Data Summary *1996*

Puget Sound Air Pollution Control Agency

Thank you

for your interest in air quality.
At your request, we've enclosed
the following information:

- ☐ Executive Summary
- ☐ Lead and Sulfur Dioxide
- ☐ PM_{10} and $PM_{2.5}$
- ☐ Ozone
- ☐ Carbon Monoxide
- ☐ Monitoring Network
- ☐ Pollutant Standards Index (PSI)
- ☐ Regional Wind Patterns (Wind roses)
- ☐ Regional Visibility

Puget Sound Air Pollution Control Agency
110 Union Street, Suite 500, Seattle, WA 98101–2038
http://www.psapca.org

Executive Overview

This is our 25th annual data summary, which reviews air quality and meteorological data for the Puget Sound Region. This year's report marks the end of a quarter century of air monitoring and tremendous strides in improving air quality in the Puget Sound region. It also marks the beginning of a new era in monitoring responsibilities as a result of new federal standards for fine particulate matter. Fulfilling these requirements will challenge the agency to evolve our existing monitoring network to accurately depict fine particulate pollution levels impacting our neighborhoods and regional visibility.

It also marks the beginning of a new look for the presentation of air quality data. This executive summary and its pollutant-specific companion pages highlight the most important data for the previous year. More technical air quality data is available on the agency's web site at www.psapca.org. Specialized data packages can be ordered directly from us.

1996

Air Quality Summary for 1996

For the sixth consecutive year, we recorded no violations of any National Ambient Air Quality Standards (NAAQS). Good air quality conditions prevailed throughout 1996 with no days of unhealthy air measured on the daily Pollutant Standards Index. Brief periods of elevated air pollution levels are summarized by pollutant:

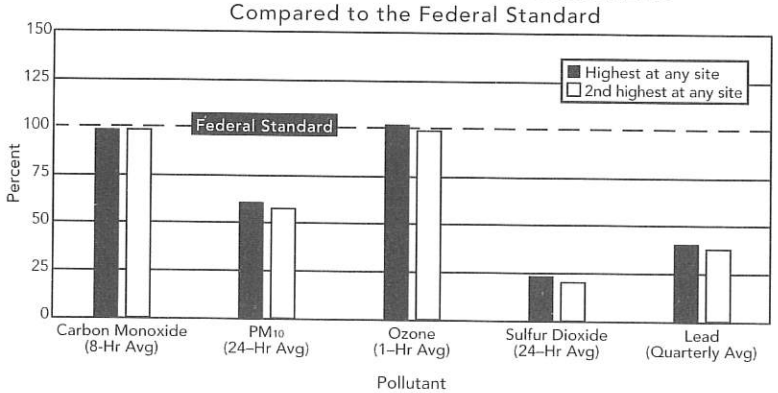
Carbon Monoxide (CO). The highest recorded 8-hour average was measured at 8.7 ppm on October 9, 1996 at both the University District and downtown Seattle (5th and James St.) monitoring stations. While these values accurately reflect real conditions, they occurred during an unusually warm weather pattern not normally associated with cold air stagnation that traps and elevates carbon monoxide values.

The Department of Ecology's Northwest Regional Office conducted a special study of carbon monoxide in the vicinity of Sea-Tac International Airport and the surrounding communities. This study did not identify any hot spots or exceedances of the ambient air quality standards.

Attainment continues to be demonstrated across the Puget Sound region CO monitoring network.

Particulate Matter (PM_{10} and $PM_{2.5}$). Attainment of the PM_{10} standard was again demonstrated throughout the Puget Sound region in 1996. In February, an air stagnation resulted in a brief period of impaired air quality. During this period, 24-hour PM_{10} values exceeded the Washington State trigger of 75 ug/m^3, but remained well below the federal standard. The agency issued a first stage burn ban for King, Pierce and Snohomish counties. Although a significant portion of the particulate matter was believed to be road dust as a result of winter road sanding, the burn ban was called to reduce the wood smoke contribution to total particulate matter pollution. Record rain and snowfall from winter storms prevailed during much of November and December, making that period of our traditional wood smoke season uneventful. During the winter the agency and Ecology's Northwest Regional Office initiated a joint particulate matter pollution survey in the Issaquah area. The purpose of the survey was to determine if pollution levels in Issaquah are higher than those detected at other monitoring sites, and if so, locate any hot spots for particulate matter pollution. This project was a milestone in air monitoring for the agency's Technical Services department. Staff members established two stationary monitoring sites and performed nighttime mobile nephelometer monitoring during periods when temperature inversions were trapping pollutants. Preliminary results of the survey show that PM_{10} values were lower than at other

1996 Maximum Pollutant Concentrations
Compared to the Federal Standard



Executive Overview [cont.]

wood smoke monitoring sites and that a permanent monitoring station in Issaquah is not warranted. Ecology will publish a final report in 1997.

Ozone (O_3). The summer of 1996 brought the Puget Sound area four periods of very warm weather (temperatures in the low to mid 90s). Ozone levels above .10 ppm were recorded at monitoring stations southeast of Seattle. The agency called four Smog Watches, because hot stagnant meteorological conditions were expected to persist and elevate ozone levels close to the federal standard. Smog Watch is a voluntary pollution prevention program that urges citizens to curtail polluting activities during air stagnation periods. The season's highest value met the 1-hour standard of .12 ppm (rounded down from .121 ppm) on August 10 at the Enumclaw monitoring site. This value, even when combined with other exceedances over that past three years, still demonstrated compliance with the ozone air quality standard.

Sulfur Dioxide (SO_2). Sulfur dioxide releases above background levels continue to be detected at air monitoring sites but are well below the federal standards for this pollutant.

Lead (Pb). No monitored values reached 50% of the federal standard.

Visibility/Regional Haze.

This year's data summary includes a new discussion of visual range. We continue to study the extent to which visibility degradation occurs in our region due to air pollution, and this new section details our work in this area.

Plans for air monitoring in 1997-98.

New federal standards for particulate matter ($PM_{10}$and $PM_{2.5}$) and ozone went into effect September 16, 1997. The new fine particulate matter $PM_{2.5}$ standard requires additional monitoring and possibly the establishment of new monitoring stations. While we will be reducing some manual PM_{10} sampling, this new standard represents a significant increase in the monitoring service that PSAPCA provides to the Puget Sound region. The atmospheric profiler located at the NOAA Campus in Seattle will receive a major software upgrade in the fall of 1997. This is expected to improve the reliability and data resolution of this important meteorological tool used to help us determine conditions for burn bans and our voluntary Smog Watch program.

We are considering the possibility of relocating some of our existing PM_{10} manual method monitoring sites during the coming year. These sites have fulfilled their objectives of characterizing air quality in specific areas. Closing these sites would allow us to meet other new monitoring requirements for the new federal standards. These changes will in no way affect our ability to protect public health. Due to low ambient concentrations of sulfur dioxide (SO_2) detected at monitoring stations in Tacoma, Seattle and Everett, our internal air monitoring work group is evaluating the agency's future role in the monitoring of SO_2. We expect a recommendation in early 1998.

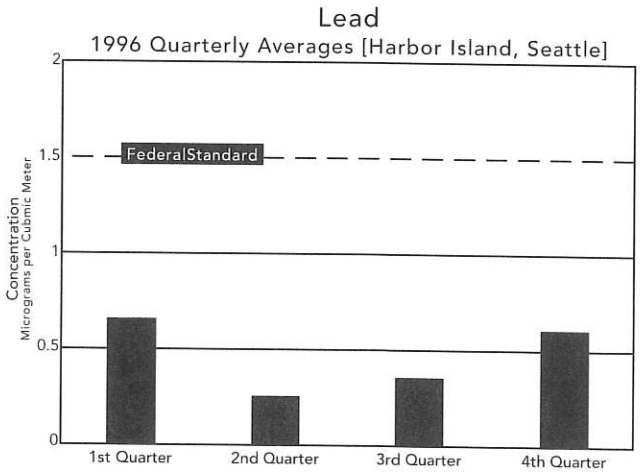
We are planning to conduct a pilot survey of particulate matter pollution in and around the Duwamish Valley, in anticipation of a new $PM_{2.5}$ site to be installed there.

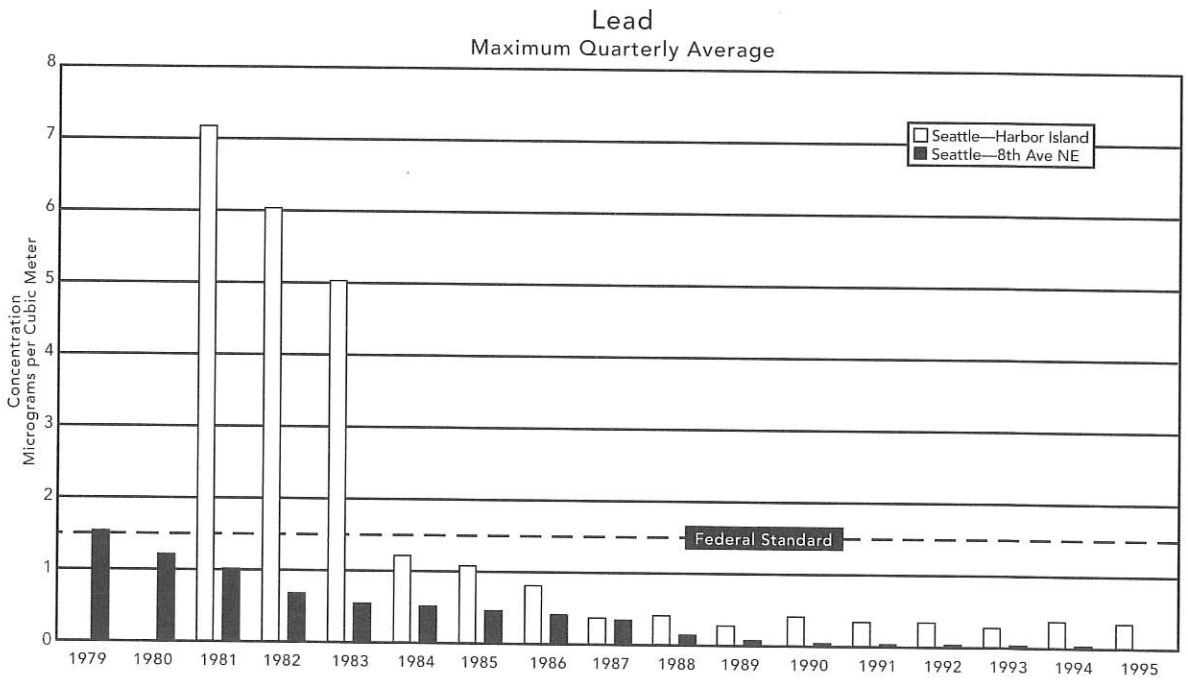
We are currently working with the Department of Ecology to provide near real-time air quality monitoring data on the Internet World Wide Web.

Lead.

Airborne lead typically has been associated with automobile tailpipe emissions and lead smelters. Lead in gasoline has been phased out nationwide over the past 20 years, particularly during the mid and late 1980s. As a result, automobile emissions are no longer recognized as a source of lead. The last operating lead smelter in PSAPCA's jurisdiction was on Harbor Island. The facility ceased smelting operations in the mid 1980s, but it still produces some lead products. Our only remaining lead air monitoring site measures the lead content of wind-blown dust from this facility.

Trends. The freeway monitoring site at 5701 8th Ave NE showed dramatic decreases in monitored lead levels between 1979 and 1994. In 1979, the national standard was exceeded by 16%, but by 1994 monitored values were only 2% of the standard and monitoring was discontinued. There were no measured exceedances at this site after 1979. The Harbor Island lead levels also dropped dramatically during the 1980s with the end of smelting operations. The last measured standard exceedance at the Harbor Island site was in 1983.

