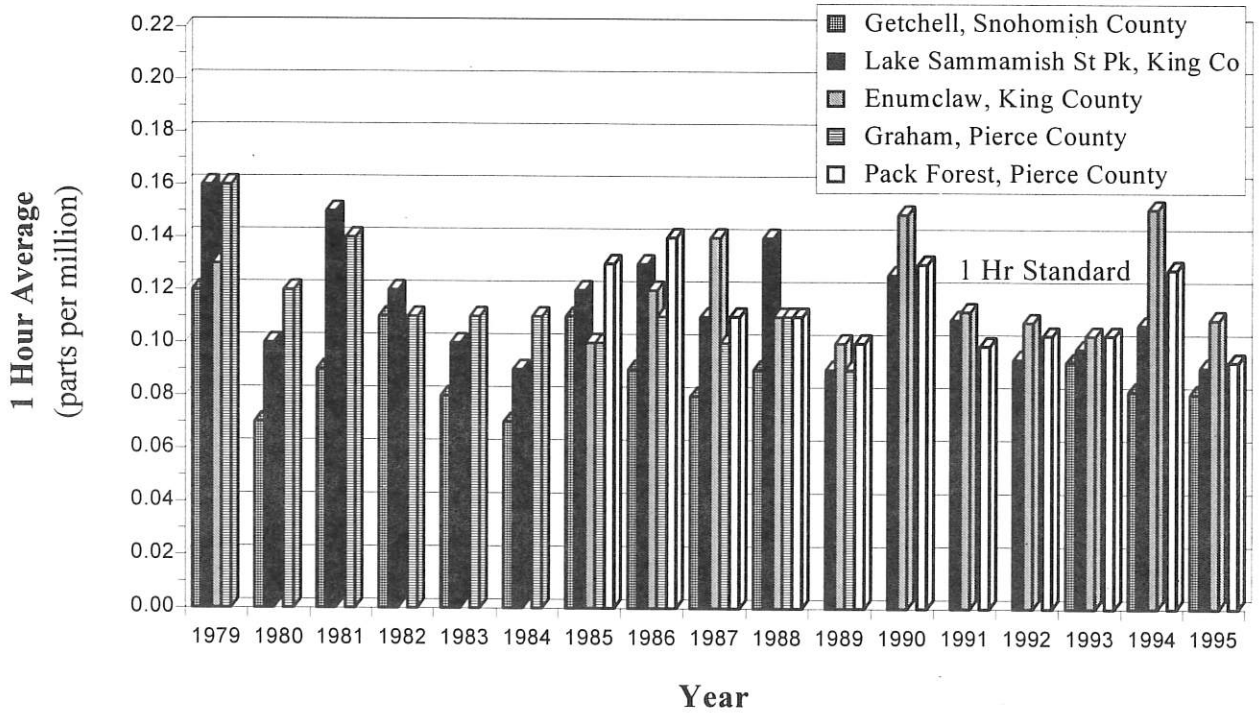
Graphs of ozone data for the years from 1979 through 1995 show the history. One column chart presents the number of days on which the 1 hour average exceeded 0.12 ppm for each year at the longer term monitoring sites in Snohomish, King and Pierce Counties. This chart shows two or more exceedances for the years 1979, 1981, 1990 and 1994. Nine of the other years in this period show zero exceedances. Four years (1985 - 1988) recorded just one exceedance at a site plus, in some cases, an added fraction due to missing data.

A companion chart shows the maximum 1 hour average at these locations. The highest 1 hour average of 0.16 ppm occurred at two sites in 1979 and values reached 0.15 ppm at one site in 1981, 1990 and 1994. These charts suggest that short periods favorable for producing ozone existed during the summers of 1979, 1981, 1990 and 1994; during the remaining twelve years the standard was less in jeopardy. There is no clear trend in the numbers; however, there is a risk of exceeding the level of the standard during any summer that experiences record hot temperatures that accelerate and drive the ozone producing photochemical reactions.

Number of Days 1 Hour Average Exceeded 0.12 ppm



Maximum 1 Hour Average



OZONE

(Parts per Million)
1995

Location / Continuous Sampling Period(s)	Six 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	1993	1994	1995	
Fire Station #22, 8426 99th Ave NE Getchell, Wa 1 Apr-31 Oct	.081 .079 .073 .068 .067 .065	29 Jun 1 Jul 30 Jun 28 Jun 18 Jul 24 May	1600 1400 1400 1500 1500 1600	0.0	0.0	0.0	0.0
20050 SE 56th Lake Sammamish State Park, Wa 1 Apr-31 Oct	.091 .087 .074 .074 .072 .072	19 Jul 1 Jul 29 Jun 17 Jul 30 Jun 18 Jul	1500 1500 1700 1500 1400 1500	0.0	0.0	0.0	0.0
Highway 410 2 miles east of Enumclaw, Wa 1 Apr-31 Oct	.109 .099 .090 .088 .085 .081	1 Jul 19 Jul 2 Sep 17 Jul 28 May 30 Jun	1700 1800 1500 1600 1600 1800	0.0	2.0	0.0	0.7
Charles L Pack Forest La Grande, Wa 1 Apr-31 Oct	.093 .089 .088 .087 .083 .082	19 Jul 30 Jun 17 Jul 29 May 28 Jun 2 Sep	1800 1700 1600 1600 1600 1500	0.0	1.0	0.0	0.3

Notes

(1) All ozone stations operated by the Washington State Department of Ecology.
(2) Ending times are reported in Pacific Standard Time.
(3) For equal concentration values the date and time refer to the earliest occurrences.
(4) Continuous sampling periods are those with fewer than 10 consecutive days of missing data.
(5) At all stations ozone was measured using the continuous ultraviolet photometric detection method.

AIR POLLUTION EPISODES and IMPAIRED AIR QUALITY PERIODS

Introduction

The policy and rules for air pollution episode avoidance and for restrictions on the use of solid fuel burning devices during periods of "impaired air quality" are established by the Washington Clean Air Act and implemented by state and local regulations. Legislative amendments significantly revised these rules effective in mid 1990.

Air Pollution Episodes

The Washington Clean Air Act defines air pollution episodes and the policy for establishing an avoidance plan in RCW 70.94.710 through 70.94.730. The Washington State Department of Ecology has adopted WAC 173-435 which implements an episode avoidance plan.

The "First" or "Forecast" stage of the Episode Plan may be declared by the Department of Ecology when an air stagnation advisory is issued by the National Weather Service or there is equivalent indication of stagnant atmospheric conditions and conditions are forecast to persist for 24 hours. During 1994, the Department of Ecology did not declare any stage of an air pollution episode in the Puget Sound Region.

Impaired Air Quality Periods

The Washington Clean Air Act defines two stages of "impaired air quality" in RCW 70.94.473. A *first stage* of "impaired air quality" is reached when PM10 is at an ambient level of 75 $\mu g/m^3$ measured on a 24 hour average or when carbon monoxide is at an ambient level of 8 ppm measured on an 8 hour average.

During a first stage of "impaired air quality", any person in a residence or commercial establishment which has an adequate source of heat without burning wood shall not burn wood in any solid fuel burning device except those certified as described in RCW 70.94.473 or a pellet stove either certified or issued an exemption by the U. S. Environmental Protection Agency.

A *second stage* of "impaired air quality" is reached when PM10 is at an ambient level of 105 $\mu g/m^3$ measured on a 24 hour average. When a second stage of "impaired air quality" is in effect, any person in a residence or commercial establishment which has an adequate source of heat without burning wood shall not burn wood in any solid fuel burning device.

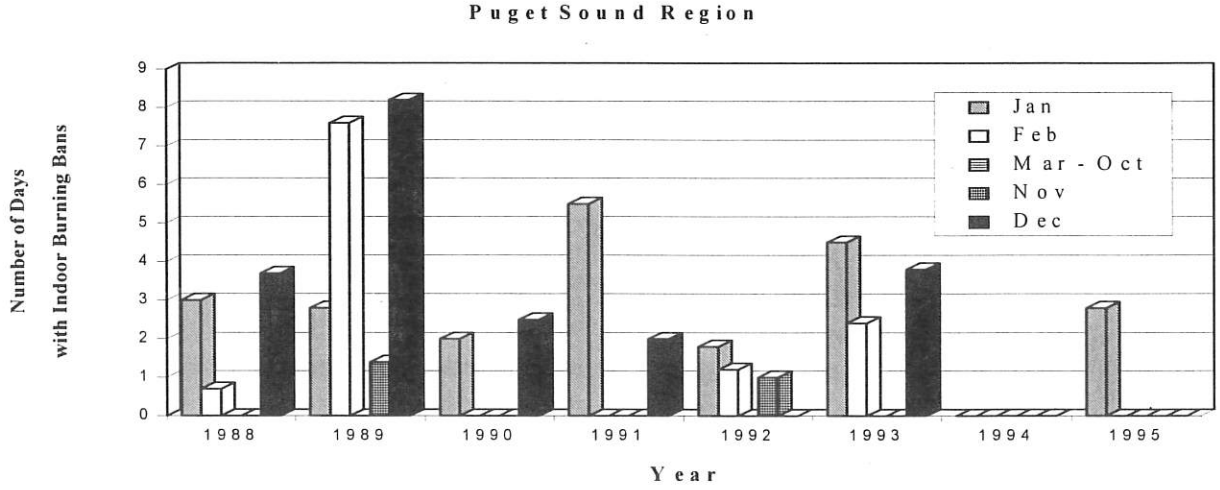
During 1995, "impaired air quality" was in effect in the Puget Sound Region as follows:

Stage	Dates/Counties
1	2:30 pm, Wednesday, January 4 - 9:00 am, Saturday, January 7; (King, Pierce & Snohomish)

Along with the restrictions on the use of solid fuel burning devices as outlined above, all outdoor fires are prohibited during any period of "impaired air quality".

