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Seattle, Washington 98101

2002
Air Quality Data Summary

January 2004

Working Together for Clean Air

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The 2002 Air Quality Data Summary is available
for viewing or download on the internet at:

www.pscleanair.org/

Links to additional documents for download are also available at the web site.

This material is available in alternate formats for people with disabilities. Please call Carol Pogers at (206) 689-4080 (1-800-552-3565, ext. 4080).

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Introduction

This report is issued by the Puget Sound Clean Air Agency (the Agency) to inform the public of air quality throughout the Puget Sound region. It describes the sources and effects of the following pollutants, for which the U.S. Environmental Protection Agency (EPA) and the State of Washington have established ambient air quality standards:

- Particulate Matter (10 micrometers and 2.5 micrometers)
- Carbon Monoxide
- Sulfur Dioxide
- Nitrogen Dioxide
- Ozone
- Lead

This report also summarizes the region's Air Quality Index (AQI) as well as visibility estimates as measured by our nephelometer network.

A brief discussion is provided of the ambient air-monitoring program, including a description of the monitoring network, AQI, visibility, and pollutant descriptions and levels. The data are presented graphically and as statistical summaries, including comparisons to the ambient air quality standards. The report discusses the recorded data, and the seasonal variability of some pollutants. Data and areas exceeding the ambient air quality standards are identified. Also included are the results of an emissions inventory of major sources in the region conducted by the Agency for calendar year 1999.

The Puget Sound Clean Air Agency and Washington State Department of Ecology work together to monitor air quality within the Puget Sound region. Real-time air monitoring data are available on the Internet at www.pscleanair.org and https://fortress.wa.gov/ecy/aqp/Public/aqn.shtml. We encourage you to visit our website at www.pscleanair.org to find more extensive air quality data, educational materials, monthly air quality summaries, and discussions of current topics.

We are expanding and refining our Internet site to better serve the residents of the Puget Sound region. We want your feedback on our air quality data and program. Please submit your comments via email to Mary Hoffman at maryh@pscleanair.org or call at 206-689-4006.

Executive Summary for 2002

The national measure of the "quality" of the air is EPA's Air Quality Index (AQI). In the Puget Sound area, the number of 'good' air quality days continues to dominate regionally. There were no violations of the national ambient air quality standards (NAAQS) in 2002. However, there were brief periods when the air quality degraded into "moderate" or "unhealthy for sensitive groups". Based upon a review of this year's data the region continues to stay within the NAAQS.

We declared two burn bans in 2002, both in November. The burn bans were issued for November 1-6 and November 27 – December 4. The burn bans prohibited burning in fireplaces and older, uncertified wood stoves.

The table below shows the AQI breakdown by percentage in each category for the year. In 2002 the AQI highest value of 158, which falls within the category of "unhealthy," was measured on November 27, during a burn ban, at the South L Street monitoring station in Tacoma.

2002 AQI Ratings

County	AQI Rating (% of year)				Highest AQI
	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	
Snohomish	79%	19%	2%	—	116
King	74%	25%	1%	—	112
Pierce	74%	23%	3%	1 day	158
Kitsap	89%	11%	0%	—	77

The charts at the end of this summary show the region's air quality ratings for our four counties: Snohomish, King, Pierce, and Kitsap.

The table below presents the maximum pollutant concentrations measured in 2002, compared with the region's ambient air quality standards. The minimum measured visibility is also shown.

The Highest Concentrations and Lowest Visibility Measured During 2002

Parameter	Max/ Min	Value	Units	Averaging Time	Standard	Air Quality Index	Monitoring Station	Date	Time
$PM_{2.5}$ Reference	Max	61	µg/m3	24 Hour	65	141	7802 South L St, Tacoma	Monday, November 4	Full day
$PM_{2.5}$ Continuous Bam/Teom	Max	77	µg/m3	24 Hour	65	158	7802 South L St, Tacoma	Wednesday, November 27	Full day
$PM_{2.5}$ Continuous Nephelometer	Max	66	µg/m3	24 Hour	65	151	7802 South L St, Tacoma	Wednesday, November 27	Full day
PM_{10} Reference	Max	99	µg/m3	24 Hour	150	73	2301 Alexander Ave, Tacoma	Thursday, May 2	Full day
PM_{10} Continuous Bam/Teom	Max	161	µg/m3	24 Hour	150	104	2301 Alexander Ave, Tacoma	Monday, April 22	Full day
Ozone	Max	99	ppb	1 Hour	120	—	30525 SE Mud Mountain Road, Enumclaw	Monday, July 22	4 pm-5 pm
Ozone	Max	84	ppb	8 Hour	84	100	30525 SE Mud Mountain Road, Enumclaw	Monday, July 22	Noon-8 pm
Carbon Monoxide	Max	9.8	ppm	1 Hour	35	—	310 Northgate Way, Seattle	Tuesday, December 31	9 am-10 am
Carbon Monoxide	Max	9.8	ppm	1 Hour	35	—	1101 Pacific Ave, Tacoma	Monday, November 4	5 pm-6 pm
Carbon Monoxide	Max	5.9	ppm	8 Hour	9	65	1101 Pacific Ave, Tacoma	Monday, November 4	4 pm-Midnight
Sulfur Dioxide	Max	78	ppb	1 Hour	400	—	15^{th} Ave S & Charlestown, Seattle	Thursday, September 12	1 am-2 am
Sulfur Dioxide	Max	16	ppb	24 Hour	100	24	15^{th} Ave S & Charlestown, Seattle	Wed, Sept 11-Thu, Sept 12	11 am-11 am
Visibility	Min	3	miles	1 Hour	None	—	1605 7th St, Marysville	Thursday, July 4	10 pm-11 pm
Visibility	Min	8	miles	24 Hour	None	—	7802 South L St, Tacoma	Thursday, November 28	Full day

Note: All times are Pacific Standard Time (PST)

Particulate Matter (PM): The Agency monitors two sizes of particulate matter, 10-micrometers and 2.5-micrometers. Particles smaller than 2.5 micrometers in diameter are called "fine" particles, or $PM_{2.5}$ and comes from all types of combustion, including cars, diesel trucks and buses, industrial facilities, and wood burning. It can also be formed in the atmosphere by chemical reactions of pollutant gases. Particles between 2.5 and 10 micrometers in diameter are called "coarse" particles. Pm_{10} includes both "fine" and "coarse" particles. Coarse particles typically come from crushing or grinding operations and dust from roads. In 2002, the maximum concentration for PM_{10} was measured in Tacoma's industrial area, near the Port of Tacoma. Maximum PM_{10} concentrations are nearly always measured in the Seattle or Tacoma industrial areas because of the density and diversity of commercial and industrial activities. The maximum concentration for $PM_{2.5}$ was measured at the South L Street site in South Tacoma, a neighborhood where wood burning stoves and fireplaces are the major source of particulates during the heating season. Even though the maximum concentrations for both $PM_{2.5}$ and PM_{10} exceeded the level of the standards, they did not constitute violations because of flexibilities in the form of the standards.

Ozone (O_3): Ozone forms in the lower atmosphere when hydrocarbons (volatile organic compounds, or VOCs) and nitrogen oxides chemically react in sunlight and high temperatures. The highest measured concentrations for ozone were in the southern portion of the Puget Sound air shed, near Enumclaw. The highest ozone levels in the Puget Sound region occur from mid-May to mid-September on the few hot days favorable for photochemical activity. In this region the hot, sunny days favorable for ozone formation typically have light north-to-northwest afternoon winds. The photochemical reactions that produce ozone continue for several hours, and the trapped pollutants are transported downwind. This creates the greatest ozone concentrations between noon and early evening, at locations 10 to 30 miles from the major sources of the NO_x and VOCs. The highest concentrations in the Puget Sound region are measured in areas such as North Bend, Enumclaw, and Eatonville.

The measured maximum 8-hour average ozone concentration in 2002 reached the NAAQS concentration of 84 ppb, and none of the measured values at any monitoring sites exceeded or violated the standard. The standard accounts for minor exceedances due to variable meteorological conditions by comparing the 3-year average of the 4^{th} highest daily maximum to 84 ppb. The highest 3-year average of the 4^{th} highest daily maximum concentration was 69 ppb in 2002, well below the standard.

Carbon monoxide (CO): Carbon monoxide largely results from fuel combustion. The most likely areas to have excessive CO concentrations are larger cities where there are more cars, trucks, and congested streets. The highest concentrations of CO were measured in the downtown urban areas of Tacoma and Seattle and were less than 70% of the standard. Neither the 1-hour nor 8-hour standard for CO was exceeded in 2002.

Sulfur dioxide (SO_2): Sulfur dioxide is mainly produced by combustion of fossil fuels containing sulfur compounds. Since the region's largest sources of SO_2 have ceased operation, most monitoring for this pollutant was stopped at the end of 1999 and has been reduced to a single monitor at the Seattle Beacon Hill site. The maximum measured SO_2 concentrations in 2002 were less than 20 percent of the standards.

Lead (Pb): The primary sources of lead in the region were the combustion of leaded gasoline and a large commercial lead smelter. Monitoring for lead was stopped at the end of 1999 because of the closure of the Harbor Island lead smelter and the elimination of leaded gasoline.

Nitrogen dioxide (NO_2): Nitrogen dioxide is created from nitrogen oxide (NO) emissions from high temperature fuel combustion sources such as industrial furnaces and boilers, trucks and automobiles. It is not considered a significant problem in the Puget Sound region. The annual hourly average measured at the Seattle Beacon Hill site has consistently been less than half of the standard.

Visibility: Visibility is often explained in terms of visual range and light extinction. *Visual range* is the maximum distance at which you can see a black object against the horizon. *Light extinction* is the sum of light scattering and light absorption by fine particles and gases in the atmosphere. The more light extinction you have, the shorter your visual range. Reduced visibility is caused by weather (clouds, fog, and rain) and air pollution (fine particles and gases). The major pollution contributor is fine particulate matter ($PM_{2.5}$), which is transported aloft and may remain suspended for a week or longer. Visibility is generally seasonal, with lower visibilities during fall and winter. Summertime visibilities can be up to 20 miles higher than during winter months.

Based upon measurements by the Agency's nephelometer network, the average visibility for the Puget Sound basin has steadily increased over the last decade with year-to-year variability caused by meteorology. For the 12-year period from January 1991 through December 2002, the 12-month moving average of visual range increased from 48 miles to 67 miles, an average increase of 3% per year. The minimum daily visual range in 2002 was measured in November, a very stagnant period which included a 5-day burn ban and a 7-day burn ban. For the last four years, visibility was significantly impaired following July 4th celebrations, when fine particulate matter from fireworks created excessive smoke.

Smog Watch and Burn Bans

Indoor wood burning bans are most likely during the winter months, due to increased wood burning activities and longer lasting temperature inversions. A Smog Watch is a voluntary outreach awareness air quality program that addresses the causes of ozone pollution during the summer months.

In 2002 there were two first-stage bans, both declared in November.

- When the PM_{10} trigger was reached, a burn ban was declared on Friday, November 1st which lasted 5 days. A persistent ridge of high pressure over the Northwest with clear skies created nightly temperature inversions that trapped pollutants. This, combined with poor air circulation and limited day-time ventilation, inhibited effective dispersion of pollutants and led to elevated coarse and fine particulate levels. A Pacific weather system ended the stagnant conditions and the burn ban was ended Wednesday, November 6.
- The second burn ban was declared on Wednesday, November 27 which lasted 7 days. High pressure settled over the Northwest for the last ten days of November and didn't completely leave until December 10th. As in the earlier ban, a regional temperature inversion and very little wind allowed particulate levels to elevate. A passing weather system on December 4th provided enough mixing and dispersion to end the burn ban.

There were no smog watches issued in 2002 due primarily to an unseasonably cool summer.

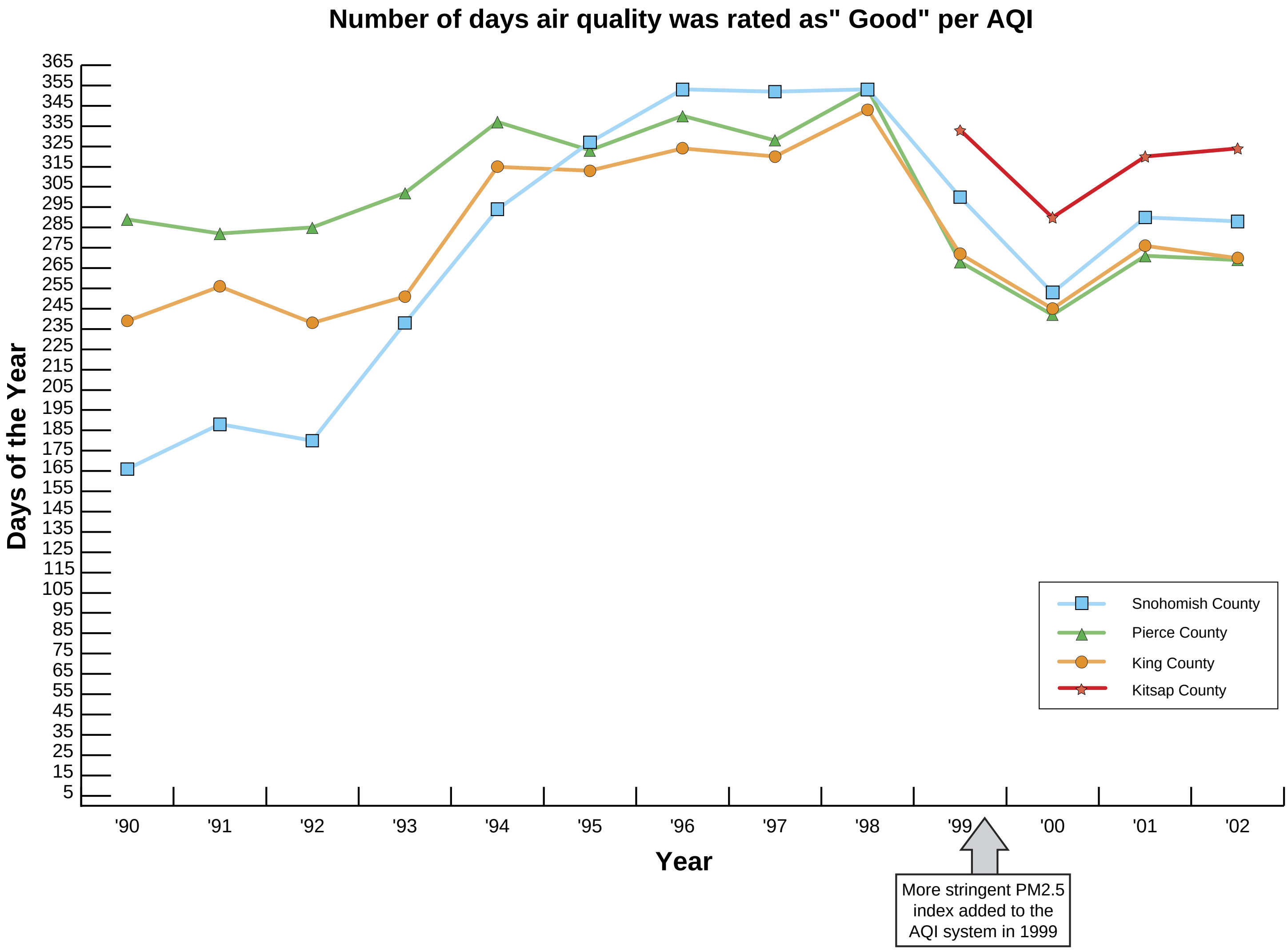
Emissions Inventory: An emissions inventory was developed by the Agency for calendar year 1999, summarizing the quantities of criteria air pollutants reported by large industrial sources or estimated using EPA methods. Inventories are typically performed every three years for the Puget Sound region. The inventory covered King, Kitsap, Pierce, and Snohomish counties. The table below presents the results of the Emissions Inventory. The next update of this inventory is expected to be completed in 2004. Estimated and Reported Air Contaminant Emission Inventory Summary for 1999 (thousands of tons)

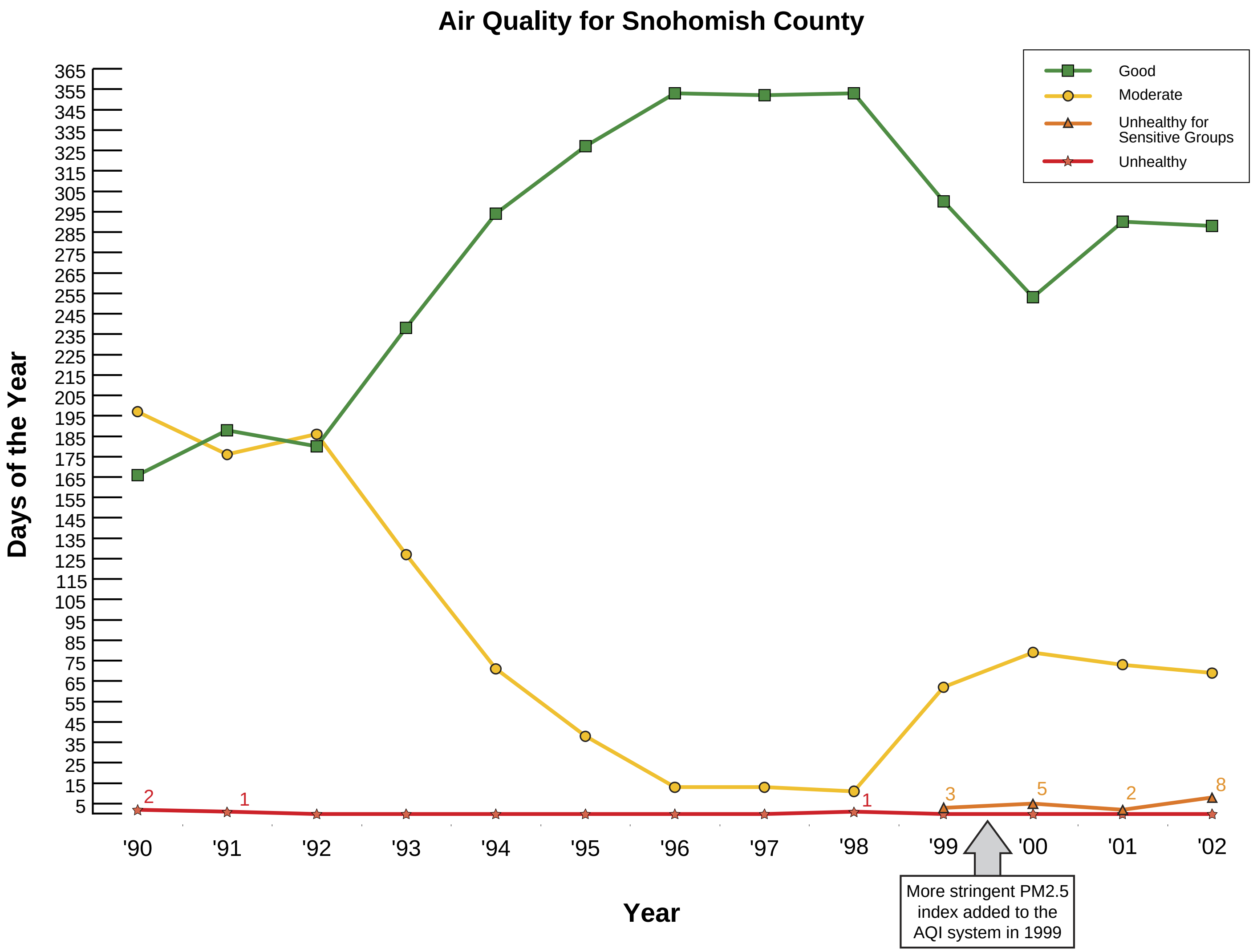
Source Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOCs
Point Sources	22	10	2	1	5	24
On-road Vehicles	733	83	2	2	3	56
Off-road Vehicles	269	40	3	3	5	21
Stationary Area Sources	115	10	65	29	2	53
TOTALS	**1138**	**143**	**71**	**34**	**15**	**154**

This inventory demonstrates that on-road and off-road vehicles are significant contributors to criteria pollutant emission in the Puget Sound air shed. Stationary area sources (home heating, small industrial sources, outdoor burning, etc.) are a major contributor of $PM_{2.5}$ emissions. Although biogenic sources (including trees, plants, and crops, all of which produce hydrocarbons) are not included in the above table, they are estimated to produce 70,000 tons of VOCs per year in Puget Sound and impact the production of ozone concentrations. Most of the changes from the previous inventory report are due to revised on-road mobile source estimates completed for our region by EPA using their newest MOBILE6 emission factor model. For additional information on emissions contact our Air Resource Department at 206-689-4051.

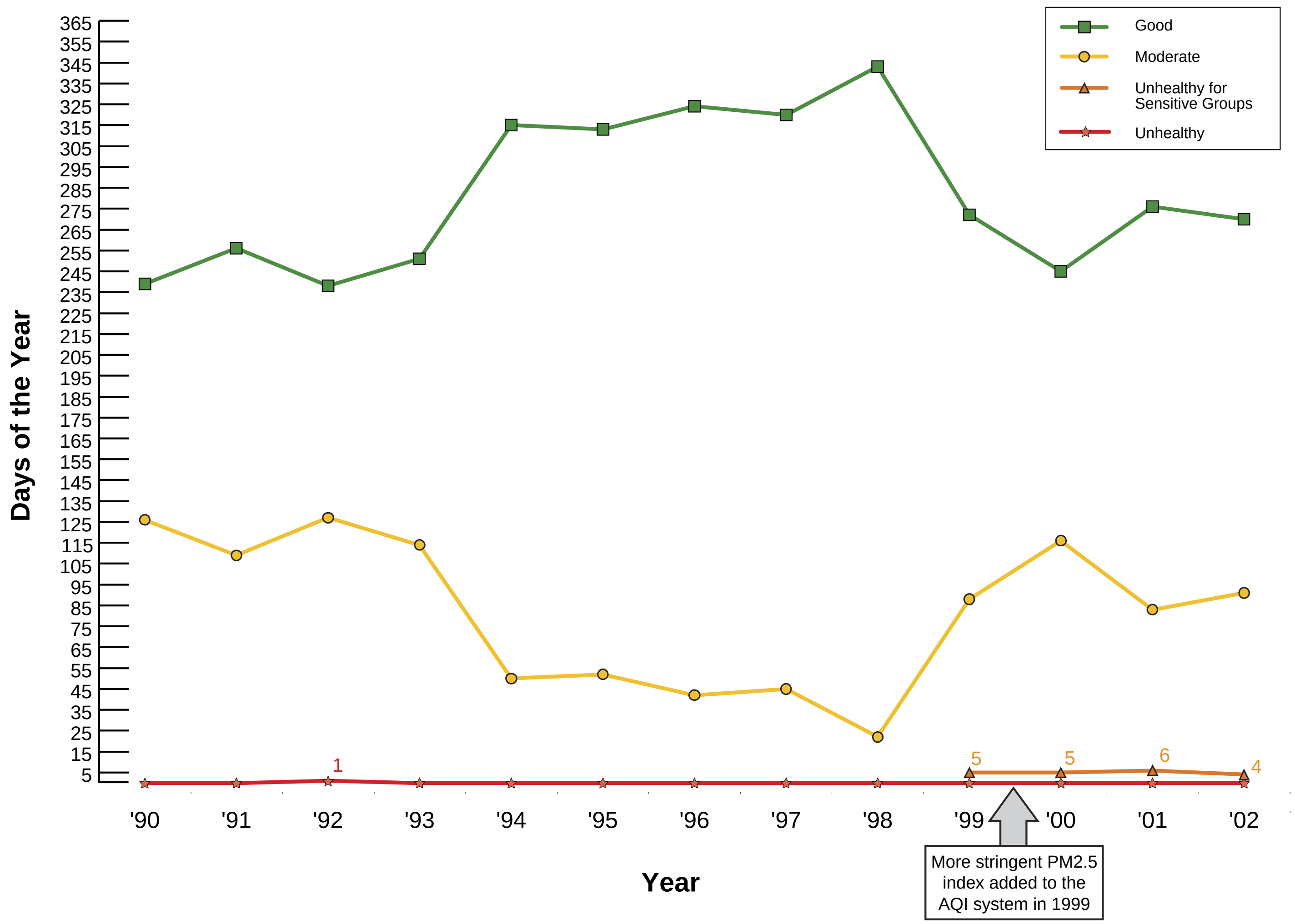
Percentage of Emissions Contributed

Source Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOCs
On-road/Off-road Vehicles	88%	86%	7%	12%	54%	51%
Stationary Area Sources	10%	7%	91%	84%	11%	34%
Point Sources	2%	7%	2%	4%	35%	15%

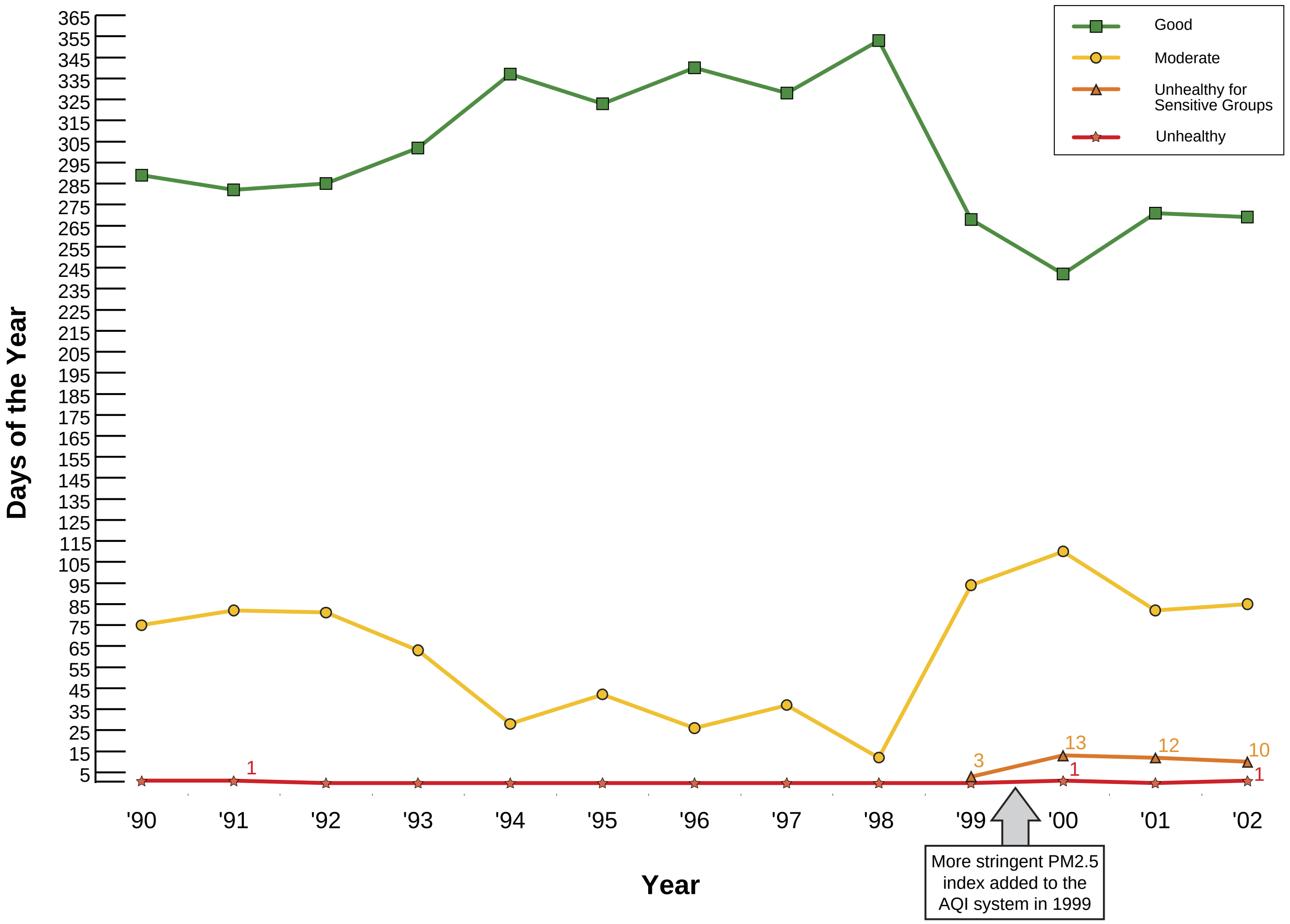

Number of days air quality was rated as" Good" per AQI
Days of the Year
365
355
345
335
325
315
305
295
285
275
265
255
245
235
225
215
205
195
185
175
165
155
145
135
125
115
105
95
85
75
65
55
45
35
25
15
5
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Snohomish County
Pierce County
King County
Kitsap County
More stringent PM2.5 index added to the AQI system in 1999


Air Quality for Snohomish County
Days of the Year
365
355
345
335
325
315
305
295
285
275
265
255
245
235
225
215
205
195
185
175
165
155
145
135
125
115
105
95
85
75
65
55
45
35
25
15
5
Good
Moderate
Unhealthy for Sensitive Groups
Unhealthy
2
1
1
3
5
2
8
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
More stringent PM2.5 index added to the AQI system in 1999

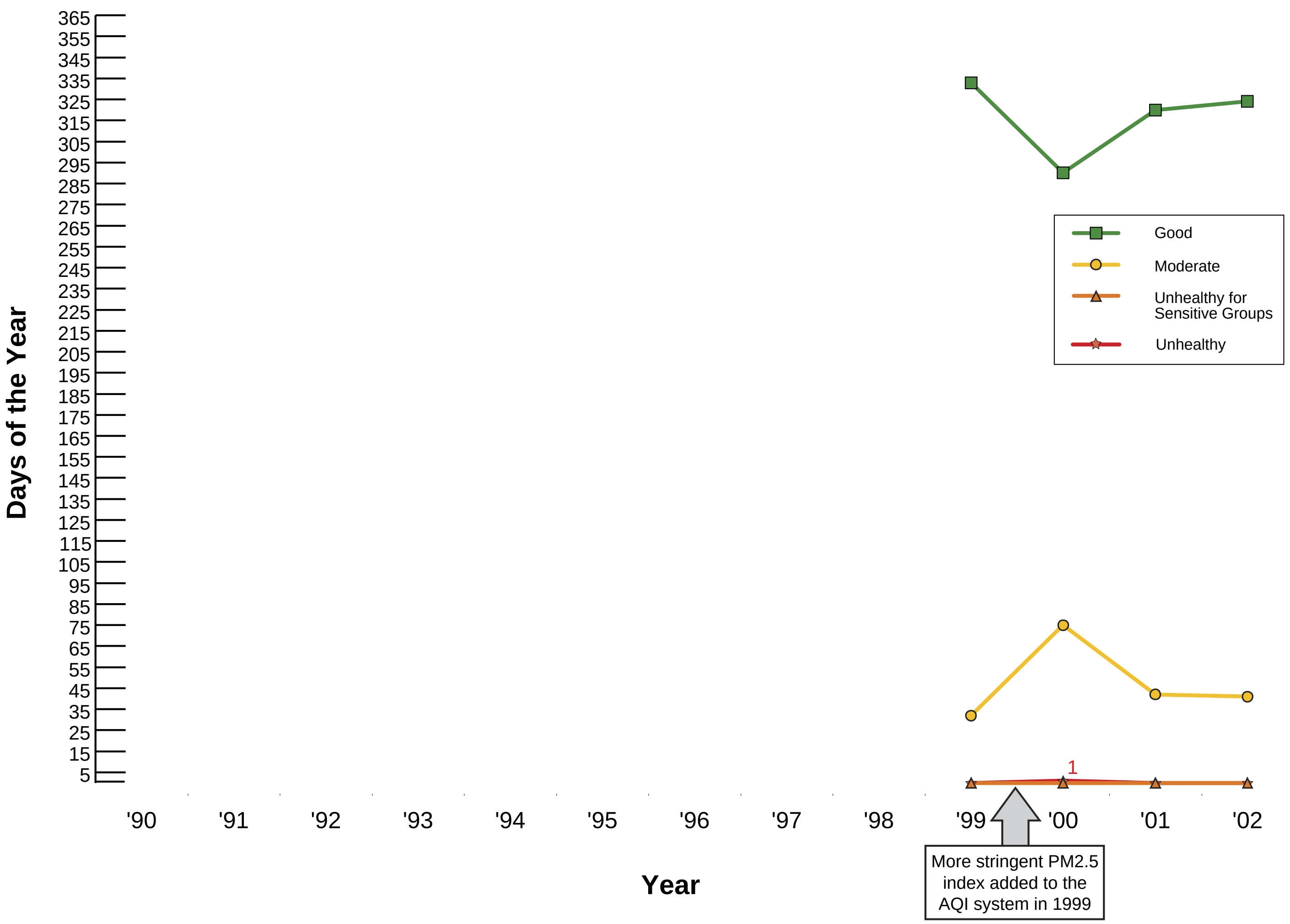
Air Quality for King County



Air Quality for Pierce County



Air Quality for Kitsap County



Monitoring Network

The Puget Sound monitoring network is a composite of meteorological and pollutant-specific monitoring equipment. The Puget Sound Clean Air Agency and the Washington State Department of Ecology operate all of the monitoring stations. Data from the network are either collected manually by field staff or sent directly to engineers and scientists through a telemetry network. The table on the next page presents a summary of the monitoring stations used and parameters monitored from 1999 to 2002.