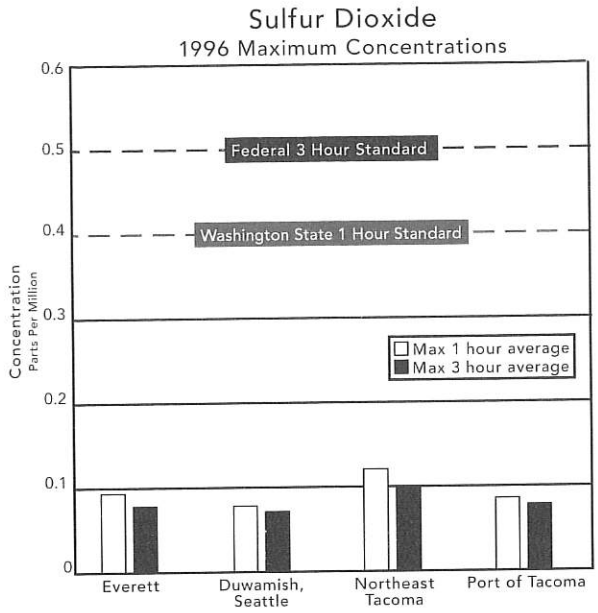




Sulfur Dioxide.

Elevated levels of ambient SO_2 are usually associated with emissions from large coal or oil burning power plants, industrial facilities incorporating sulfuric acid plants, and other industrial facilities where sulfur is exposed to high temperatures such as pulp mills. The dominant SO_2 source locally was the ASARCO smelter located in Tacoma, which closed in 1985. A total of four monitoring stations sited in the Everett, Seattle and Tacoma industrial areas measure SO_2.

Trends. The only SO_2 exceedance in the past nine years was attributed to emissions from an Everett pulp and paper mill in 1994. This single exceedance did not constitute a violation of the state one-hour standard. Our four-county area remains in attainment for SO_2.



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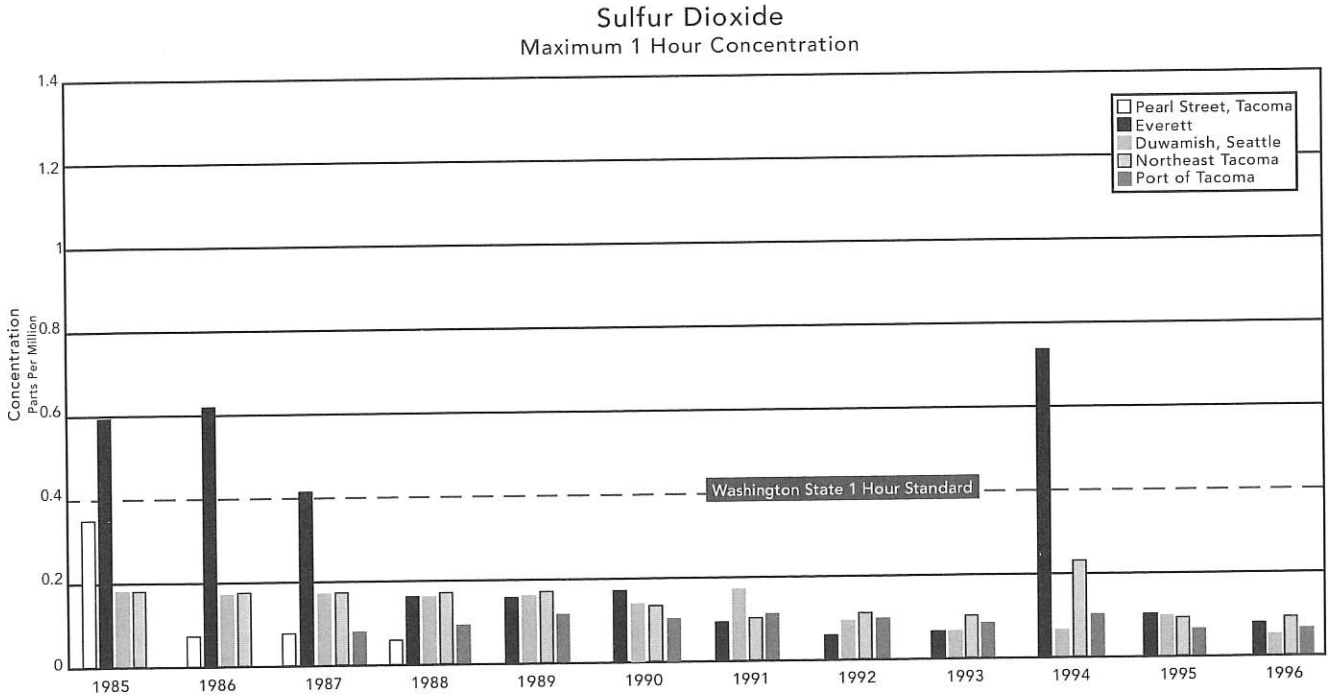


Particulate matter—PM_{10} & $PM_{2.5}$

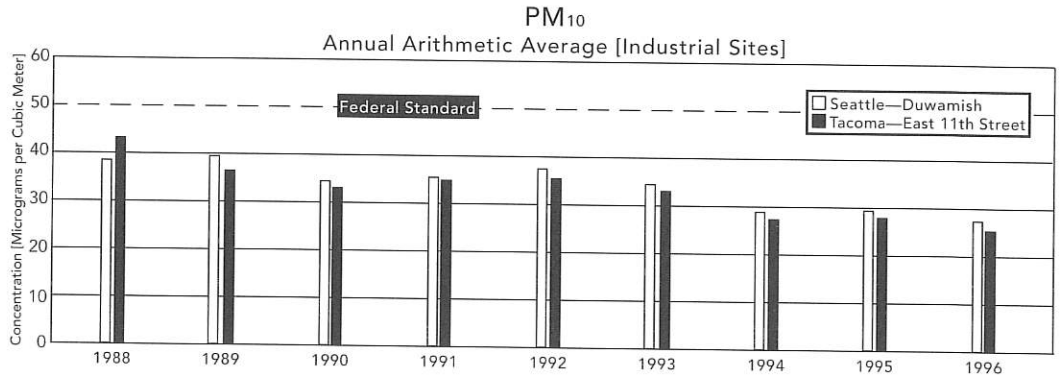
Airborne particulate matter originates from a wide variety of sources, including car and truck exhaust, tire wear, combustion sources such as wood stoves and fireplaces, dusty industrial and commercial processes, and wind-blown soils. Fine particulate matter is also formed in the atmosphere from chemical reactions with pollutant gases. Beginning in July 1987, particulate matter standards were changed from a "total suspended particulate" (TSP) standard to a standard that measures only those particles that are 10 microns or less (PM_{10}). These particles were thought to be more damaging to human health and plant life. The 24-hour PM_{10} standard was set at 150 ug/m³ and the annual average standard set at 50 ug/m³.

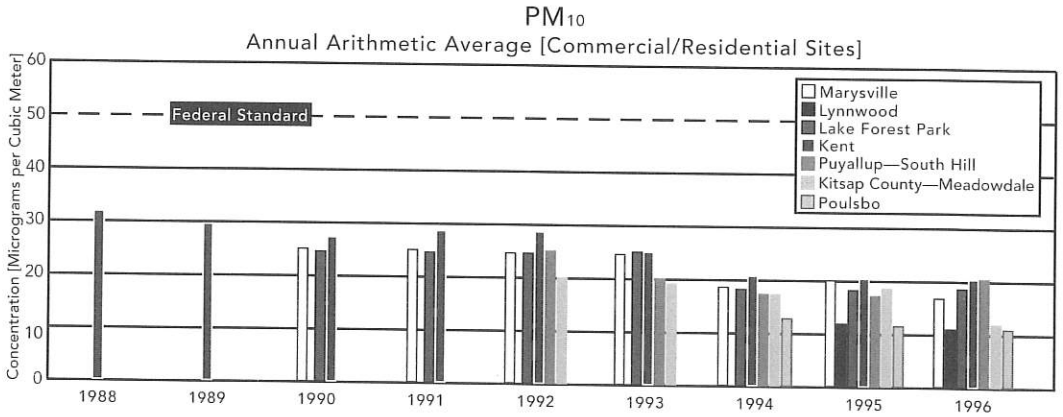
The U.S. EPA has promulgated a new standard for fine particulate matter, smaller than 2.5 microns in diameter ($PM_{2.5}$). This new standard took effect on September 16, 1997. These fine airborne particles are the greatest threat to health and visibility. The new $PM_{2.5}$ standard will be set at a 65 ug/m³ 24-hour standard and a 15 ug/m³ annual standard. PSAPCA has been conducting $PM_{2.5}$ monitoring since 1987. EPA also intends to retain the current PM_{10} 24-hour and annual standards.

There are 15 PM_{10} monitoring sites within our jurisdiction; four industrial sites and 11 residential or commercial. At two of the industrial sites, $PM_{2.5}$ monitoring has also been conducted since 1987, and another site was added in 1989.

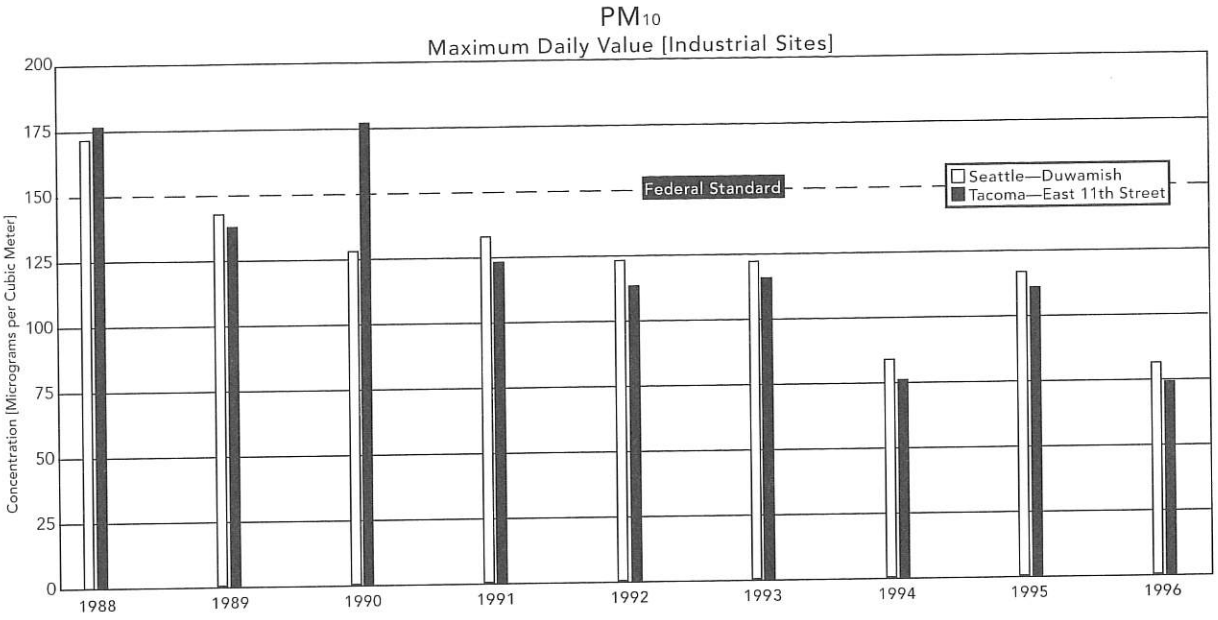
Trends. PM_{10} levels are showing steady declines over the past 10 years as measured by annual averages, maximum daily values, and the number of days above the Washington State Impaired Air Quality trigger level of 75 ug/m³. These trends apply to industrial as well as residential/commercial monitoring sites. Effective industrial control strategies, cleaner burning residential wood stoves, along with changing heating habits in favor of clean-burning natural gas, are the chief factors behind the declines. There have been no exceedances of PM_{10} standards at any of the 15 monitoring sites since 1990. It is anticipated that EPA will formally redesignate all three central Puget Sound PM_{10} nonattainment areas in 1998.