Air Quality Impairment Chart

The following graph displays occurrences of air quality impairment beginning in January 1988 when indoor burning restrictions were first applied. The number of days is determined from the total number of hours of prohibited indoor burning divided by 24. Results for January, February, November and December are displayed individually. The March - October category shows that no burn bans have ever occurred during those spring through fall months.



QUALITY ASSURANCE

Introduction

Quality Assurance (QA) includes all activities involved with obtaining valid data and documenting the quality of the data. Quality Assurance 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.

The Agency participates in audit programs conducted independently by the U. S. Environmental Protection Agency and the Washington State Department of Ecology. For the EPA, this consists of (1) Agency participation in EPA's national performance audits, and (2) occasional on-site audits of some Agency monitoring equipment by EPA or a designated representative. Each quarter the Department of Ecology also independently performs audits on Agency monitoring equipment at various locations.

Precision and Accuracy Audits

The QA program requirements are established in Title 40, Code of Federal Regulations, Part 58. The important QA characteristics that 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.

At a minimum, each instrument measuring a pollutant at a location 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 is calculated.

Each calendar quarter the average and the standard deviation of these percentage differences are calculated. These two statistics are then pooled for all audits involving the same parameter.

Probability Limits

The Federal regulation requires summary of the precision and accuracy audit results by computing the 95 percent probability limits for each pollutant from the weighted average percentage difference, D, and the pooled standard deviation, S_a, as follows:

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

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

These upper and lower limits reflect data quality by establishing that, with 95 percent probability, the data values during the audit period fall within these limits. As an example, if the average of the percentage differences is zero and the standard deviation of the percentage differences is 4.1 percent, the upper and lower 95 percent probability limits are respectively +8 and -8 percent.

Agency Precision and Accuracy

For most Puget Sound Air Pollution Control Agency monitoring locations precision audits are performed each week and accuracy audits are completed each month or each quarter. The table following this page summarizes the precision and accuracy probability limits by quarter for all air monitoring data that the Agency originated in 1995.

For each parameter, the type of audit, (accuracy or precision), is followed by a brief phrase description of the audit process or the actual measurement point that is audited. The number of audits and the lower and upper probability limits (of percentage differences) are presented for each quarter.

Wind sensor audits report the quarterly audit of the direction system for the cardinal points and the speed system at two controlled rates of shaft rotation. The propeller turned by the wind at the specific rate (revolutions per minute) should report the wind speed (miles per hour) as shown.

DATA QUALITY ASSESSMENT
1995

Lower and Upper 95 Percent Probability Limits of Percent Differences

Parameter & Type of Audit	Number of Stations	*Audit Results by Quarter*											
		1st			*2nd*			*3rd*			*4th*		
		Number of Audits	Prob. Limits Lwr (%)	Prob. Limits Upr (%)	Number of Audits	Prob. Limits Lwr (%)	Prob. Limits Upr (%)	Number of Audits	Prob. Limits Lwr (%)	Prob. Limits Upr (%)	Number of Audits	Prob. Limits Lwr (%)	Prob. Limits Upr (%)
Particulate Matter (PM10) (Reference Method)	14												
Accuracy													
Flow Rate		110	-4	2	100	-5	4	101	-1	5	91	0	5
Precision													
Collocated Samples		23	-9	6	17	-6	3	18	-5	6	16	-5	4
Particulate Matter (PM10) (Equivalent Method)	8												
Accuracy													
Flow Rate		30	-3	4	30	-1	9	30	-1	9	30	-1	7
Particulate Matter (PM2.5) (Dichotomous Method)	3												
Accuracy													
Flow Rate		3	-5	6	3	3	7	4	-3	11	4	-3	12
Sulfur Dioxide	4												
Accuracy													
Level 1		14	-5	13	18	-3	12	12	-2	10	10	-1	9
Level 2		14	-3	9	18	-4	9	12	0	8	10	0	8
Level 3		14	-6	8	18	-4	7	12	-2	8	10	-2	7
Level 4		3	-2	4	8	-4	4	2	1	6	3	1	8
Precision													
One point check		53	-3	5	51	-3	7	50	-1	5	54	-4	6
Atmospheric Particles (Nephelometer)	3												
Precision													
One point check		40	-4	5	40	-4	5	38	-2	8	41	-5	3
Wind	12												
Direction													
Accuracy													
90 degrees (E)		12	0	1	12	0	0	12	-1	1	12	-1	1
180 degrees (S)		12	0	1	12	0	1	12	-1	1	12	0	1
270 degrees (W)		12	0	1	12	0	1	12	-1	1	12	0	1
360 degrees (N)		12	0	0	12	0	0	12	0	0	12	0	0
Speed													
Accuracy													
11.0 mph (1000 rpm)		12	-1	1	12	-1	1	12	0	0	13	-1	0
32.9 mph (3000 rpm)		12	0	0	12	0	0	12	0	0	13	0	0

WIND ANALYSIS

Wind Data

Everyone has a qualitative sense of surface wind and some effects produced by the wind. The wind direction helps to locate the sources or source areas affecting a specific location.

From an air pollution standpoint, low wind speed poorly dilutes pollutants and is therefore associated with higher ambient pollutant concentrations. During a stable, temperature inversion condition, the wind is often light or calm. When this condition persists, the natural process that effectively disperses pollutants is greatly diminished, and pollutant levels are higher near the source areas.

Wind Speed Averages

The table below presents monthly and annual average wind speed computed from hour average wind speed at various locations. These average values are sometimes used to compare locations or different months. Air stagnation episodes are not exposed by this analysis unless episode conditions predominate during most of a month.

Wind Roses

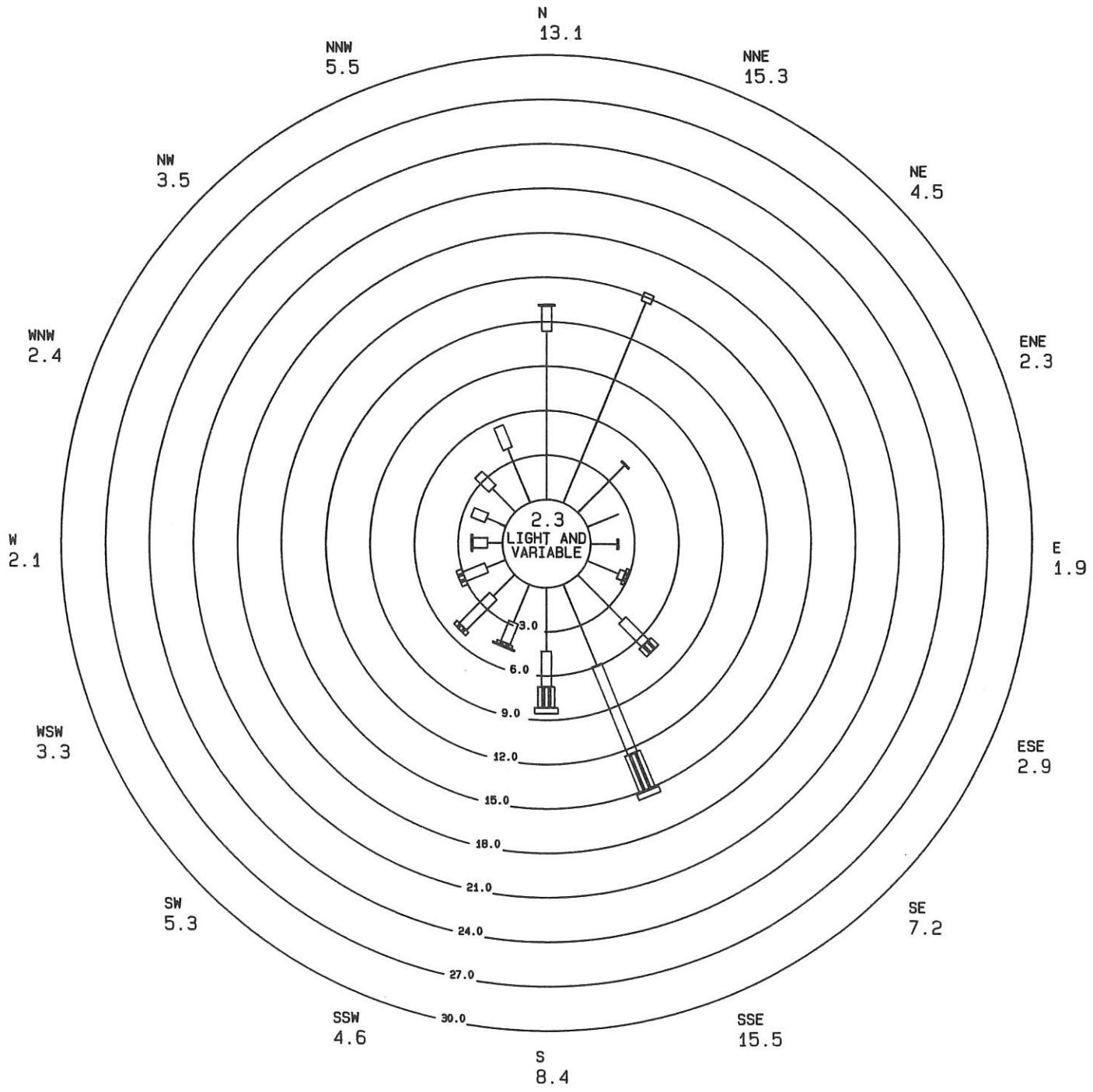
A wind rose is a quantitative graphical summary of the wind direction and speed for a given time. The following wind rose graphs show the number of observations or hours, expressed as a percentage, that had a particular direction and speed during the summary period.