Numerous parameters affect the choice of site for a monitoring station. Using EPA citing criteria ensures a consistent and representative picture of air quality in the Puget Sound area. However, some sites are selected to focus on the emissions of a single pollutant or group of sources. Some sites are intended to represent an industrial area, while others represent a residential area.

For pollutants of particular interest in the Puget Sound, the Agency uses more than one method in order to better understand the effects of the pollutant on the environment. For example, as shown in the monitoring network table, particulates (both 10 micrometers and 2.5 micrometers) are monitored according to EPA methods as well as through continuous methods. The second table below lists the monitoring methods used.

The monitoring network map shows that monitoring stations are located throughout the Puget Sound region. As you might expect, there are more stations in highly populated areas and fewer stations in rural areas. The station IDs listed in the table corresponds with map identification letters. These identifications are used throughout this data summary.

Monitoring Network for 1999-2002

Station ID	Location	PM_{10}	PM_{10}co	$PM_{2.5}$	$PM_{2.5}$co	$PM_{2.5}$ls	O_3	SO_2	NO_x	CO	TSP/Pb	b_{sp}	Wind	Temp	b_{ap}	RH	VSBY	PHOTO
AO⦿	Northgate, 310 NE Northgate Way, Seattle									●								
AQ	Queen Anne Hill, 400 W Garfield St, Seattle (began Mar 1, 2001)					●						●					●	●
AR⦿	4th Ave & Pike St, 1424 4th Ave, Seattle									●								
AS⦿	5th Ave & James St, Seattle (ended Feb 28, 2001)									●								
AU⦿	622 Bellevue Way NE, Bellevue (ended Jul 30, 1999)									●								
BF⦿	University District, 1307 NE 45th St, Seattle									●								
BU⦿	Highway 410, 2 miles E of Enumclaw (ended Sep 30, 2000)						●											
BV⦿	Sand Point, 7600 Sand Pt Way NE, Seattle												●	●				
BW⦿	Beacon Hill, 15th S & Charlestown, Seattle			●			●	●	●			●	●	●	●	●	●	
CE	Duwamish, 4752 E Marginal Way S, Seattle	●	●	●	●	●						●	●				●	
CU	Harbor Island, 2555 13th Ave SW, Seattle (ended Sep 30, 1999)										●							
CW	James St & Central Ave, Kent	●	●	●	●	●						●	●				●	
CX	17711 Ballinger Way NE, Lake Forest Park (ended Jun 4, 1999)	●	●									●	●				●	
CZ	Aquatic Center, 601 143rd Ave NE, Bellevue (began Oct 1,2000)				●	●						●					●	
DA	South Park, 8025 10th Ave S, Seattle			●		●						●	●				●	
DB	17171 Bothell Way NE, Lake Forest Park (began Mar 10, 1999)	●	●	●	●	●						●	●				●	
DC⦿	305 Bellevue Way NE, Bellevue (began Nov 2, 2000)			●														
DE⦿	City Hall, 15670 NE 85th St, Redmond (began Aug 4, 1999)			●														
DF⦿	30525 SE Mud Mountain Road, Enumclaw						●											
DG⦿	42404 SE North Bend Way, North Bend (began Jan 3, 1999)			●	●		●					●	●	●				
DH⦿	2421 148th Ave NE, Bellevue (began Jan 1, 2000)									●								
DK⦿	43407 212th Ave SE, 2 mi W of Enumclaw												●	●				
DL⦿	NE 8th St & 108th Ave NE, Bellevue									●								
DN⦿	20050 SE 56th, Lake Sammamish State Park, Issaquah						●											
DP⦿	504 Bellevue Way NE, Bellevue (ended Sep 30, 1999)	●		●														

Monitoring Network for 1999-2002

Station ID	Location	PM_{10}	PM_{10}co	$PM_{2.5}$	$PM_{2.5}$co	$PM_{2.5}$ls	O_3	SO_2	NO_x	CO	TSP/Pb	b_{sp}	Wind	Temp	b_{ap}	RH	VSBY	PHOTO
DZ⦿	Georgetown, 6431 Corson Ave S, Seattle (began Feb 1, 2000)								●	●			●					
EA	Fire Station #12, 2316 E 11th St, Tacoma (ended Dec 31, 2000)	●	●										●					
EP	27th St NE & 54th Ave NE, Tacoma (ended Feb 29, 2000)	●						●					●					
EQ	Port of Tacoma, 2301 Alexander Ave, Tacoma	●	●	●	●	●						●	●				●	
ER	South Hill, 9616 128th St E, Puyallup	●	●	●	●	●						●	●				●	
ES	7802 South L St, Tacoma (began Oct 3, 1999)			●	●	●						●	●				●	
FF⦿	5225 Tower Drive NE, Northeast Tacoma												●	●				
FG⦿	Mt Rainier National Park, Jackson Visitor Center (began May 1, 1999)						●											
FH⦿	Charles L Pack Forest, La Grande						●											
FL⦿	1101 Pacific Ave, Tacoma									●								
ID	Hoyt Ave & 26th St, Everett (ended Feb 29, 2000)							●					●					
IG	Marysville JHS, 1605 7th St, Marysville	●	●	●	●	●						●	●				●	
IH	20935 59th Place West, Lynnwood (ended Jun 8, 1999)	●	●									●	●				●	
II	6120 212th St SW, Lynnwood (began Oct 1, 1999)			●	●	●						●	●				●	
JP⦿	2939 Broadway Ave, Everett (began Apr 1, 2001)									●								
JQ⦿	44th Ave W & 196th St SW, Lynnwood									●								
JS⦿	Broadway & Hewitt Ave, Everett (ended May 21, 2000)									●								
QE	Meadowdale, 7252 Blackbird Dr NE, Bremerton	●			●								●					
QF	Lions Park, 6th Ave NE & Fjord Dr, Poulsbo (ended Feb 29, 2000)												●					
QG	Fire Sta #51, 10955 Silverdale Way, Silverdale (began Jun 2, 2000)				●								●					
UB⦿	71 E Campus Dr, Belfair (began May 1, 2002)						●											
VK⦿	Fire Station, 709 Mill Road SE, Yelm (began May 1, 2000)						●											

Notes:

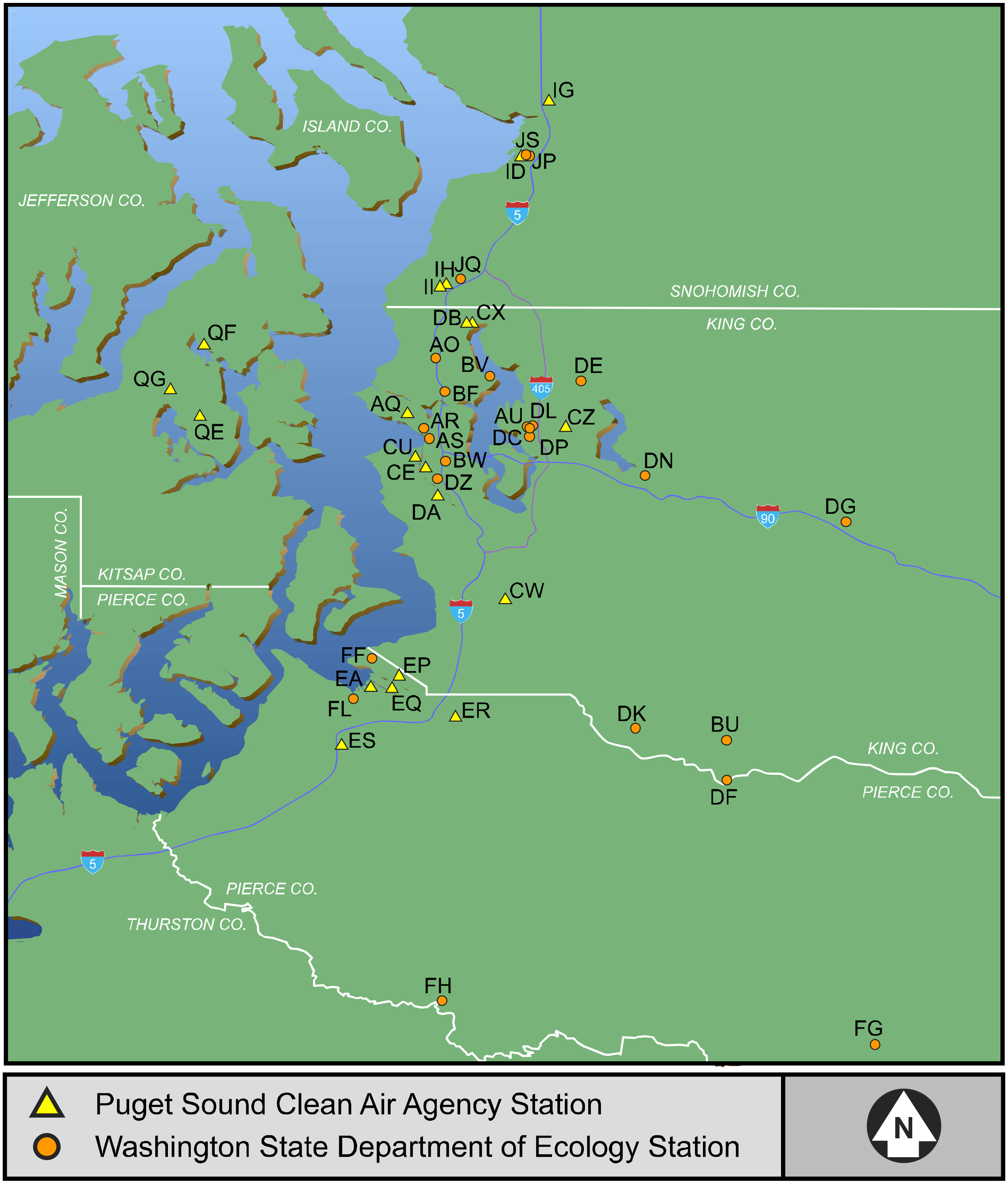
⦿: Station operated by Washington State Department of Ecology
b_{ap}: Light absorption by atmospheric particles (absorption photometer)
b_{sp}: Light scattering by atmospheric particles (nephelometer)
CO: Carbon Monoxide
NO_x: Nitrogen Oxide
O_3: Ozone

PHOTO: Visibility (camera)
PM_{10}: Particulate Matter 10 micrometers (reference)
PM_{10}co: Particulate Matter 10 micrometers (continuous)
$PM_{2.5}$: Particulate Matter 2.5 micrometers (reference)
$PM_{2.5}$co: Particulate Matter 2.5 micrometers (continuous)
$PM_{2.5}$ls: Particulate Matter 2.5 micrometers (light scattering)

RH: Relative Humidity
SO_2: Sulfur Dioxide
Temp: Air temperature
TSP/Pb: Total suspended particles and Lead
VSBY: Visual range (light scattering by atmospheric particles)
Wind: Wind direction & speed

Monitoring Methods Used from 1999 to 2002 in Puget Sound Air Shed

Pollutant Code	Measurement	Method	Units
Bap	Light Absorption by Particles	Light Absorption by Aethalometer	bap (x 10 exp-4)/m
Bsp	Light Scattering by Particles	Nephelometer - Heated Inlet	bsp (x 10 exp-4)/m
CO	Carbon Monoxide	Gas Nondispersive Infrared Radiation	Parts per Million
NO_x	Nitrogen Oxides (NO_x)	Chemiluminescence	Parts per Million
	Nitric Oxide (NO)	Chemiluminescence	Parts per Million
	Nitrogen Dioxide (NO_2)	Chemiluminescence	Parts per Million
O_3	Ozone	UV Absorption	Parts per Million
Pb	Lead	Standard High Volume	Micrograms per Standard Cubic Meter
PM_{10}	PM_{10}	Reference - Hi Vol Andersen/ GMW 1200	Micrograms per Cubic Meter
PM_{10}co	PM_{10} Beta Attenuation	Andersen FH621-N	Micrograms per Cubic Meter
	PM_{10} Teom	R&P Mass Transducer	Micrograms per Cubic Meter
$PM_{2.5}$	$PM_{2.5}$ Partisol	Reference—R&P Partisol 2025	Micrograms per Cubic Meter
$PM_{2.5}$co	$PM_{2.5}$ Beta Attenuation	Andersen FH621-N	Micrograms per Cubic Meter
	$PM_{2.5}$ Teom	R&P Mass Transducer	Micrograms per Cubic Meter
$PM_{2.5}$ls	$PM_{2.5}$ Nephelometer	Radiance Research M903 Nephelometer	Micrograms per Cubic Meter
RH	Relative Humidity	Continuous Instrument Output	Percent Relative Humidity
SO_2	Sulfur Dioxide	UV Fluorescence	Parts per Million
Temp	Temperature	Continuous Instrument Output	Degrees F
TSP	PM Total Hi-Vol	Standard High Volume	Micrograms per Standard Cubic Meter
Vsby	Visual Range	Light Scattering by Nephelometer	Miles
Wind	Wind Speed	RM Young 05305 Wind Monitor AQ	Miles per Hour
	Wind Direction	RM Young 05305 Wind Monitor AQ	Degrees


ISLAND CO.
JEFFERSON CO.
SNOHOMISH CO.
KING CO.
MASON CO.
KITSAP CO.
PIERCE CO.
KING CO.
PIERCE CO.
PIERCE CO.
THURSTON CO.
IG
JS
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ID
5
IH
JQ
II
DB
CX
AO
QF
QG
QE
BV
DE
BF
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AQ
AR
AU
DL
CZ
DC
AS
DP
CU
BW
DN
CE
DZ
DA
90
DG
CW
5
FF
EP
EA
EQ
FL
ER
DK
BU
ES
DF
5
FH
FG
Puget Sound Clean Air Agency Station
Washington State Department of Ecology Station
N

Impaired Air Quality—Burn Bans and Smog Watch

Burn Bans

Washington State has a winter impaired air quality program targeting sources of particulate matter from wood stoves and fireplaces. According to the Agency's *Regulation I, Article 13 Solid Fuel Burning Device Standards*, the first stage of impaired air quality is reached when at any monitoring station:

- PM_{10} concentrations (24-hour average) reach 60 µg/m^3, or
- Carbon monoxide concentrations (8-hour average) reach 8 ppm

At these levels, a first-stage burn ban may be declared. For a first-stage burn ban, residential burning in fireplaces or uncertified wood stoves is prohibited (unless it is the only adequate source of heat). A second-stage burn ban may be declared when PM_{10} levels reach 105 µg/m^3 (24-hour average). For a second-stage burn ban, the use of any kind of wood-burning device is prohibited. The Agency has not issued a second-stage burn ban since 1991.

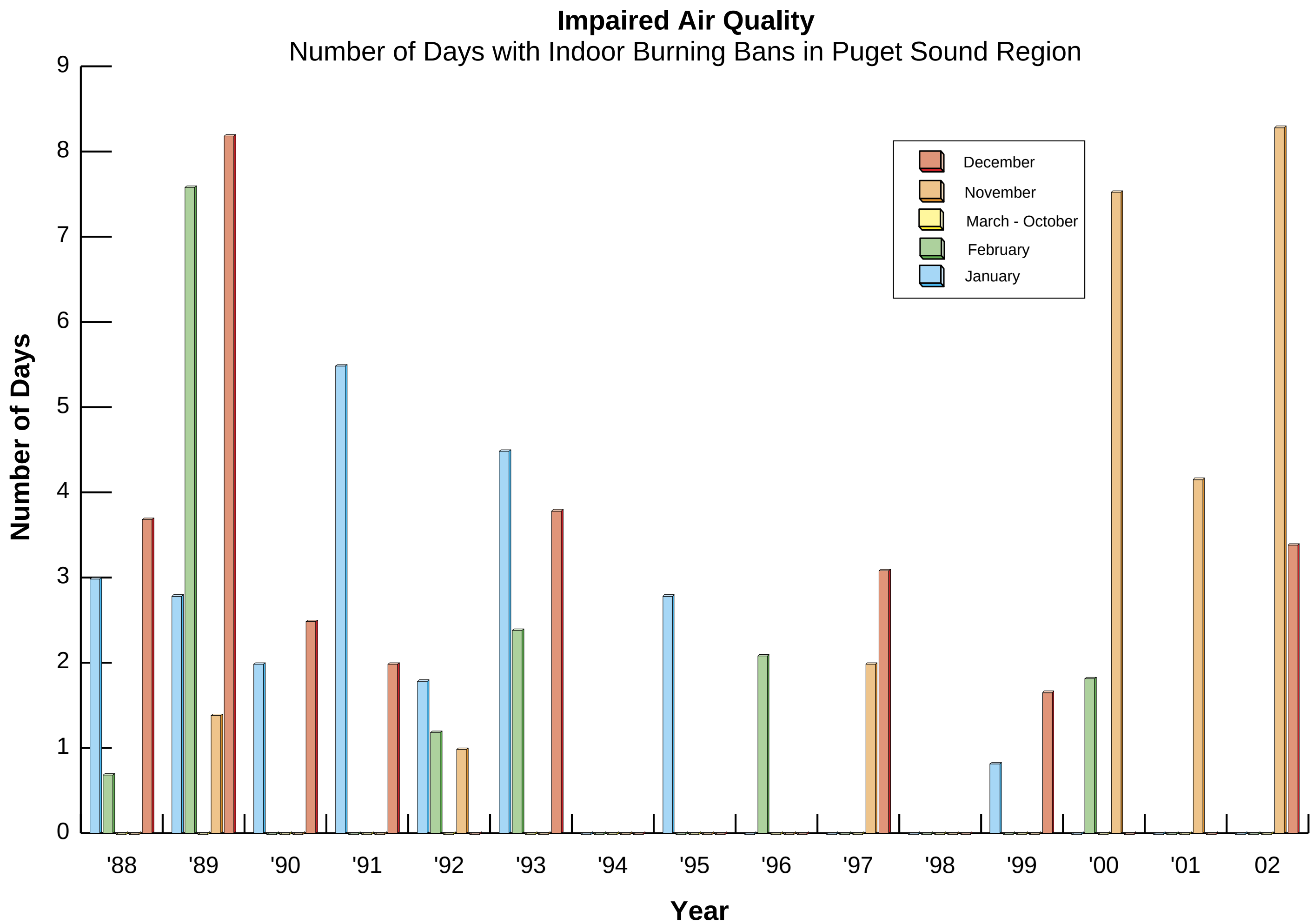
In decisions related to burn bans, the Agency considers that $PM_{2.5}$ levels, as the fine particulate fraction (<2.5 micrometers), are more indicative of wood smoke than PM_{10}, which also contains a coarse particulate fraction (2.5-10 micrometers).

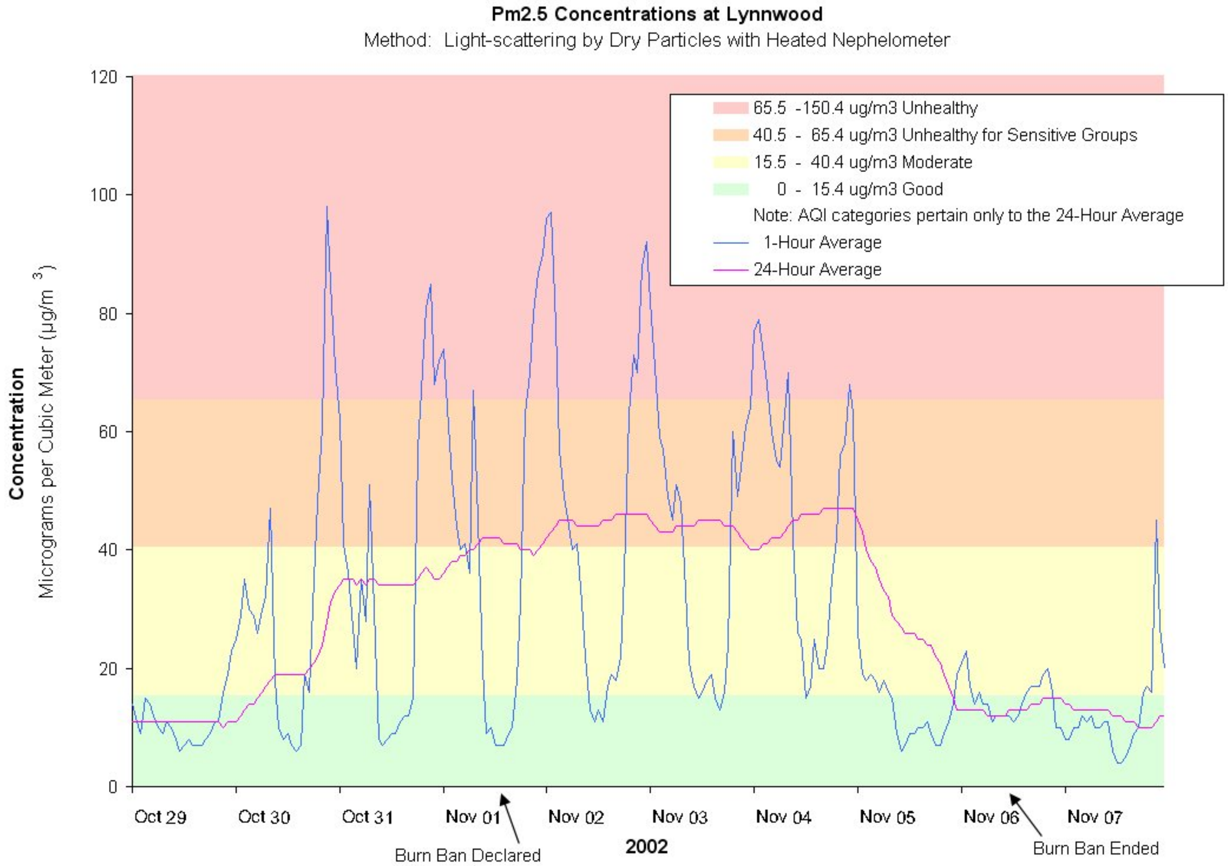
Burn bans typically occur in November through February. In 2002 there were two first-stage bans, both declared in November.

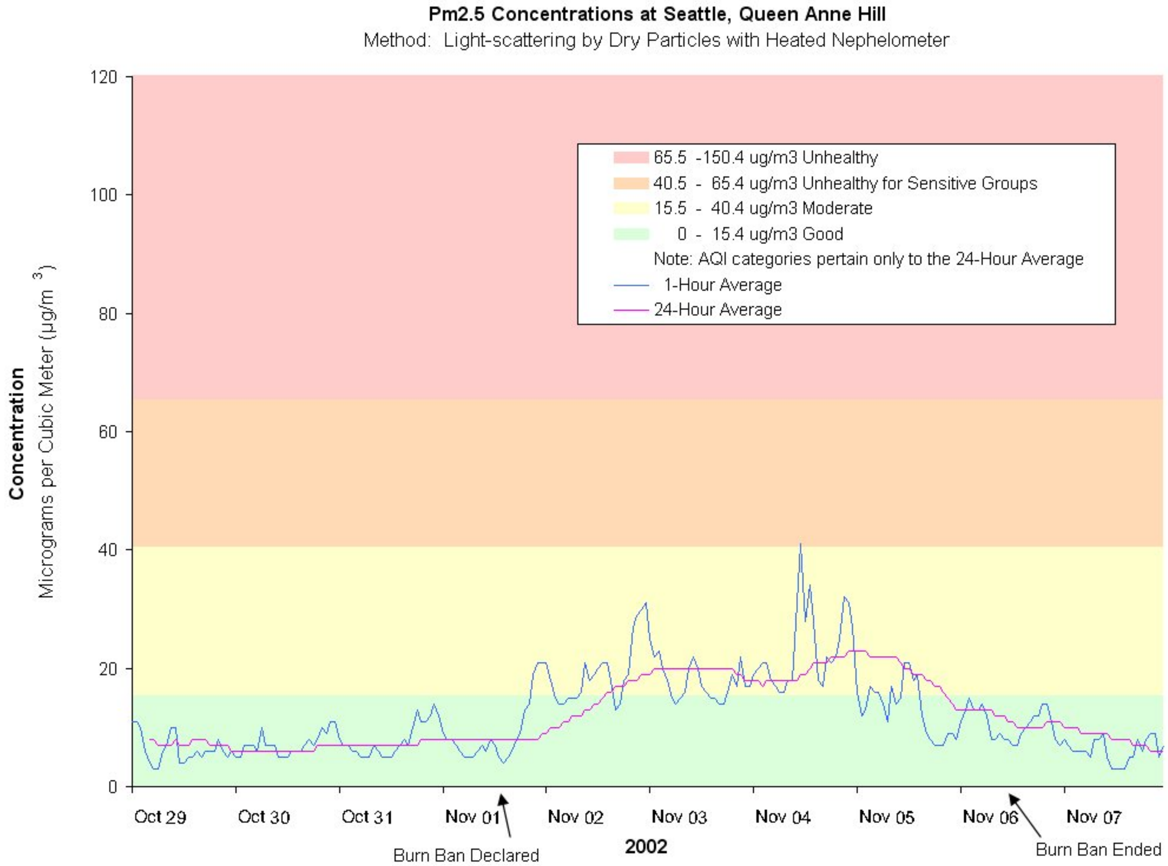
- When the PM_{10} trigger was reached, a burn ban was declared on Friday, November 1st which lasted 5 days. A persistent ridge of high pressure over the Northwest with clear skies created nightly temperature inversions that trapped pollutants. This, combined with poor air circulation and limited day-time ventilation, inhibited effective dispersion of pollutants and led to elevated coarse and fine particulate levels.

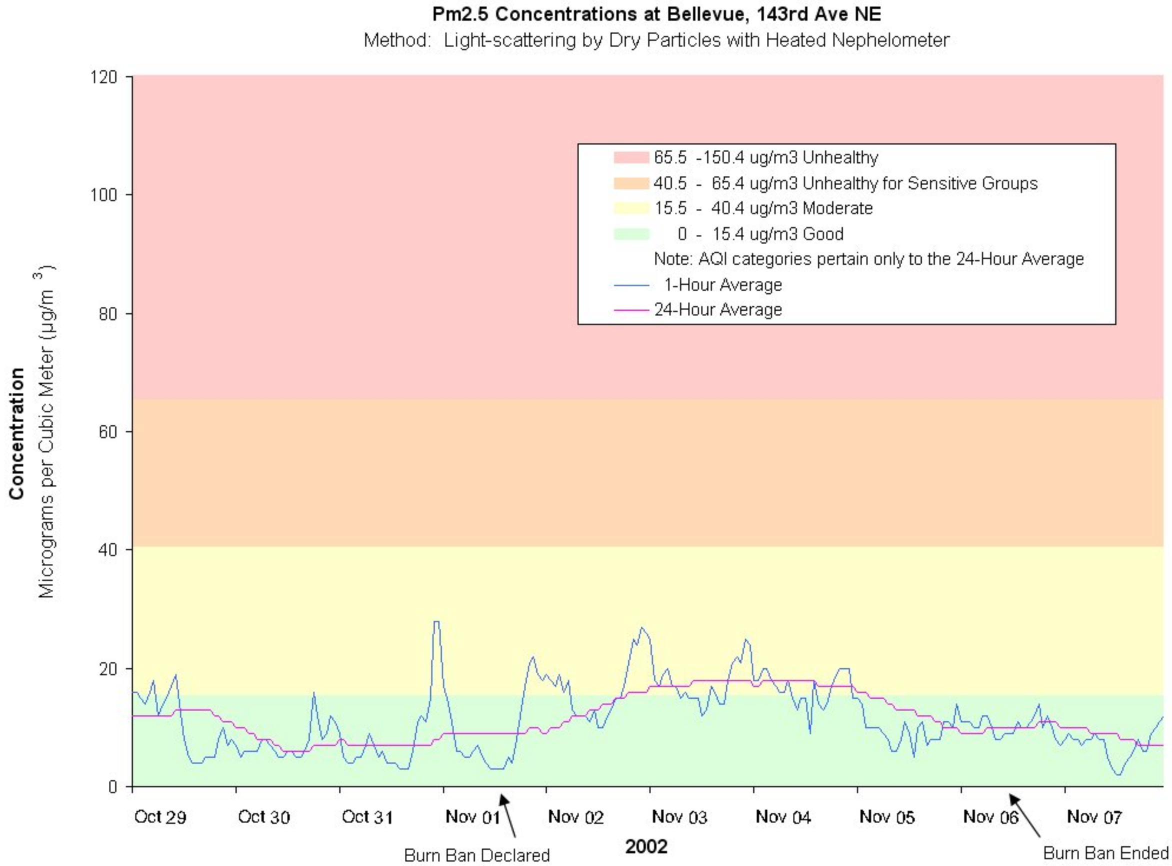
  The charts below illustrate particulate levels at four sites, Bellevue, Lynnwood, South L Street in Tacoma, and Queen Anne Hill in Seattle. Two of the sites, South L Street and Lynnwood, typify fine particle conditions in residential areas where wood burning is common. Note the large nightly peaks of fine particulate ($PM_{2.5}$) and conversely the daily afternoon "clearing out" as the temperature inversion "heats out" around noon every day. The Bellevue and Queen Anne charts depict areas where cleaner home-heating fuels (natural gas, etc.) are prevalent. A Pacific weather system ended the stagnant conditions and the burn ban was ended Wednesday, November 6.

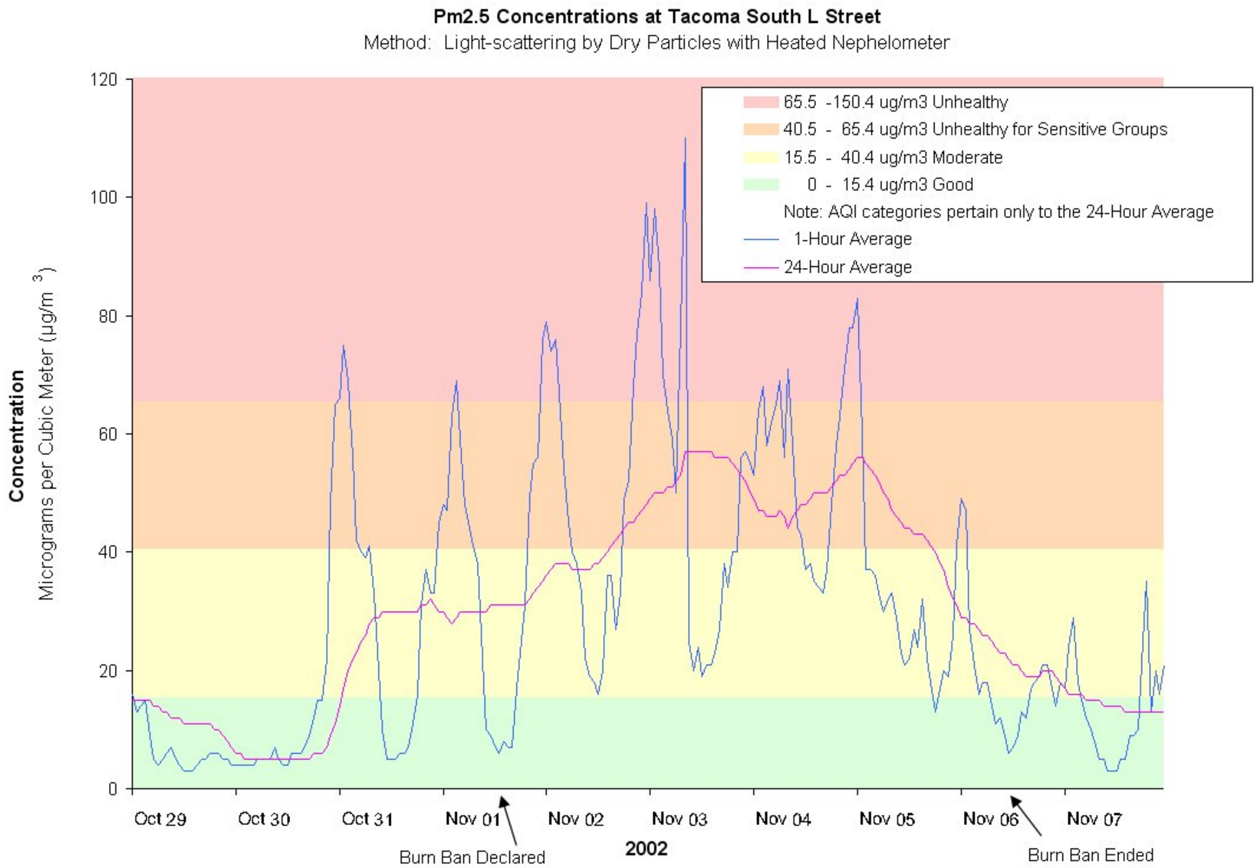
- The second burn ban was declared on Wednesday, November 27 which lasted 7 days. High pressure settled over the Northwest for the last ten days of November and didn't completely leave until December 10th. As in the earlier ban, a regional temperature inversion and very little wind allowed particulate levels to elevate. A passing weather system on December 4th provided enough mixing and dispersion to end the burn ban.