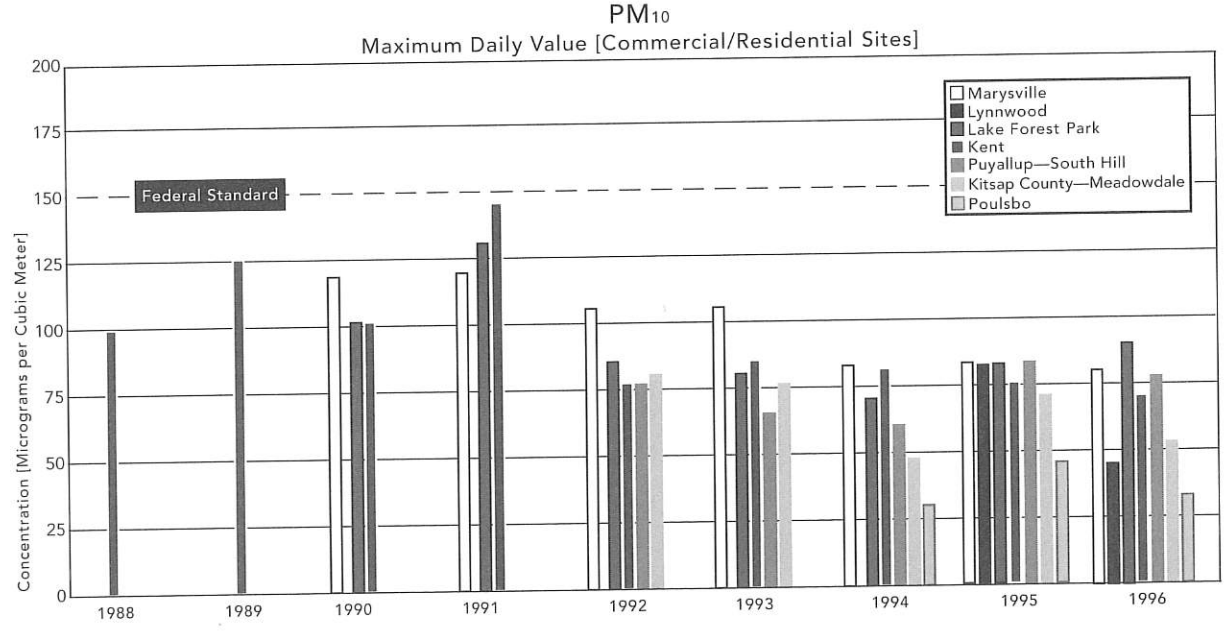
24-hour $PM_{2.5}$ levels show similar decreases. Annual average $PM_{2.5}$ data also shows improvement (averages for 1990 through 1993 were not calculated due to lack of data).

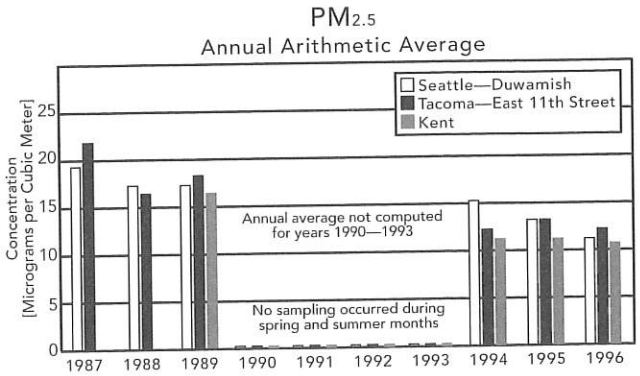


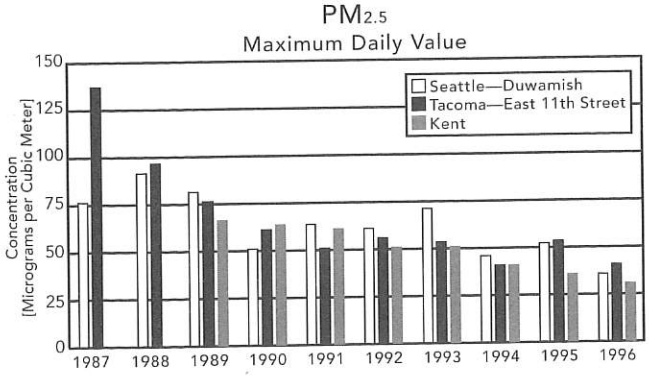


Particulate matter—PM_{10} & $PM_{2.5}$ [cont.]









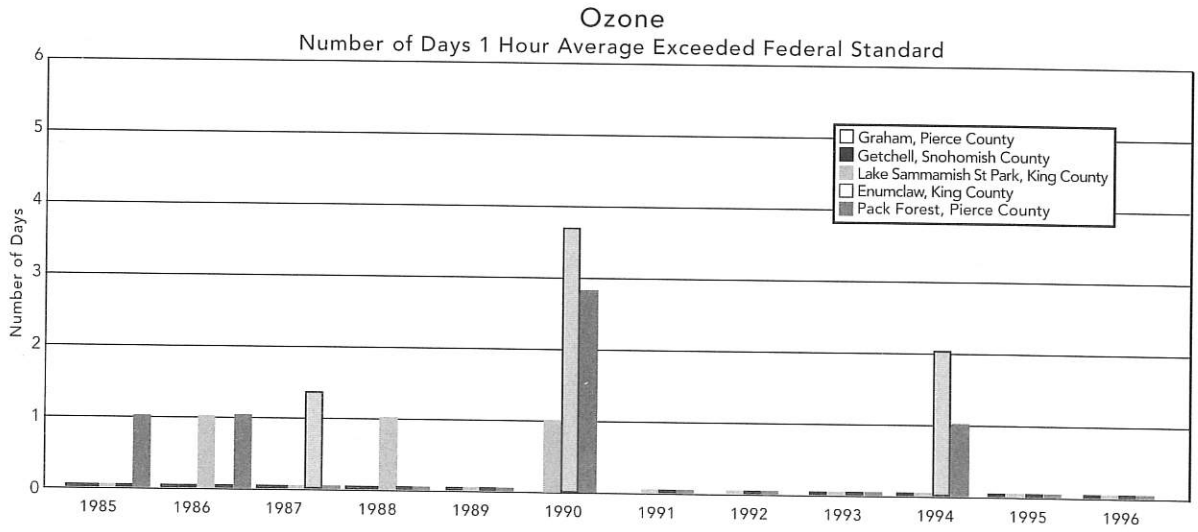
Ozone.

Ozone is the only criteria pollutant not emitted directly by sources. It is a product of chemical reactions in the atmosphere on hot, sunny days. Most of the chemical pollutants that contribute to ozone formation come from cars and trucks. There are five monitoring sites for ozone—Lake Sammamish, Enumclaw (2), Getchell near Marysville and Pack Forest near Eatonville. The Washington State Department of Ecology conducts all ozone monitoring in our jurisdiction, as well as throughout the state.

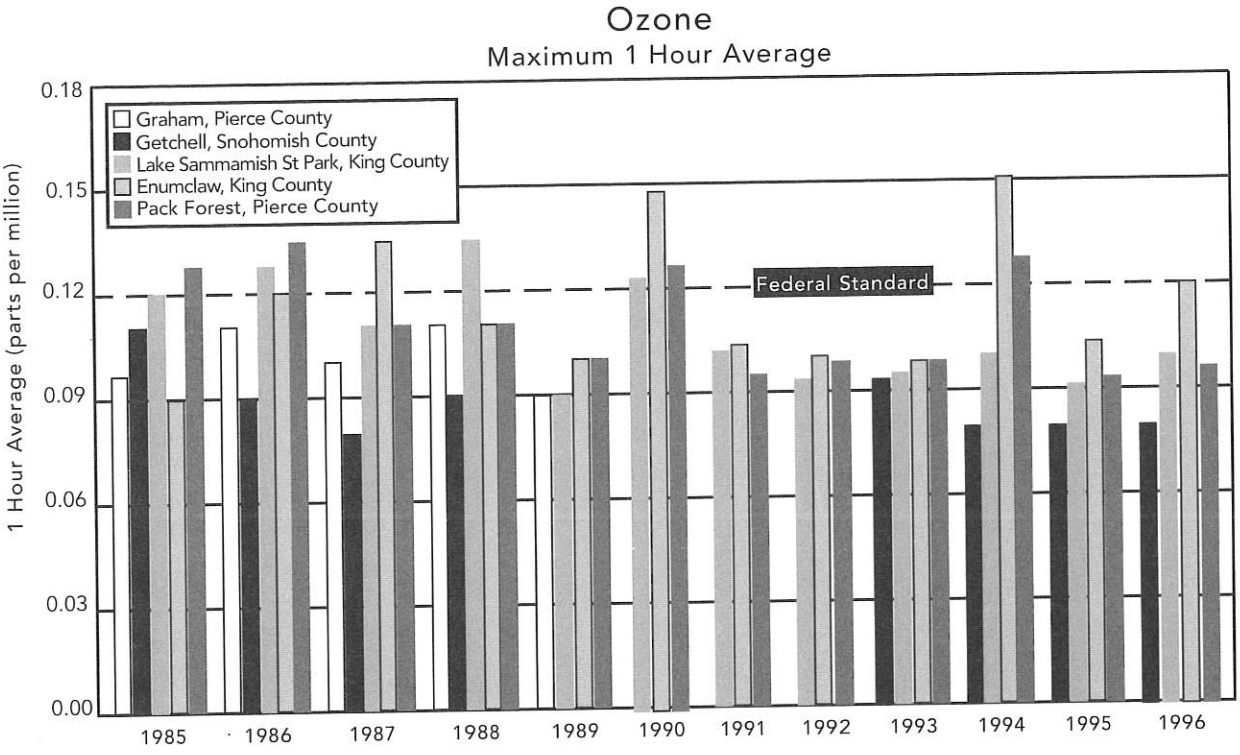
The U.S. EPA has promulgated a new, more stringent national ambient standard for ozone. This new standard took effect on September 16, 1997. The one-hour standard of 0.12 ppm has been changed to an eight-hour 0.08 ppm standard with additional changes in the way compliance with the standard is calculated.

Trends. Although maximum monitored ozone levels fell from the late 1970s to the mid 1980s, ozone monitoring data collected over the past 17 years shows a flat trend. The explanations for this flat trend are presently unclear. Scientific research is currently being conducted by the Washington State Department of Ecology and the University of Washington to try to explain the trend.

All monitoring sites have shown attainment with the existing standard since 1991. Attainment has been demonstrated when the region recorded fewer than four exceedances at the same monitoring site in a three-year period. We remain at least marginally in attainment with no clear increasing or decreasing trends. EPA formally redesignated our area to attainment for ozone in October 1996. We anticipate that all monitoring sites will continue to show attainment with the new standard as well.



Ozone [cont.]