The wind rose spokes or arms represent 16 points of the compass and are labeled by wind direction. The percentage of time the wind blew *from* a given direction (without regard to speed) is expressed numerically beneath that direction on the perimeter of each rose.

For a particular wind direction the length of each segment of a spoke represents the percentage of time the wind speed was within a specific speed interval. If summed for all wind directions, the result would provide the percentage of all hours the wind speed was measured within a particular interval. The percentage of time during which the wind was light and variable shows in the center of the rose.

WIND SPEED
(Miles per Hour)
1995

Location	Monthly Arithmetic Averages												No. of 1 Hour Samples	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Marysville JHS, 1605 7th St, Marysville, Wa	3.8	3.9	4.5	3.9	3.7	4.1	3.9	3.5	3.0	3.2	4.8	4.0	8727	3.9
Hoyt Ave & 26th St, Everett, Wa	5.2	4.9	5.0	4.5	4.6	4.7	4.4	4.2	3.9	4.5	5.4	5.4	8746	4.7
20935 59th Place W, Lynnwood, Wa	2.1	2.3	2.6	2.2	2.0	2.1	2.0	1.9	1.6	1.7	2.9	2.1	8754	2.1
17711 Ballinger Way NE, Lake Forest Park, Wa	2.2	2.5	3.1	2.9	2.4	2.6	2.6	2.3	2.2	2.3	3.5	2.4	8740	2.6
Duwamish, 4752 E Marginal Way S, Seattle, Wa	4.1	5.5	5.2	4.9	4.7	4.6	5.1	4.8	3.8	4.6	6.3	4.9	8725	4.9
James St & Central Ave, Kent, Wa	4.9	4.7	4.3	4.2	3.9	3.7	4.0	3.8	3.0	3.5	4.9	4.1	8750	4.1
South Hill, 9616 128th St E, Puyallup, Wa	2.0	2.5	2.8	2.7	2.2	2.3	2.3	2.3	1.7	2.4	3.6	2.3	8732	2.4
27th St NE & 54th Ave NE, Northeast Tacoma, Wa	4.0	5.0	4.2	3.6	3.3	3.3	3.2	3.2	2.9	3.4	4.2	3.5	8747	3.6
2301 Alexander Ave, Tacoma, Wa			3.3	5.2	5.4	5.5	5.8	5.5	4.2	5.0	5.7	4.4	7831	5.1
Fire Station #12, 2316 E 11th St, Tacoma, Wa	3.7	5.8	5.6	5.6	5.5	5.5	5.8	5.5	4.3	5.1	6.1	4.7	8652	5.3
Meadowdale, 7252 Blackbird Dr NE, Kitsap Co, Wa	1.7	2.3	2.3	1.9	2.0	2.0	2.1	1.8	1.7	1.9	2.8	1.8	8710	2.0
Lions Park, 6th Ave NE & Fjord Dr, Poulsbo, Wa	4.8	5.7	5.8	4.6	4.2	4.5	4.0	3.8	3.7	4.7	6.7	4.9	8742	4.8



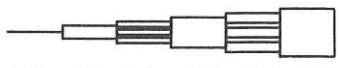
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Marysville JHS, 1605 7th St, Marysville, Wa

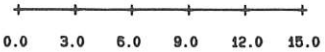
INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,727



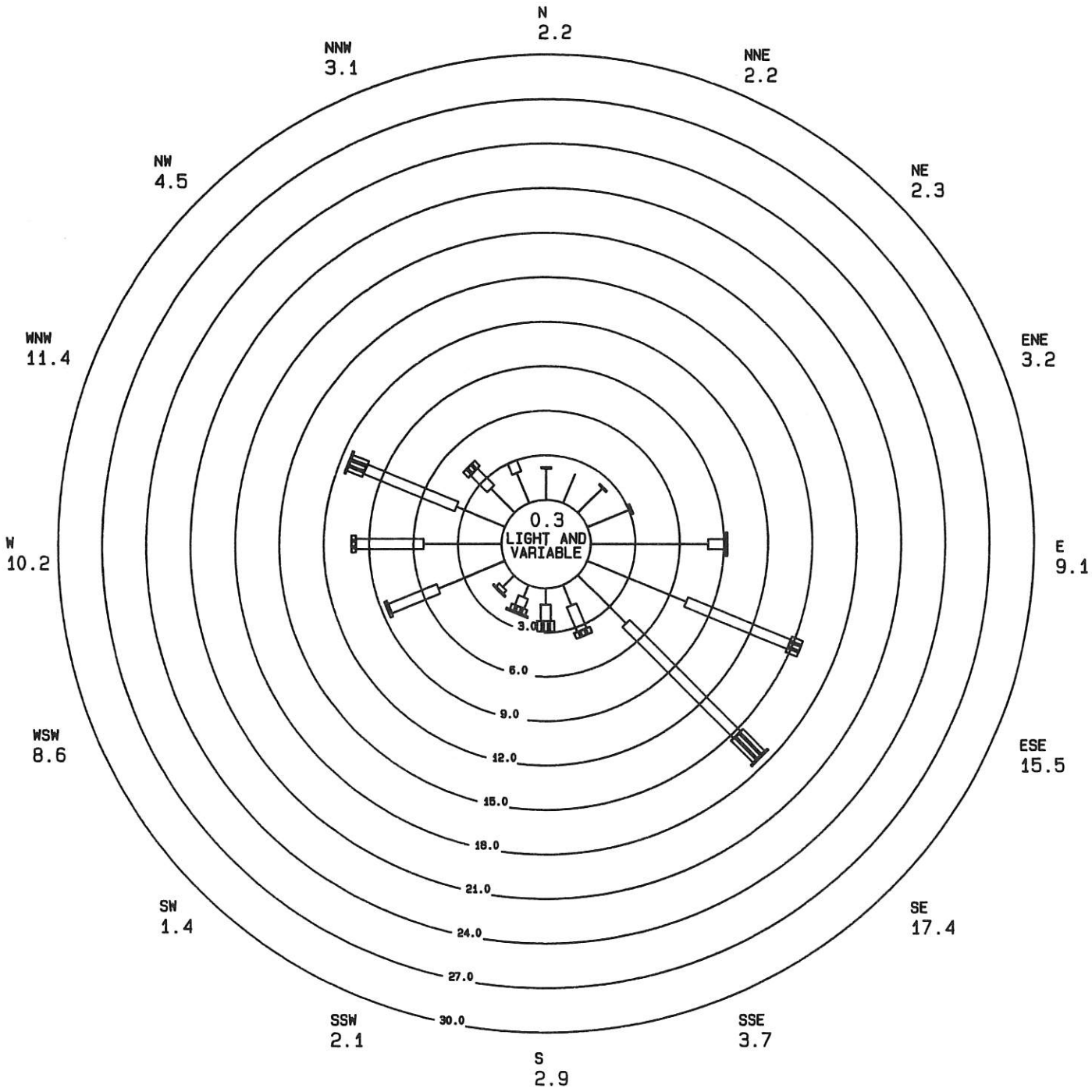
0.9- 3.9 | 4.0- 6.9 | 7.0- 10.9 | 11.0- 16.9 | 17.0- 21.9 | OVER 21.9