Impaired Air Quality
Number of Days with Indoor Burning Bans in Puget Sound Region
Number of Days
0
1
2
3
4
5
6
7
8
9
December
November
March - October
February
January
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
02
Year


Pm2.5 Concentrations at Lynnwood
Method: Light-scattering by Dry Particles with Heated Nephelometer
Concentration
Micrograms per Cubic Meter (µg/m 3)
120
100
80
60
40
20
0
65.5 -150.4 ug/m3 Unhealthy
40.5 - 65.4 ug/m3 Unhealthy for Sensitive Groups
15.5 - 40.4 ug/m3 Moderate
0 - 15.4 ug/m3 Good
Note: AQI categories pertain only to the 24-Hour Average
1-Hour Average
24-Hour Average
Oct 29
Oct 30
Oct 31
Nov 01
Nov 02
Nov 03
Nov 04
Nov 05
Nov 06
Nov 07
2002
Burn Ban Declared
Burn Ban Ended


Pm2.5 Concentrations at Seattle, Queen Anne Hill
Method: Light-scattering by Dry Particles with Heated Nephelometer
Concentration
Micrograms per Cubic Meter (µg/m 3)
120
100
80
60
40
20
0
65.5 -150.4 ug/m3 Unhealthy
40.5 - 65.4 ug/m3 Unhealthy for Sensitive Groups
15.5 - 40.4 ug/m3 Moderate
0 - 15.4 ug/m3 Good
Note: AQI categories pertain only to the 24-Hour Average
1-Hour Average
24-Hour Average
Oct 29
Oct 30
Oct 31
Nov 01
Nov 02
Nov 03
Nov 04
Nov 05
Nov 06
Nov 07
2002
Burn Ban Declared
Burn Ban Ended


Pm2.5 Concentrations at Bellevue, 143rd Ave NE
Method: Light-scattering by Dry Particles with Heated Nephelometer
65.5 -150.4 ug/m3 Unhealthy
40.5 - 65.4 ug/m3 Unhealthy for Sensitive Groups
15.5 - 40.4 ug/m3 Moderate
0 - 15.4 ug/m3 Good
Note: AQI categories pertain only to the 24-Hour Average
1-Hour Average
24-Hour Average
Concentration
Micrograms per Cubic Meter (µg/m 3)
Oct 29
Oct 30
Oct 31
Nov 01
Nov 02
Nov 03
Nov 04
Nov 05
Nov 06
Nov 07
2002
Burn Ban Declared
Burn Ban Ended


Pm2.5 Concentrations at Tacoma South L Street
Method: Light-scattering by Dry Particles with Heated Nephelometer
Concentration
Micrograms per Cubic Meter (µg/m 3)
120
100
80
60
40
20
0
65.5 -150.4 ug/m3 Unhealthy
40.5 - 65.4 ug/m3 Unhealthy for Sensitive Groups
15.5 - 40.4 ug/m3 Moderate
0 - 15.4 ug/m3 Good
Note: AQI categories pertain only to the 24-Hour Average
1-Hour Average
24-Hour Average
Oct 29
Oct 30
Oct 31
Nov 01
Nov 02
Nov 03
Nov 04
Nov 05
Nov 06
Nov 07
2002
Burn Ban Declared
Burn Ban Ended

Smog Watch

The Agency maintains a voluntary air quality program called Smog Watch. It is an outreach awareness program that addresses causes of summer smog between June and September. The purpose of the program is to advise residents of potential smog problems and to recommend short-term actions they can take to help reduce maximum ozone levels. Smog Watch advisories are driven more by meteorology than by monitored air quality data. A Smog Watch is called when forecasts call for temperatures in the upper 80s or higher with little or no wind for at least a 72-hour period.

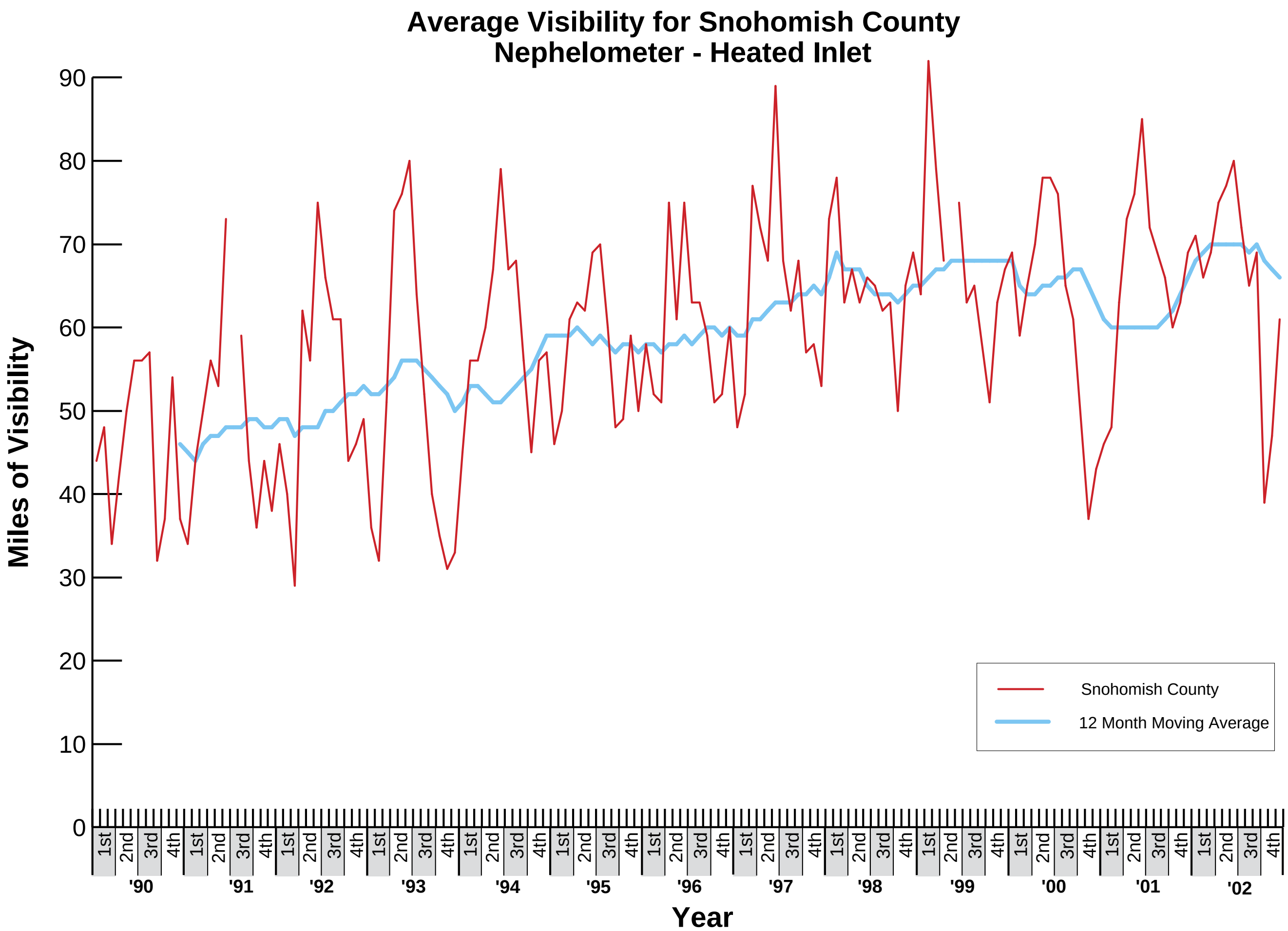
There were no Smog Watches issued during the summer of 2002 because there were no prolonged hot, stagnant periods.

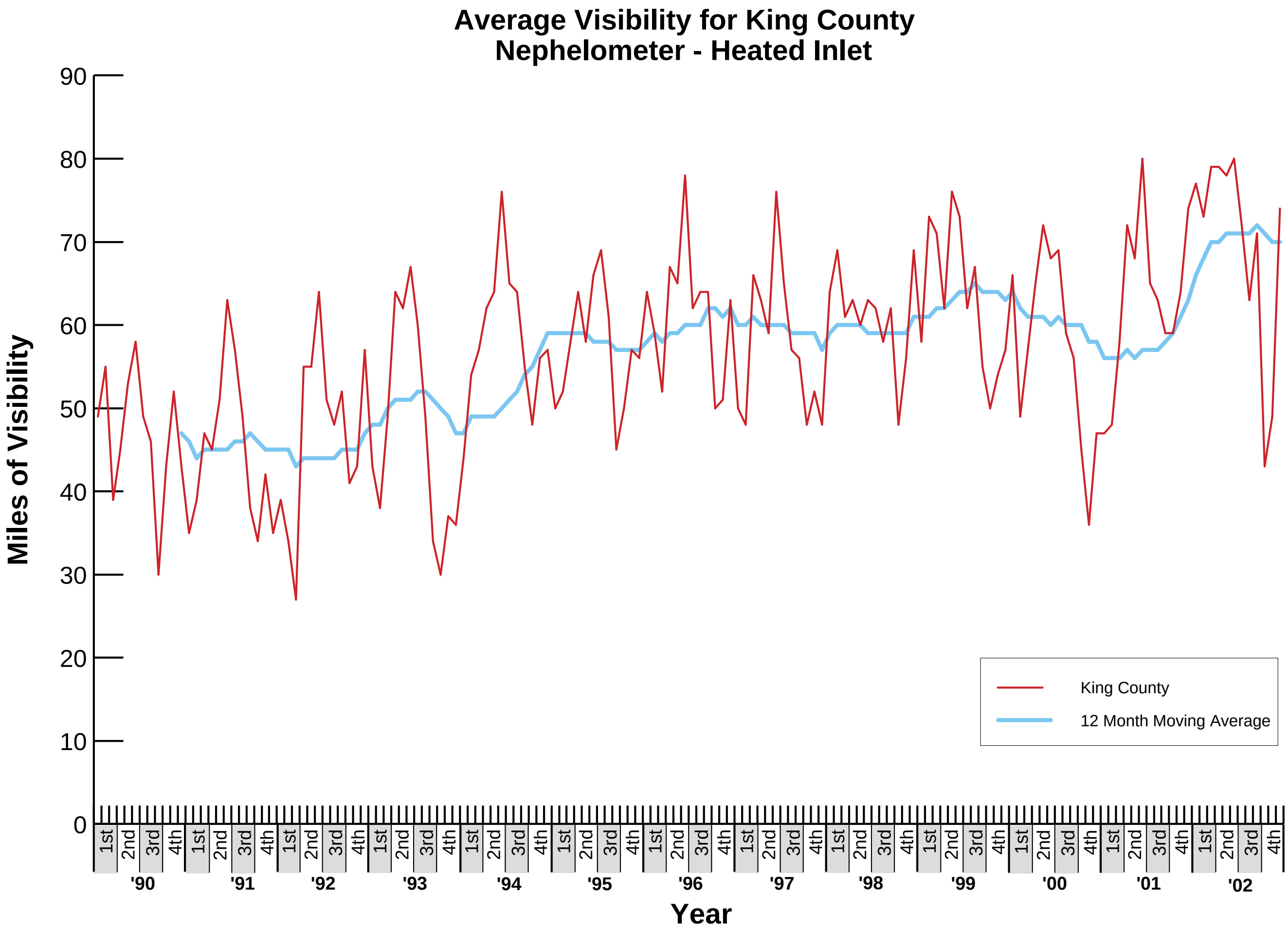
Visibility

Visibility is often explained in terms of visual range and light extinction. *Visual range* is the maximum distance—usually miles or kilometers—that you can see a black object against the horizon. *Light extinction* is the sum of light scattering and light absorption by fine particles and gases in the atmosphere. The more light extinction you have, the shorter your visual range will be. Visual range as measured by nephelometer instruments utilizing light-scattering methodology provides an objective approach to measuring visibility at a specific location, but does not address individual perceptions regarding the "quality" of a view on a given day.

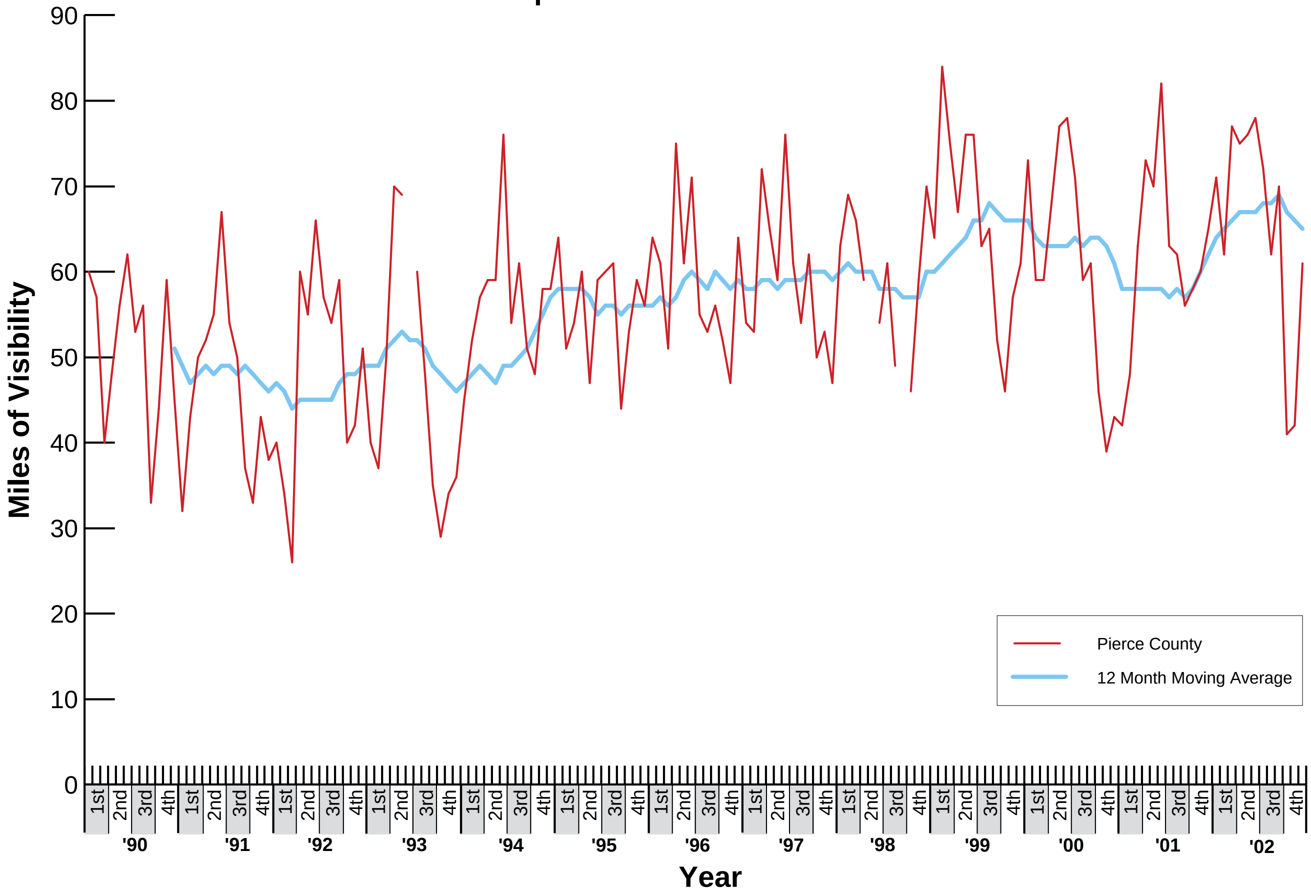
Reduced visibility (or visual range) is caused by weather (clouds, fog, and rain) and air pollution (fine particles and gases). The major pollution contributor is fine particulate matter ($PM_{2.5}$) emissions, which are transported aloft and may remain suspended for a week or longer. Fine particles have a greater impact than coarse particles at locations far from the emitting source because they remain suspended in the atmosphere longer and travel further. $PM_{2.5}$ also presents some of the most serious health hazards to the public, so you can roughly assume that the worse the visibility, the unhealthier the air is to breathe.

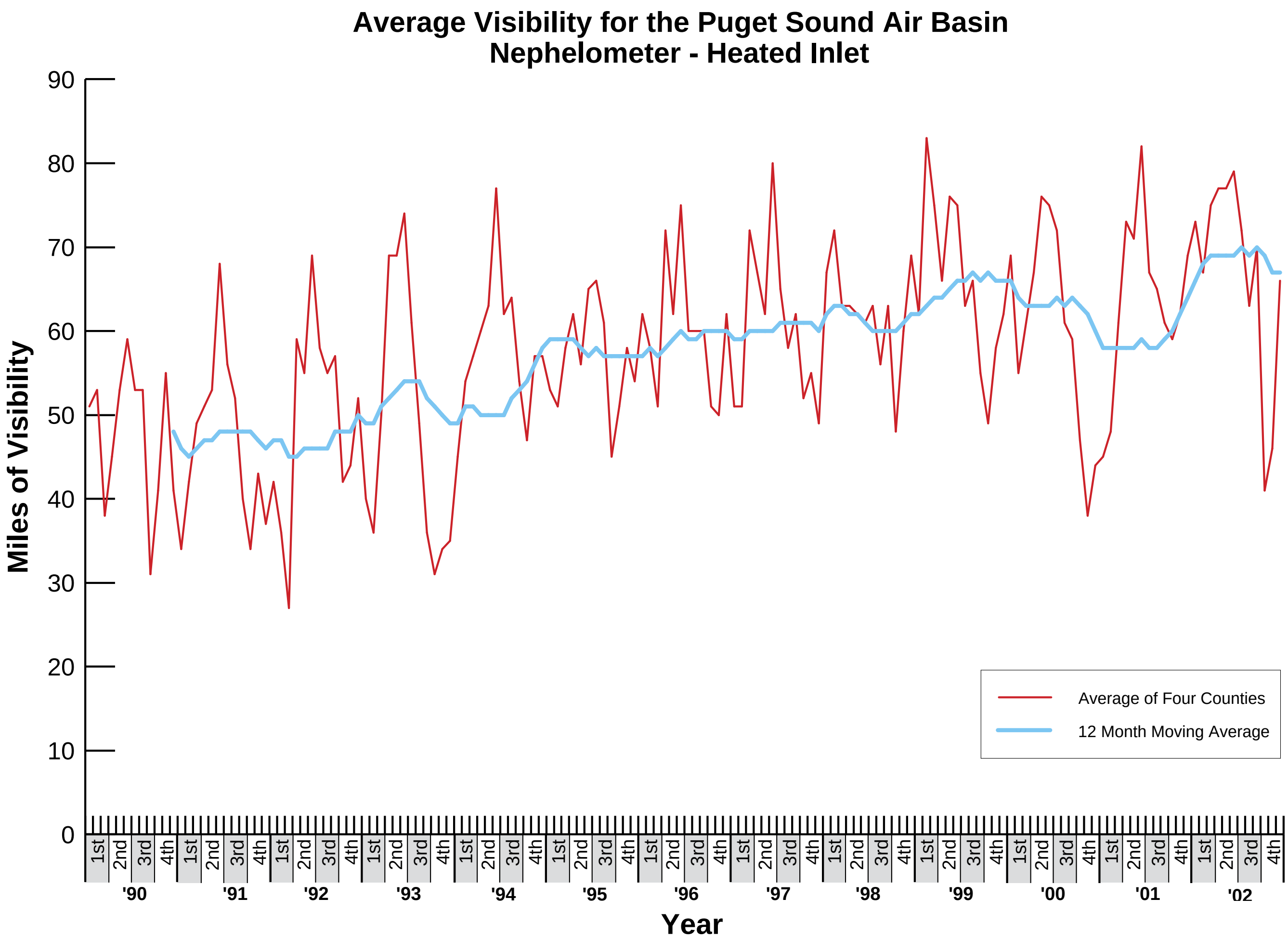
As shown in the following charts, visibility is seasonal, with the highest levels in the summer months and the lowest levels in the winter. Based upon measurements by the Agency's nephelometer network, the average visibility for the Puget Sound basin has steadily increased over the last decade with year-to-year variability caused by meteorology. From December 2001 to December 2002, the 12-month moving average of visual range increased from 64 miles to 67 miles. For the 12-year period from January 1991 through December 2002, the 12-month moving average of visual range increased from 48 miles to 67 miles, an average increase of 3% per year.


Average Visibility for Snohomish County
Nephelometer - Heated Inlet
Miles of Visibility
90
80
70
60
50
40
30
20
10
0
Snohomish County
12 Month Moving Average
1st
2nd
3rd
4th
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year


Average Visibility for King County
Nephelometer - Heated Inlet
Miles of Visibility
90
80
70
60
50
40
30
20
10
0
King County
12 Month Moving Average
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year

Average Visibility for Pierce County
Nephelometer - Heated Inlet




Average Visibility for the Puget Sound Air Basin
Nephelometer - Heated Inlet
Miles of Visibility
90
80
70
60
50
40
30
20
10
0
Average of Four Counties
12 Month Moving Average
1st
2nd
3rd
4th
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year

Regional Emission Inventory

This section presents an emission inventory summary for the six criteria pollutants and hazardous air pollutants. This inventory for the Puget Sound region is performed every three years by the Agency. The next update of this inventory is expected to be completed in 2004.

Criteria Pollutants

An emissions inventory was performed by the Agency ~~in~~ for 1999 that summarized the quantities of criteria air pollutants that were reported by large point sources or estimated using EPA methods. The inventory covered King, Kitsap, Pierce, and Snohomish counties and was based on the following sources of information:

- Annual operating permit emission reports.
- Annual registered facility emission reports.
- Emission factor derived estimates.
- Transportation models.

Emission inventory results are tabulated from:

- Point sources that are required to report emissions on a yearly basis.
- Stationary area sources, comprising sources that have emissions below reporting thresholds such as indoor burning, painting, dry cleaning, and stationary diesel engines.
- Emission factors for sources such as vegetation and agricultural activities.
- Calculated emissions based on regional transportation models for sources such as automobiles.

Hazardous air pollutants and toxic air contaminants are reported only for point sources. The following charts present the contributions from each source category for the six criteria pollutants.

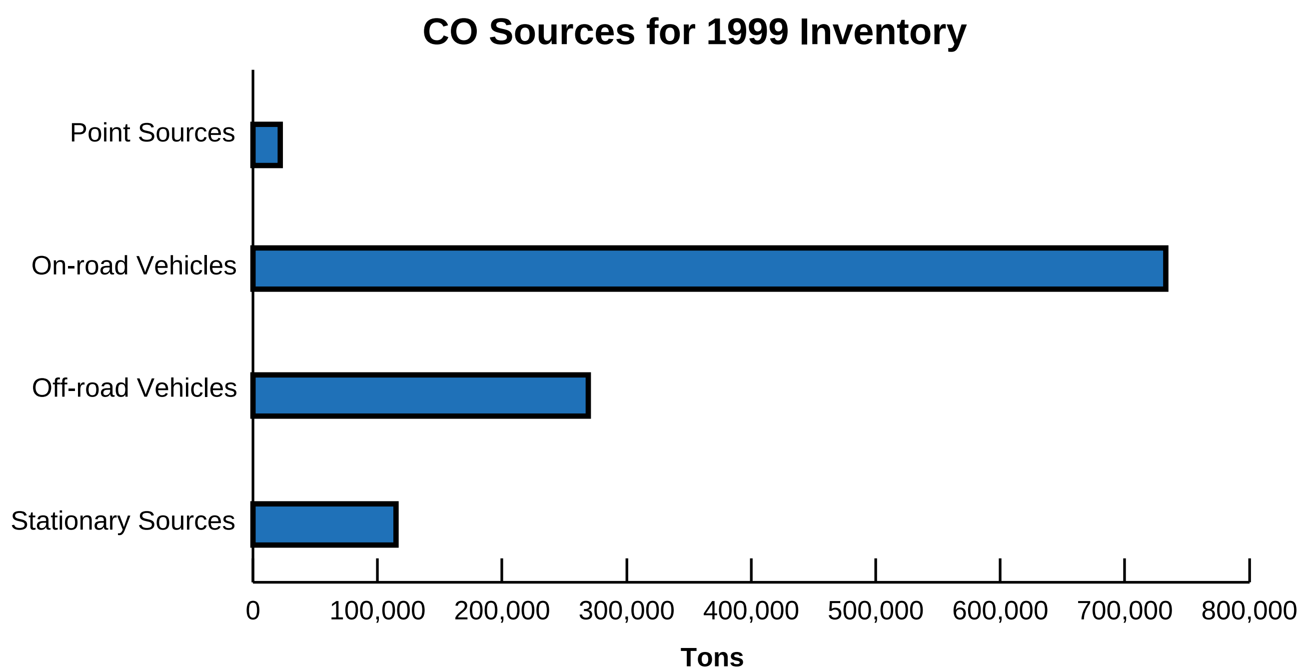
Estimated and Reported Air Contaminant Emission Inventory Summary for 1999 (thousand of tons)

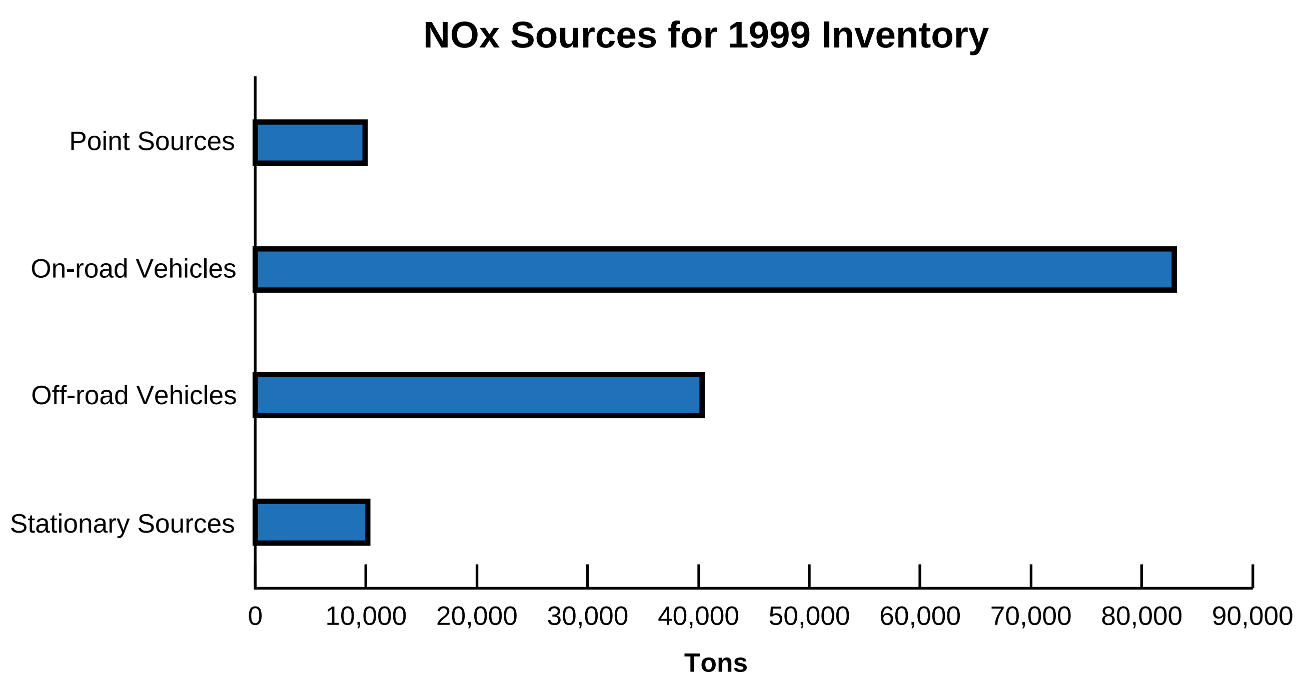
Source Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOCs
Point Sources	22	10	2	1	5	24
On-road Vehicles	733	83	2	2	3	56
Off-road Vehicles	269	40	3	3	5	21
Stationary Area Sources	115	10	65	29	2	53
TOTALS	1138	143	71	34	15	154

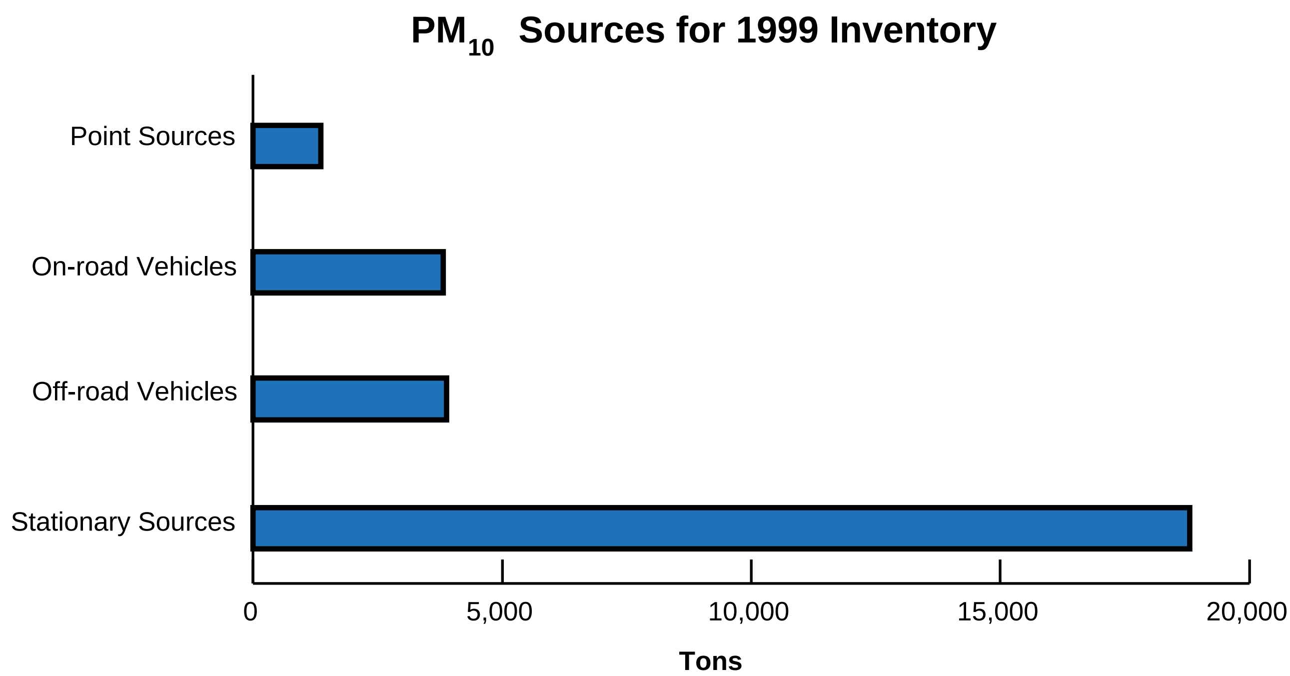
This inventory demonstrates that on-road and off-road vehicles are significant contributors to criteria pollutant emission in the Puget Sound air shed. Stationary area sources are a major contributor of $PM_{2.5}$ emissions. Although biogenic sources (including trees, plants, and crops, all of which produce hydrocarbons) are not included in the above table, they are estimated to produce 70,000 tons of VOCs per year in Puget Sound and impact the production of ozone concentrations. Most of the changes from the previous inventory report are due to revised on-road mobile source estimates completed for our region by EPA using their newest MOBILE6 emission factor model. For additional information on emissions contact our Air Resources Department at 206-689-4051.