Ozone
Maximum 1 Hour Average
1 Hour Average (parts per million)
0.18
0.15
0.12
0.09
0.06
0.03
0.00
Graham, Pierce County
Getchell, Snohomish County
Lake Sammamish St Park, King County
Enumclaw, King County
Pack Forest, Pierce County
Federal Standard
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996

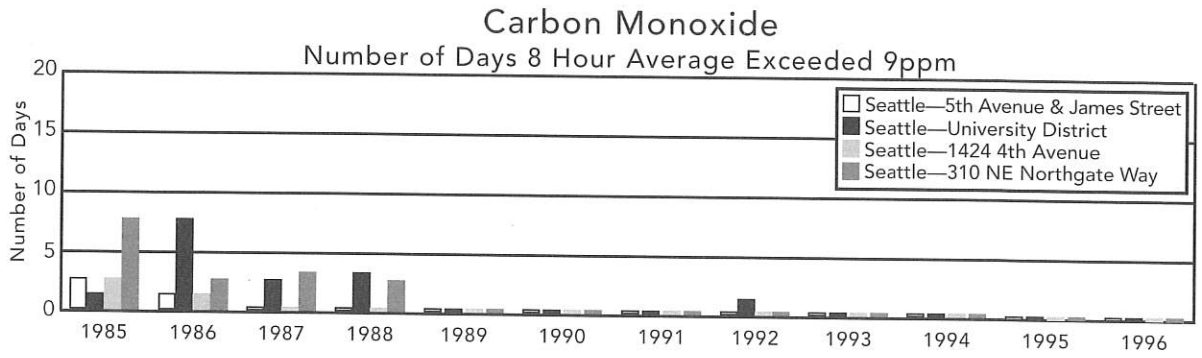
Carbon Monoxide.

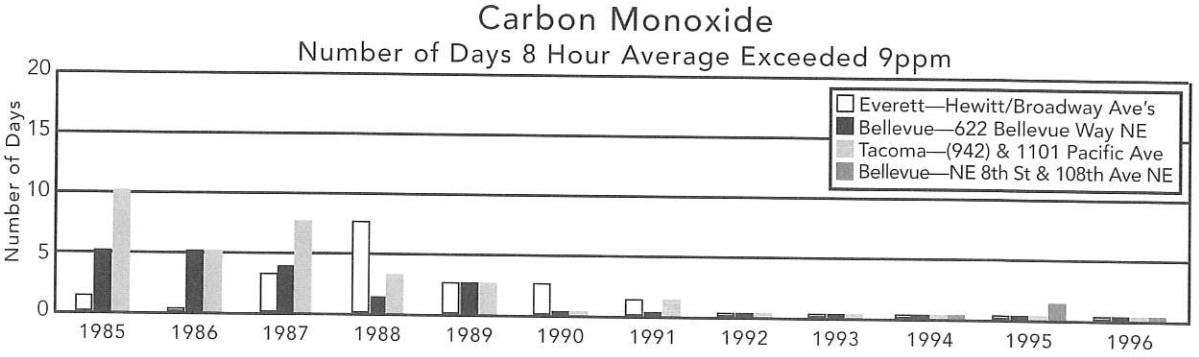
High ambient carbon monoxide (CO) levels are almost exclusively related to car and truck exhaust. All nine monitoring sites in our jurisdiction are located in areas of traffic congestion. These include the central business districts of our largest cities, and other high traffic areas such as shopping malls. As with ozone, all carbon monoxide monitoring in our jurisdiction is performed by the Washington State Department of Ecology.

Trends. Over the last 10 years, and more dramatically over the past 18 years, carbon monoxide levels have dropped significantly. Cleaner operating motor vehicles, the State motor vehicle inspection program and better formulated gasoline are the main explanations for this decrease. The winter of 1996-97 marked the end of the oxygenated fuel program. Since 1992, ethyl alcohol had been added to gasoline from November through February for the purpose of reducing carbon monoxide vehicle emissions. The program was detemined to be unnecessary to maintain compliance with the CO standard.

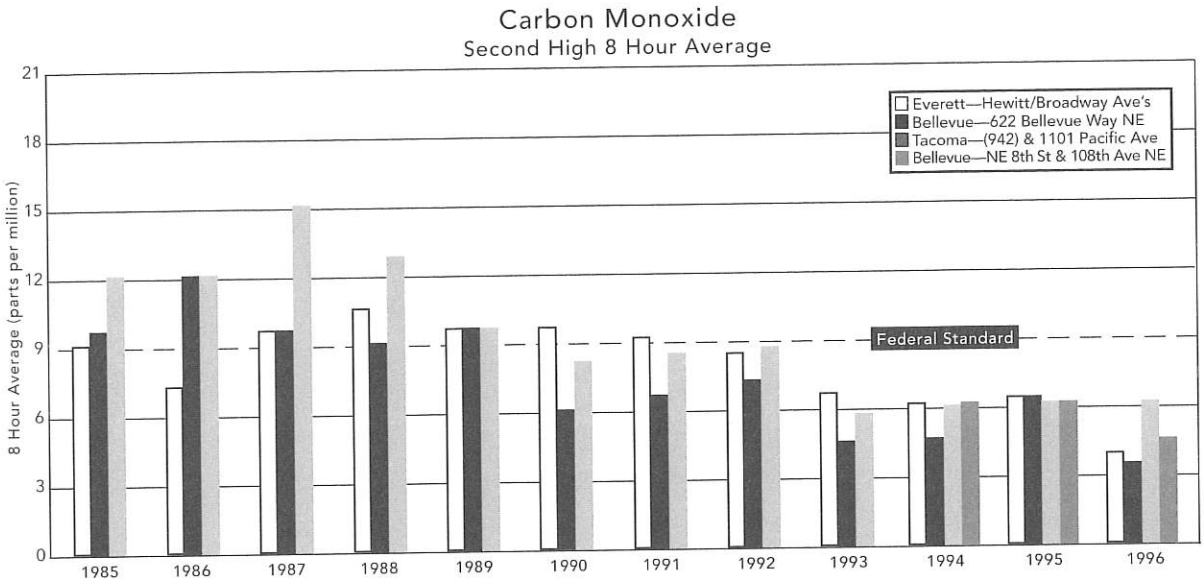
All monitoring sites have shown attainment with the federal standard since 1991. EPA recognized our region in October 1996 as being in attainment for carbon monoxide.

1996





Carbon Monoxide [cont.]



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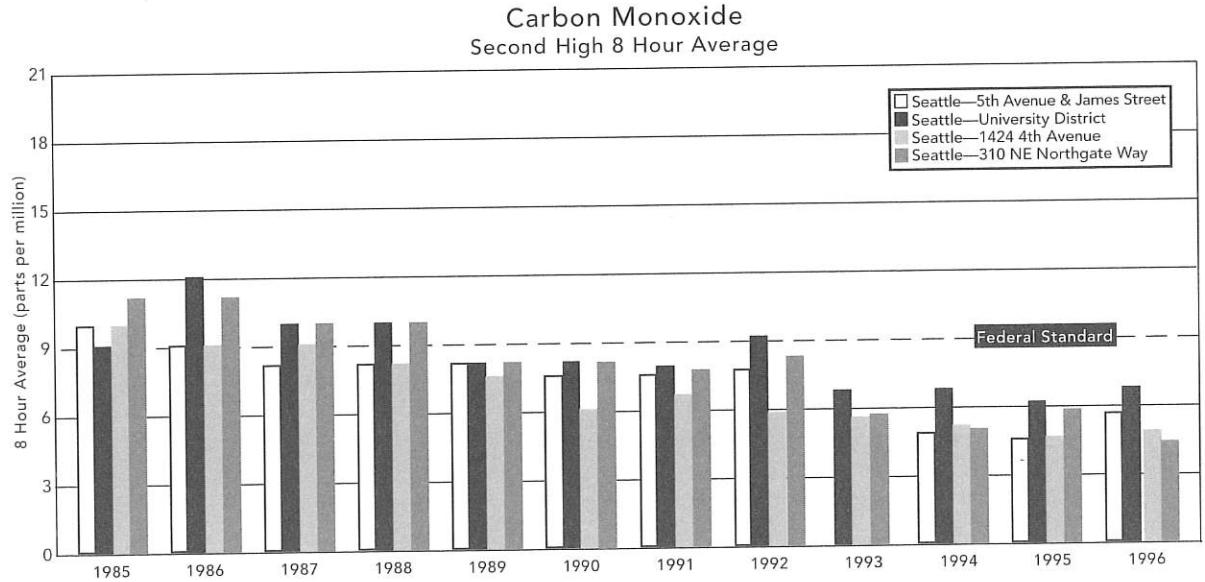


Sampling Network

PSAPCA's ambient air monitoring network is a composite of meteorological and pollutant-specific monitoring equipment. This equipment is both manual and automated, meaning that data measurements are collected by our field staff or sent directly via a telemetry network. Sites are operated by both PSAPCA and the Washington State Department of Ecology. Air quality monitoring is conducted for PM_{10}, $PM_{2.5}$, lead, carbon monoxide, ozone, sulfur dioxide, oxides of nitrogen and visibility. Weather conditions are monitored for temperature, wind speed and wind direction.

Monitoring equipment is sited on the basis of numerous parameters. EPA siting criteria are followed in order to obtain a consistent and representative picture of air quality. Some sites are selected to focus on the emissions of a single air pollution source or group of sources. Some sites are intended to be representative of an industrial area while others may be oriented toward residential air pollution.

All 34 monitoring sites in our four-county area, their locations, and type of monitoring conducted at each site are shown here. The map also shows how these monitoring stations are spread geographically throughout our area.