KNOTS



0.0 3.0 6.0 9.0 12.0 15.0

PERCENT



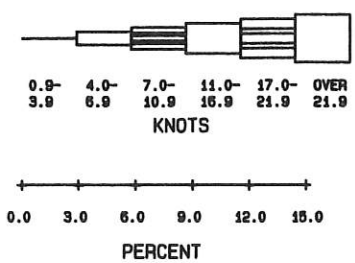
HOUR AVERAGE SURFACE WINDS

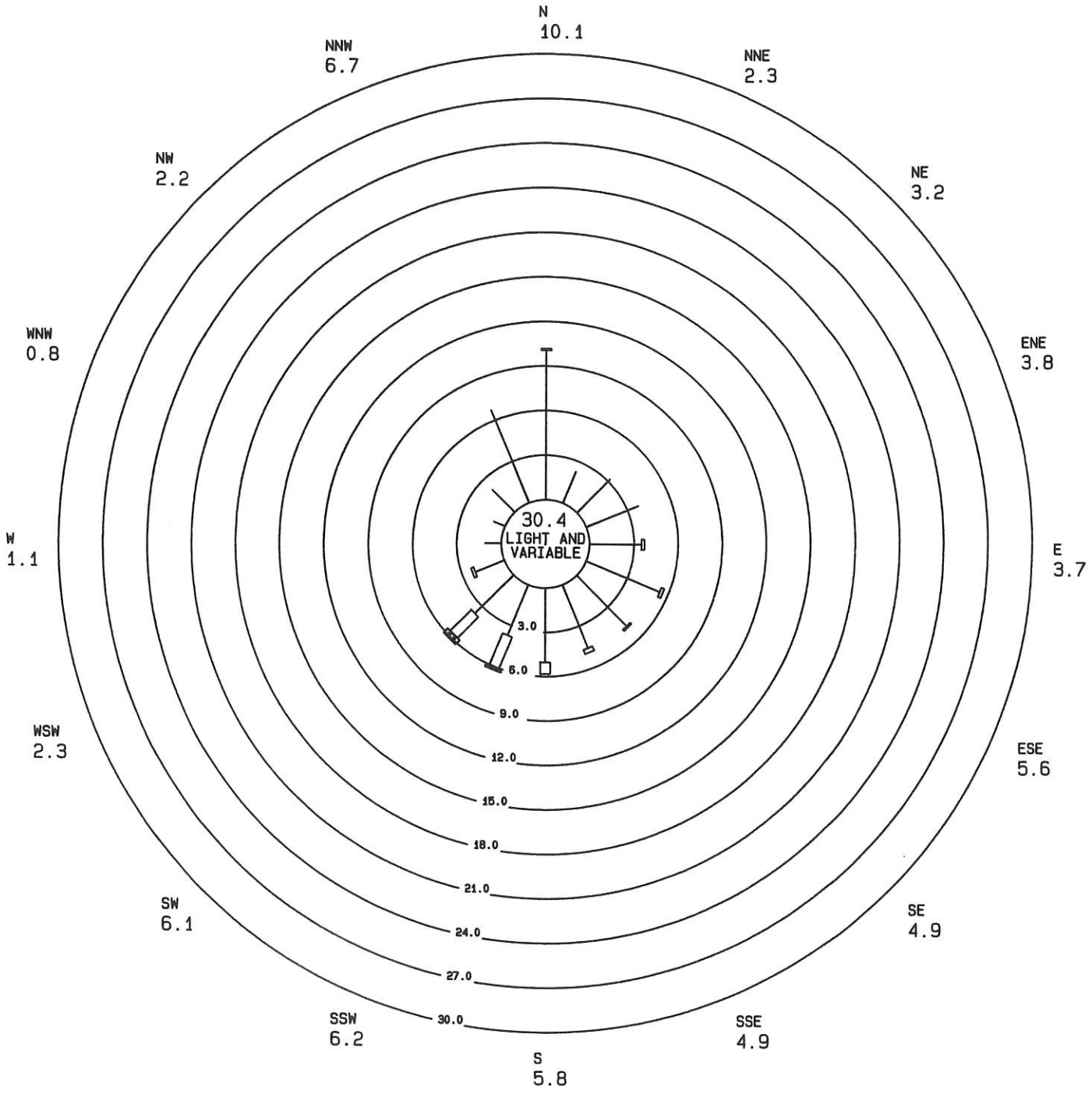
PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Hoyt Ave & 26th St, Everett, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,746





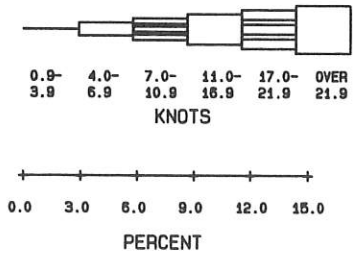
HOUR AVERAGE SURFACE WINDS

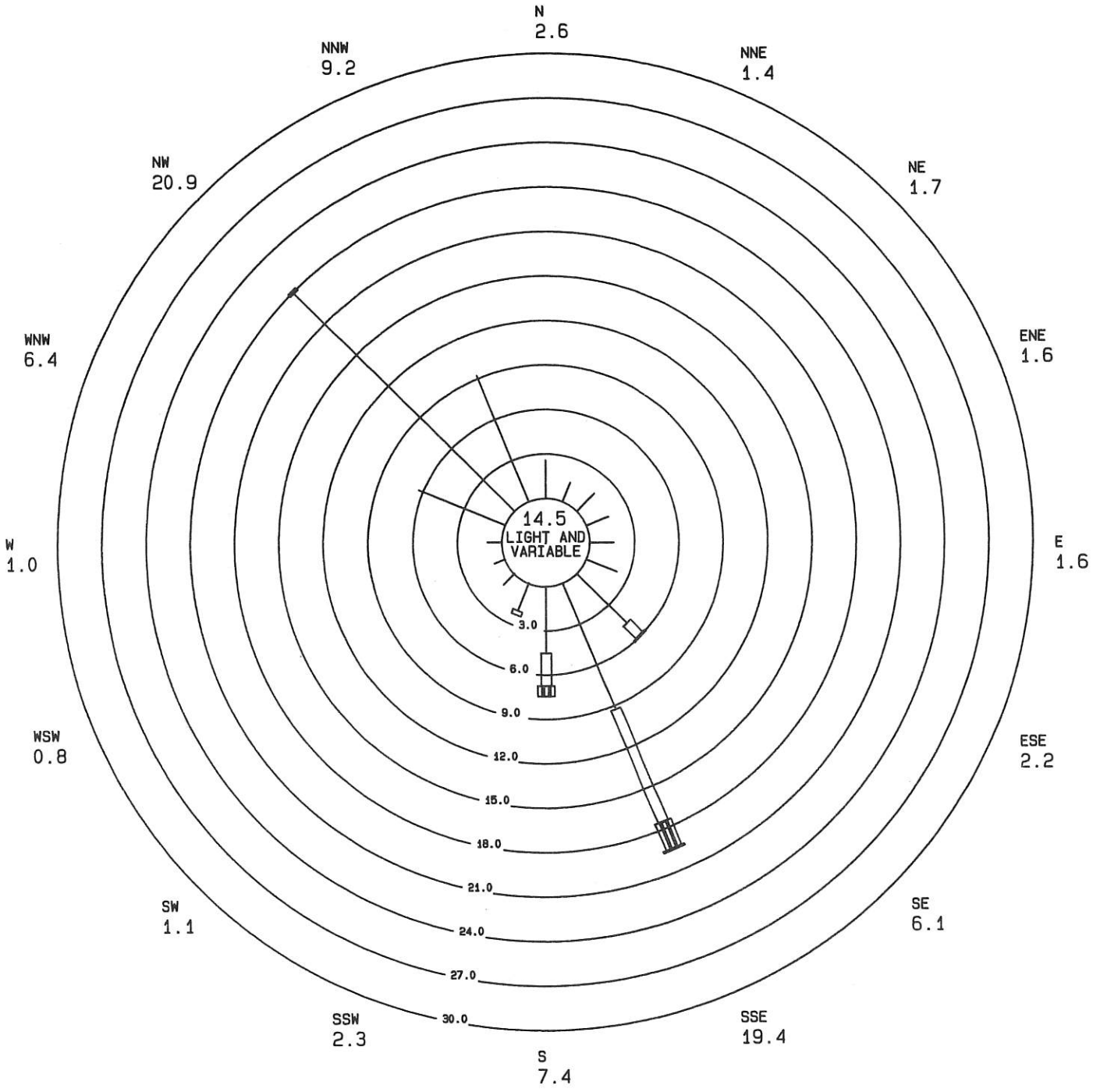
PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
20935 59th Place West, Lynnwood, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,754