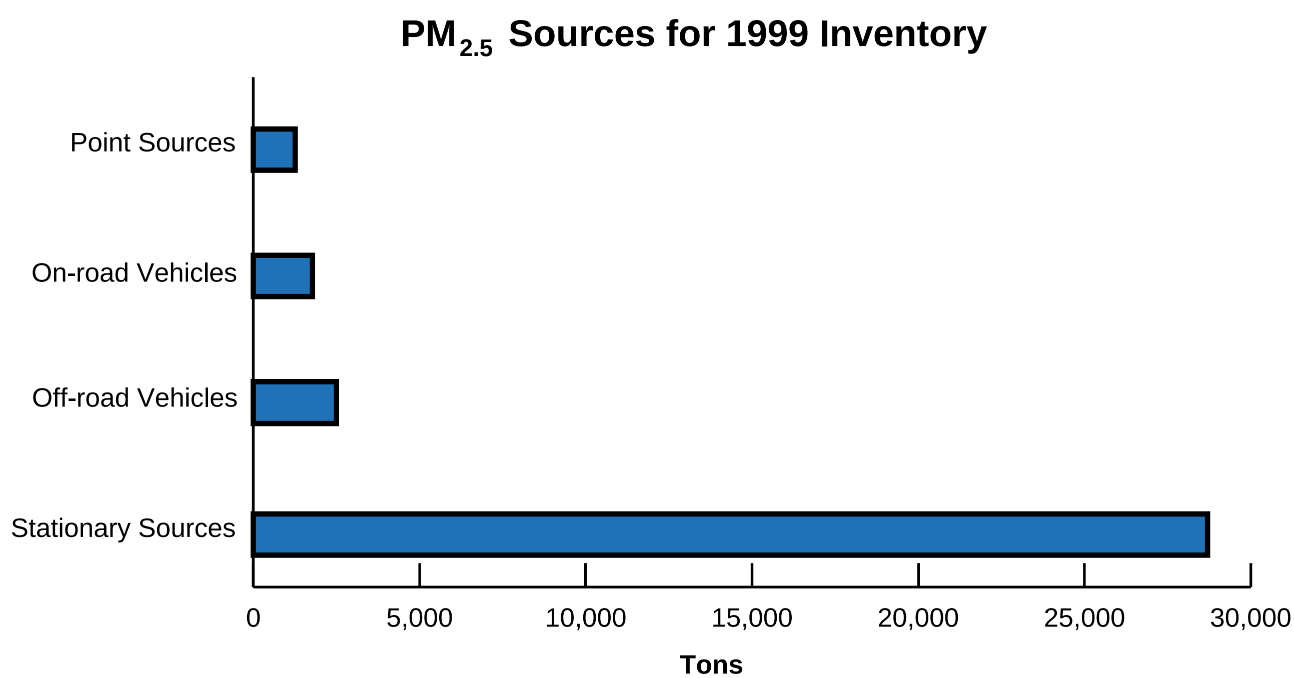
Estimated Percentage of Emissions Contributed for 1999

Source Category	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOCs
On-road/Off-road Vehicles	88%	86%	7%	12%	54%	51%
Stationary Area Sources	10%	7%	91%	84%	11%	34%
Point Sources	2%	7%	2%	4%	35%	15%

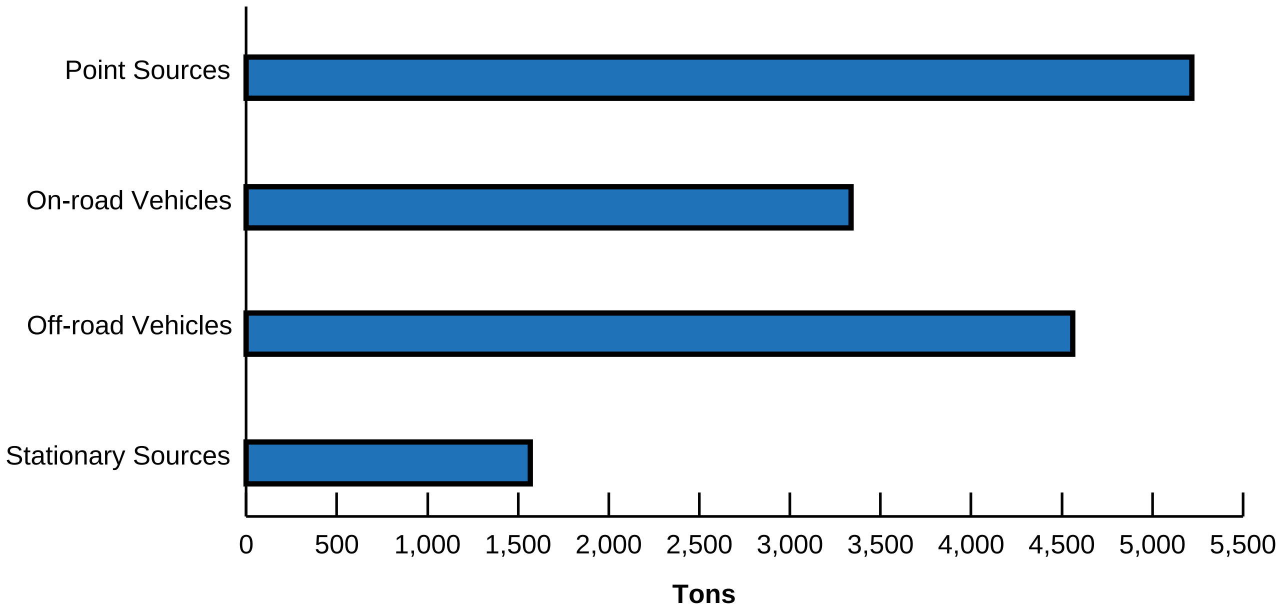

CO Sources for 1999 Inventory
Point Sources
On-road Vehicles
Off-road Vehicles
Stationary Sources
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
Tons


NOx Sources for 1999 Inventory
Point Sources
On-road Vehicles
Off-road Vehicles
Stationary Sources
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
Tons

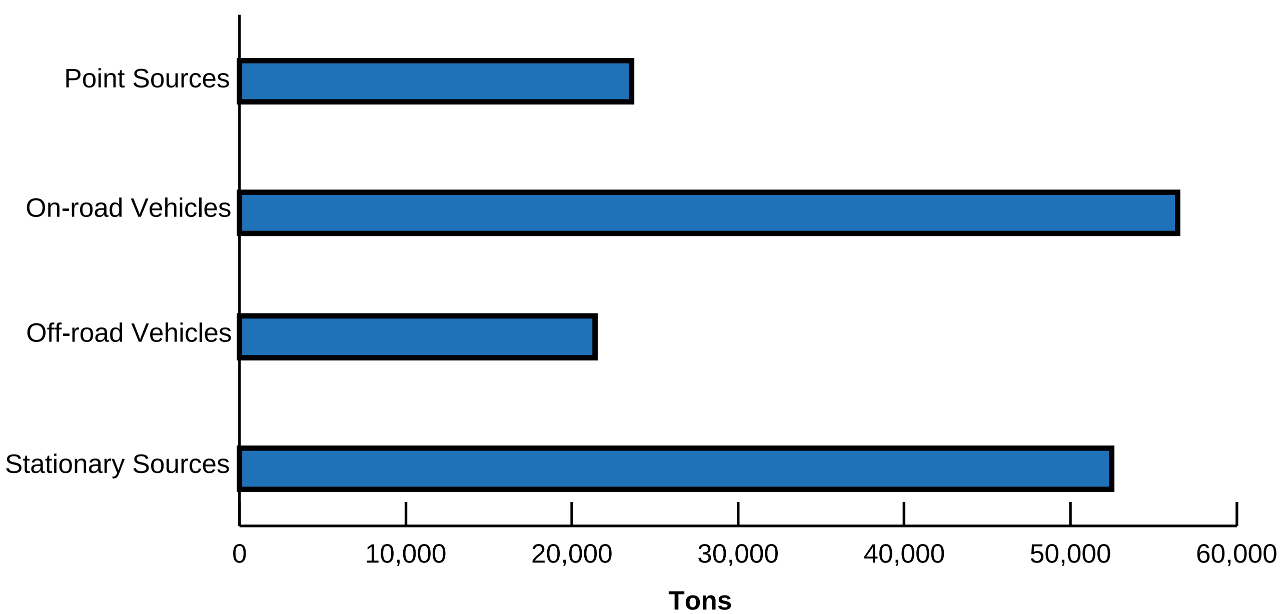

PM10 Sources for 1999 Inventory
Point Sources
On-road Vehicles
Off-road Vehicles
Stationary Sources
0
5,000
10,000
15,000
20,000
Tons


PM2.5 Sources for 1999 Inventory
Point Sources
On-road Vehicles
Off-road Vehicles
Stationary Sources
0
5,000
10,000
15,000
20,000
25,000
30,000
Tons

SOx Sources for 1999 Inventory



VOC Sources for 1999 Inventory



Hazardous Air Pollutants (HAPs)

In 1999, 7,427 tons of HAPs were emitted into the Puget Sound air shed from point sources throughout the region. The highest levels were associated with solvents (MEK, toluene, methanol) as well as common household products. Additionally, the Agency estimates that 35,463 tons of HAPs were emitted from stationary area and mobile sources. For details on chemical toxicity, visit the EPA web site www.epa.gov/ttn/atw/index.htm.

20 Highest Totals of Hazardous Air Pollutants Emitted from Point Sources in 1999

CAS	Chemical Name	Tons
67-56-1	Methanol	3,698
78-93-3	Methyl Ethyl Ketone	435
108-88-3	Toluene	307
67-66-3	Chloroform	277
7647-01-0	Hydrochloric Acid	254
1319-77-3	Cresol	244
75-07-0	Acetaldehyde	217
1330-20-7	Xylene	205
98-82-8	Cumene	189
100-42-5	Styrene	135
100-41-4	Ethylbenzene	131
79-01-6	Trichloroethylene	108
463-58-1	Carbonyl Sulfide	106
108-95-2	Phenol	92
108-10-1	Methyl Isobutyl Ketone	89
120-82-1	1,2,4-Trichlorobenzene	84
56-23-5	Carbon Tetrachloride	80
7664-39-3	Hydrogen Fluoride	68
75-09-2	Methylene Chloride	66
540-84-1	2,2,4-Trimethylpentane	46

20 Highest Totals of Hazardous Air Pollutants from Non-point Area Sources and Mobile Sources for 1999

CAS	Chemical Name	Tons
108-88-3	Toluene	8651
1330-20-7	Xylene	5621
71-43-2	Benzene	4052
540-84-1	2,2,4-Trimethylpentane	2527
110-54-3	Hexane	2486
78-93-3	Methyl Ethyl Ketone	1582
100-41-4	Ethylbenzene	1361
67-56-1	Methanol	1078
75-07-0	Acetaldehyde	724
74-83-9	Methyl Bromide	624
100-42-5	Styrene	549
79-01-6	Trichloroethylene	545
75-09-2	Methylene Chloride	534
542-75-6	1,3-Dichloropropene	449
106-99-0	1,3-Butadiene	405
91-20-3	Napthalene	272
127-18-4	Perchloroethylene	228
108-10-1	Methyl Isobutyl Ketone	217
108-90-7	Chlorobenzene	202
106-46-7	1,4-Dichlorobenzene	176

Air Quality Standards

The Clean Air Act (CAA), which was last amended in 1990 requires the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The standards are designed to protect the general public; sensitive populations such as asthmatics, children, and the elderly; and safeguard public welfare in such issues as decreased visibility and damage to animals, crops, vegetation and buildings. The US EPA has established standards for six criteria pollutants. The State of Washington and the Puget Sound Region have adopted these standards, and in the case of sulfur dioxide also apply a stricter State standard. See Regulation I, Article 11 *Ambient Air Quality Standards* of the PSCAA regulations. The air quality standards for the Puget Sound air shed are:

Puget Sound Region Air Quality Standards

Pollutant	Standard	Level
Ozone	Over a 3-consecutive-year period, the daily maximum 1-hour average cannot exceed the level more than an average of once per year	0.12 ppm
	Over a 3-consecutive-year period, the 4th highest 8-hour average concentration cannot exceed	0.084 ppm
Particulate Matter (10 micrometers)	The 3-year annual average of the daily concentrations cannot exceed	50 $\mu g/m^3$
	The 3-year average of the 99th percentile (based on the number of samples taken) of the daily concentrations cannot exceed	150 $\mu g/m^3$
Particulate Matter (2.5 micrometers)	The 3-year annual average of the daily concentrations cannot exceed	15 $\mu g/m^3$
	The 3-year average of the 98th percentile (based on the number of samples taken) of the daily concentrations cannot exceed	65 $\mu g/m^3$
Carbon Monoxide	The 1-hour average cannot exceed the level more than once per year	35 ppm
	The 8-hour average cannot exceed the level more than once per year	9 ppm
Sulfur Dioxide	Annual arithmetic mean of 1-hour averages cannot exceed	0.02 ppm
	24-hour average cannot exceed	0.10 ppm
	1-hour average cannot exceed	0.40 ppm
	AND no more than twice in 7 consecutive days can the 1-hour average exceed	0.25 ppm
Lead	The quarterly average (by calendar) cannot exceed	1.5 $\mu g/m^3$
Nitrogen Dioxide	The annual mean of 1-hour averages cannot exceed	0.053 ppm

Note: Daily concentration is the 24-hour average, measured from midnight to midnight.

The standards for ozone were implemented as a result of scientific research demonstrating a more serious health impact of long-term exposure (8-hour) to ozone pollution than to short term (1-hour) peak levels. In the case of particulate matter standards, EPA added standards for 2.5 micrometers and below because of the serious health effects associated with smaller particulate sizes.

The summaries that follow show how the Puget Sound air shed compared to these standards for the year 2002.

Ozone

Ozone is a summertime air pollution problem, and is not directly emitted by pollutant sources. It forms when photo-chemical pollutants from cars and industrial sources react with sunlight. Ozone levels are usually highest in the afternoon. High concentrations of ozone can cause respiratory distress in humans and is responsible for decreased yields of agricultural crops and forests. The damage it causes to the lungs heals within a few days, but repeated or prolonged exposure may cause permanent damage. If ozone levels are high and you have a respiratory condition or are normally active outdoors, try to limit your outdoor exertion.

As shown in the charts below, the Puget Sound Air basin maintained attainment for ozone between 1998 and 2002. This means the 3-year average of the 4th-highest 8-hour concentration never exceeded the NAAQS standard. Because of the way the ozone standard is defined, the three highest concentrations can exceed the level of the standard while still maintaining attainment. In 2002, the highest 8-hour concentration near Enumclaw (0.084 ppm) just reached the level of the standard.

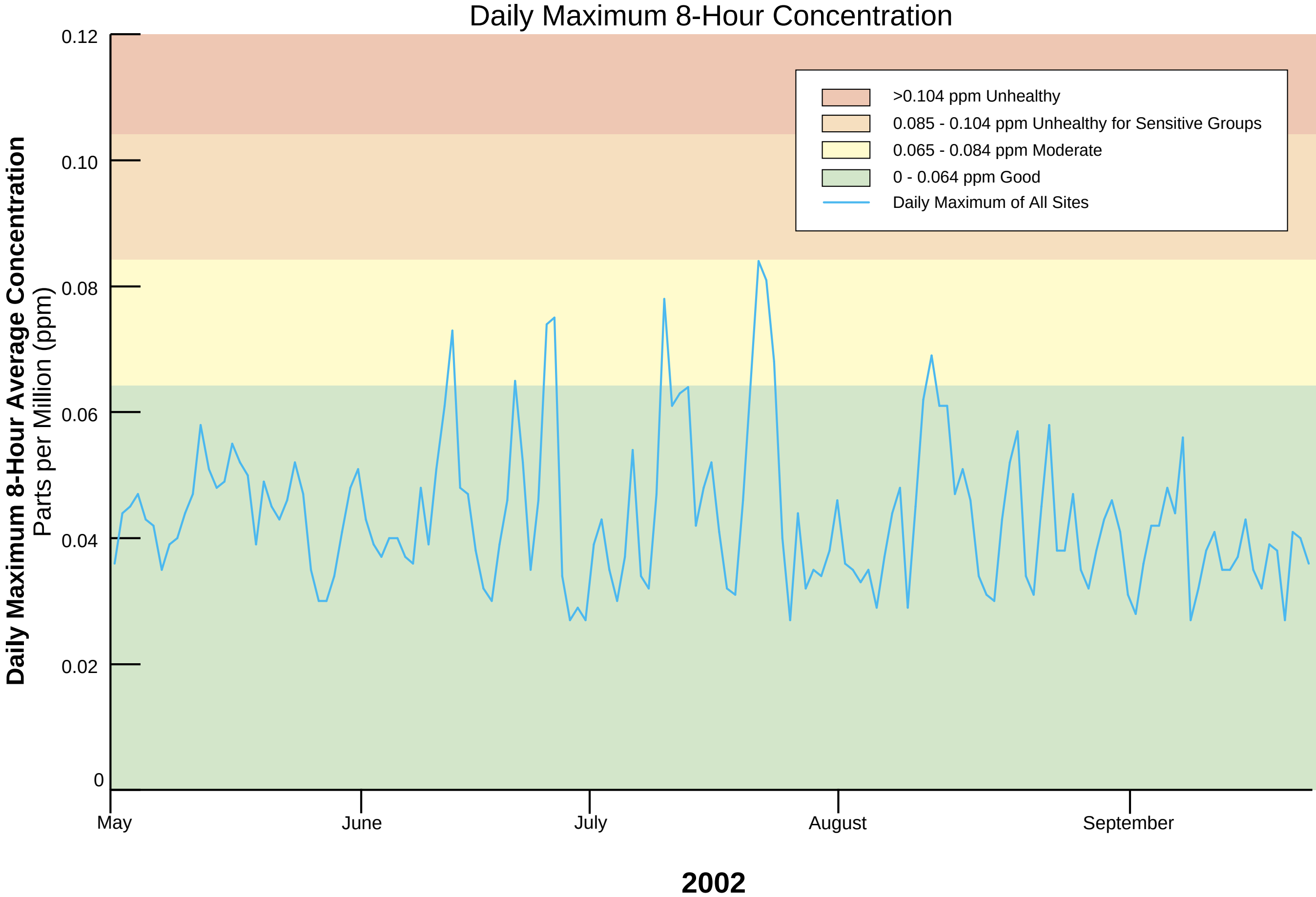
The majority of monitoring stations measuring ozone are located in rural regions of the Puget Sound. The precursor chemicals that react with sunlight to produce ozone are generated primarily in large metropolitan areas. Because the photochemical process takes several hours, the communities downwind of the large urban areas are where the highest concentrations are measured. In the Puget Sound region, the hot sunny days favorable for ozone formation are typified by light north-to-northwest winds. By the time the highest concentration of ozone has formed in the afternoon and early evening, it has been transported 10 to 30 miles from the original source. In the Puget Sound region the highest concentrations are measured in areas such as North Bend, Enumclaw, and Eatonville.

Regional trends show a slight decrease over the 1998-2002 period. Because of our mild climate, ideal conditions for high ozone levels are infrequent in the Puget Sound area. Compared to other parts of the country, such as the southern states, ozone is not a critical health problem in our area.

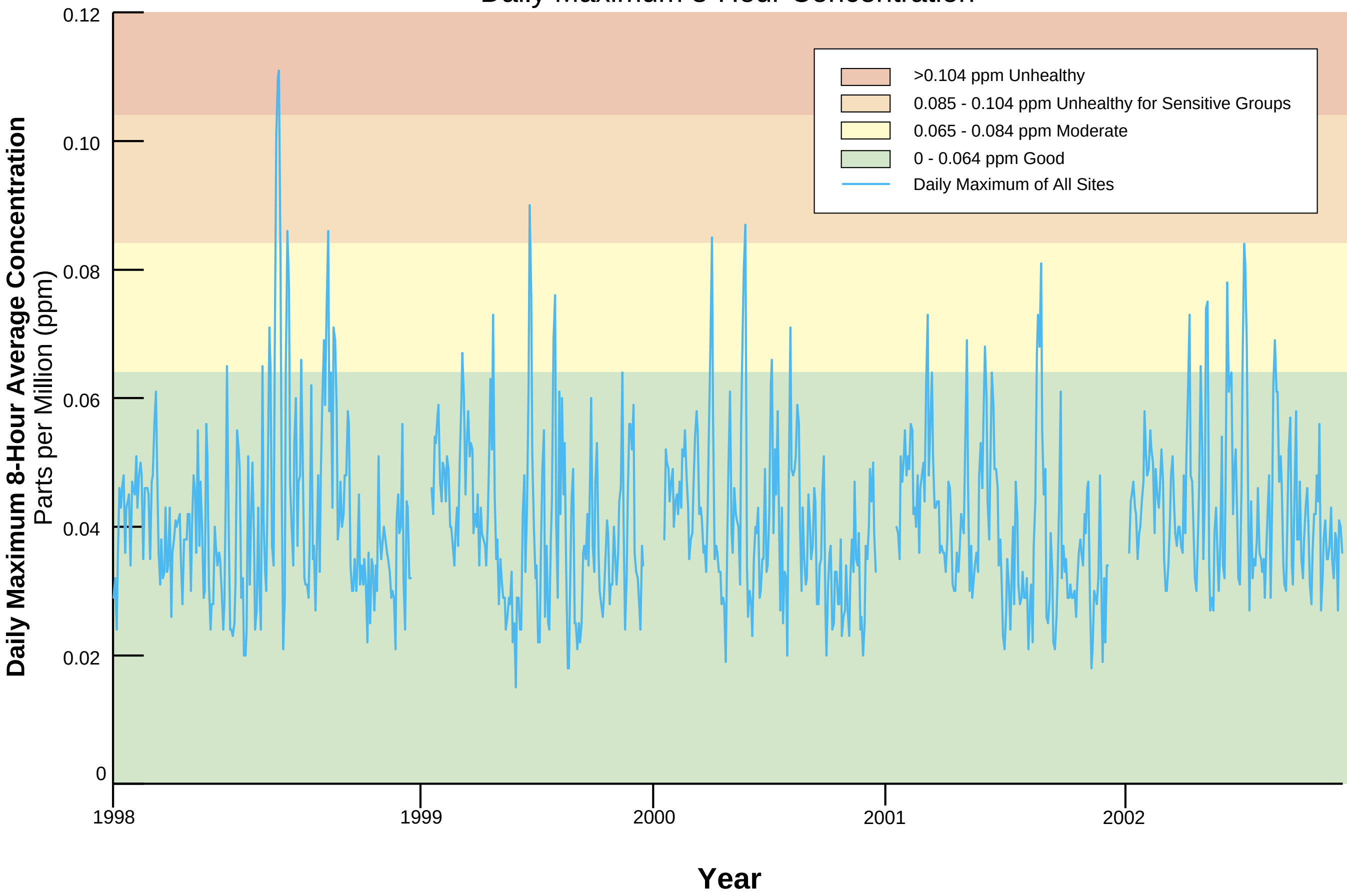
For additional information on ozone, visit www.epa.gov/air/urbanair/ozone/index.html.

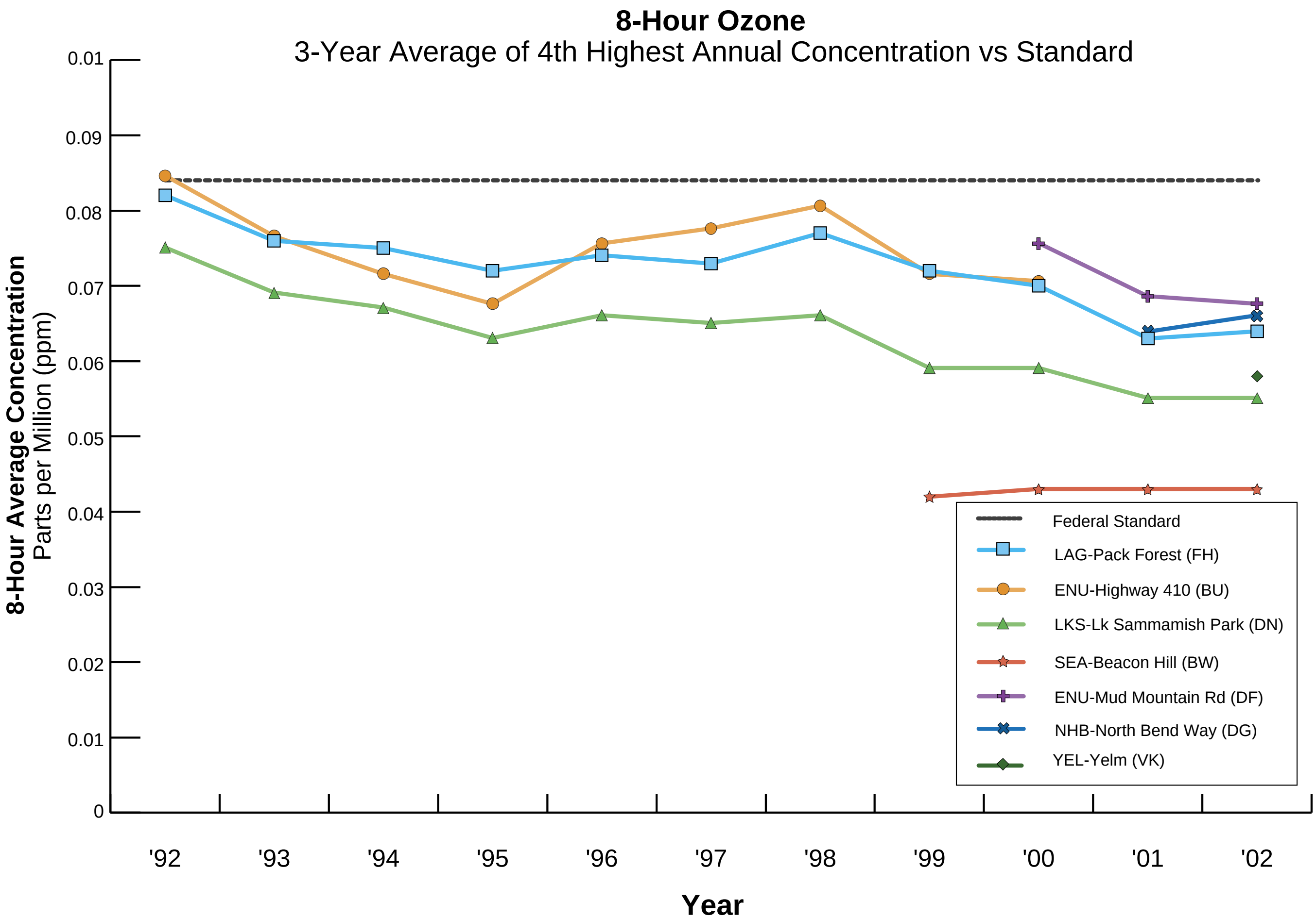
Ozone (O_3) in Puget Sound Region

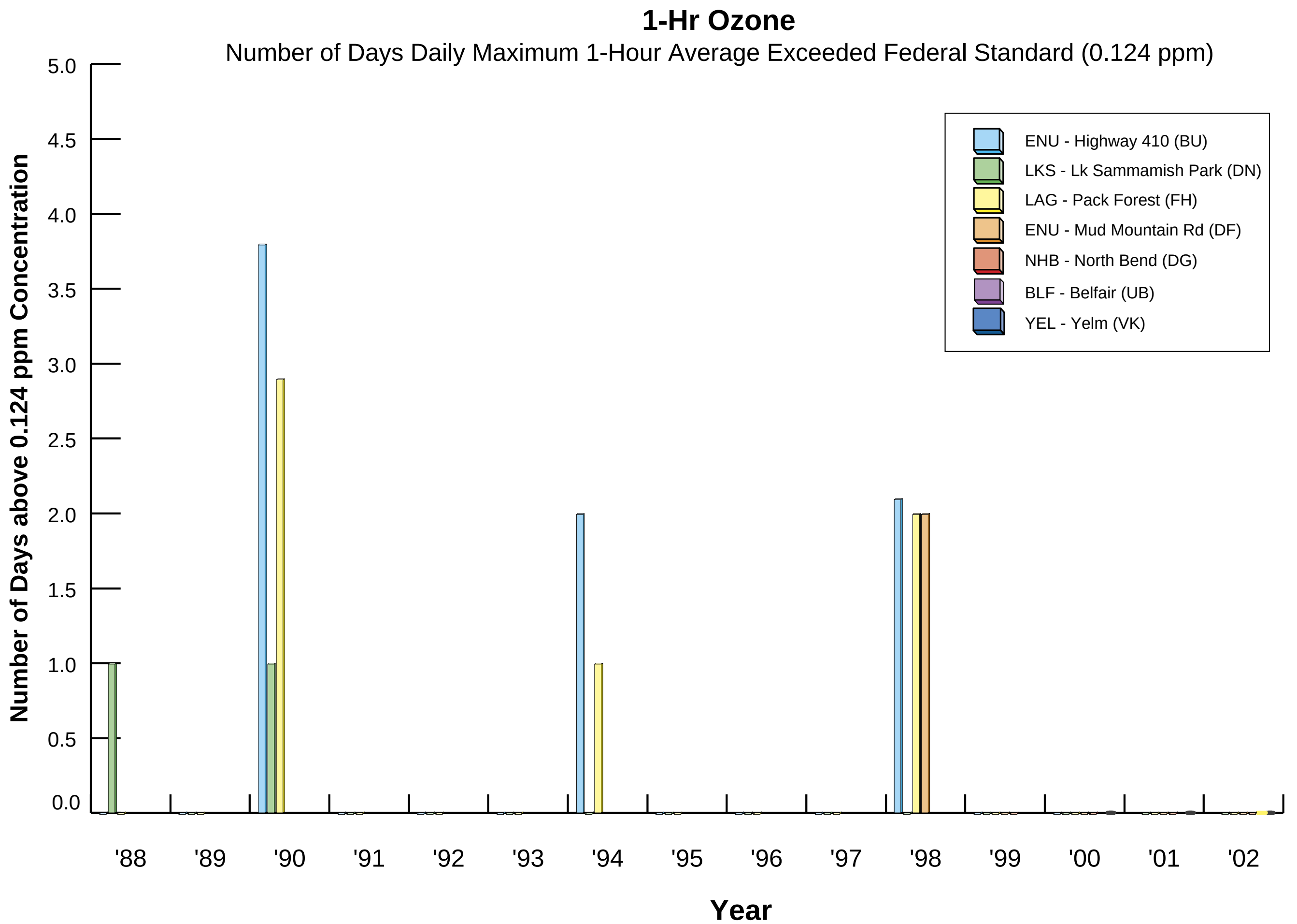
Daily Maximum 8-Hour Concentration



Ozone (O_3) in Puget Sound Region
for the months May Through September
Daily Maximum 8-Hour Concentration




8-Hour Ozone
3-Year Average of 4th Highest Annual Concentration vs Standard
8-Hour Average Concentration
Parts per Million (ppm)
0.01
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Federal Standard
LAG-Pack Forest (FH)
ENU-Highway 410 (BU)
LKS-Lk Sammamish Park (DN)
SEA-Beacon Hill (BW)
ENU-Mud Mountain Rd (DF)
NHB-North Bend Way (DG)
YEL-Yelm (VK)


1-Hr Ozone
Number of Days Daily Maximum 1-Hour Average Exceeded Federal Standard (0.124 ppm)
Number of Days above 0.124 ppm Concentration
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ENU - Highway 410 (BU)
LKS - Lk Sammamish Park (DN)
LAG - Pack Forest (FH)
ENU - Mud Mountain Rd (DF)
NHB - North Bend (DG)
BLF - Belfair (UB)
YEL - Yelm (VK)
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year

Particulate Matter (10 micrometers)

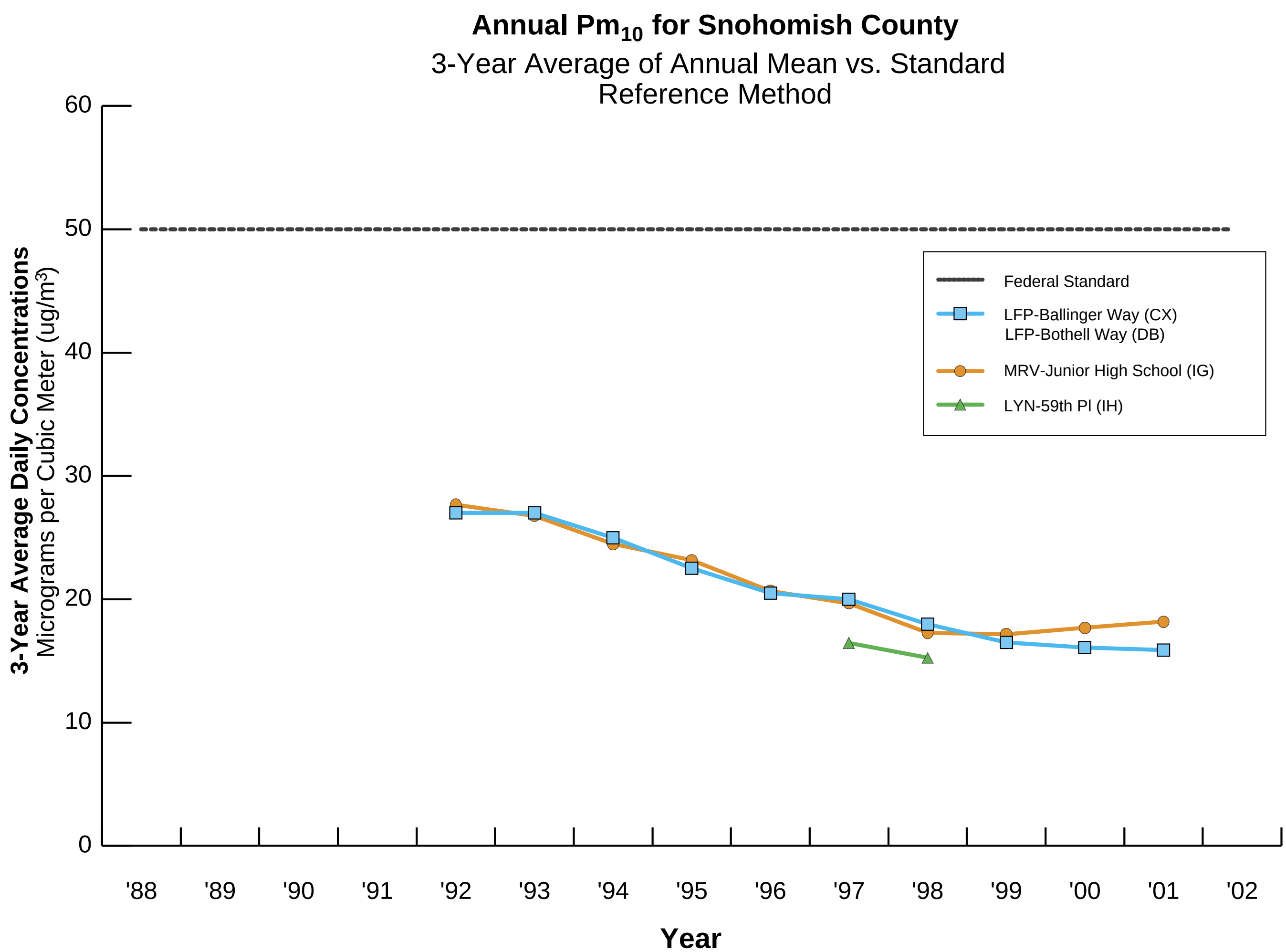
"Particulate matter" (PM) includes both solid matter and liquid droplets suspended in the air. Particles smaller than 2.5 micrometers in diameter are called "fine" particles, or $PM_{2.5}$. Particles between 2.5 and 10 micrometers in diameter are called "coarse" particles. PM_{10} includes both "fine" and "coarse" particles. "Coarse" particles typically come from crushing or grinding operations and dust from roads. PM_{10} can aggravate respiratory conditions such as asthma. If PM_{10} levels are high, people with respiratory conditions should avoid outdoor exertion.