1996 Sampling Network [Reference Map on Back]

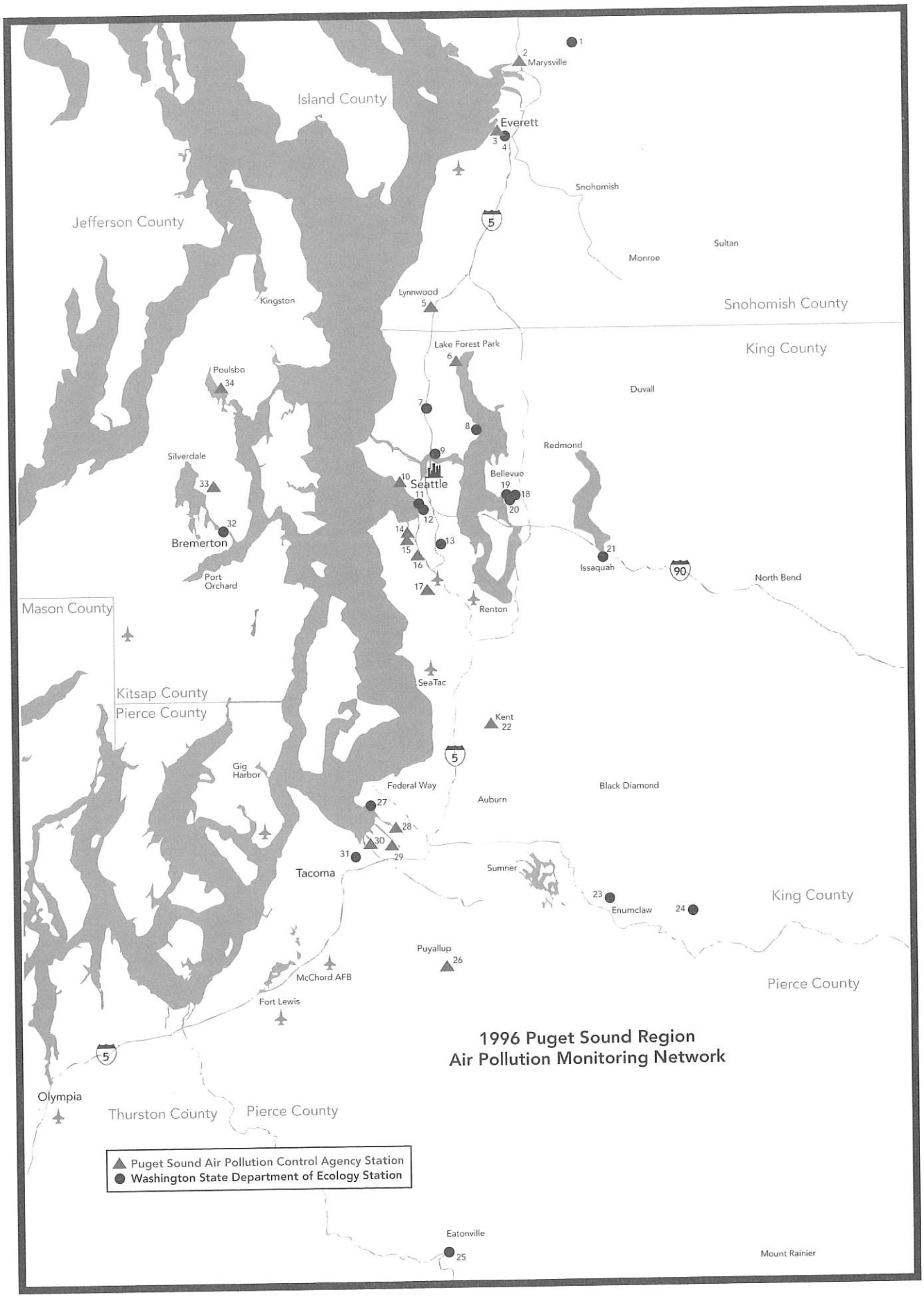
Map ID	Location				Type of Sampling
1	8426 99th Avenue NE, Getchell				O_3
2	Marysville JHS, 1605 7th Street, Marysville	PM_{10}	PM_{10eq}		$PM_{2.5eq}$, Wind
3	Hoyt Avenue & 26th Street, Everett	PM_{10}			SO_2, Wind
4	Broadway & Hewitt Avenue, Everett			CO	
5	20935 59th Place West, Lynnwood	PM_{10}	PM_{10eq}		Wind
6	17711 Ballinger Way NE, Lake Forest Park	PM_{10}	PM_{10eq}		bsp, Wind
7	Northgate, 310 NE Northgate Way, Seattle			CO	
8	Sand Point, 7600 Sand Point Way NE, Seattle				Wind, Temp
9	University District, 1307 NE 45th Street, Seattle			CO	
10	Queen Anne Hill, 400 West Garfield Street, Seattle				Vsby
11	1424 4th Avenue, Seattle			CO	
12	5th Avenue & James Street, Seattle			CO	
13	Beacon Hill, 15th South & Charlestown, Seattle				bsp, NO, NO_2, NO_x, Wind, Temp
14	Harbor Island, 2555 13th Avenue SW, Seattle				TSP/Pb
15	Harbor Island, 3400 13th Avenue SW, Seattle	PM_{10}			
16	Duwamish, 4752 East Marginal Way South, Seattle	PM_{10}	PM_{10eq}		$PM_{2.5}$, $PM_{2.5eq}$, bsp, $S0_2$, Wind
17	South Park, 723 South Concord Street, Seattle	PM_{10}			
18	NE 8th Street & 108th Avenue NE, Bellevue			CO	
19	622 Bellevue Way NE, Bellevue			CO	
20	504 Bellevue Way NE, Bellevue	PM_{10}			
21	20050 SE 56th, Lake Sammamish State Park				O_3
22	James Street & Central Avenue, Kent	PM_{10}	PM_{10eq}		$PM_{2.5}$, $PM_{2.5eq}$, bsp, Wind
23	43407 212th Avenue SE, 2 miles West of Enumclaw [began July 1, 1996]				O_3, NO, NO_2, NO_x, Wind, Temp
24	Highway 410, 2 miles East of Enumclaw				
25	Charles L Pack Forest, La Grande				O_3
26	South Hill, 9616 128th Street East, Puyallup	PM_{10}	PM_{10eq}		Wind
27	5225 Tower Drive NE, Northeast Tacoma				Wind
28	27th Street NE & 54th Avenue NE, Northeast Tacoma	PM_{10}			SO_2, Wind
29	2301 Alexander Avenue, Tacoma	PM_{10}			SO_2, Wind
30	Fire Station #12, 2316 East 11th Street, Tacoma	PM_{10}	PM_{10eq}		$PM_{2.5}$, Wind
31	1101 Pacific Avenue, Tacoma			CO	
32	2909 Wheaton Way, Bremerton [ended July 19, 1996]			CO	
33	Meadowdale, 7252 Blackbird Drive NE, Kitsap County	PM_{10}	PM_{10eq}		Wind
34	Lions Park, 6th Avenue NE & Fjord Drive, Poulsbo	PM_{10}	PM_{10eq}		Wind

NOTES

Type of Sampling
Shading indicates stations operated by Washington State Department of Ecology.

- PM_{10} = Particulate Matter ≤ 10 micrometers [reference method]
- PM_{10eq} = Particulate Matter ≤ 10 micrometers [equivalent method]
- CO = Carbon Monoxide
- O_3 = Ozone
- Wind = Wind Direction and Speed
- SO_2 = Sulfur Dioxide
- $PM_{2.5}$ = Particulate Matter ≤ 2.5 micrometers [by dichot]
- $PM_{2.5eq}$ = Particulate Matter ≤ 2.5 micrometers [continuous method]
- bsp = Atmospheric Particles [by nephelometer]
- Temp = Air Temperature
- NO = Nitric Oxide
- NO_2 = Nitrogen Dioxide
- NO_x = Nitrogen Oxides
- Vsby = Visibility [by camera]
- TSP/Pb = Total Suspended Particulates and Lead

Sampling Network [cont.]



1996

Pollutant Standards Index

The Pollutant Standards Index (PSI) provides a nationally uniform method for reporting air quality as related to health impacts. PSI values are calculated on a pollutant-specific basis and are reported daily. The daily PSI value reported is the highest pollutant-specific index noted for that day, at any monitoring site, for any criteria pollutant, within the area identified. A numerical scale for the PSI ranges from 0 to 500 with five different intervals or health categories as identified below:

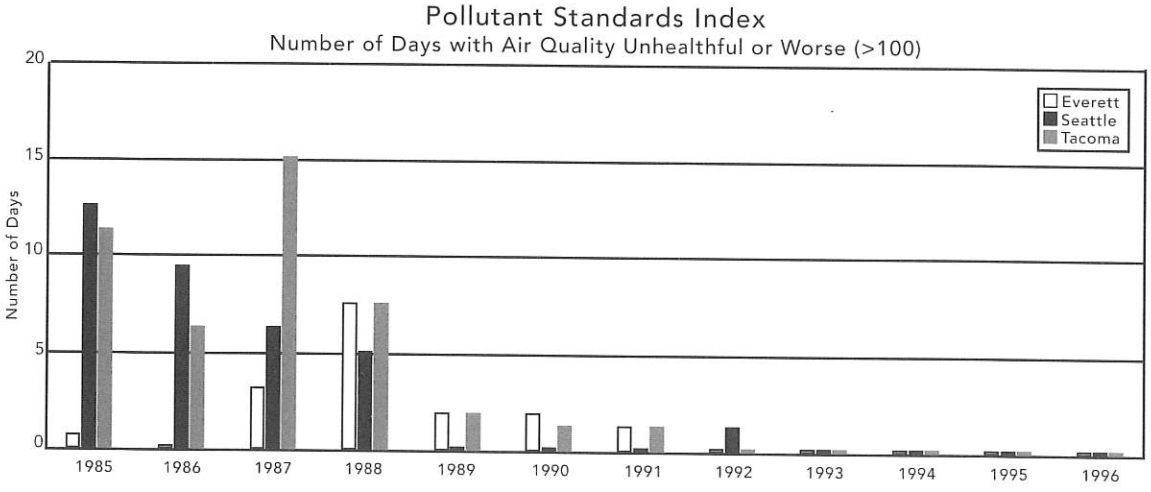
From 0 to 50	Good
From 51 to 100	Moderate
From 101 to 199	Unhealthful
From 200 to 299	Very unhealthful
From 300 to 500	Hazardous

A pollutant-specific PSI reading of 100 is equivalent to the federal health standard for that pollutant. The two categories above a PSI value of 199 correspond to the first two air pollution episode levels as defined in the Washington Episode Avoidance Plan—Alert and Warning.

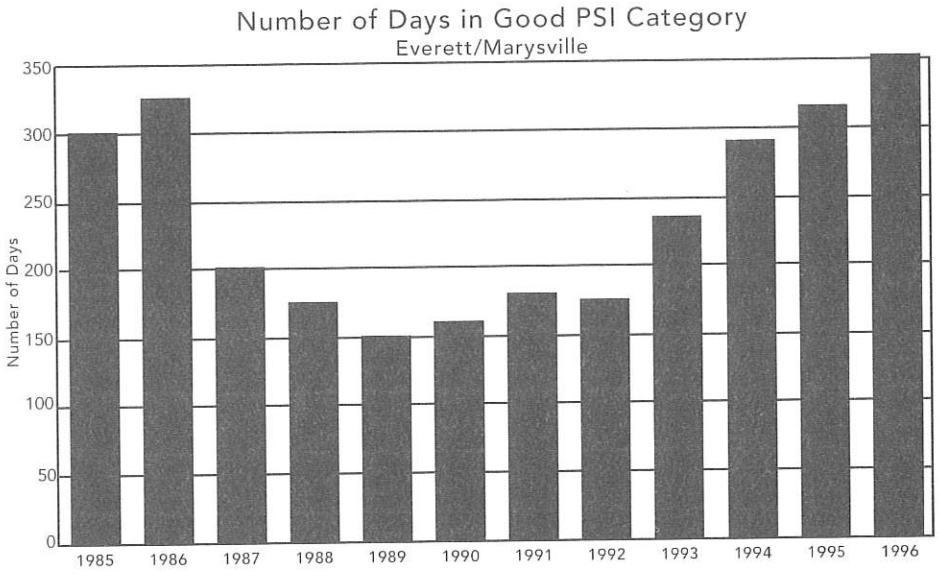
Trends. The first bar graph shows the trend of the number of days per year since 1985 with a PSI greater than 100—unhealthful or worse. No exceedances of health standards were recorded anywhere in our four-county area in 1996. In 1994, ozone monitoring recorded two exceedances in Enumclaw and one in LaGrande (Pack Forest).

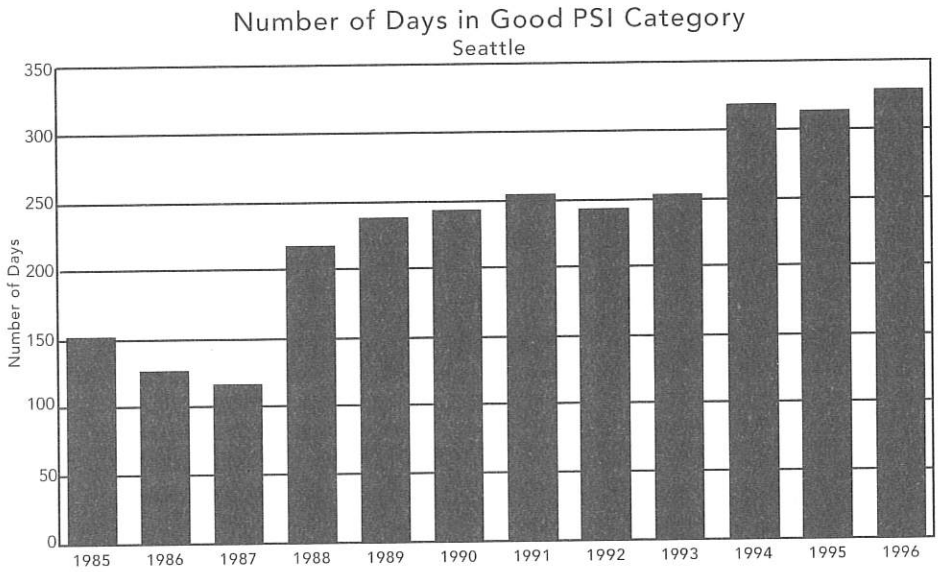
The subsequent three bar graphs show trends since 1985 of days with a PSI of 50 or less—good, or the healthiest air quality. The trend shows increasing numbers of good days per year over the past eight to 10 years.