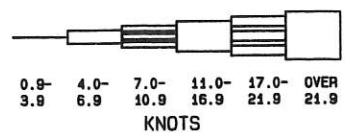
HOUR AVERAGE SURFACE WINDS

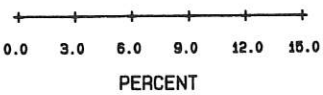
PERCENTAGE FREQUENCY OF OCCURRENCE

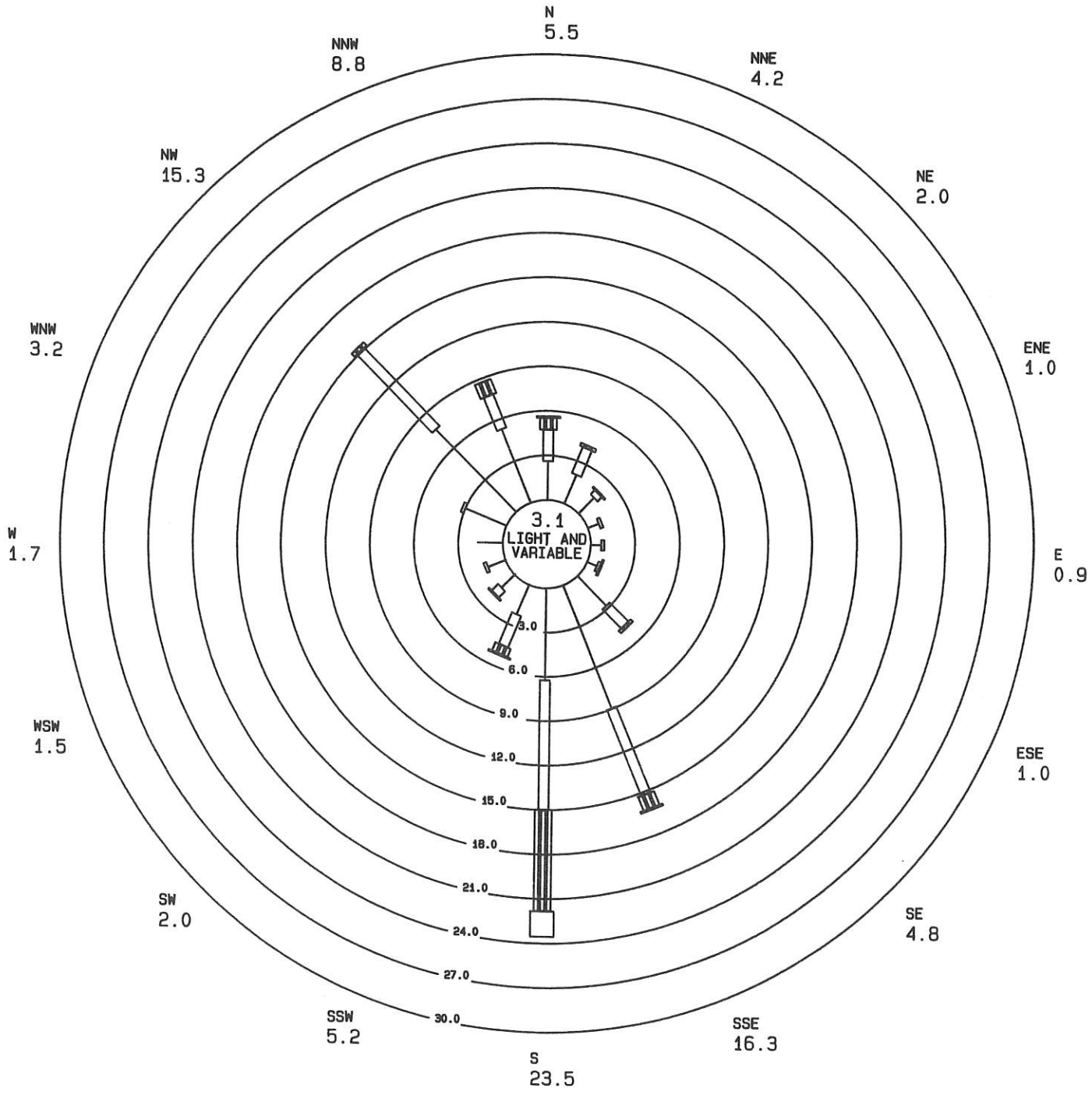
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
17711 Ballinger Way NE, Lake Forest Park, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,740







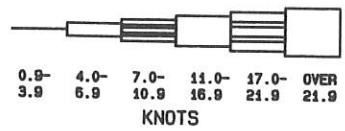
HOUR AVERAGE SURFACE WINDS

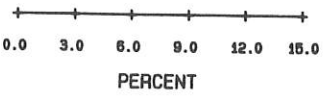
PERCENTAGE FREQUENCY OF OCCURRENCE

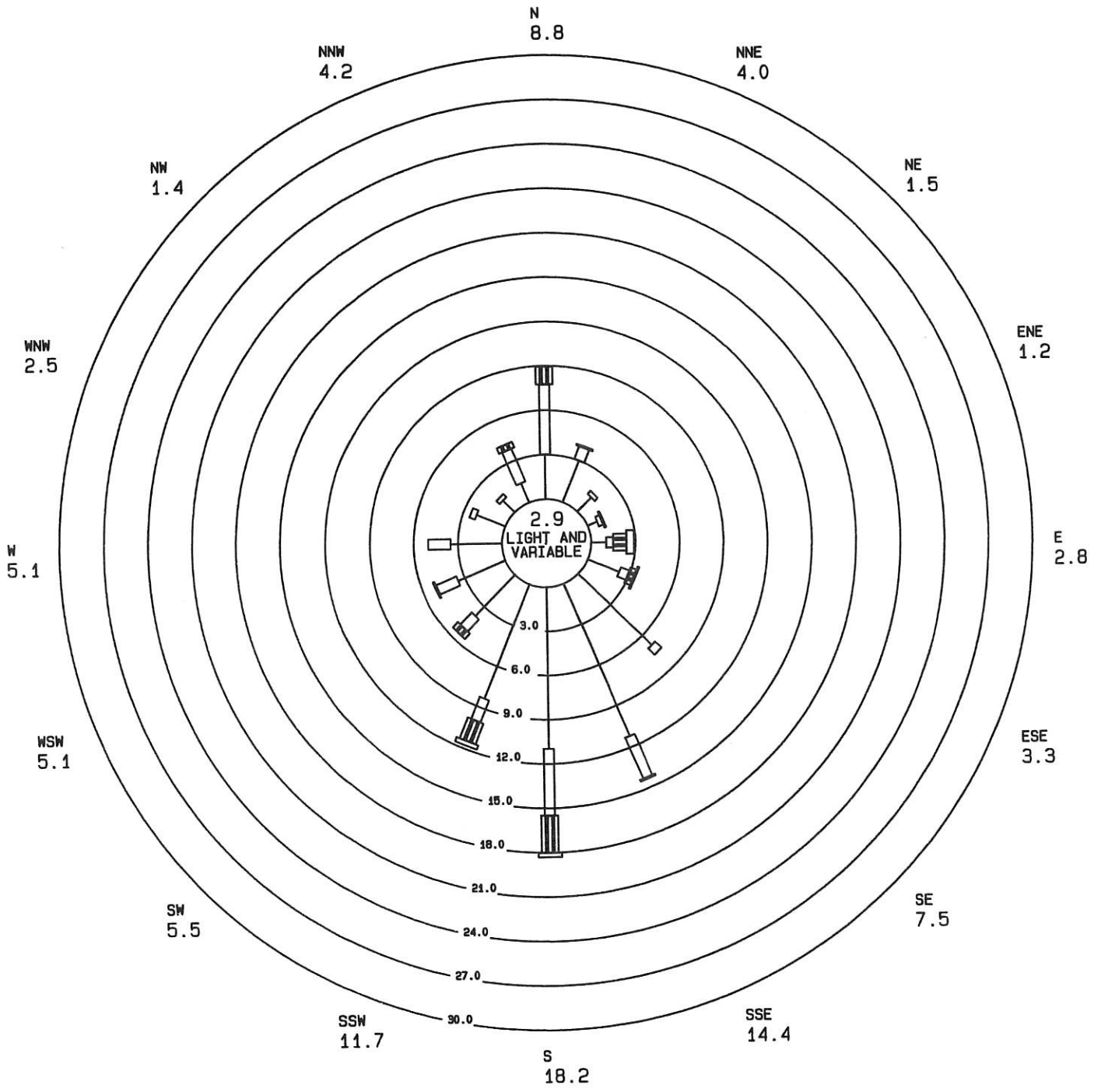
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Duwamish, 4752 E Marginal Way S, Seattle, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,725