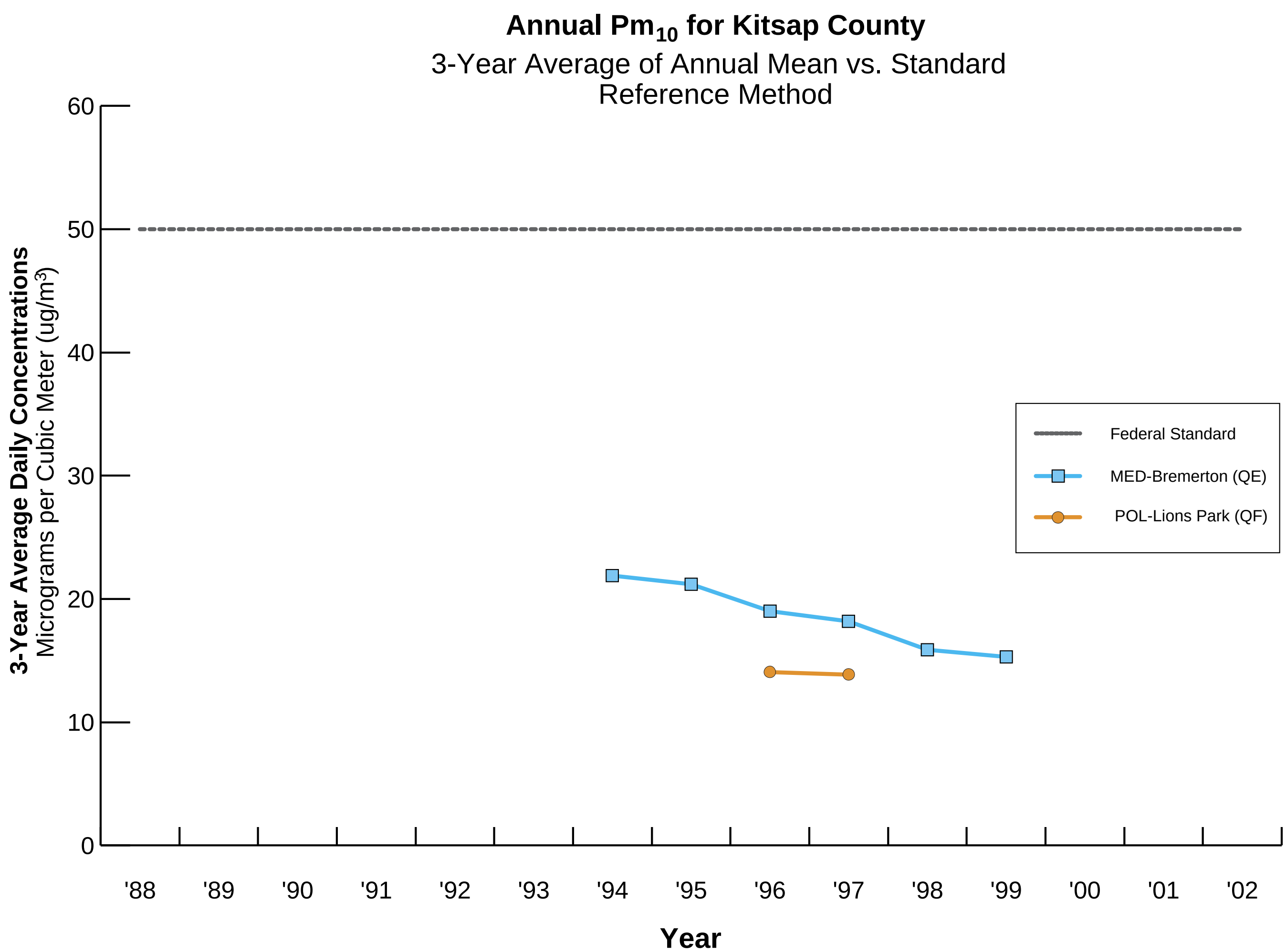
As shown in the charts below, the Puget Sound air shed was in compliance with both the annual and daily standards for PM_{10}. No monitored values exceeded the 50 $\mu g/m^3$ annual standard . In 2001, the US EPA designated the Puget Sound in attainment for PM_{10}. Annual PM_{10} trends have flattened since 1998, and are well below the 50 $\mu g/m^3$ standard. Consistently, the highest values for PM_{10} are measured in the industrial areas of the Duwamish valley in Seattle (Station CE) and the port area in Tacoma (Station EQ).

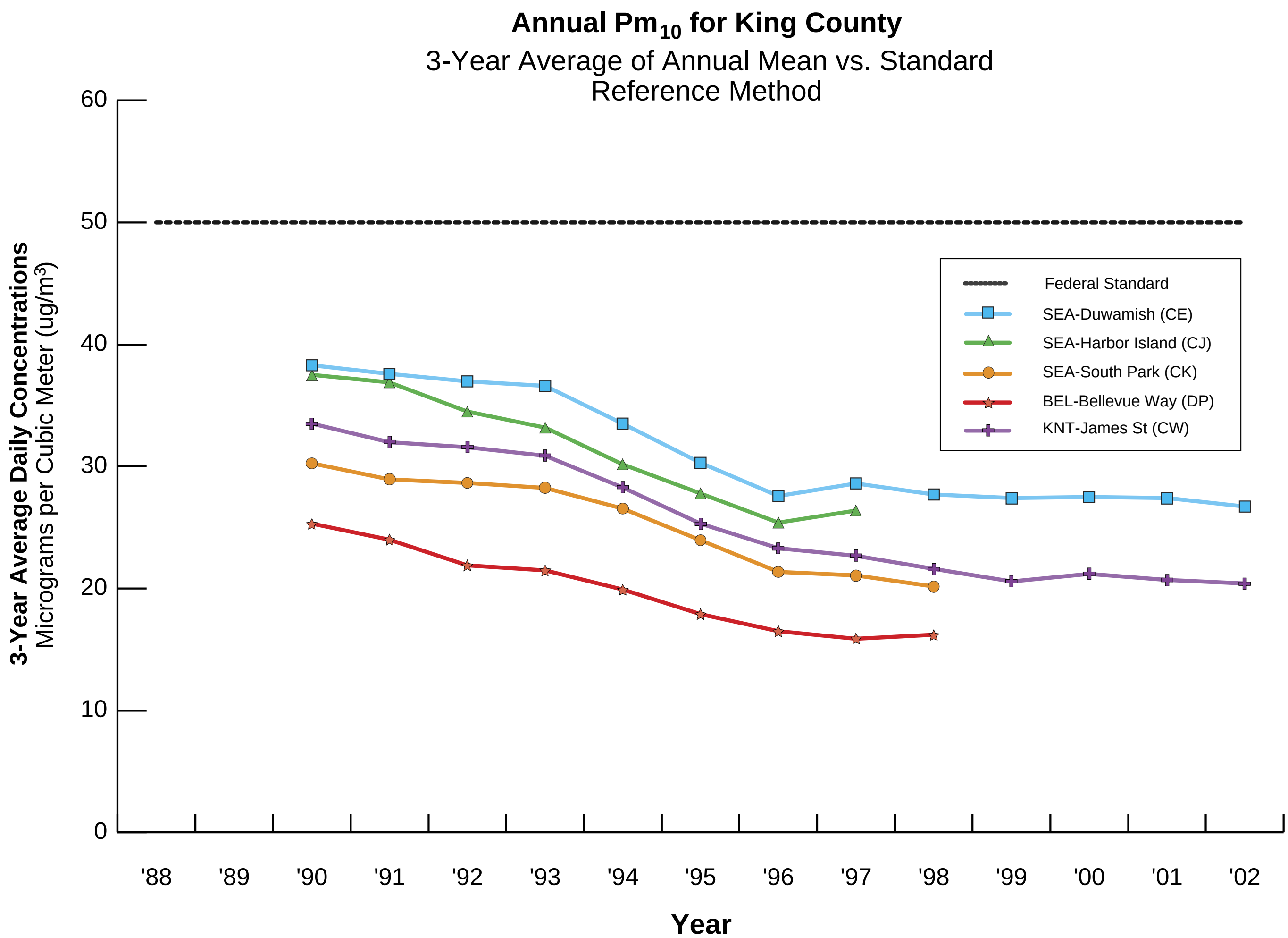
The daily maximum 24-hour PM_{10} value has shown a fairly consistent decrease since 1990 in the majority of the Puget Sound air shed. The industrial areas occasionally are impacted by industrial or commercial operations. The maximum PM_{10} concentration in 2002 was 161 $\mu g/m^3$ on April 22 in the Tacoma port area measured by a continuous equivalent method analyzer. The cause of the high concentration appeared to be nearby off-road trucking operations stirring up dust from unpaved dirt lots and being blown about by strong wind speeds of up to 20 miles per hour. Even though the measurement exceeded the level of the daily standard (150 $\mu g/m^3$), it is not a violation of the NAAQS.

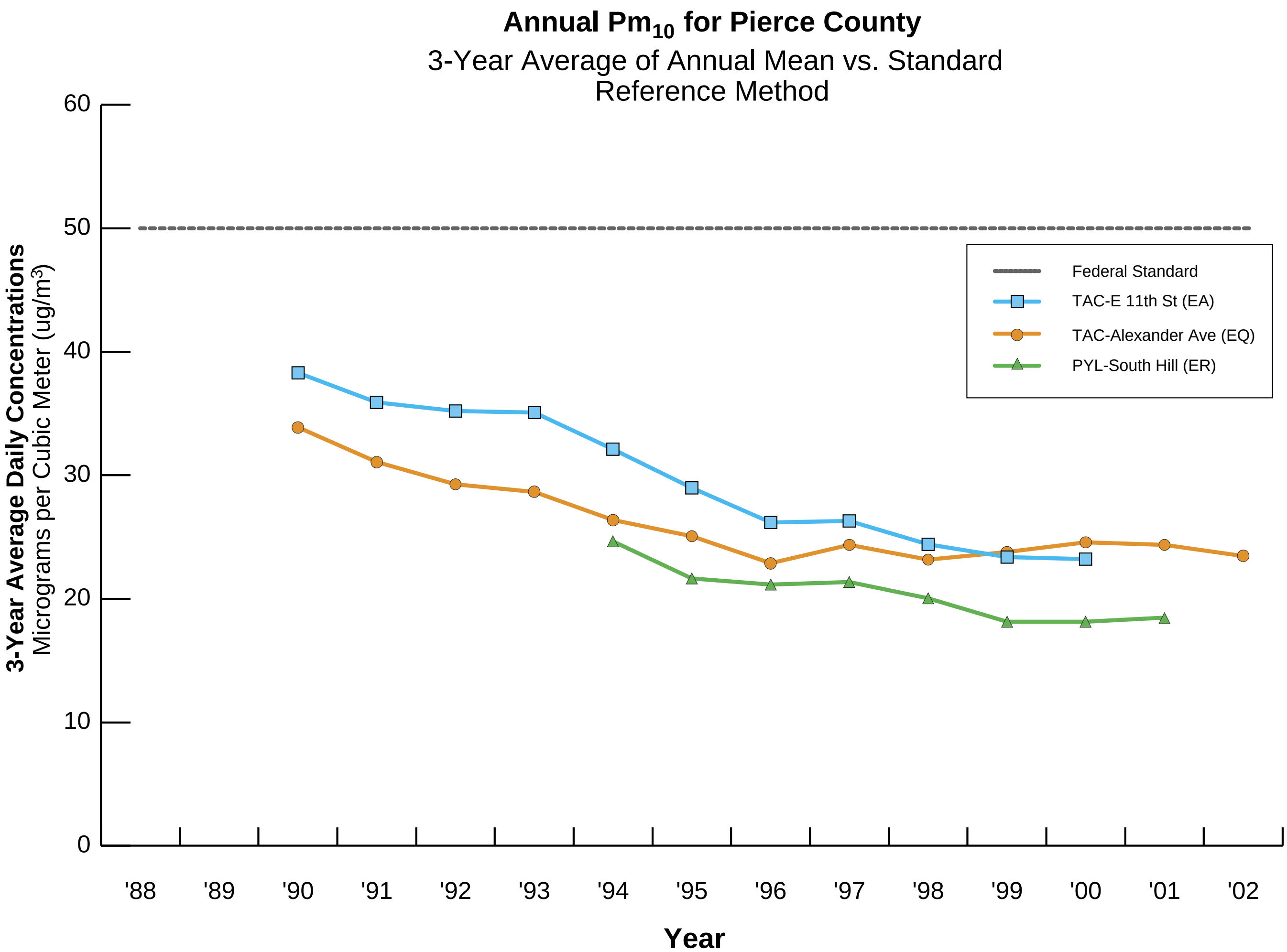
The last PM_{10} measurement in the Puget Sound region that exceeded the level of the daily standard was in 1990 and also occurred in the Tacoma port area. To determine compliance, the 3-year average of the 99th percentile of measurements must be less than or equal to 150 $\mu g/m^3$. The current 99th percentile 3-year average for the Tacoma port site is 77 $\mu g/m^3$, about one-half of the daily standard.

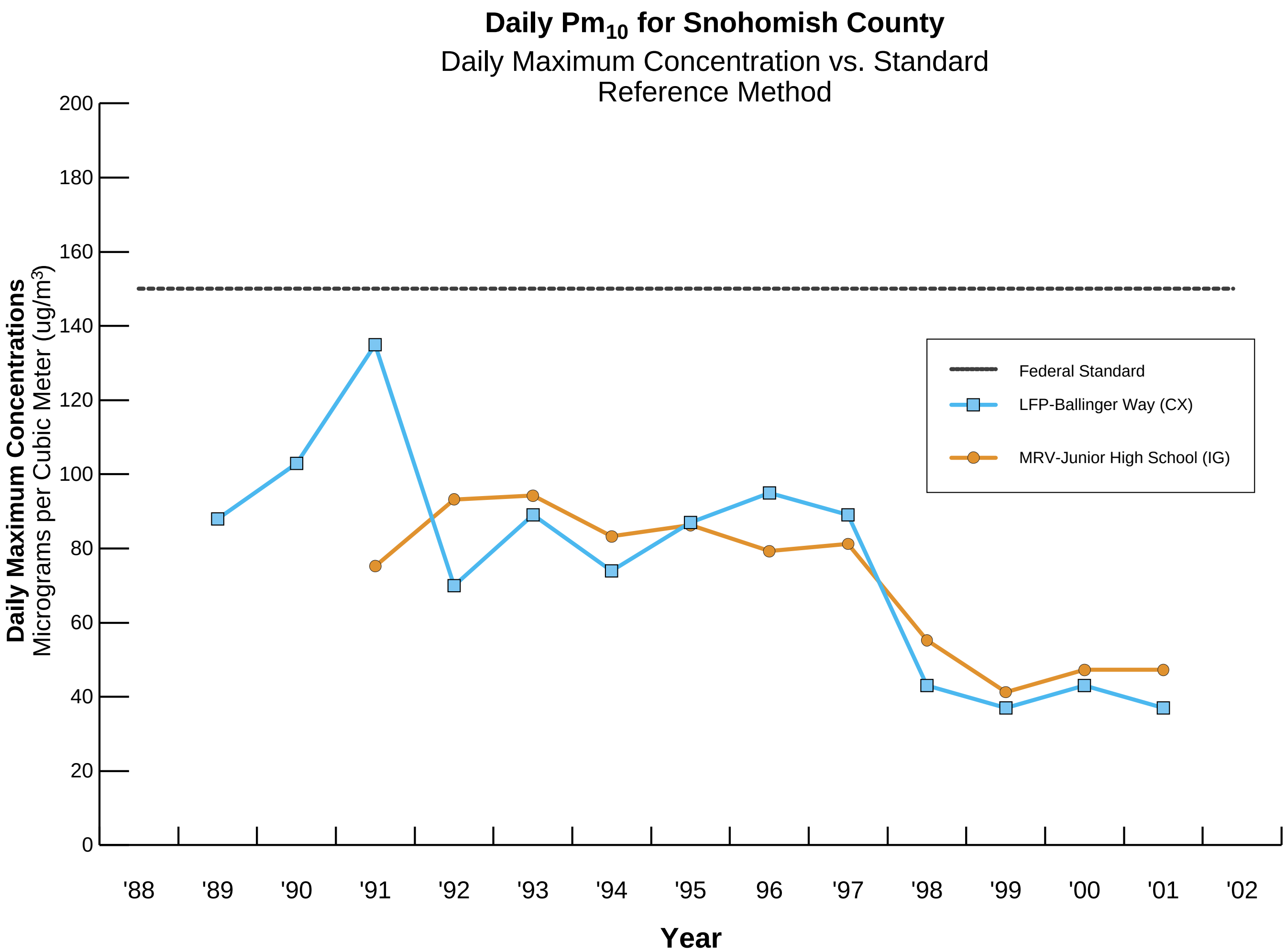
For additional information on PM, visit www.epa.gov/air/urbanair/pm/index.html.

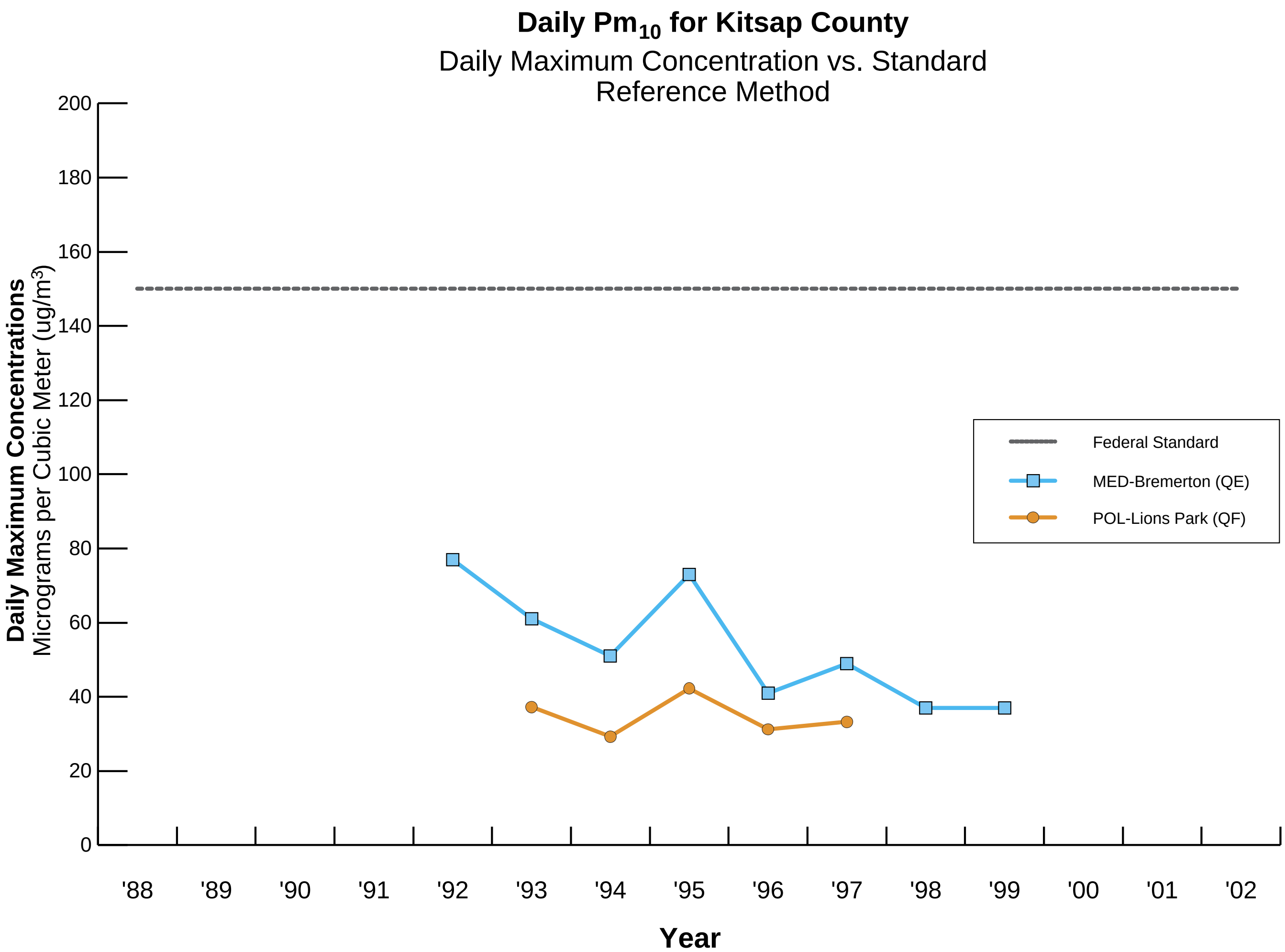

Annual Pm10 for Snohomish County
3-Year Average of Annual Mean vs. Standard Reference Method
3-Year Average Daily Concentrations
Micrograms per Cubic Meter (ug/m3)
60
50
40
30
20
10
0
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Federal Standard
LFP-Ballinger Way (CX)
LFP-Bothell Way (DB)
MRV-Junior High School (IG)
LYN-59th Pl (IH)

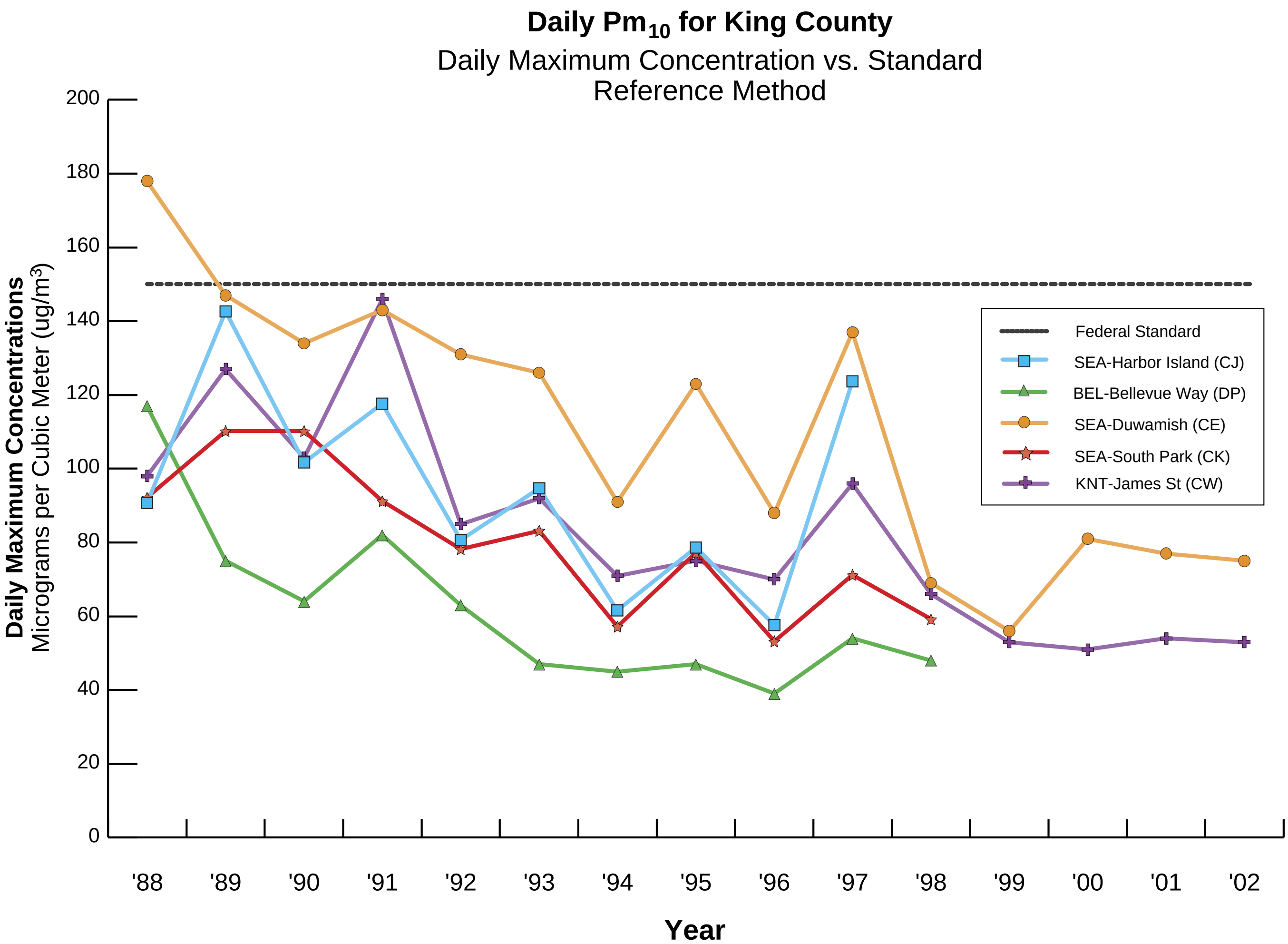

Annual Pm10 for Kitsap County
3-Year Average of Annual Mean vs. Standard Reference Method
3-Year Average Daily Concentrations
Micrograms per Cubic Meter (ug/m3)
60
50
40
30
20
10
0
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Federal Standard
MED-Bremerton (QE)
POL-Lions Park (QF)

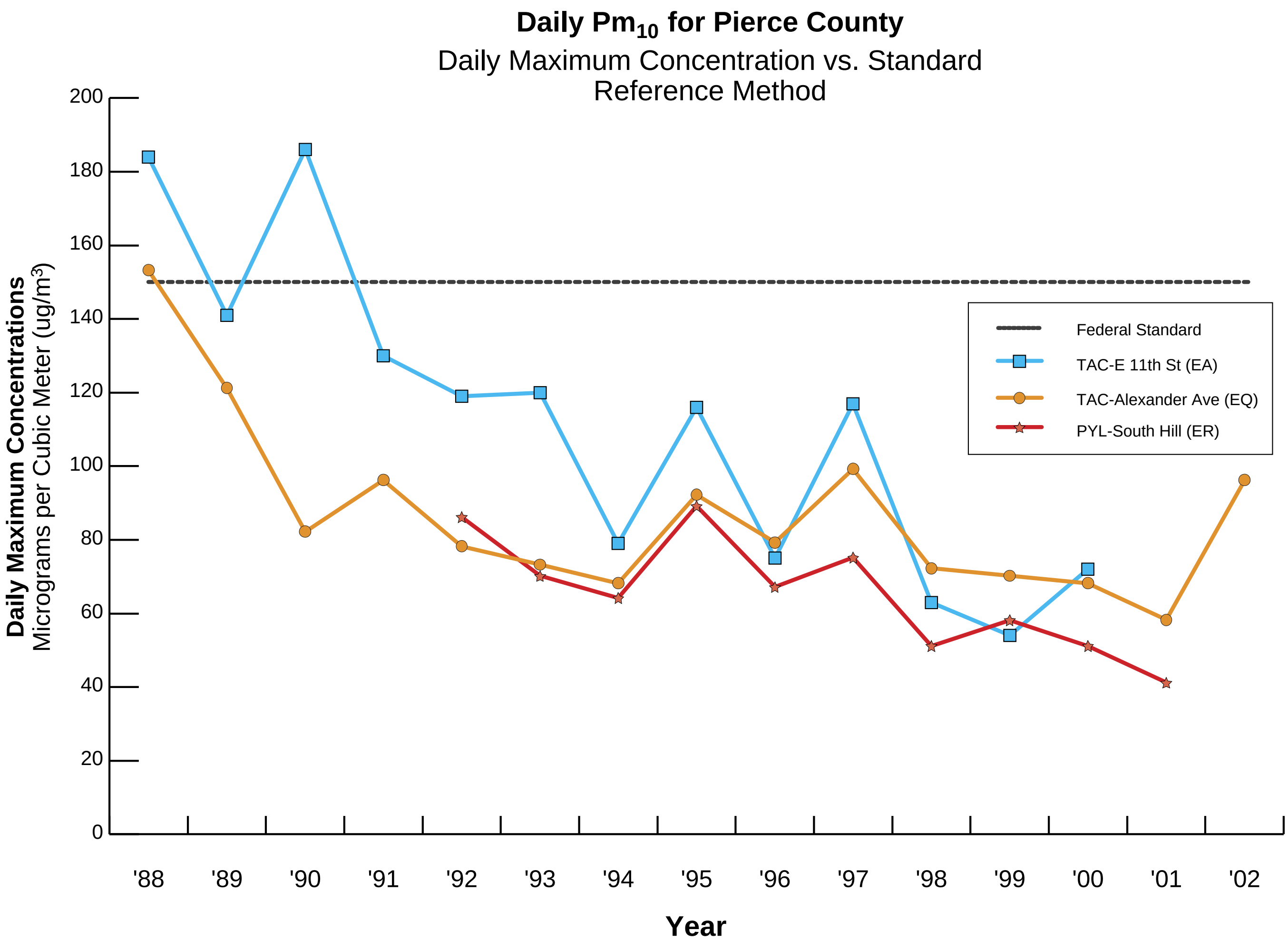

Annual Pm10 for King County
3-Year Average of Annual Mean vs. Standard Reference Method
3-Year Average Daily Concentrations
Micrograms per Cubic Meter (ug/m3)
60
50
40
30
20
10
0
Federal Standard
SEA-Duwamish (CE)
SEA-Harbor Island (CJ)
SEA-South Park (CK)
BEL-Bellevue Way (DP)
KNT-James St (CW)
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year


Annual Pm_{10} for Pierce County
3-Year Average of Annual Mean vs. Standard Reference Method
3-Year Average Daily Concentrations
Micrograms per Cubic Meter (ug/m³)
60
50
40
30
20
10
0
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Federal Standard
TAC-E 11th St (EA)
TAC-Alexander Ave (EQ)
PYL-South Hill (ER)


Daily Pm10 for Snohomish County
Daily Maximum Concentration vs. Standard
Reference Method
Daily Maximum Concentrations
Micrograms per Cubic Meter (ug/m3)
200
180
160
140
120
100
80
60
40
20
0
'88
'89
'90
'91
'92
'93
'94
'95
96
'97
'98
'99
'00
'01
'02
Year
Federal Standard
LFP-Ballinger Way (CX)
MRV-Junior High School (IG)


Daily Pm10 for Kitsap County
Daily Maximum Concentration vs. Standard
Reference Method
Daily Maximum Concentrations
Micrograms per Cubic Meter (ug/m3)
200
180
160
140
120
100
80
60
40
20
0
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Federal Standard
MED-Bremerton (QE)
POL-Lions Park (QF)


Daily Pm10 for King County
Daily Maximum Concentration vs. Standard
Reference Method
Daily Maximum Concentrations
Micrograms per Cubic Meter (ug/m3)
200
180
160
140
120
100
80
60
40
20
0
Federal Standard
SEA-Harbor Island (CJ)
BEL-Bellevue Way (DP)
SEA-Duwamish (CE)
SEA-South Park (CK)
KNT-James St (CW)
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year


Daily Pm10 for Pierce County
Daily Maximum Concentration vs. Standard
Reference Method
Daily Maximum Concentrations
Micrograms per Cubic Meter (ug/m3)
200
180
160
140
120
100
80
60
40
20
0
Federal Standard
TAC-E 11th St (EA)
TAC-Alexander Ave (EQ)
PYL-South Hill (ER)
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year

Particulate Matter (2.5 micrometers)

Particles smaller than 2.5 micrometers in diameter are called "fine" particles, or *$PM_{2.5}$*. The Agency considers $PM_{2.5}$ one of the major air pollution concerns affecting our community.