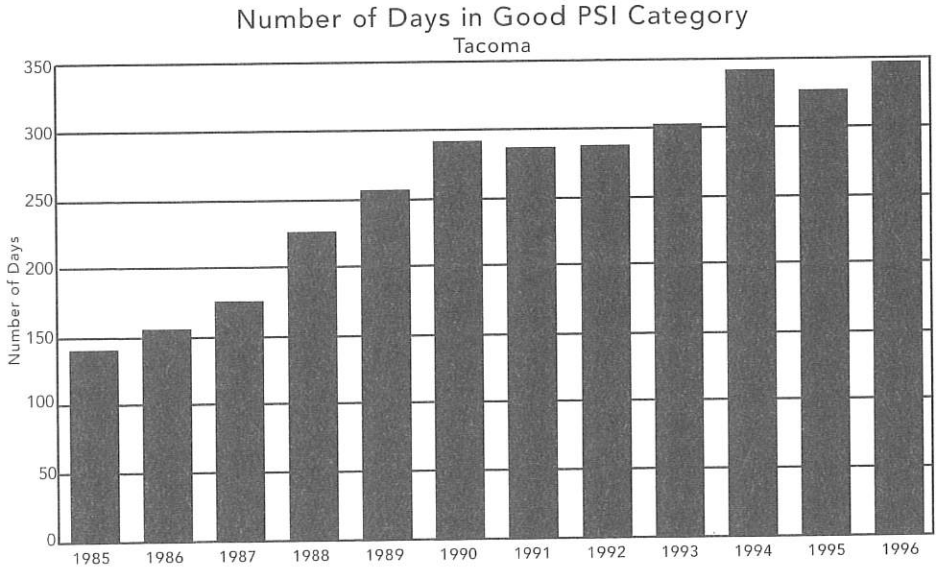
Since there were no measured exceedances of the health-based standards in 1996, all measured PSI values were either good or moderate. PSI readings in the good range are now so predominant that even moderate levels are becoming infrequent to rare.



Pollutant Standards Index [cont.]

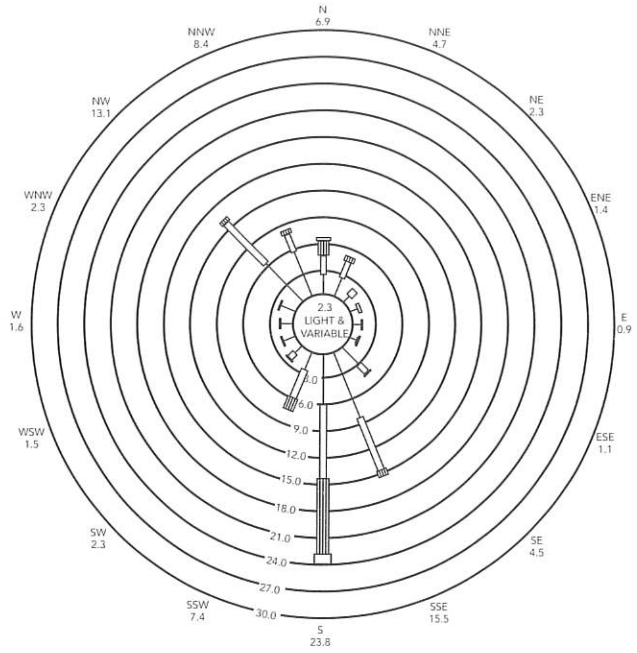






Wind Roses

Hour Average Surface Winds
Percentage Frequency of Occurrence

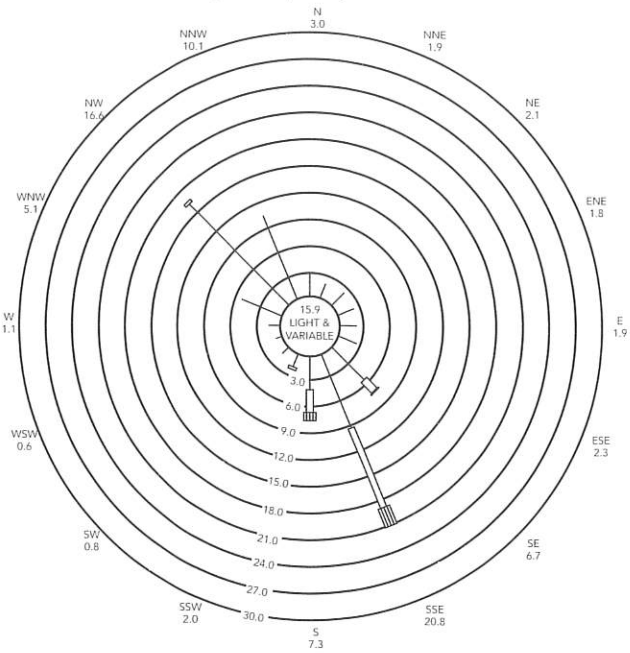


Station Location: Puget Sound Air Pollution Control Agency
Duwamish, 4752 East Marginal Way South
Seattle, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,764

Hour Average Surface Winds
Percentage Frequency of Occurrence



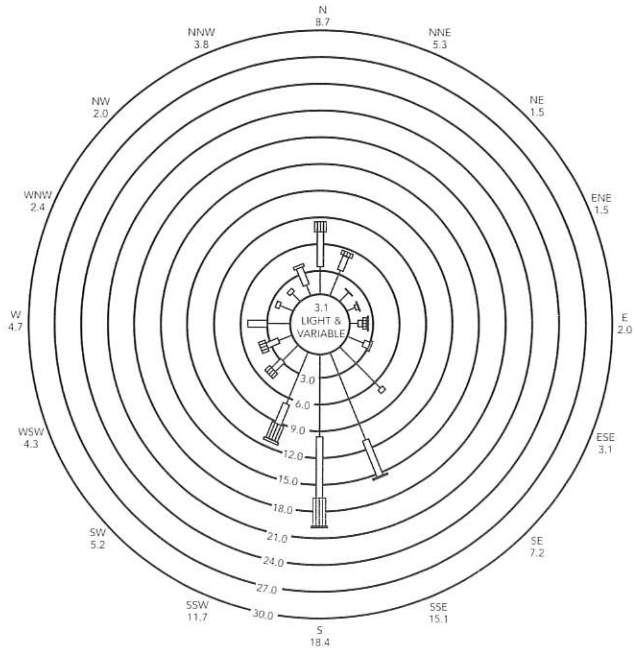
Station Location: Puget Sound Air Pollution Control Agency
17711 Ballinger Way NE
Lake Forest Park, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,723

1996

Hour Average Surface Winds
Percentage Frequency of Occurrence



Station Location: Puget Sound Air Pollution Control Agency
James Street and Central Avenue
Kent, Washington

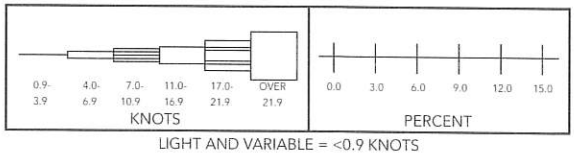
Inclusive Dates: All Months 1996

Total Observations: 8,756

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 hours—expressed as a percentage—that the wind blew from a particular direction and speed.

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 is expressed by percentage for that direction on the perimeter of each rose.

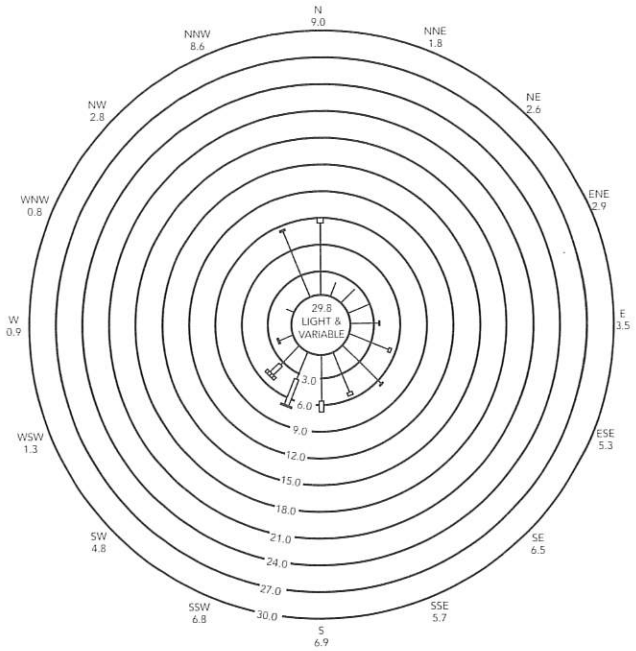
The length of each segment of a spoke represents the percentage of time the wind speed was within a specific speed interval for a particular direction. If summed for all wind directions, the result would provide the percentage of all hours the wind speed was measured within a specific interval. The percentage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



LIGHT AND VARIABLE = <0.9 KNOTS

Wind Roses [cont.]

Hour Average Surface Winds
Percentage Frequency of Occurrence



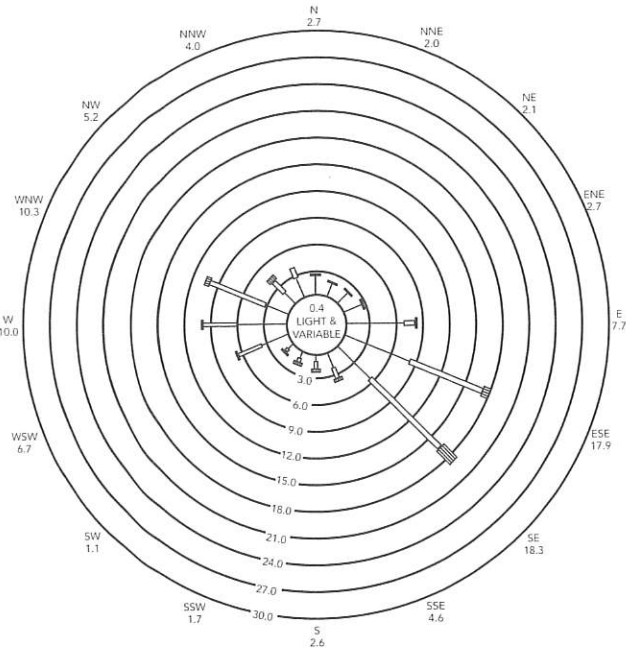
Station Location: Puget Sound Air Pollution Control Agency
20935 59th Place West
Lynnwood, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,753