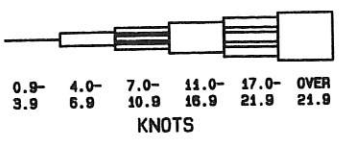
HOUR AVERAGE SURFACE WINDS

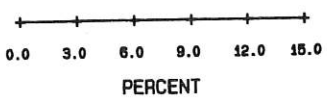
PERCENTAGE FREQUENCY OF OCCURRENCE

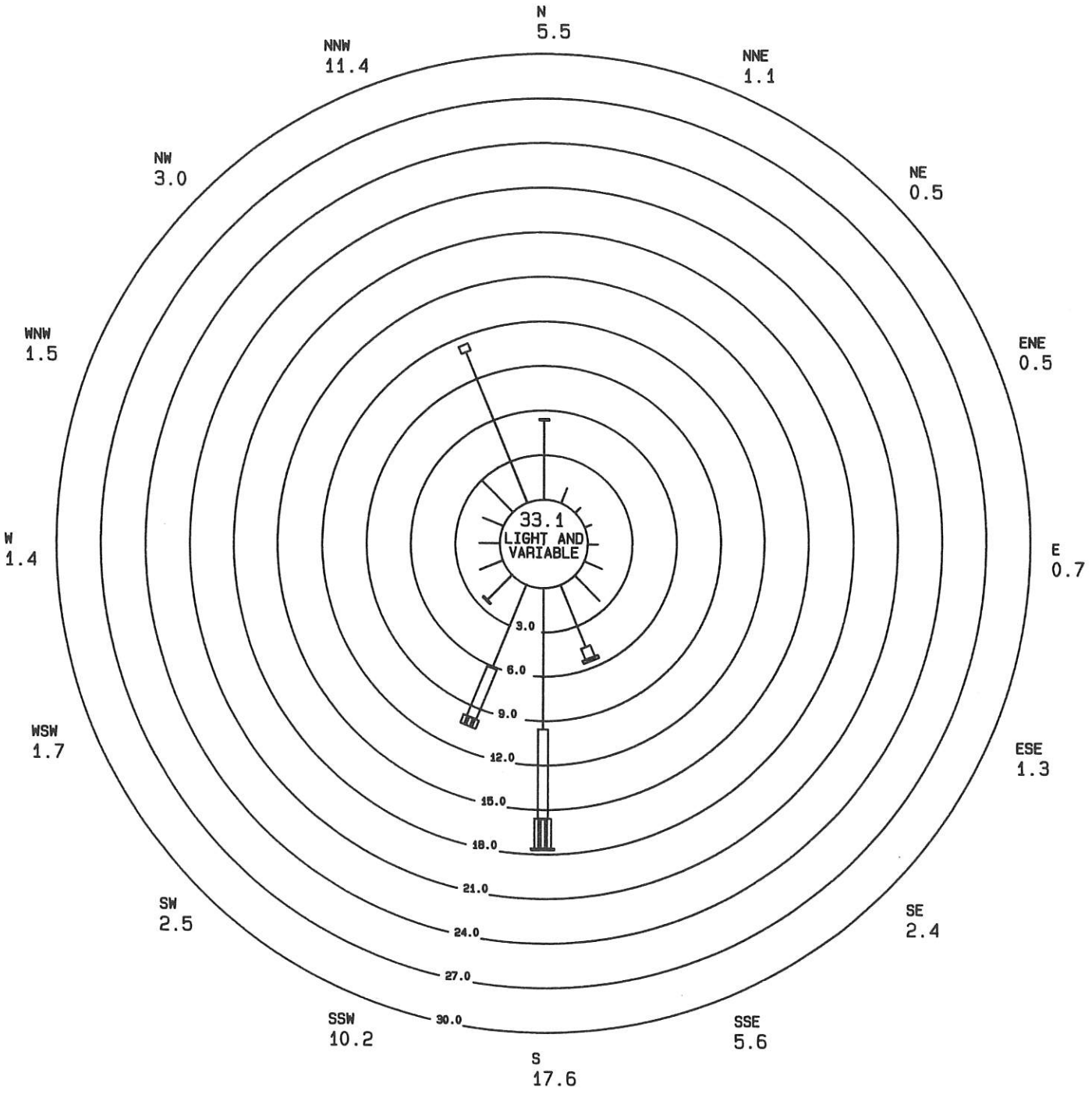
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
James St & Central Ave, Kent, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,750







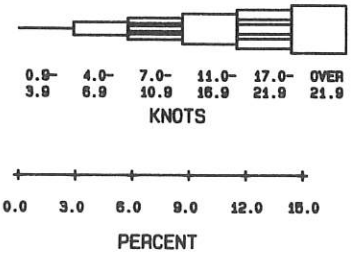
HOUR AVERAGE SURFACE WINDS

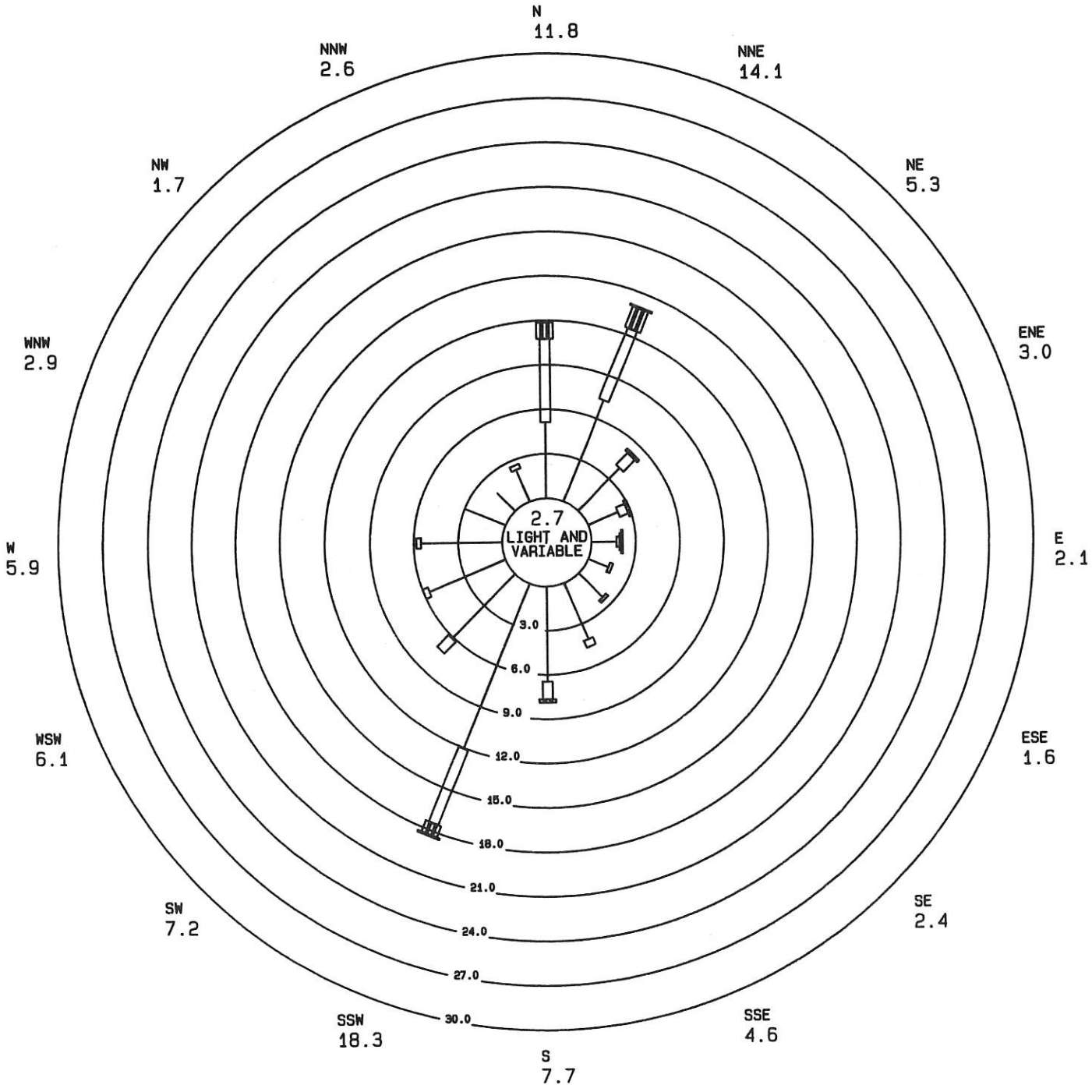
PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
South Hill, 9616 128th St E, Puyallup, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,732