$PM_{2.5}$ generally comes from industrial fuel combustion, vehicle exhaust including cars, diesel trucks and buses, and from wood burning. It can also be formed in the atmosphere by chemical reactions of pollutant gases. $PM_{2.5}$ exposure can have serious health effects. Fine particles are most closely associated with increased respiratory disease, decreased lung function, and even premature death. Children and older adults are more likely to develop heart or lung problems. $PM_{2.5}$ also significantly affects visibility. If $PM_{2.5}$ levels are high, people with respiratory or heart disease, older adults, and children should avoid outdoor exertion.

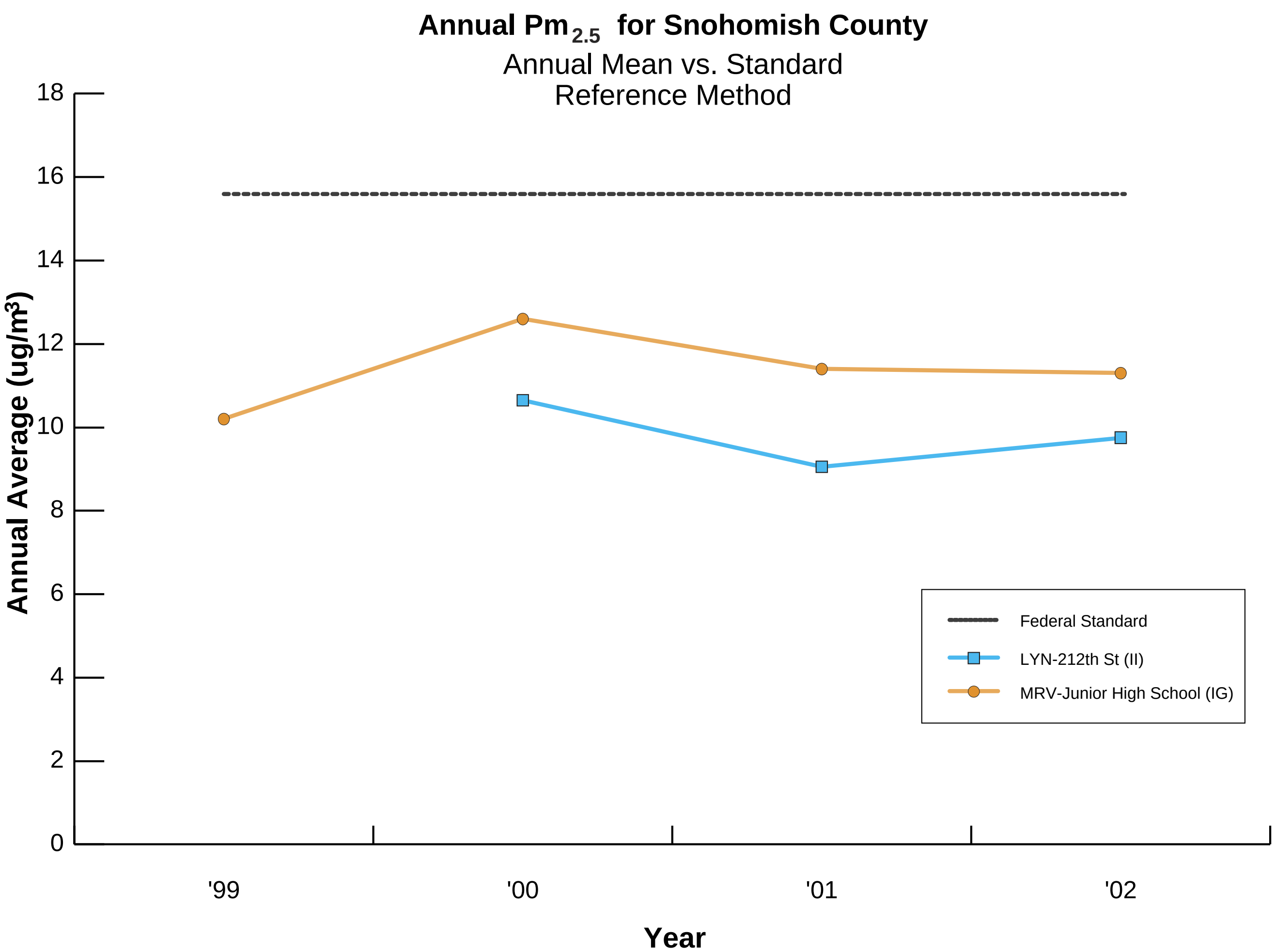
As shown in the charts below, the Puget Sound air shed was in compliance with both standards for $PM_{2.5}$ for the years 1999-2002. The annual standard of 15 $\mu g/m^3$ was not exceeded at any of the monitoring stations. Although the highest $PM_{2.5}$ concentration (77 $\mu g/m^3$) measured in 2002 at Marysville by a continuous method analyzer exceeded the standard, it did not violate the standard. Because of the way the daily $PM_{2.5}$ standard is defined, the 3-year average of the 98th percentile of daily concentrations must not exceed 65 $\mu g/m^3$. In 2002, the highest 98th percentile measured by reference method samplers was 43 $\mu g/m^3$ at two sites (both sites are in neighborhoods impacted by wood smoke in the winter months).. For the years 2000-2002, the highest 3-year averages of the 98th percentile was 42 $\mu g/m^3$ for the Marysville site and 45 $\mu g/m^3$ for the Tacoma South L Street site. Values above 40 $\mu g/m^3$ are viewed by EPA as "unhealthy for sensitive groups". This means that although we "attain" the standard, there are time periods when certain individuals are at risk from fine particle pollution. For the 1999 to 2002 period, concentration trends for $PM_{2.5}$ were flat at the 98th percentile of daily levels of 30-50 $\mu g/m^3$ and annual daily levels of 10-12 $\mu g/m^3$.

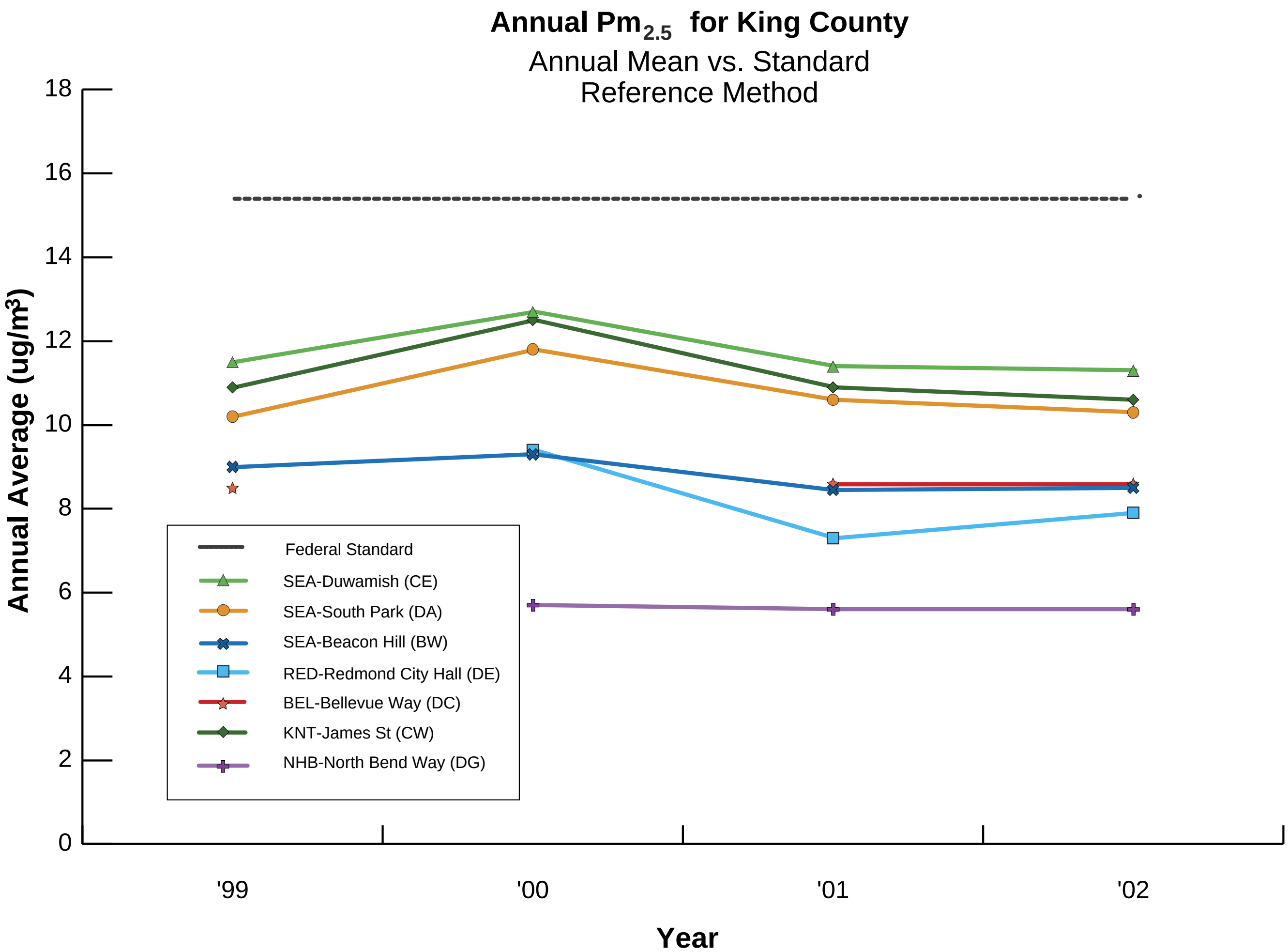
Prior to adoption of the $PM_{2.5}$ reference method standard, the Agency collected $PM_{2.5}$ data using the dichotomous sampler method from the late 1980s through the spring of 2000. The long term trend indicates a gradual downward tendency in $PM_{2.5}$ concentrations. In the years 1988-89 the annual averages for $PM_{2.5}$ were 12-15 $\mu g/m^3$ and by 1999 were 9-11 $\mu g/m^3$. The 98th percentiles for the same period went from 50-60 $\mu g/m^3$ and by 1999 were in the 30-40 $\mu g/m^3$ range. This additional $PM_{2.5}$ data is available by contacting the Agency at 206-689-4006.

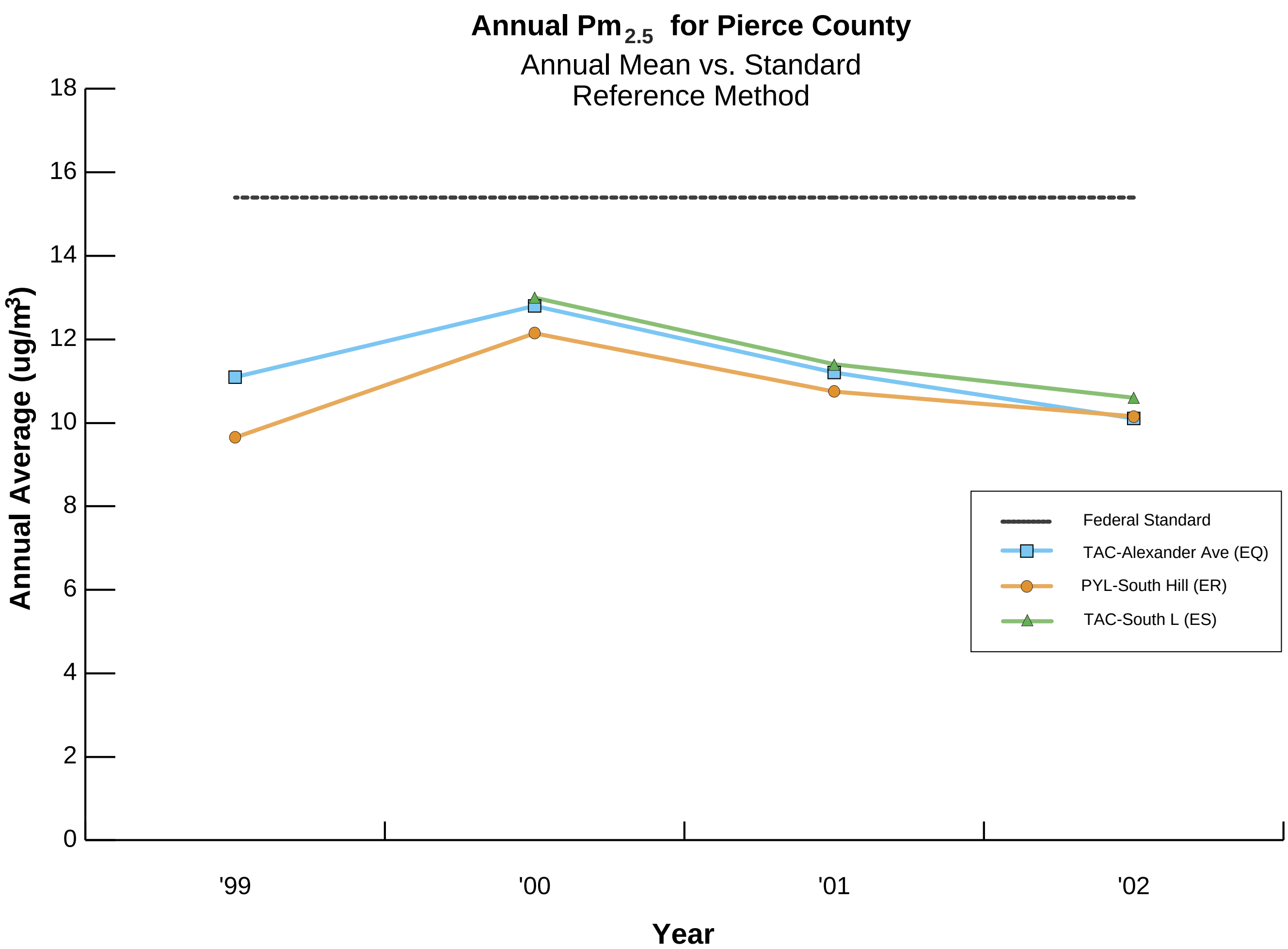
Also shown in the charts below are graphs of the daily $PM_{2.5}$ concentrations measured at 4 sites during 2002 by continuous analyzers (2 different method types at each site). Three of the sites are neighborhood/commercial in character and the other is the industrial site in the Duwamish valley of Seattle.

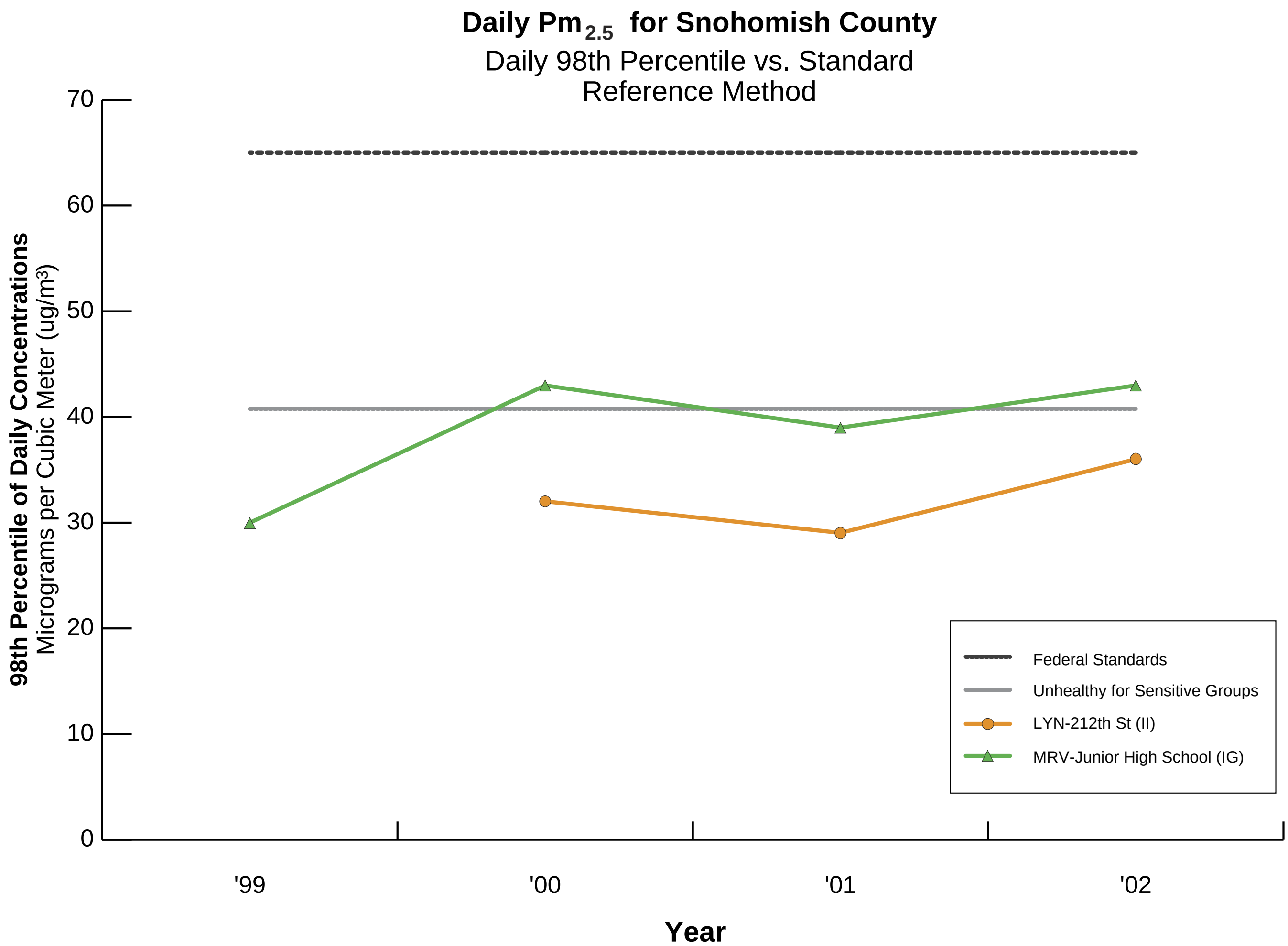
A notable feature of all 4 graphs is the seasonal difference between summertime (May – September) and wintertime (October – March). The winter months of 2002 (October – December) clearly demonstrate that air quality issues with regard to fine particles are a concern. Several stagnant weather periods were prevalent that prevented the dispersion of pollutants, with the primary polluting source being wood smoke from stoves and fireplaces. Newer neighborhoods with cleaner home heating have considerably lower fine particle measurements.

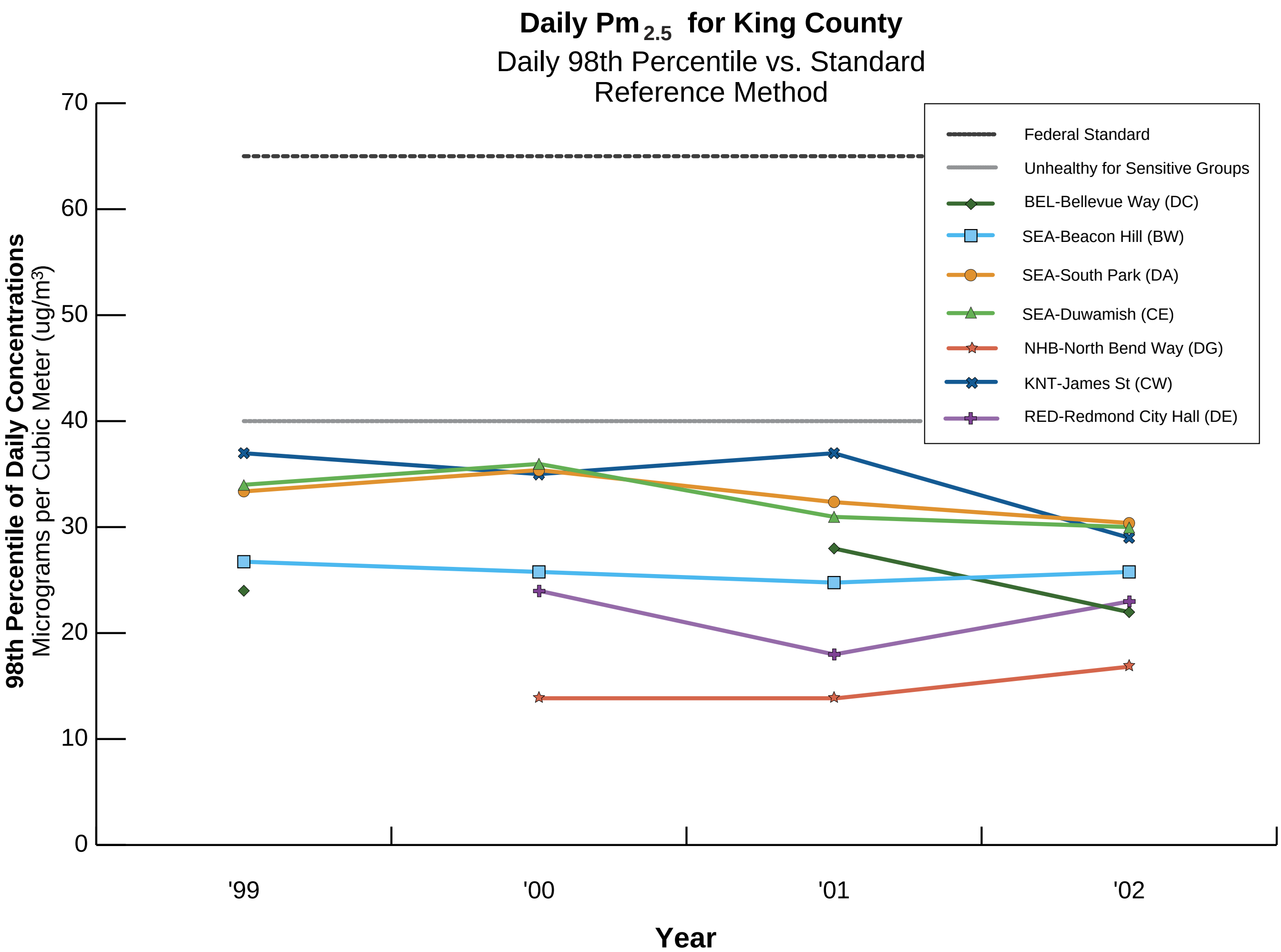
Another point of interest is that at the 3 neighborhood sites, fine particle emissions by July 4th fireworks are clearly evident. For additional information on PM, visit www.epa.gov/air/urbanair/pm/index.html.

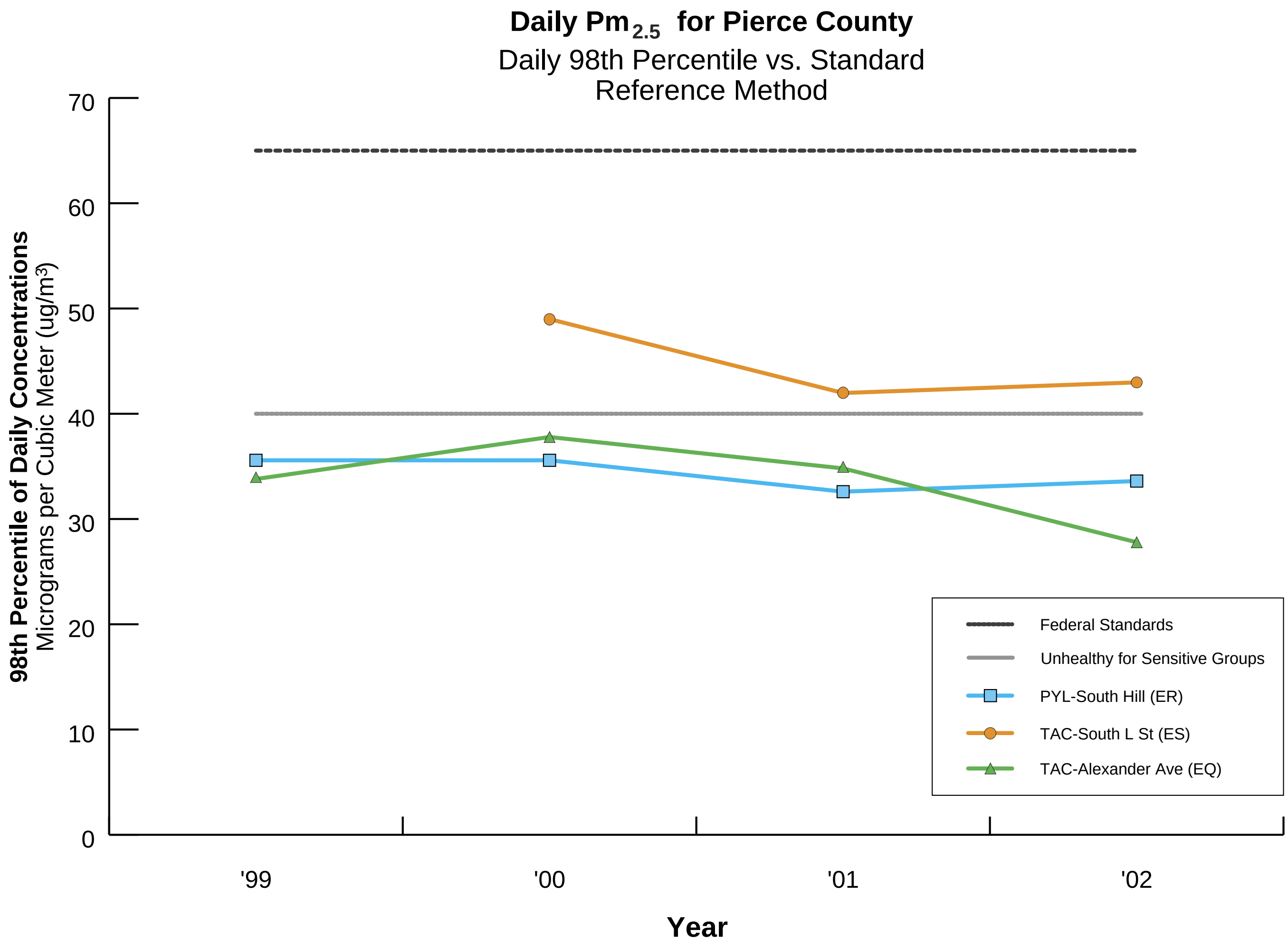

Annual $Pm_{2.5}$ for Snohomish County
Annual Mean vs. Standard
Reference Method
Annual Average (ug/m³)
18
16
14
12
10
8
6
4
2
0
'99
'00
'01
'02
Year
Federal Standard
LYN-212th St (II)
MRV-Junior High School (IG)

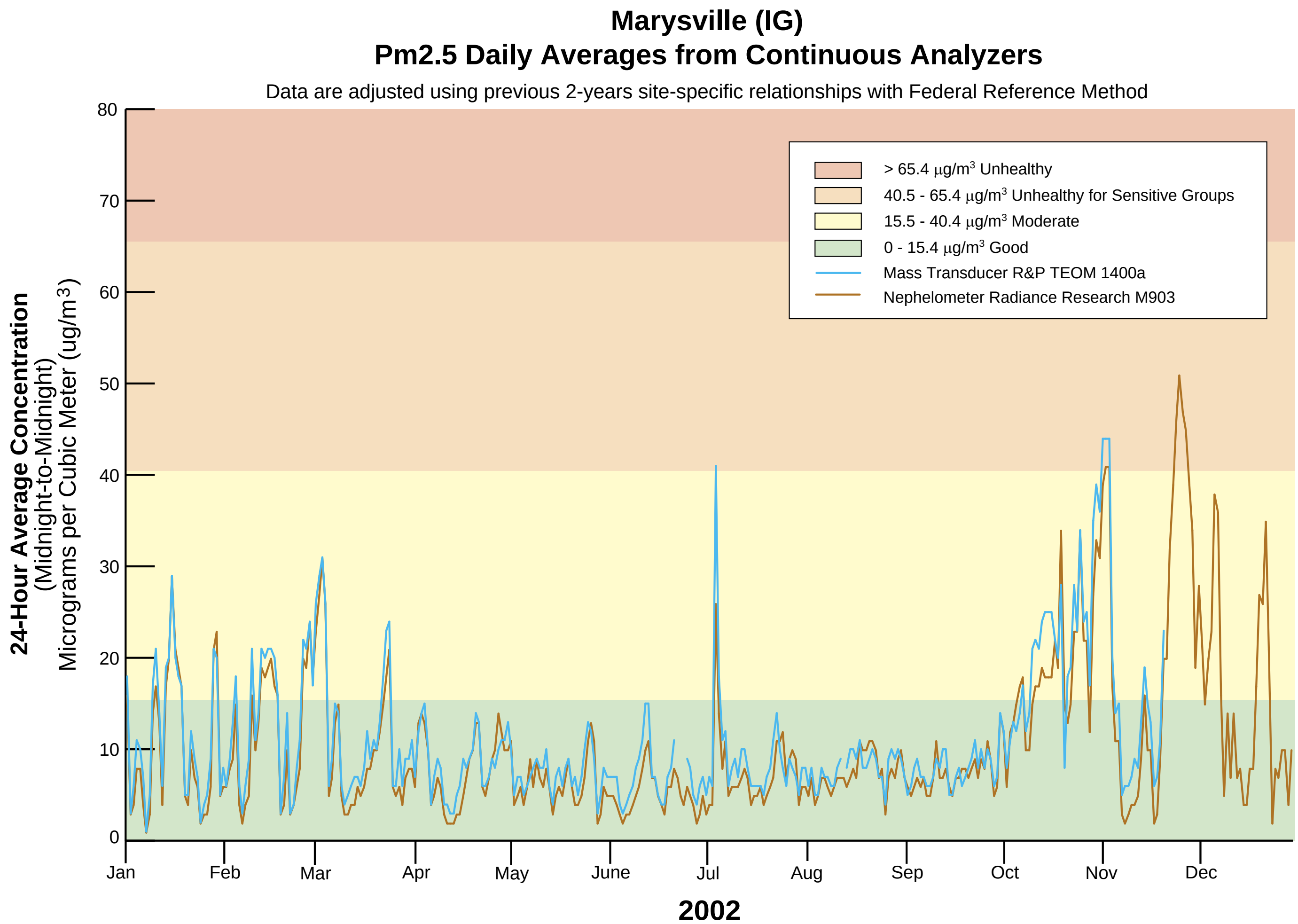

Annual Pm2.5 for King County
Annual Mean vs. Standard
Reference Method
Annual Average (ug/m³)
18
16
14
12
10
8
6
4
2
0
'99
'00
'01
'02
Year
Federal Standard
SEA-Duwamish (CE)
SEA-South Park (DA)
SEA-Beacon Hill (BW)
RED-Redmond City Hall (DE)
BEL-Bellevue Way (DC)
KNT-James St (CW)
NHB-North Bend Way (DG)

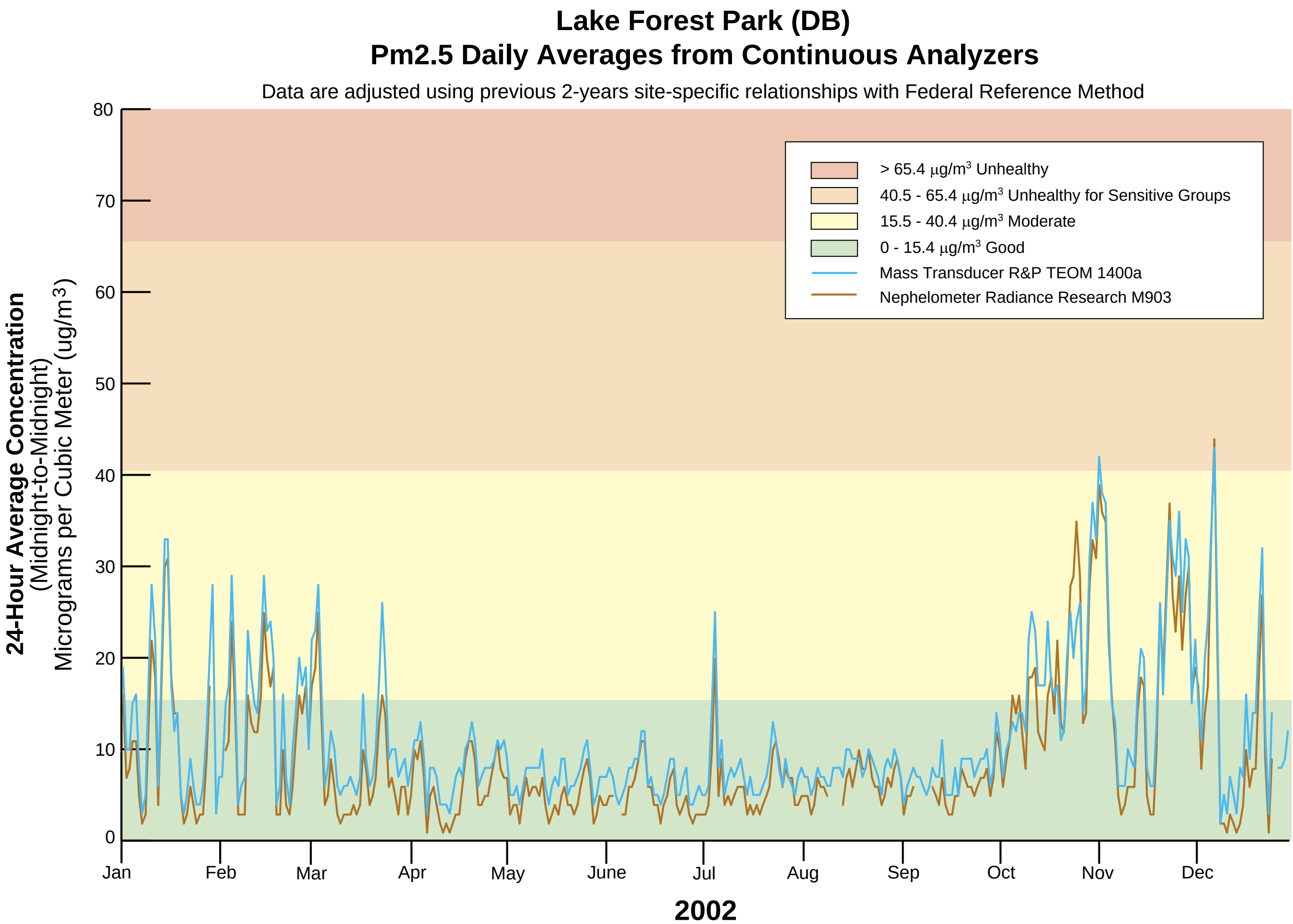

Annual Pm2.5 for Pierce County
Annual Mean vs. Standard
Reference Method
Annual Average (ug/m3)
18
16
14
12
10
8
6
4
2
0
'99
'00
'01
'02
Year
Federal Standard
TAC-Alexander Ave (EQ)
PYL-South Hill (ER)
TAC-South L (ES)