1996

Hour Average Surface Winds
Percentage Frequency of Occurrence

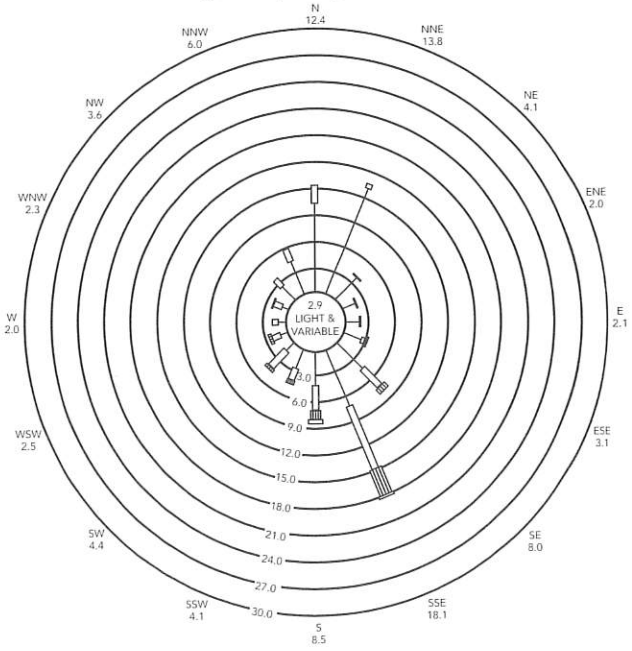


Station Location: Puget Sound Air Pollution Control Agency
Hoyt Avenue & 26th Street
Everett, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,779

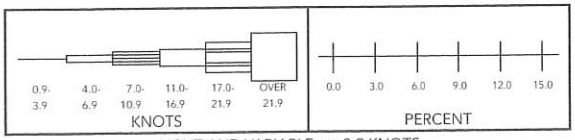
Hour Average Surface Winds
Percentage Frequency of Occurrence



Station Location: Puget Sound Air Pollution Control Agency
Marysville Junior High School 1605 7th Street
Marysville, Washington

Inclusive Dates: All Months 1996

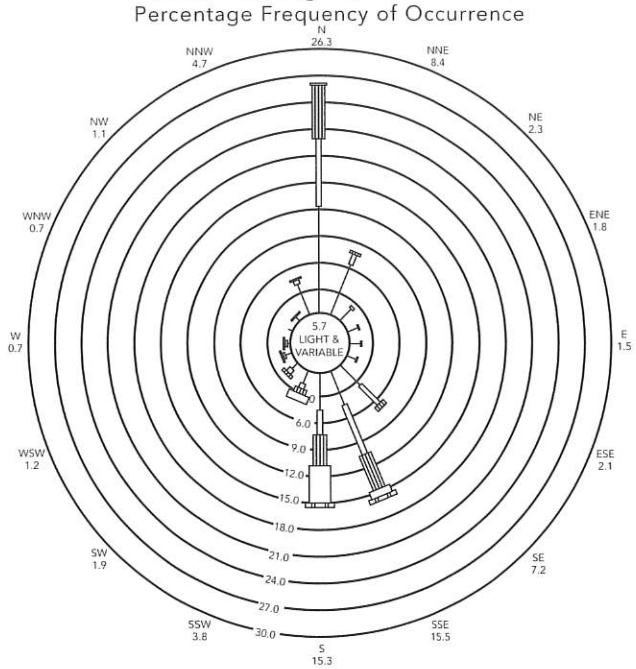
Total Observations: 8,773



LIGHT AND VARIABLE = <0.9 KNOTS

Wind Roses [cont.]

Hour Average Surface Winds
Percentage Frequency of Occurrence

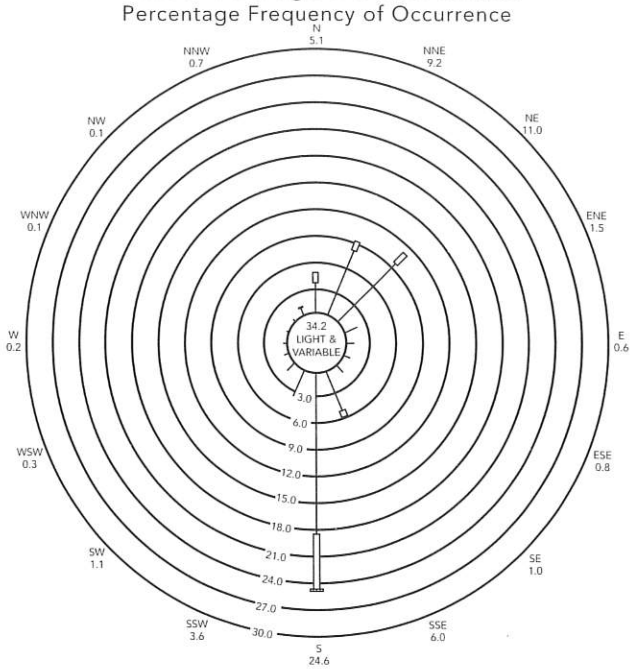


Station Location: Puget Sound Air Pollution Control Agency
Lions Park, 6th Avenue NE & Fjord Drive
Poulsbo, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,741

Hour Average Surface Winds
Percentage Frequency of Occurrence



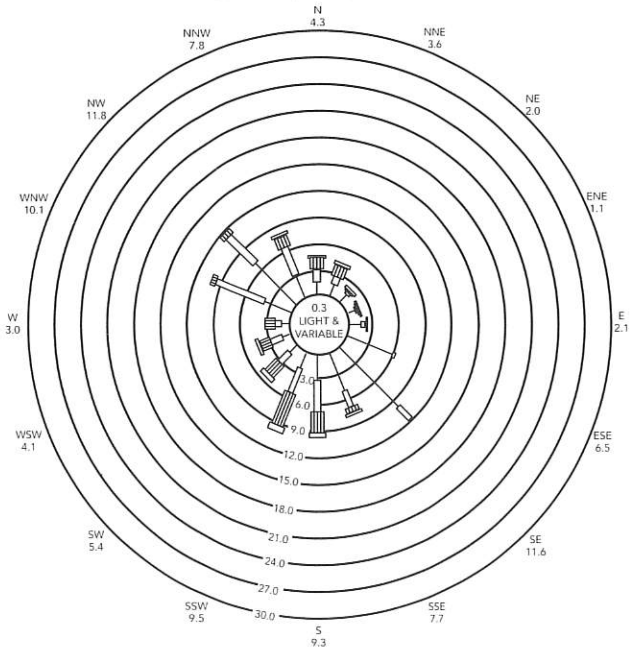
Station Location: Puget Sound Air Pollution Control Agency
Meadowdale, 7252 Blackbird Drive NE
Kitsap County, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,686

1996

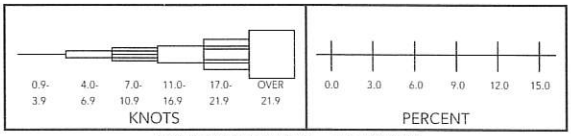
Hour Average Surface Winds
Percentage Frequency of Occurrence



Station Location: Puget Sound Air Pollution Control Agency
Fire Station #12, 2316 East 11th Street
Tacoma, Washington

Inclusive Dates: All Months 1996

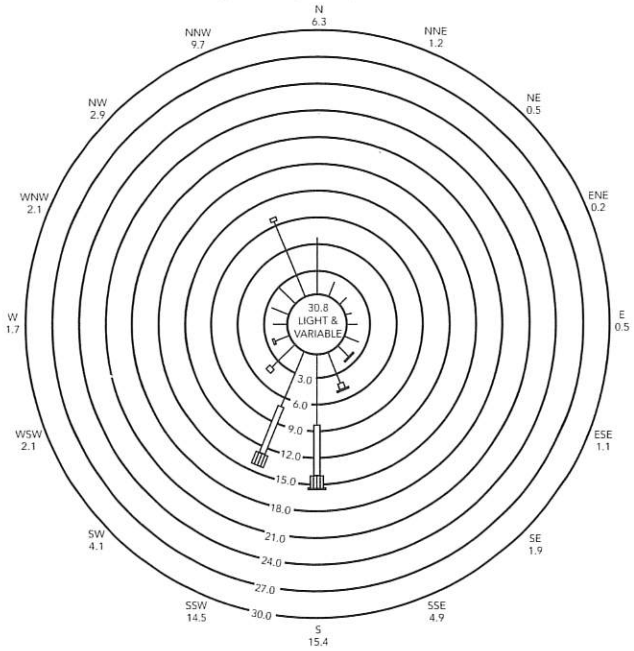
Total Observations: 8,674



LIGHT AND VARIABLE = <0.9 KNOTS

Wind Roses [cont.]

Hour Average Surface Winds
Percentage Frequency of Occurrence

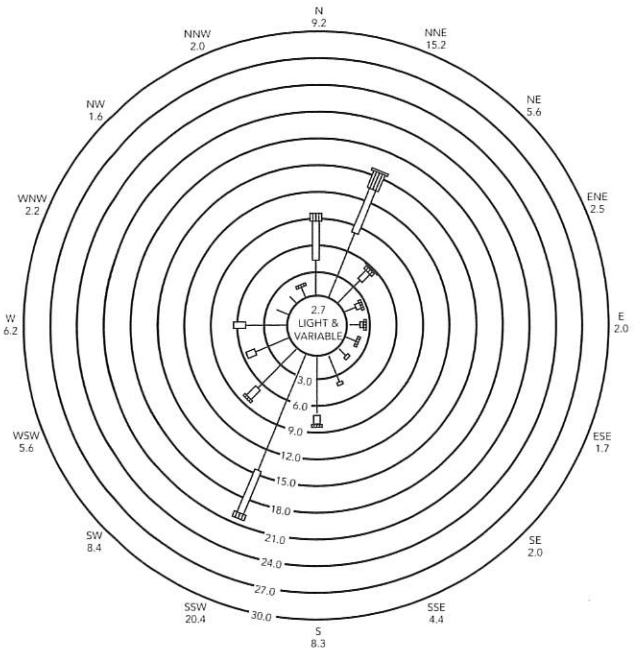


Station Location: Puget Sound Air Pollution Control Agency
South Hill, 9616 128th Street East
Puyallup, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,611

Hour Average Surface Winds
Percentage Frequency of Occurrence



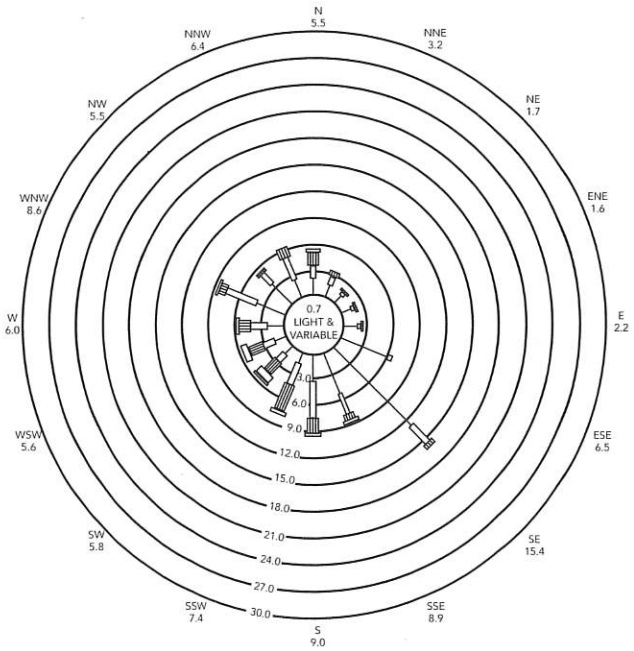
Station Location: Puget Sound Air Pollution Control Agency
27th Street NE & 54th Avenue NE
Northeast Tacoma, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,703

1996

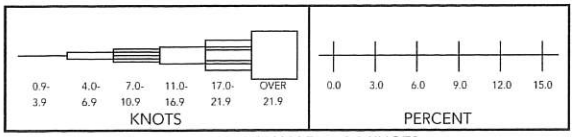
Hour Average Surface Winds
Percentage Frequency of Occurrence



Station Location: Puget Sound Air Pollution Control Agency
2301 Alexander Avenue
Tacoma, Washington

Inclusive Dates: All Months 1996

Total Observations: 8,757



LIGHT AND VARIABLE = <0.9 KNOTS

Visibility

Visibility reduction is technically referred to as light extinction. Light extinction is caused by two physical mechanisms—light scattering and light absorption. Light scattering, the main cause of light extinction, is a factor of relative humidity and fine particles in the atmosphere, particularly those less than 2.5 microns in diameter. Light is also absorbed in the atmosphere by fine particles and specific pollutant gases, particularly NO_2.