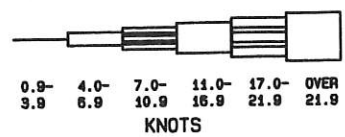
HOUR AVERAGE SURFACE WINDS

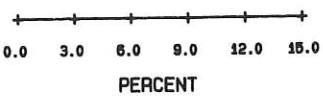
PERCENTAGE FREQUENCY OF OCCURRENCE

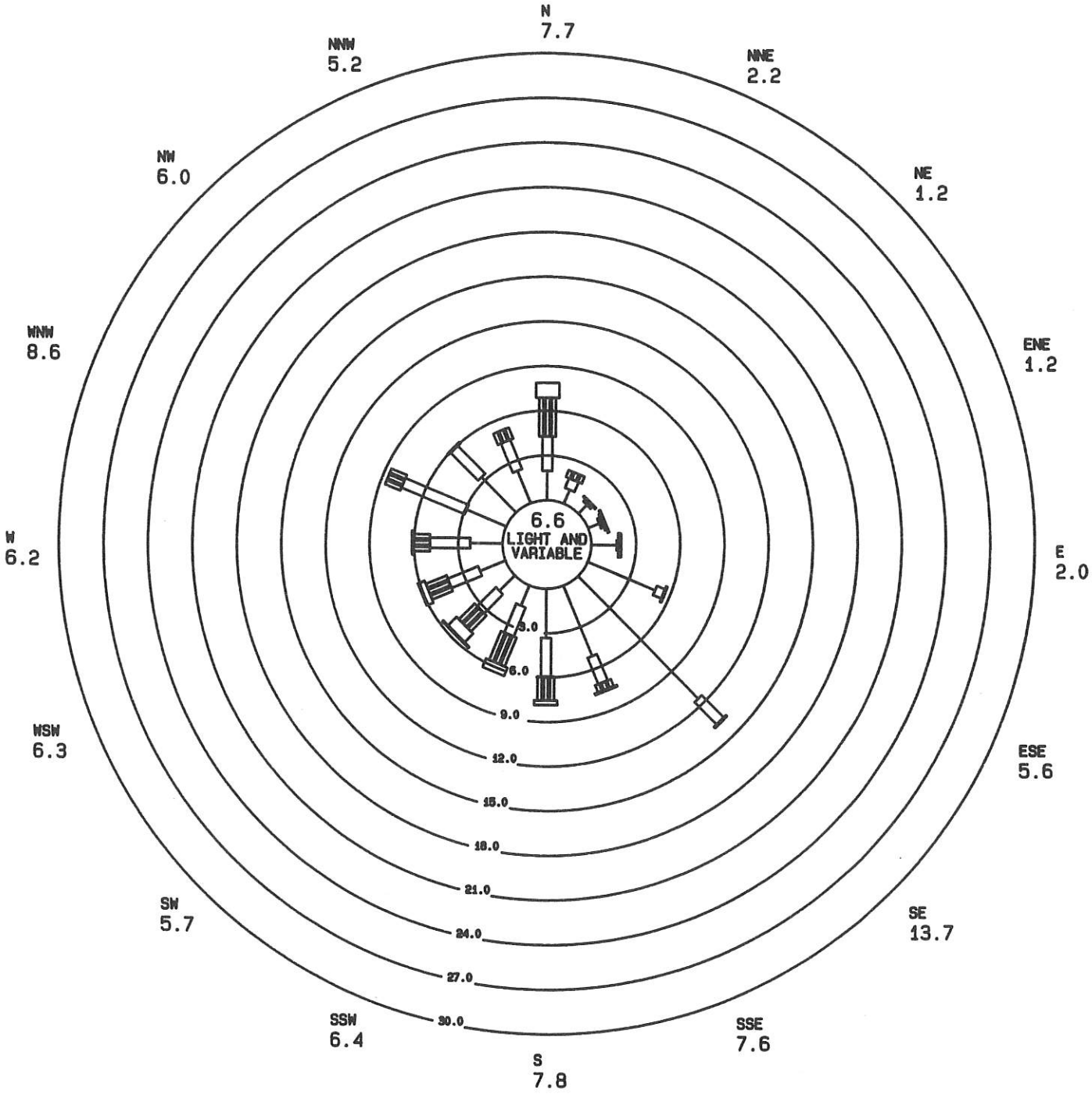
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
27th St NE & 54th Ave NE, Northeast Tacoma, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,747







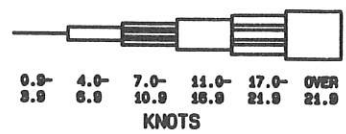
HOUR AVERAGE SURFACE WINDS

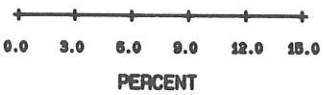
PERCENTAGE FREQUENCY OF OCCURRENCE

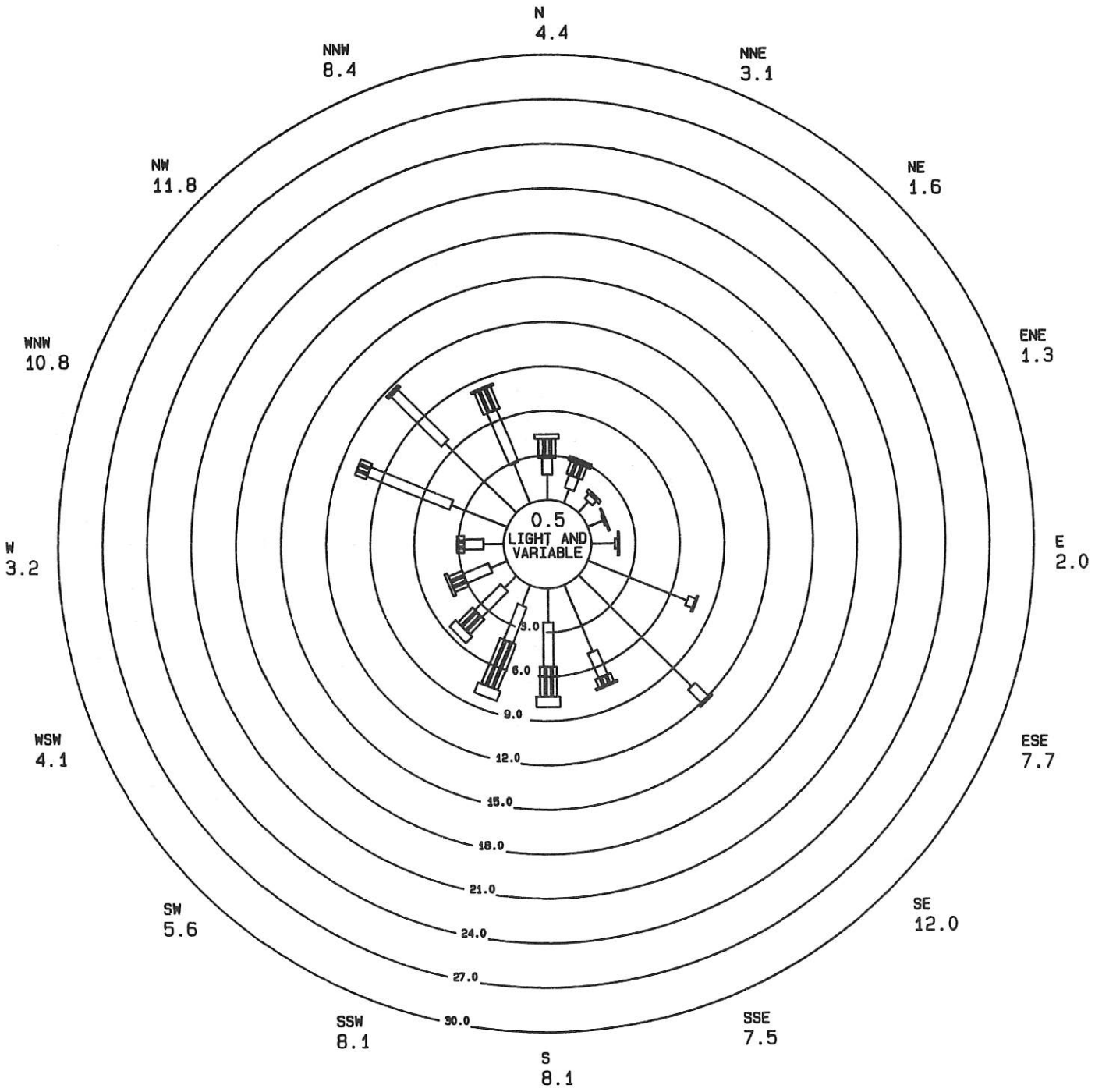
STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
2301 Alexander Ave, Tacoma, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 7,831