Daily Pm 2.5 for Snohomish County
Daily 98th Percentile vs. Standard
Reference Method
98th Percentile of Daily Concentrations
Micrograms per Cubic Meter (ug/m3)
70
60
50
40
30
20
10
0
'99
'00
'01
'02
Year
Federal Standards
Unhealthy for Sensitive Groups
LYN-212th St (II)
MRV-Junior High School (IG)


Daily Pm 2.5 for King County
Daily 98th Percentile vs. Standard
Reference Method
98th Percentile of Daily Concentrations
Micrograms per Cubic Meter (ug/m³)
70
60
50
40
30
20
10
0
'99
'00
'01
'02
Year
Federal Standard
Unhealthy for Sensitive Groups
BEL-Bellevue Way (DC)
SEA-Beacon Hill (BW)
SEA-South Park (DA)
SEA-Duwamish (CE)
NHB-North Bend Way (DG)
KNT-James St (CW)
RED-Redmond City Hall (DE)

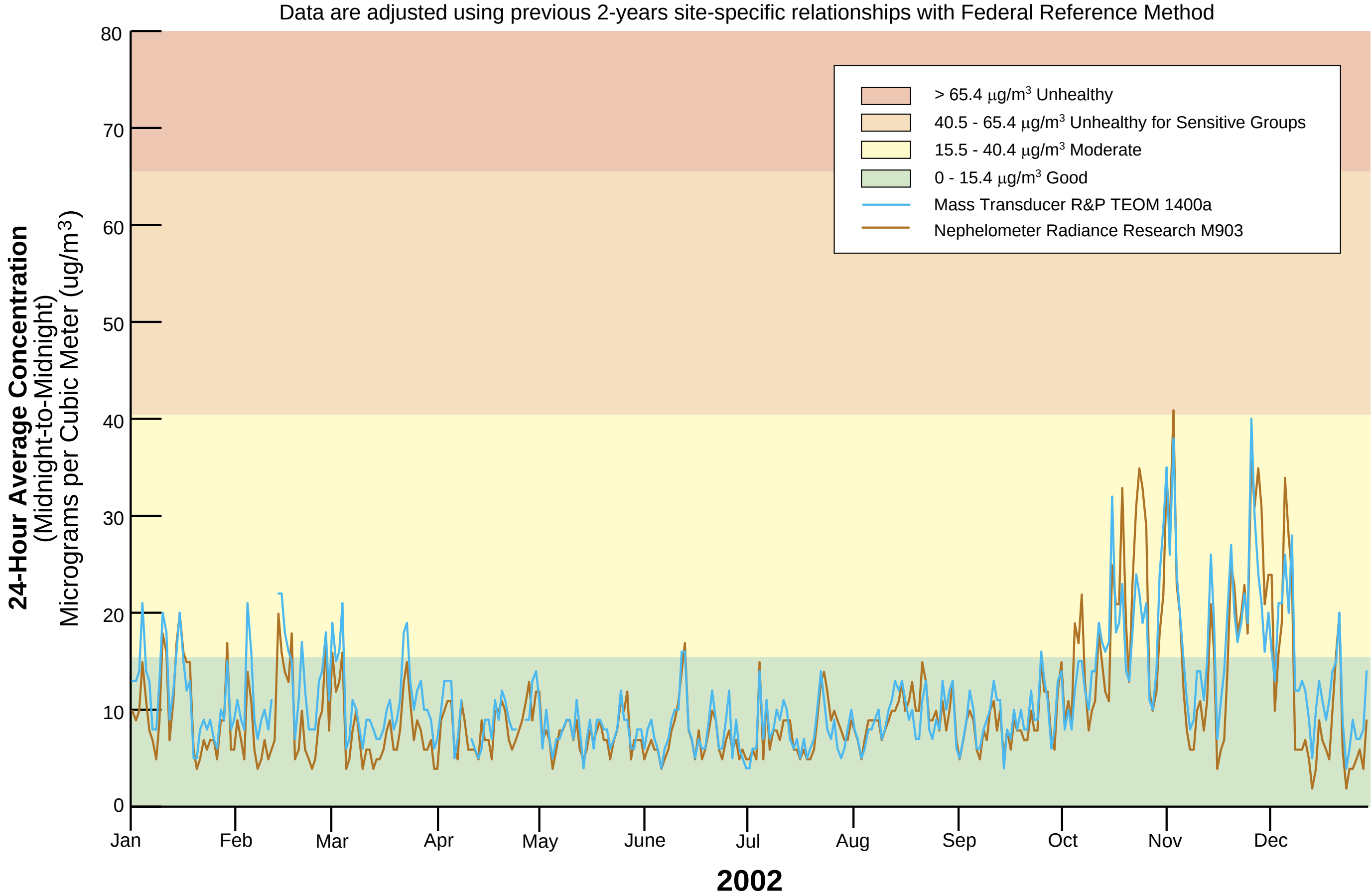

Daily $Pm_{2.5}$ for Pierce County
Daily 98th Percentile vs. Standard
Reference Method
98th Percentile of Daily Concentrations
Micrograms per Cubic Meter (ug/m³)
70
60
50
40
30
20
10
0
'99
'00
'01
'02
Year
Federal Standards
Unhealthy for Sensitive Groups
PYL-South Hill (ER)
TAC-South L St (ES)
TAC-Alexander Ave (EQ)

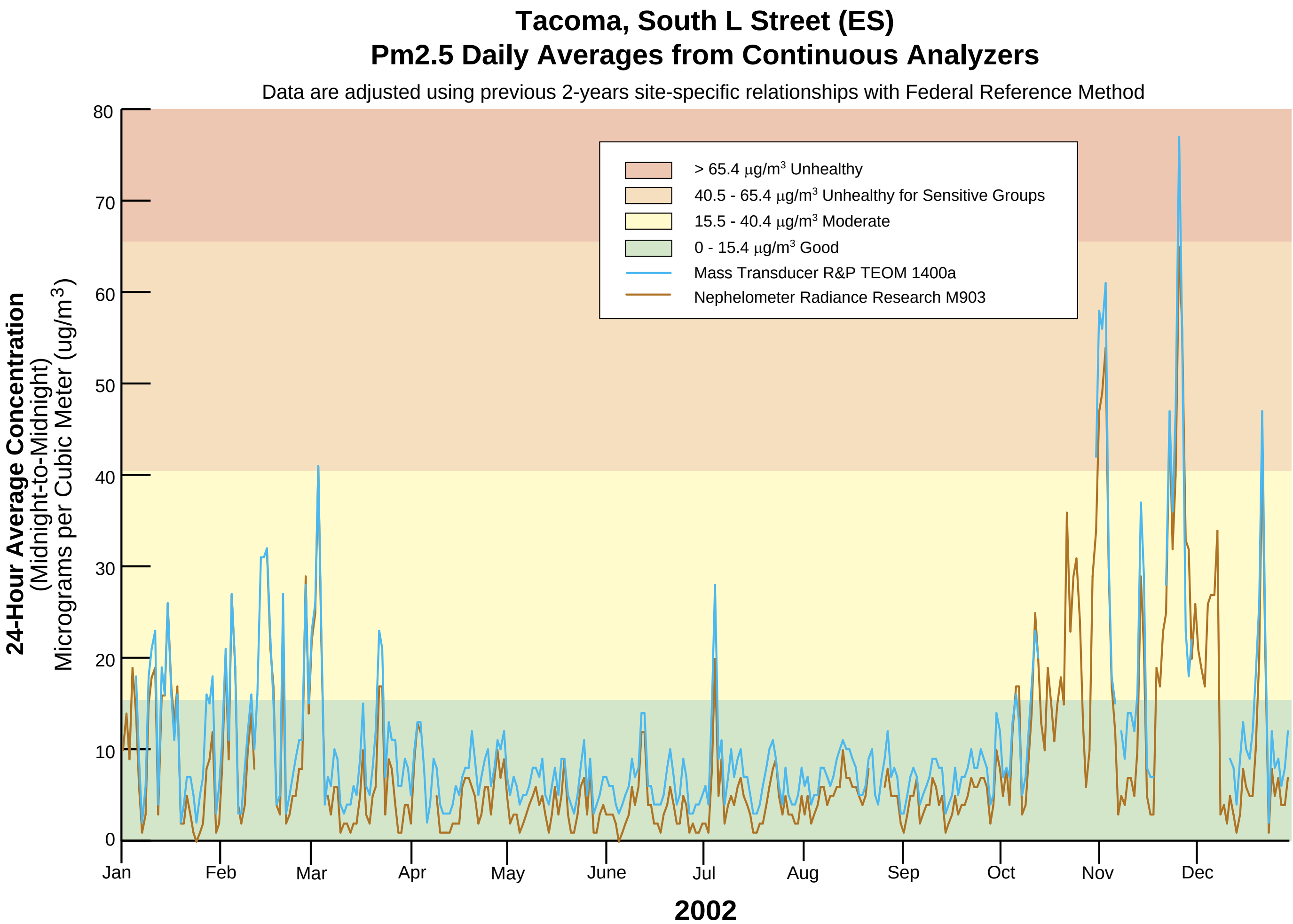

Marysville (IG)
Pm2.5 Daily Averages from Continuous Analyzers
Data are adjusted using previous 2-years site-specific relationships with Federal Reference Method
> 65.4 µg/m3 Unhealthy
40.5 - 65.4 µg/m3 Unhealthy for Sensitive Groups
15.5 - 40.4 µg/m3 Moderate
0 - 15.4 µg/m3 Good
Mass Transducer R&P TEOM 1400a
Nephelometer Radiance Research M903
24-Hour Average Concentration
(Midnight-to-Midnight)
Micrograms per Cubic Meter (ug/m3)
0
10
20
30
40
50
60
70
80
Jan
Feb
Mar
Apr
May
June
Jul
Aug
Sep
Oct
Nov
Dec
2002

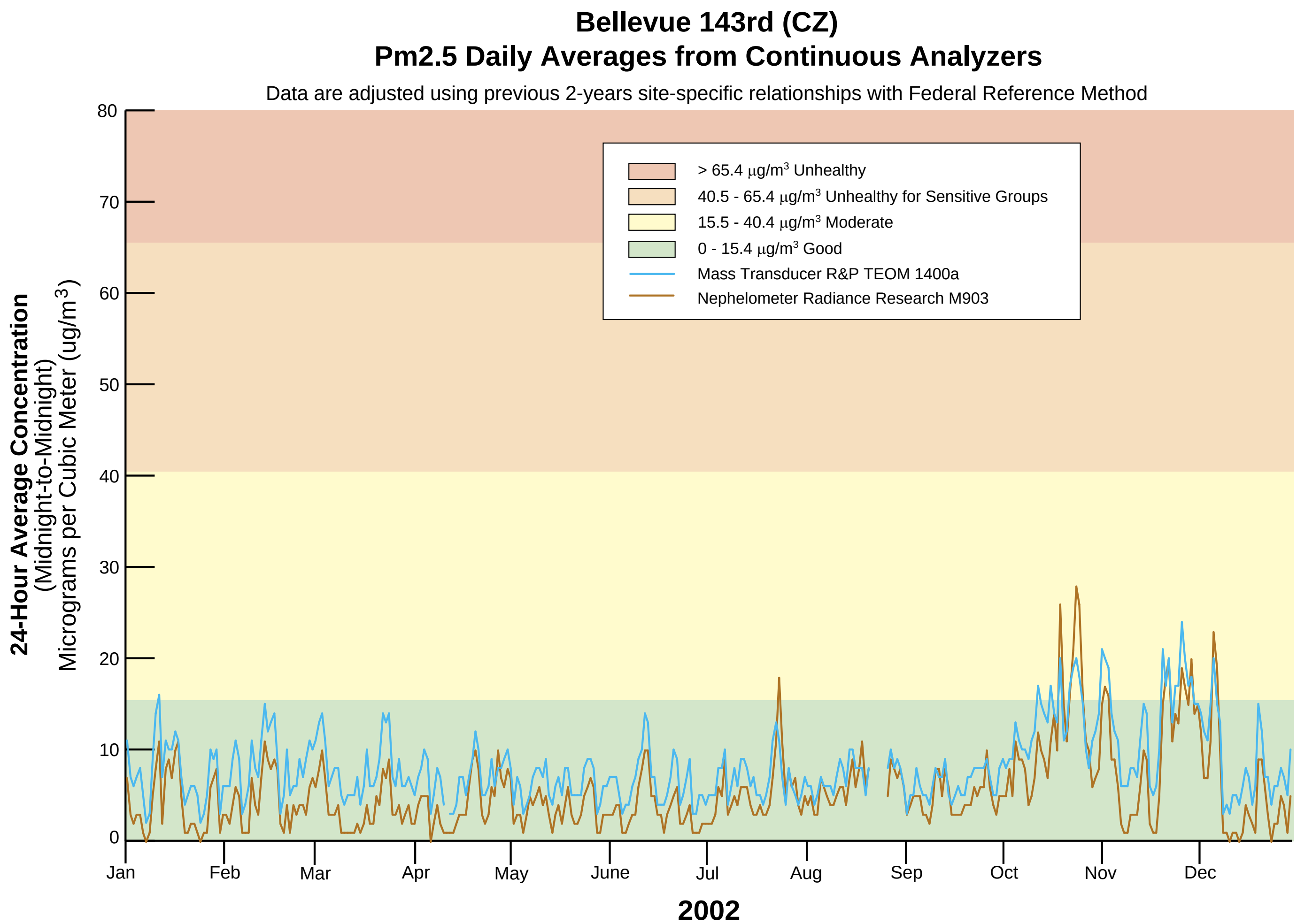

Lake Forest Park (DB)
Pm2.5 Daily Averages from Continuous Analyzers
Data are adjusted using previous 2-years site-specific relationships with Federal Reference Method
24-Hour Average Concentration
(Midnight-to-Midnight)
Micrograms per Cubic Meter (ug/m3)
0
10
20
30
40
50
60
70
80
> 65.4 µg/m3 Unhealthy
40.5 - 65.4 µg/m3 Unhealthy for Sensitive Groups
15.5 - 40.4 µg/m3 Moderate
0 - 15.4 µg/m3 Good
Mass Transducer R&P TEOM 1400a
Nephelometer Radiance Research M903
Jan
Feb
Mar
Apr
May
June
Jul
Aug
Sep
Oct
Nov
Dec
2002

Seattle, Duwamish (CE)
Pm2.5 Daily Averages from Continuous Analyzers

Data are adjusted using previous 2-years site-specific relationships with Federal Reference Method




Tacoma, South L Street (ES)
Pm2.5 Daily Averages from Continuous Analyzers
Data are adjusted using previous 2-years site-specific relationships with Federal Reference Method
> 65.4 µg/m³ Unhealthy
40.5 - 65.4 µg/m³ Unhealthy for Sensitive Groups
15.5 - 40.4 µg/m³ Moderate
0 - 15.4 µg/m³ Good
Mass Transducer R&P TEOM 1400a
Nephelometer Radiance Research M903
24-Hour Average Concentration
(Midnight-to-Midnight)
Micrograms per Cubic Meter (ug/m³)
80
70
60
50
40
30
20
10
0
Jan
Feb
Mar
Apr
May
June
Jul
Aug
Sep
Oct
Nov
Dec
2002


Bellevue 143rd (CZ)
Pm2.5 Daily Averages from Continuous Analyzers
Data are adjusted using previous 2-years site-specific relationships with Federal Reference Method
> 65.4 μg/m3 Unhealthy
40.5 - 65.4 μg/m3 Unhealthy for Sensitive Groups
15.5 - 40.4 μg/m3 Moderate
0 - 15.4 μg/m3 Good
Mass Transducer R&P TEOM 1400a
Nephelometer Radiance Research M903
24-Hour Average Concentration
(Midnight-to-Midnight)
Micrograms per Cubic Meter (ug/m3)
80
70
60
50
40
30
20
10
0
Jan
Feb
Mar
Apr
May
June
Jul
Aug
Sep
Oct
Nov
Dec
2002

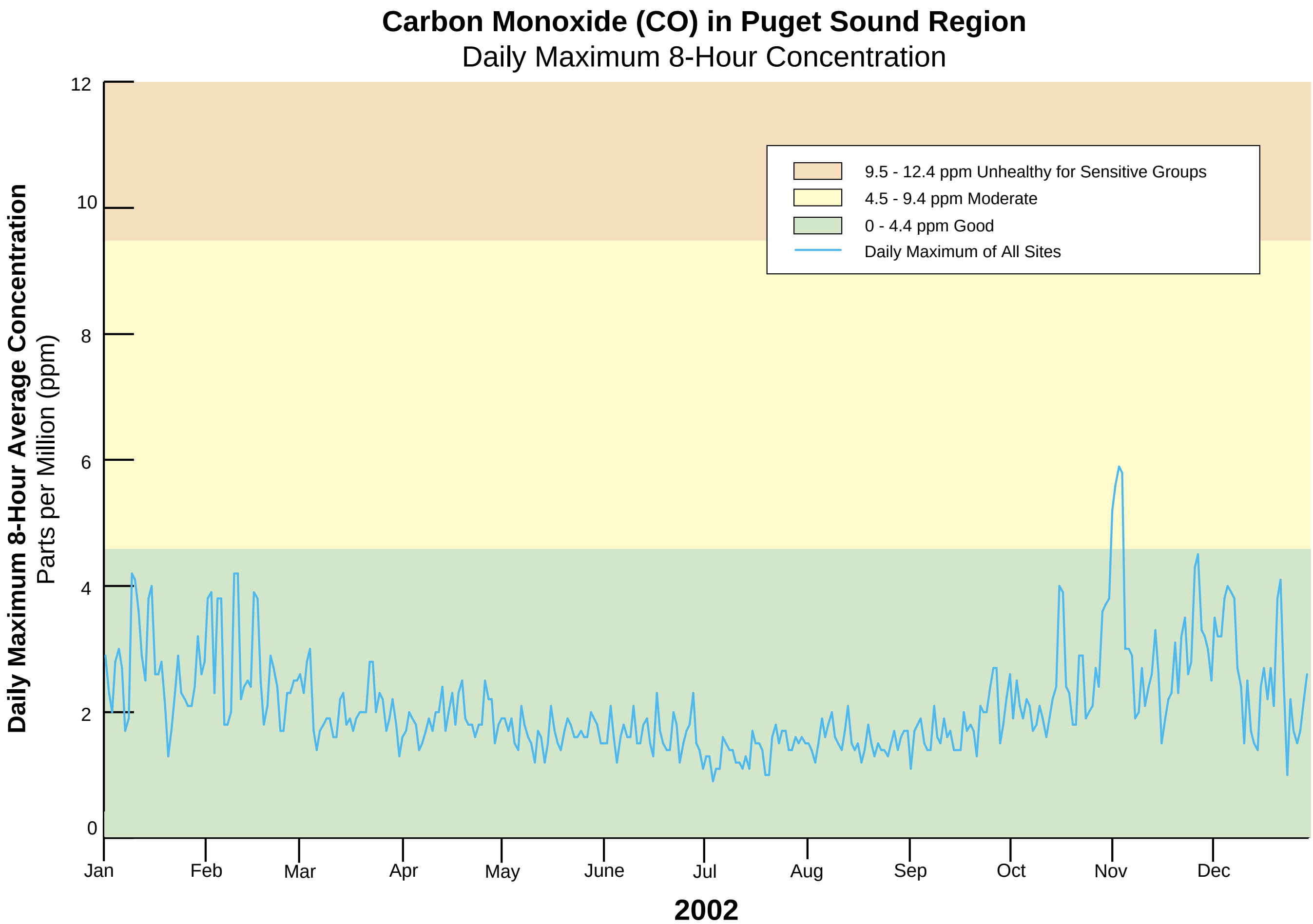
Carbon Monoxide

CO is an odorless, colorless gas that can enter the bloodstream through the lungs and reduce the amount of oxygen that reaches organs and tissues. Carbon monoxide forms when the carbon in fuels doesn't burn completely. About 60% of all CO comes from vehicle exhaust. Higher levels of CO generally occur in areas with heavy traffic congestion. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. The highest levels of CO in the outside air typically occur during the colder months of the year when temperature inversions are more frequent. People with cardiovascular disease or respiratory problems might experience chest pain and increased cardiovascular symptoms, particularly while exercising. High levels of CO can affect alertness and vision even in healthy individuals. If CO levels are high, limit exertion and avoid sources of CO such as heavy traffic.

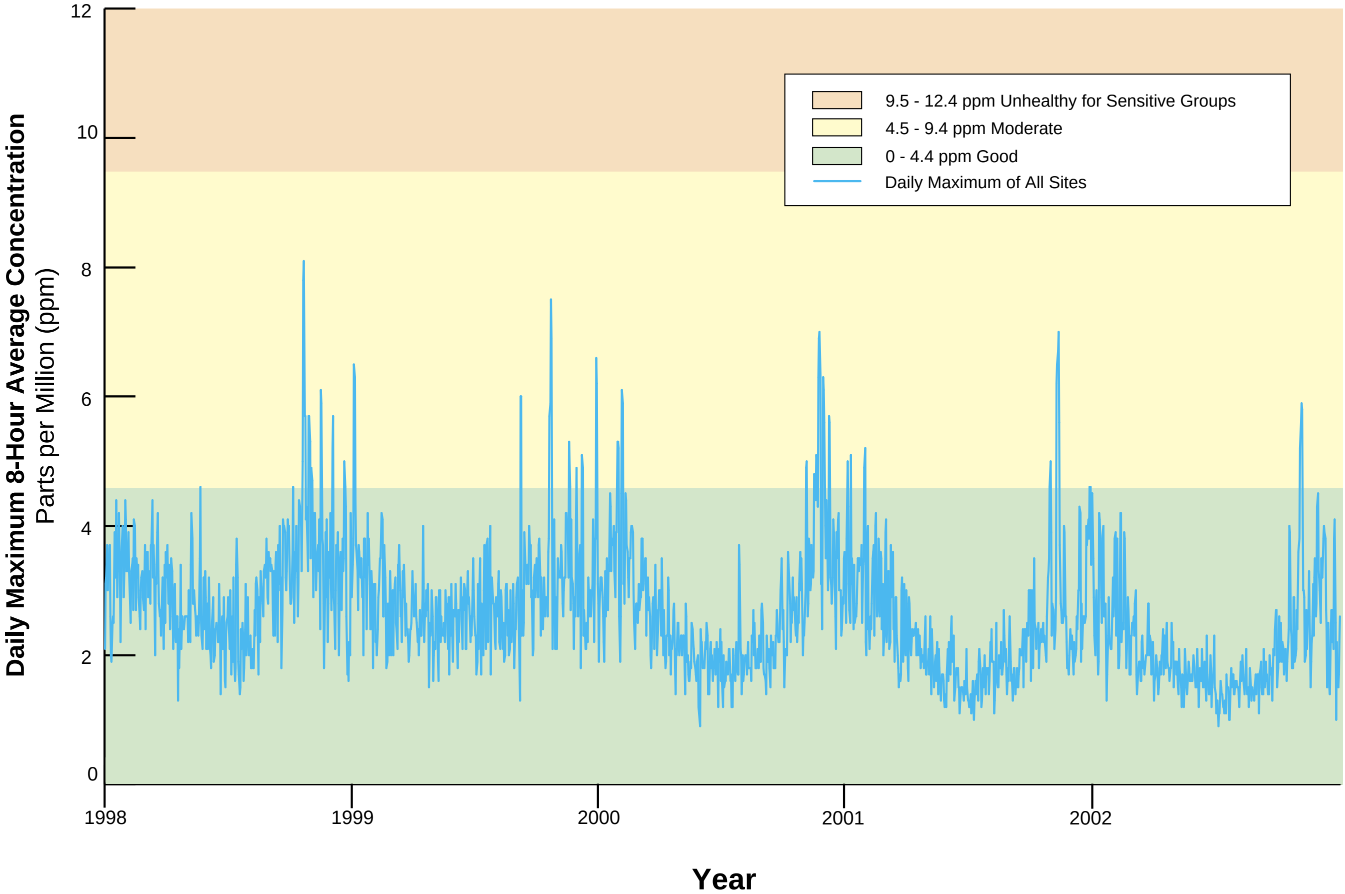
CO monitoring stations are located in areas with heavy traffic congestion. These include central business areas, roadsides, and shopping malls. The Washington Department of Ecology conducts all CO monitoring.

As shown in the charts below, the Puget Sound air shed was in compliance with the 8-hour CO standard for the years 1998 to 2002. The trend of decreasing measurements for the last 5 years can be attributed to fewer older polluting vehicles and engine emission control programs. The maximum 8-hour concentration for CO in 2002 was 5.9 ppm, well below the 8-hour standard. Because measured 1-hour concentrations are historically much lower than the 35 ppm standard, 1-hour CO trends were not charted. The maximum and second highest measured 1-hour CO in 2002 are 9.8 and 9.5 ppm.

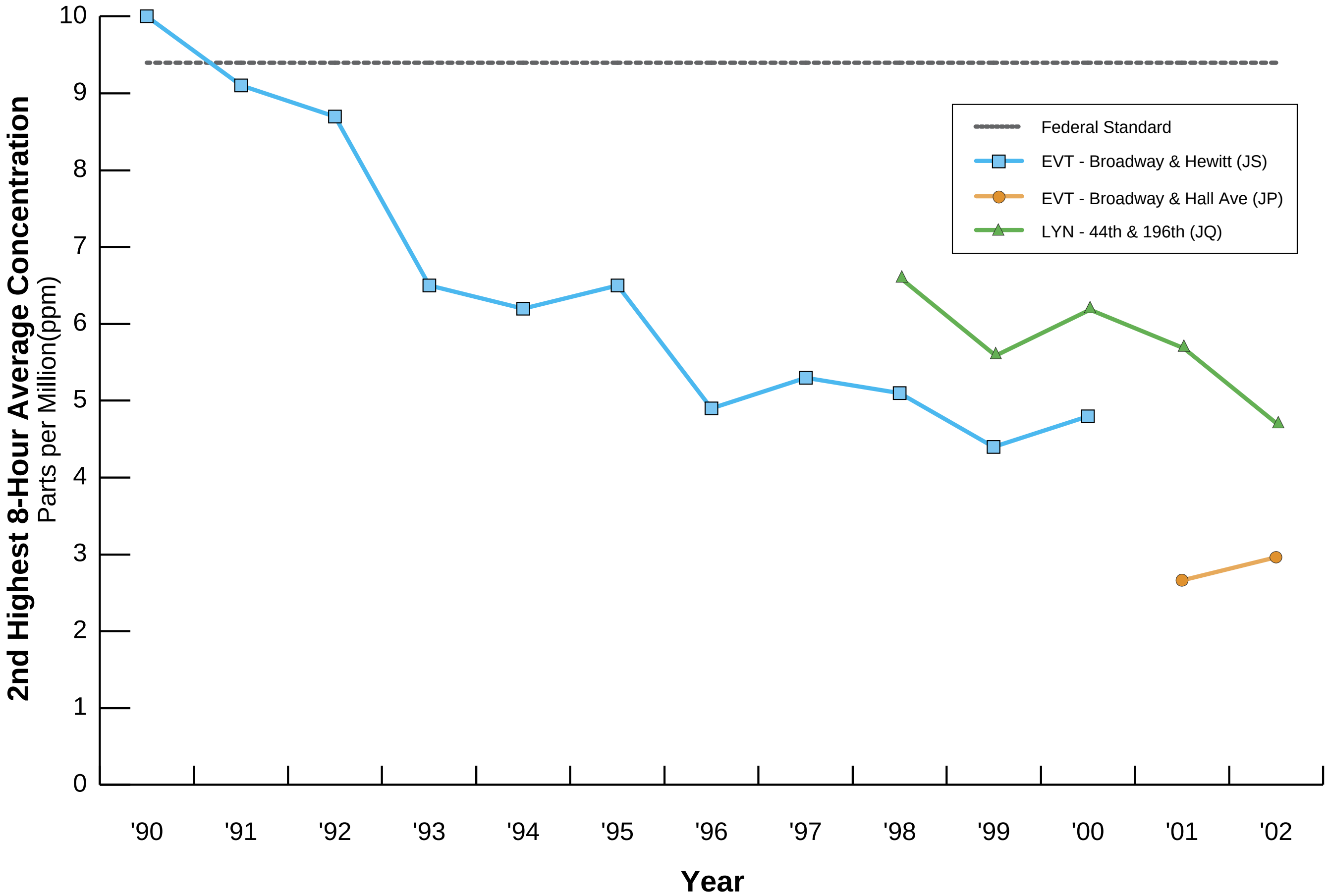
For additional information on CO, visit www.epa.gov/air/urbanair/co/index.html.