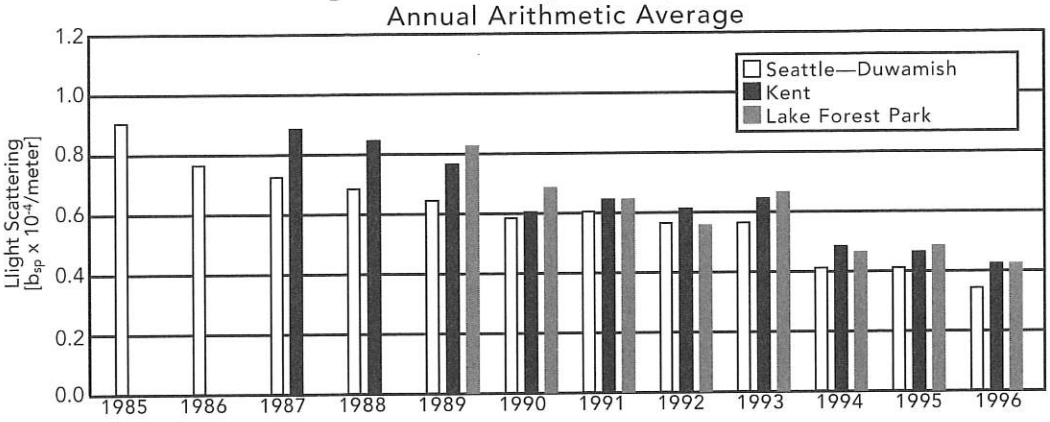
The instruments used to measure "visibility" or particulate pollution as indicated by light extinction are the nephelometer and the absorption photometer. The nephelometer is an instrument that continuously measures light scattering. Our agency operates nephelometers in Kent, Lake Forest Park and Seattle's Duwamish valley. All have heated sample inlets to eliminate water vapor—ensuring that only dry particle scattering is being measured. A limitation in using a heated nephelometer to measure visibility is that it only measures light scattering characteristics at the monitor location. What is measured at any given site may not accurately represent pollution and meteorological variability from a monitoring location to a distant point. We believe, however, that calculated visual ranges derived from nephelometers are generally representative of visibility in the communities immediately adjacent to the monitoring location.

The exact relationship between this nephelometer data and regional visibility is still uncertain. Regional visibility is likely influenced by fine particulate ($PM_{2.5}$), which is transported aloft and not easily detected by air monitoring sites (typically located in valleys). A new visibility site was installed in March 1996 on top of Beacon Hill in central Seattle. This site measures both light scattering and light absorption. Initial data from the site will be available in 1998.

Bar graphs showing trends of visual range and light scattering as measured by integrating nephelometers are provided on the accompanying page. The graphs indicate a strong trend of decreasing light scattering since 1987, and increasing visual range over this same time period. It should be noted that these calculated values do not take into consideration the impact of scattering due to changing sun angles in determining true horizontal or slant range visibility.

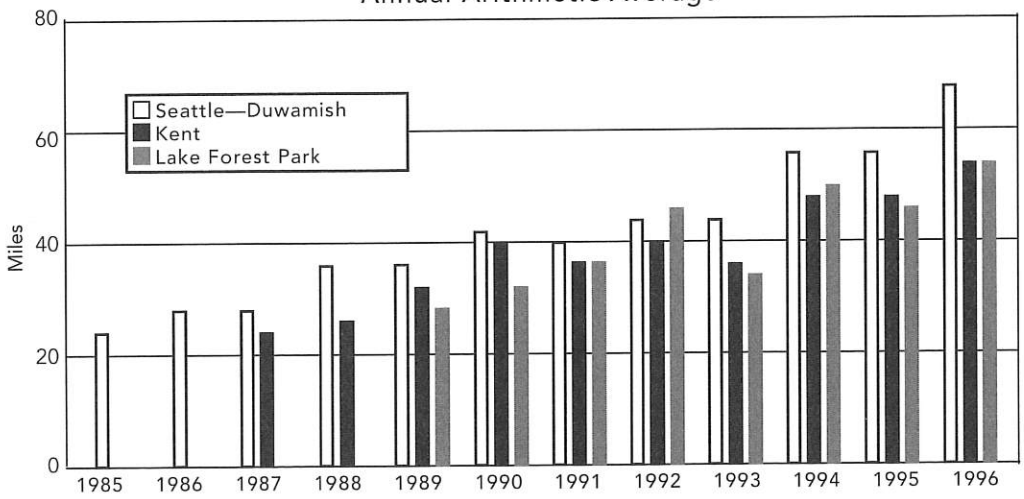
Visibility [cont.]

Light Scattering by Dry Particles
Annual Arithmetic Average



1996

Visual Range Due to Dry Particle Light Scattering
Annual Arithmetic Average



Impaired Air Quality Periods

Washington State has instituted a mandatory winter impaired air quality program targeted at sources of particulate matter, traditionally wood stoves and fireplaces. A first stage of impaired air quality is reached when PM_{10} concentrations rise to 75 ug/m^3 measured on a 24-hour average. At this level, a first stage burn ban may be called. Residential burning in fireplaces or uncertified wood stoves is prohibited (unless it is the only adequate source of heat). At PM_{10} levels of 105 ug/m^3 on a 24-hour average, a second stage burn ban is called, prohibiting the use of any kind of wood-burning appliance. PSAPCA has not called a second stage burn ban since January 1991.

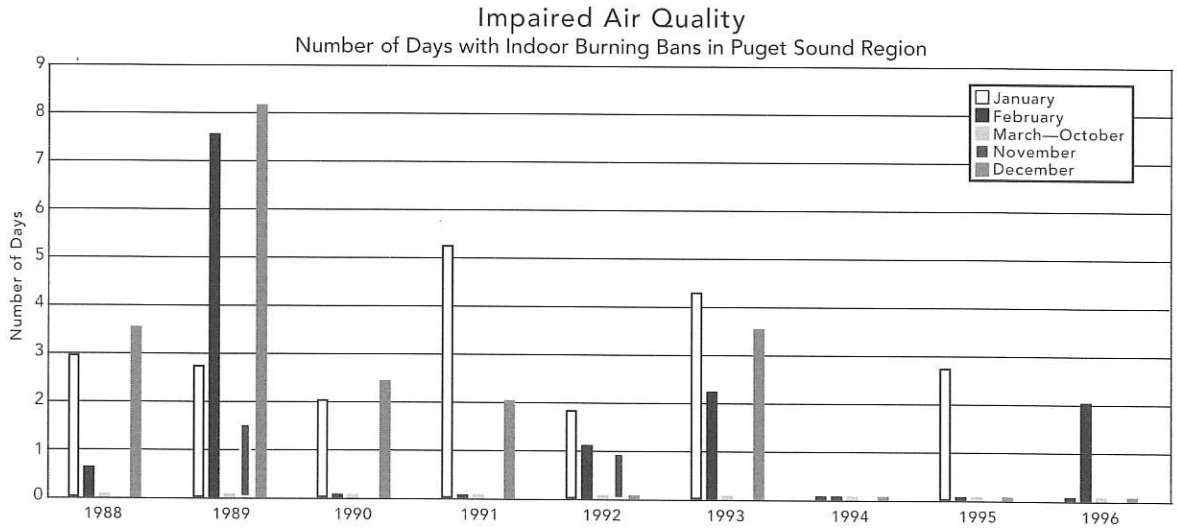
There was a single incidence of impaired air quality declared in 1996. A first stage burn ban was in effect from 2:30 pm on February 14 to 4:30 pm on February 16.

In 1996, impaired air quality response activities were expanded from only mandatory winter burn bans to voluntary programs aimed at both winter and summer air pollution. These programs involve urging citizens to take specific actions to prevent reaching winter burn ban particulate levels or summer ozone exceedances.

A Winter Air Pollution Watch involves voluntary curtailment of residential wood burning when weather conditions indicate that rising PM_{10} levels may reach a first stage burn ban. A Winter Air Pollution Watch is called when ambient particulate levels approach 75 ug/m^3 and stagnant conditions are expected to continue long enough for pollutant levels to potentially rise above the burn ban trigger level.

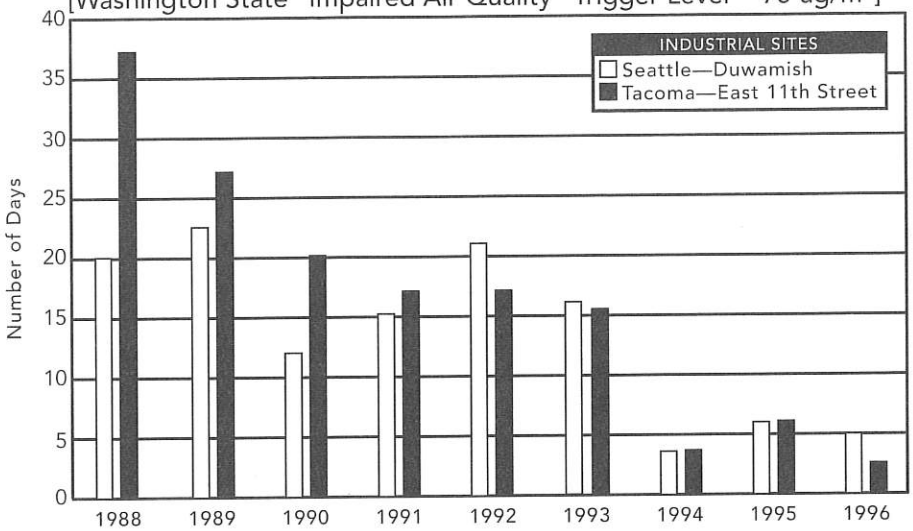
Voluntary summer activities are collectively entitled Smog Watch. As opposed to the Winter Air Pollution Watch, Smog Watch activities are driven much more by meteorology than measured air quality data. A Smog Watch is called when forecasts call for temperatures in the upper 80s or higher with little to no wind for at least a 72-hour period. Citizens are urged to take voluntary actions to help prevent an exceedance of the ozone standard. Calls to action emphasize reduced driving, refueling of motor vehicles in the cooler evening hours, and waiting until cooler weather to use gasoline-powered yard equipment.

The following bar charts show trends for the number of days per year with 24-hour PM_{10} concentrations at or above 75 ug/m^3. The first chart shows the number of days when an indoor burning ban was called for the Puget Sound region. The other charts show the number of days of elevated values for industrial and residential/commercial sites.



Impaired Air Quality Periods [cont.]

PM10
Number of Daily Values Greater than or Equal to 75 micrograms per cubic meter
[Washington State "Impaired Air Quality" Trigger Level = 75 ug/m3]



1996

PM10
Number of Daily Values Greater than or Equal to 75 micrograms per cubic meter
[Washington State "Impaired Air Quality" Trigger Level = 75 ug/m3]