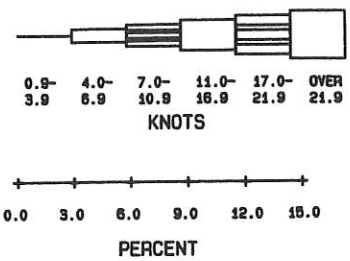
HOUR AVERAGE SURFACE WINDS

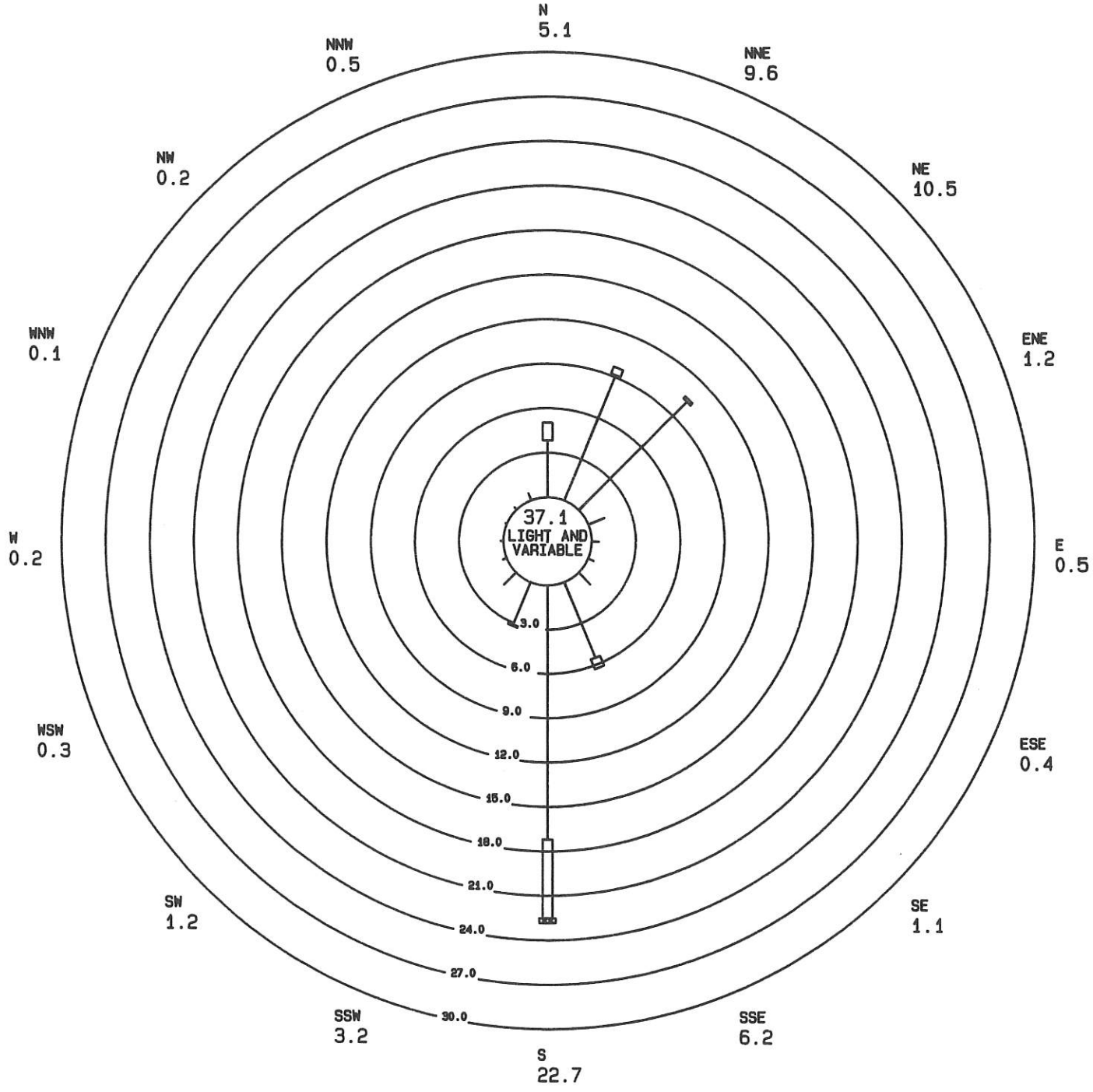
PERCENTAGE FREQUENCY OF OCCURRENCE

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

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8, 652





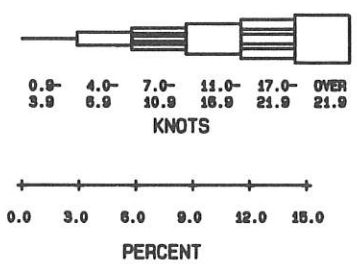
HOUR AVERAGE SURFACE WINDS

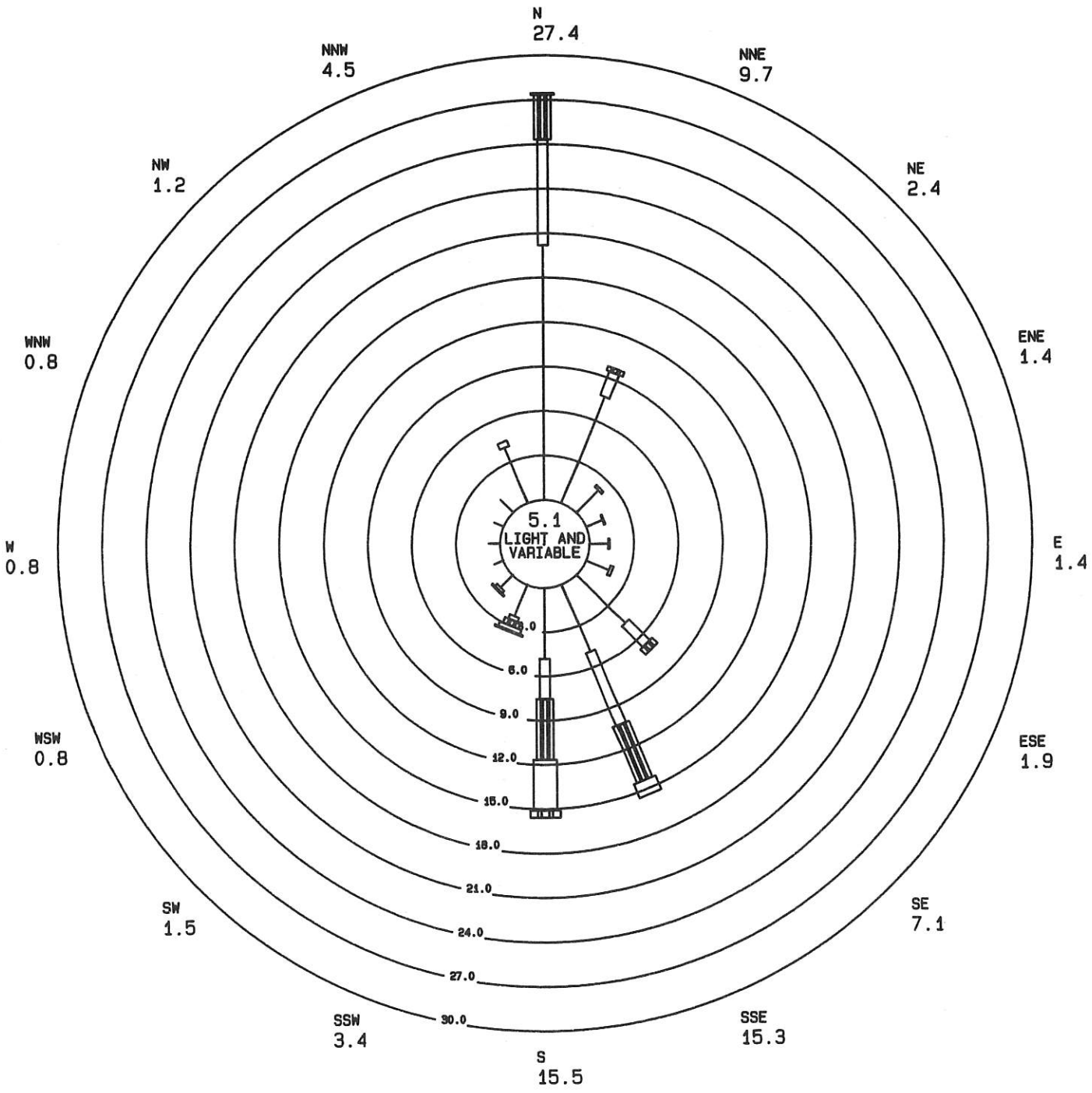
PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Meadowdale, 7252 Blackbird Dr NE, KitsapCo, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,710





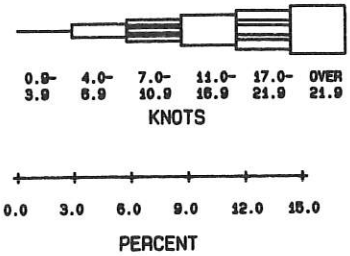
HOUR AVERAGE SURFACE WINDS

PERCENTAGE FREQUENCY OF OCCURRENCE

STATION LOCATION- PUGET SOUND AIR POLLUTION CONTROL AGENCY
Lions Park, 6th Ave NE & Fjord Dr, Poulsbo, Wa

INCLUSIVE DATES- ALL MONTHS 1995

TOTAL OBSERVATIONS- 8,742



AMBIENT AIR QUALITY STANDARDS

POLLUTANT	NATIONAL Primary	NATIONAL Secondary	WASHINGTON STATE	PUGET SOUND REGION
CARBON MONOXIDE				
8 Hour Average [a]	9 ppm		9 ppm	9 ppm
1 Hour Average [a]	35 ppm		35 ppm	35 ppm
PARTICULATE MATTER (PM10)				
Annual Arithmetic Average [b]	50 $\mu g/m^3$	50 $\mu g/m^3$	50 $\mu g/m^3$	50 $\mu g/m^3$
24 Hour Average [c]	150 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$
OZONE				
1 Hour Average [d]	0.12 ppm	0.12 ppm	0.12 ppm	0.12 ppm
SULFUR DIOXIDE				
Annual Average [e]	0.03 ppm		0.02 ppm	0.02 ppm
24 Hour Average	0.14 ppm [a]		0.10 ppm [a]	0.10 ppm [e]
3 Hour Average [a]		0.50 ppm		
1 Hour Average [f]			0.25 ppm	0.25 ppm
1 Hour Average			0.40 ppm [a]	0.40 ppm [e]
LEAD				
Calendar Quarter Average [e]	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$		1.5 $\mu g/m^3$
NITROGEN DIOXIDE				
Annual Average [e]	0.053 ppm	0.053 ppm	0.053 ppm	0.053 ppm

Notes

(1) ppm = parts per million.

(2) $\mu g/m^3$ = micrograms per cubic meter.

a -Not to be exceeded more than once per year.

b - Standard attained when the expected annual arithmetic mean concentration, as determined in accordance with 40 CFR Part 50, Appendix K, is less than or equal to 50 $\mu g/m^3$.

c -Standard attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$, as determined in accordance with 40 CFR Part 50, Appendix K, is equal to or less than one.

d -Standard 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, as determined by 40 CFR Part 50, Appendix H.

e - Never to be exceeded.

f - Not to be exceeded more than twice in seven consecutive days.

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 who wish to interpret our results in terms of μg/cubic meter or mg/cubic meter. These conversion factors from the Federal Register assume a pressure of 760 millimeters Hg and a temperature of 25 degrees C.

Pollutant	*Multiply ppm by*	*To Obtain*
Carbon Monoxide	1.145	mg/cubic meter
Ozone	1961	μg/cubic meter
Sulfur Dioxide	2619	μg/cubic meter
Nitrogen Dioxide	1880	μg/cubic meter