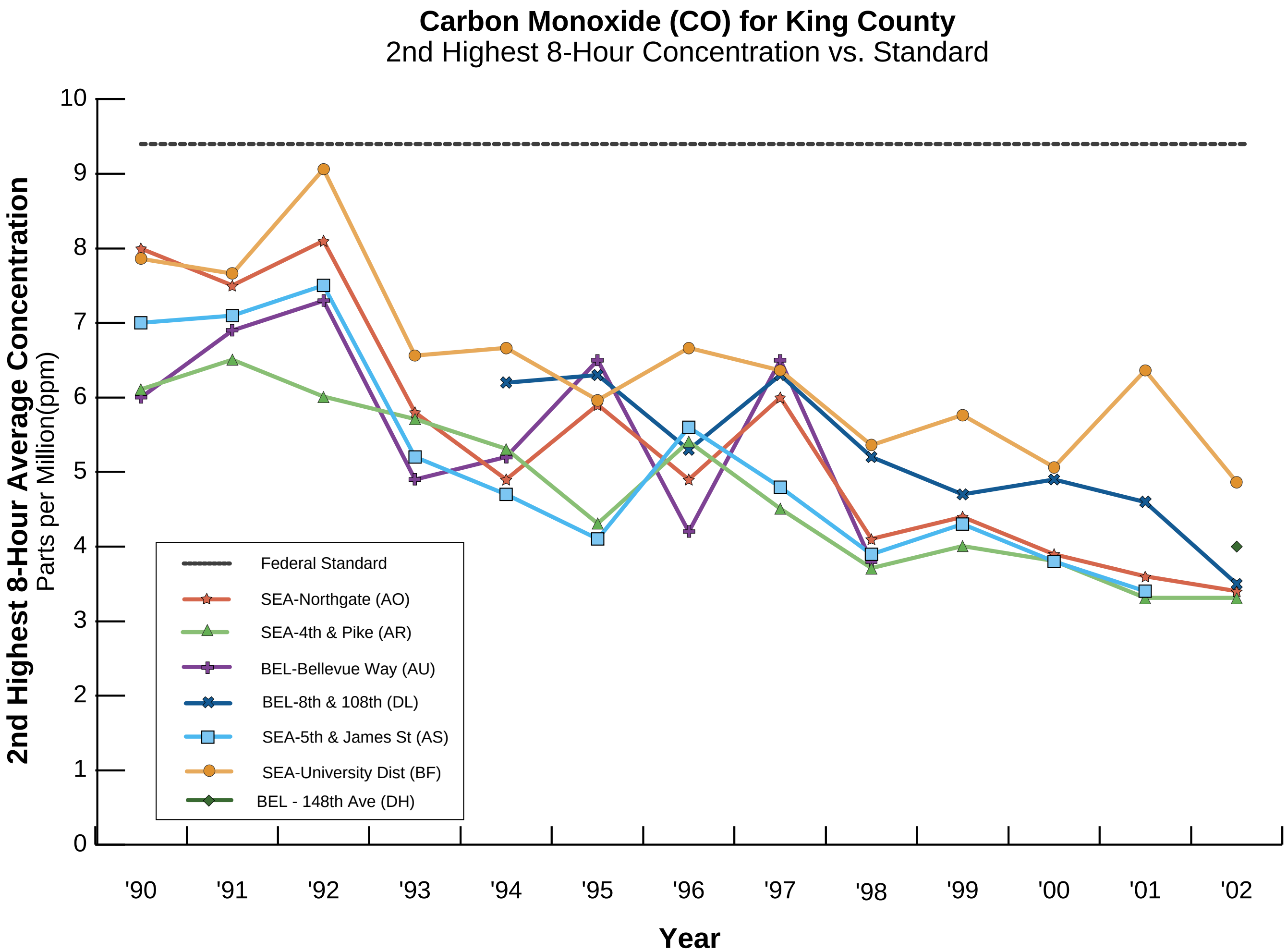

Carbon Monoxide (CO) in Puget Sound Region
Daily Maximum 8-Hour Concentration
Daily Maximum 8-Hour Average Concentration
Parts per Million (ppm)
9.5 - 12.4 ppm Unhealthy for Sensitive Groups
4.5 - 9.4 ppm Moderate
0 - 4.4 ppm Good
Daily Maximum of All Sites
0
2
4
6
8
10
12
Jan
Feb
Mar
Apr
May
June
Jul
Aug
Sep
Oct
Nov
Dec
2002

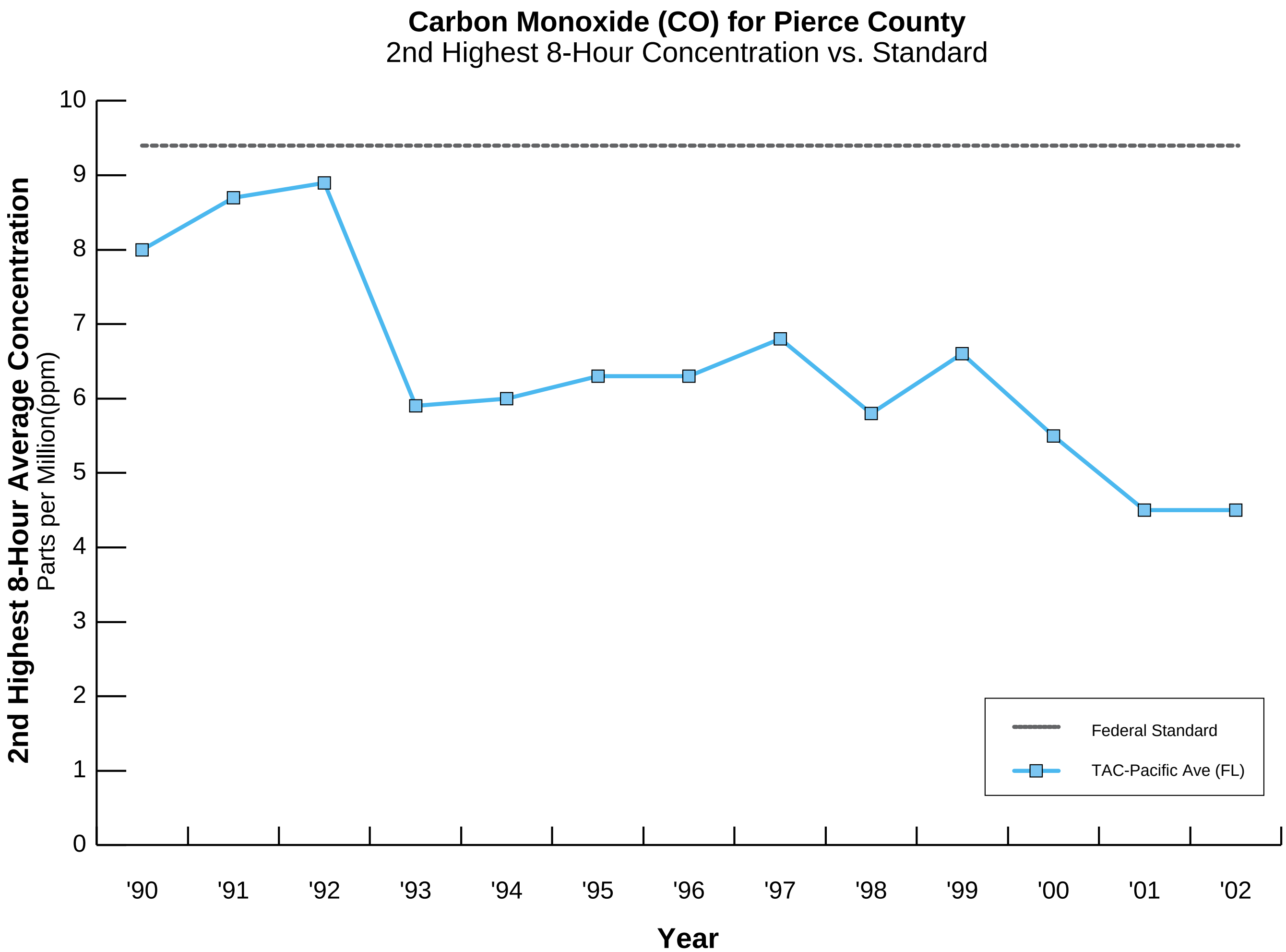
Carbon Monoxide (CO) in Puget Sound Region
Daily Maximum 8-Hour Concentration



Carbon Monoxide (CO) for Snohomish County
2nd Highest 8-Hour Concentration vs. Standard




Carbon Monoxide (CO) for King County
2nd Highest 8-Hour Concentration vs. Standard
2nd Highest 8-Hour Average Concentration
Parts per Million(ppm)
0
1
2
3
4
5
6
7
8
9
10
Federal Standard
SEA-Northgate (AO)
SEA-4th & Pike (AR)
BEL-Bellevue Way (AU)
BEL-8th & 108th (DL)
SEA-5th & James St (AS)
SEA-University Dist (BF)
BEL - 148th Ave (DH)
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year


Carbon Monoxide (CO) for Pierce County
2nd Highest 8-Hour Concentration vs. Standard
2nd Highest 8-Hour Average Concentration
Parts per Million(ppm)
10
9
8
7
6
5
4
3
2
1
0
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Federal Standard
TAC-Pacific Ave (FL)

Sulfur Dioxide

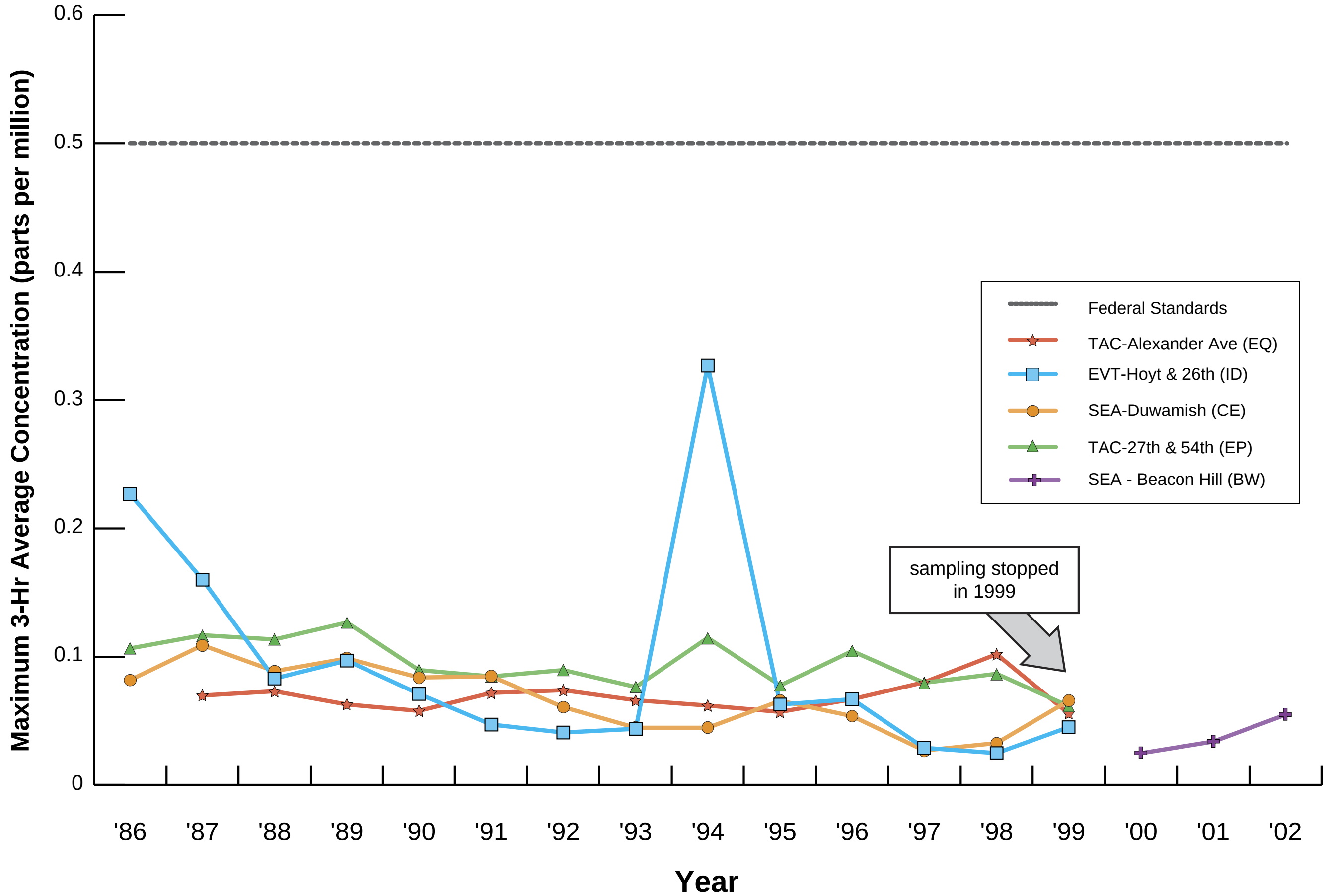
Sulfur dioxide (SO_2) is a colorless, reactive gas produced by burning fuels containing sulfur such as coal and oil, and by industrial processes. The highest concentrations of SO_2 are usually near industrial facilities that derive their products from raw materials like metallic ore, coal, and crude oil, or that burn coal or oil to produce process heat. Examples are petroleum refineries, cement manufacturing, and metal processing facilities. Also locomotives, large ships, and some non-road diesel equipment currently burn high sulfur fuel and release SO_2 emissions to the air in large quantities.

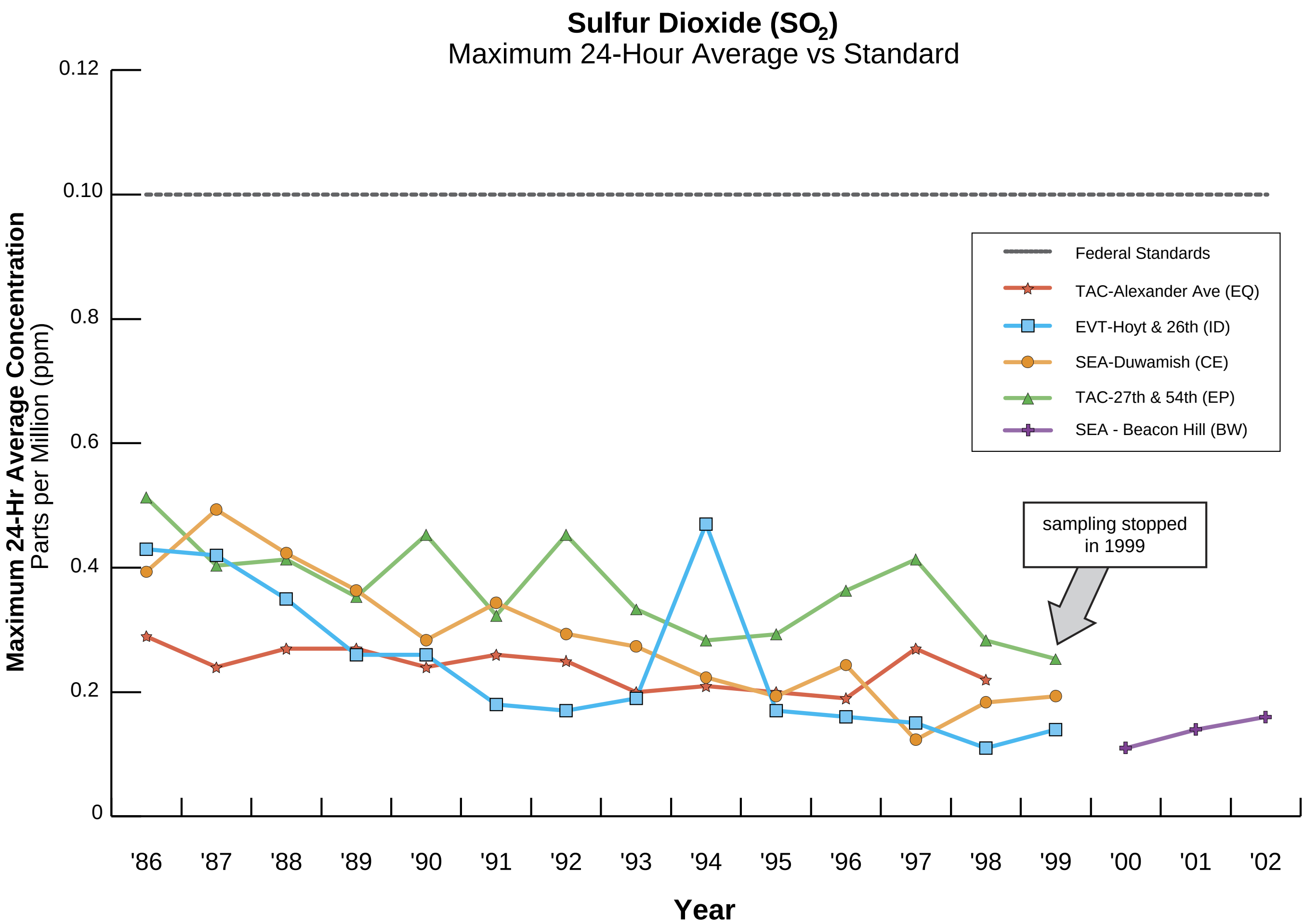
People with asthma who are active outdoors may experience bronchoconstriction, which can cause wheezing, shortness of breath, and tightening of the chest. If SO_2 levels are high, you should limit your outdoor exertion.

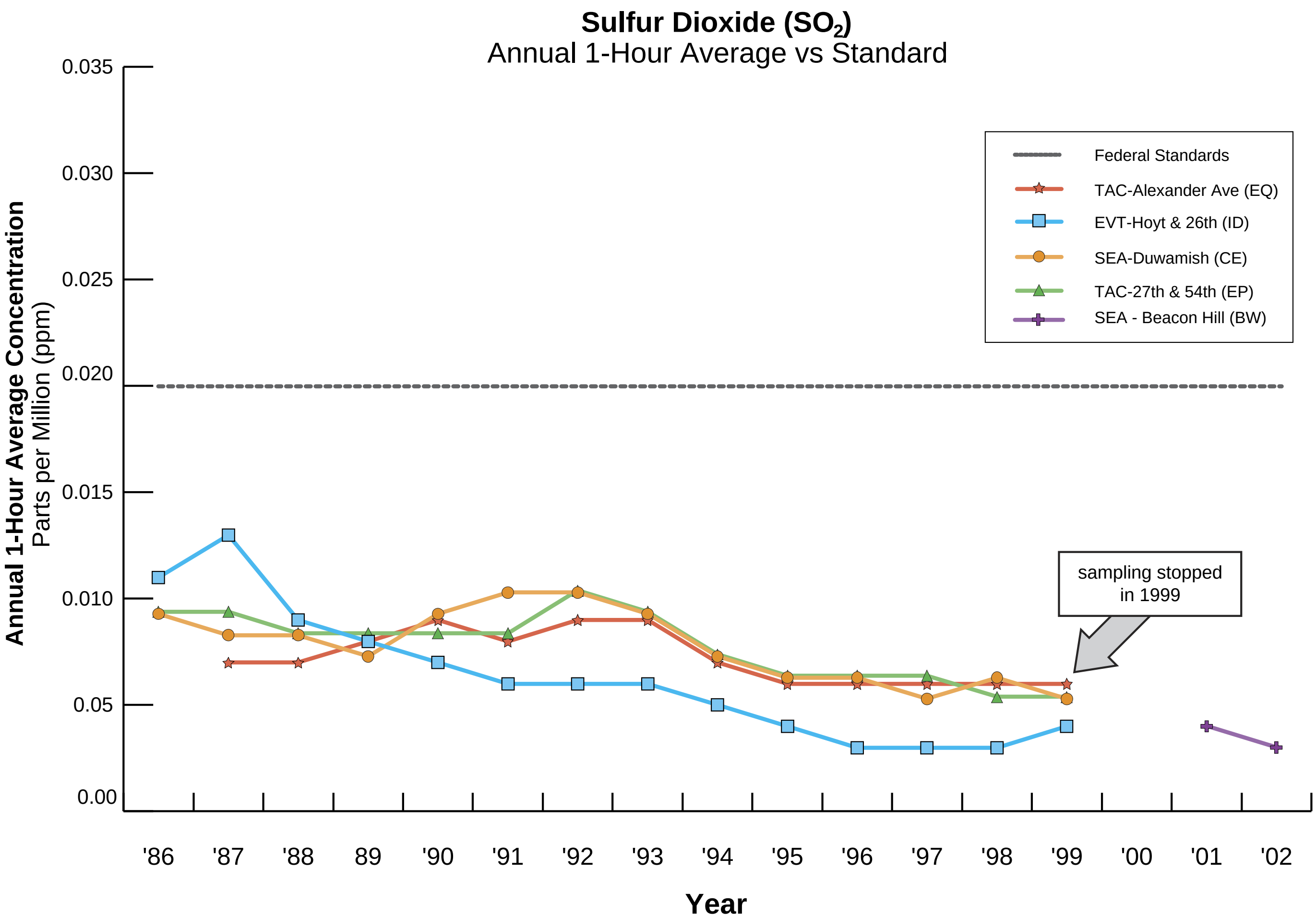
Because the major sources of SO_2 such as pulp mills~~,~~ and smelters ceased operations in the Puget Sound area, 1999 was the last year in which SO_2 was measured by the Puget Sound Clean Air Agency. Since May of 2000, the Department of Ecology monitors for SO_2 at their Beacon Hill site.

The maximum measured SO_2 concentrations in 2002 were significantly below all of the federal and regional standards. For additional information on SO_2, visit www.epa.gov/air/urbanair/so2/index.html.

Maximum 3-Hr Average Sulfur Dioxide Compared to Standard




Sulfur Dioxide (SO_2)
Maximum 24-Hour Average vs Standard
Maximum 24-Hr Average Concentration
Parts per Million (ppm)
0.12
0.10
0.8
0.6
0.4
0.2
0
'86
'87
'88
'89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year
Federal Standards
TAC-Alexander Ave (EQ)
EVT-Hoyt & 26th (ID)
SEA-Duwamish (CE)
TAC-27th & 54th (EP)
SEA - Beacon Hill (BW)
sampling stopped in 1999


Sulfur Dioxide (SO_2)
Annual 1-Hour Average vs Standard
Annual 1-Hour Average Concentration
Parts per Million (ppm)
0.035
0.030
0.025
0.020
0.015
0.010
0.05
0.00
Federal Standards
TAC-Alexander Ave (EQ)
EVT-Hoyt & 26th (ID)
SEA-Duwamish (CE)
TAC-27th & 54th (EP)
SEA - Beacon Hill (BW)
sampling stopped in 1999
'86
'87
'88
89
'90
'91
'92
'93
'94
'95
'96
'97
'98
'99
'00
'01
'02
Year

Lead

Lead is a highly toxic metal that was used for many years in household products, automobile fuel, and industrial chemicals. Locally, airborne lead was associated primarily with automobile exhaust and a lead smelter. The large reductions in lead emissions from motor vehicles have changed the nature of the air quality lead problem in the United States. Industrial processes, particularly primary and secondary lead smelters and battery manufacturers, are now responsible for most of the lead emissions.

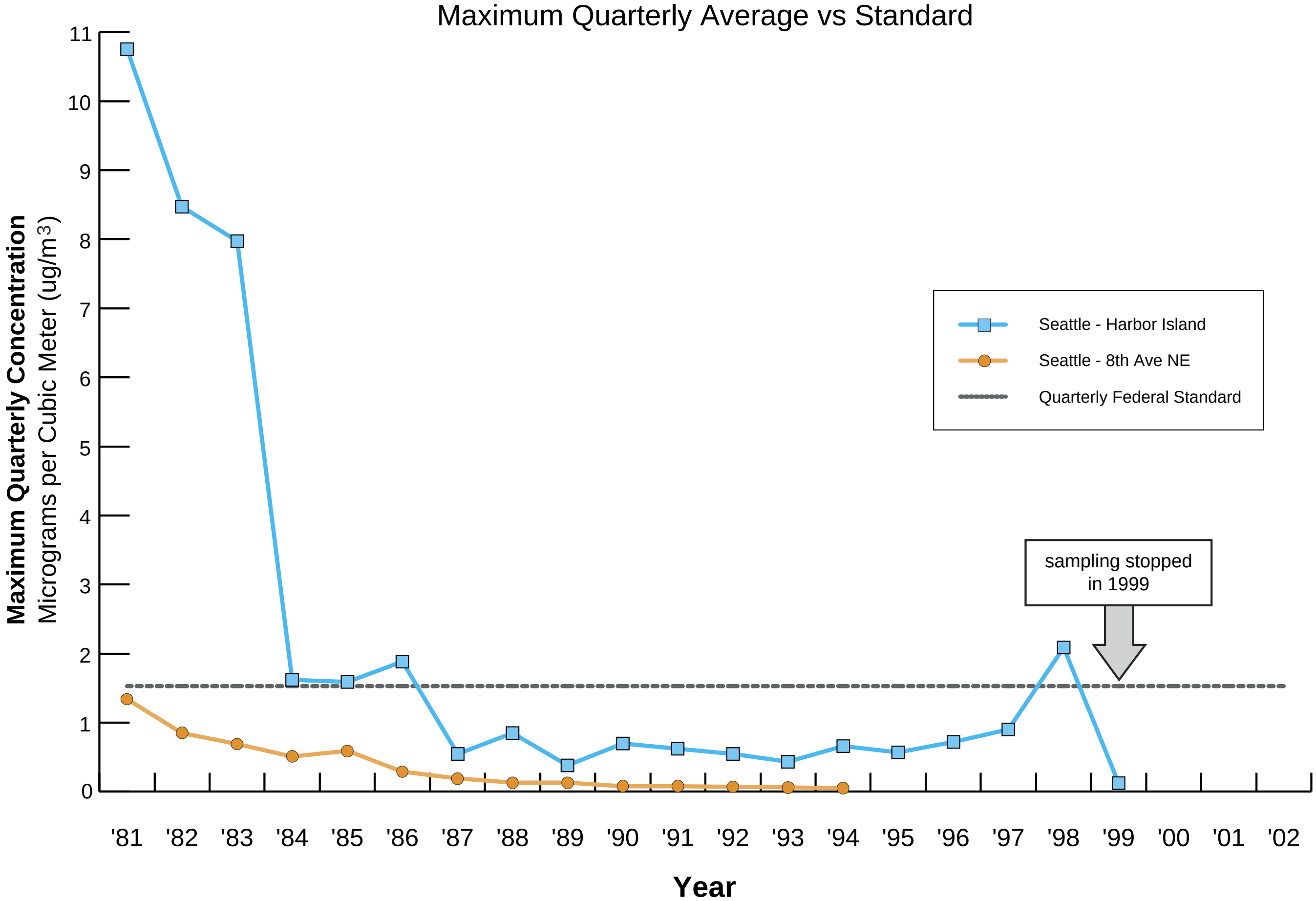
People, animals, and fish are mainly exposed to lead by breathing and ingesting it in food, water, soil, or dust. Lead accumulates in the blood, bones, muscles, and fat. Infants and young children are especially sensitive to even low levels of lead. Lead can have health effects ranging from behavioral problems and learning disabilities to seizures and death.

According to the EPA, the primary sources of lead exposure are lead-based paint, lead-contaminated dust, and lead-contaminated residual soils. Refer to the EPA website www.epa.gov/ttnatw01/hlthef/lead.html for ways to limit your exposure to these lead sources.

Lead has not been monitored in the Puget Sound area since 1999. Since the phase-out of lead in fuel and the closure of the Harbor Island lead smelter, airborne lead is no longer a public health concern in the region.

For additional information on lead, visit www.epa.gov/air/urbanair/lead/index.html.

Lead (Pb)
Maximum Quarterly Average vs Standard



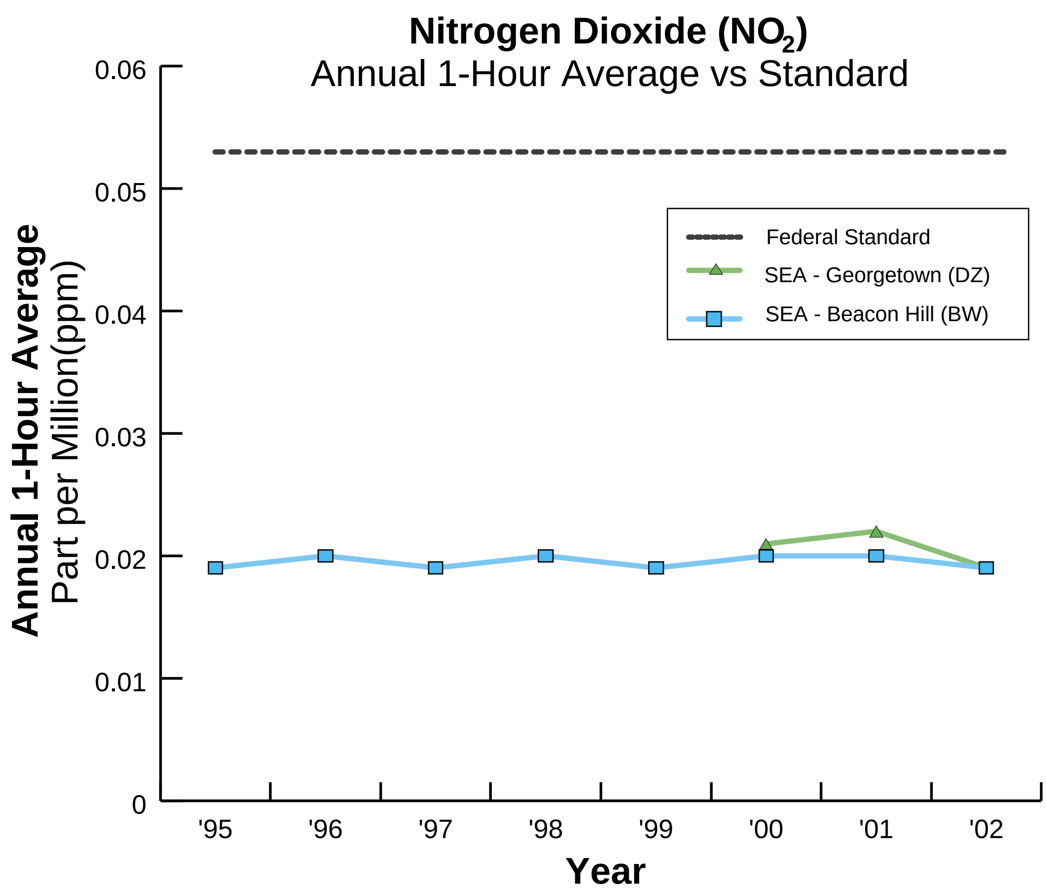
Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a reddish brown, highly reactive gas that forms from the reaction of nitrogen oxide (NO) and oxygen in the atmosphere. NO_2 will react with VOCs and can result in the formation of ozone. High temperature combustion sources such as industrial furnaces and boilers, trucks and automobiles are major producers of NO. Home heaters and gas stoves can also produce NO. NO_2 pollution is greatest in cold weather.

NO_2 can cause respiratory symptoms such as coughing, wheezing, and shortness of breath in people with respiratory diseases such as asthma. Long-term exposure can lead to respiratory infections.

Since the 1970s, motor vehicle manufacturers have been required to reduce NO_X emissions from cars and trucks. It is not a significant pollution problem in the Puget Sound area. The Department of Ecology maintains one monitoring site for nitrogen dioxide within the Puget Sound air shed, at Beacon Hill. The annual average for each year has consistently been less than half of the NAAQS standard.

For additional information on NO_2, visit www.epa.gov/air/urbanair/nox/index.html.



Definitions

Air Quality Index (AQI)

The AQI is a nationwide standard developed by the U.S. EPA to report daily air quality. Air quality is reported according to a 500-point scale for each of five major air pollutants. The scale breaks down into six categories:

- **0-50: Good.** Satisfactory air quality; little or no risk from pollution.
- **51 to 100: Moderate.** Acceptable air quality; potential moderate health concerns for a very small number of people.
- **101 to 150: Unhealthy for Sensitive Groups.** Air quality is acceptable for the general public, but people with health conditions that make them sensitive to a particular pollutant are at greater risk of health problems.
- **151 to 200: Unhealthy.** Everyone may experience some health effects, more serious for members of sensitive groups.
- **201 to 300: Very Unhealthy.** Everyone may experience more serious health effects.
- **301 to 500: Hazardous.** Health risk is at emergency levels. Everyone is likely to be affected.

A network of monitoring stations measures air quality in the Puget Sound, and an AQI value is assigned to each of the major pollutants. The highest value of the individual pollutant becomes the AQI value. For example, if an area has a carbon monoxide value of 132 on a given day and all other pollutants were below 50, the AQI for that day would be 132. The table on the next page shows a detailed breakdown of the AQI measurements for each measured pollutant.

In metropolitan areas with more than 350,000 people, state and local agencies report the AQI to the public daily. If the AQI is over 100, they also report which groups may be at risk. The AQI is a national index, so the values and colors used to show local air quality and the associated level of health concern will be the same everywhere you go in the U.S.A. Look for the reported AQI in your local newspaper, on television and radio, on the Internet, and on state and local telephone hotlines.

For more detailed information about the AQI and the pollutants it measures, go to www.epa.gov/airnow/aqibroch.

How the AQI Is Calculated

Breakpoints for Criteria Pollutants							AQI Categories	
0_3 (ppm) 8-hour	0_3 (ppm) 1-hour[a]	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	CO (ppm)	SO_2 (ppm)	NO_2 (ppm)	AQI value	Category
0.000–0.064	—	0.0–15.4	0–54	0.0–4.4	0.000–0.034	(b)	0–50	Good
0.065–0.084	—	15.5–40.4	55–154	4.5–9.4	0.035–0.144	(b)	51–100	Moderate
0.085–0.104	0.125–0.164	40.5–65.4	155–254	9.5–12.4	0.145–0.224	(b)	101–150	Unhealthy for sensitive groups
0.105–0.124	0.165–0.204	65.5–150.4	255–354	12.5–15.4	0.225–0.304	(b)	151–200	Unhealthy
0.125–0.374	0.205–0.404	150.5–250.4	355–424	15.5–30.4	0.305–0.604	0.65–1.24	201–300	Very unhealthy
(c)	0.405–0.504	250.5–350.4	425–504	30.5–40.4	0.605–0.804	1.25–1.64	301–400	Hazardous
(c)	0.505–0.604	350.4–500.4	505–604	40.5–50.4	0.805–1.004	1.65–2.04	401–500	

a Areas are generally required to report the AQI based on 8-hour ozone values. However, there are a small number of areas where an AQI based on 1-hour ozone values would be safer. In these cases, in addition to calculating the 8-hour ozone value, the 1-hour ozone value may be calculated, and the greater of the two values reported.

b NO_2 has no short-term National Ambient Air Quality Standard (NAAQS) and can generate an AQI only above a value of 200.

c 8-hour O_3 values do not define higher AQI values (above 300). AQI values above 300 are calculated with 1-hour 0_3 concentrations.

Pollutants

Ozone (O_3)

- **What is it?**
  Ozone, a bluish-colored gas molecule with a strong odor, is composed of three atoms of oxygen. In the upper atmosphere ozone occurs naturally and partially absorbs the sun's harmful ultraviolet rays. Ozone at ground level is a summertime air pollution problem.
- **How is it caused?**
  Ozone forms when photo-chemical pollutants from cars, trucks and industrial sources react with sunlight. Even gasoline-powered yard equipment, paints, solvents, and boat motors contribute.
- **When does it happen?**
  Ozone pollution is most common in the summer months, when sunlight and stable atmospheric conditions occur. Ozone levels are usually highest in the afternoon, as sunlight photochemically transforms NO_x and VOCs into ozone.
- **Who is affected?**
  Adults and children who are active outdoors, people with respiratory disease such as asthma, and people with unusual sensitivity to ozone. During physical activity, ozone penetrates deeper into the lungs and can do more damage.

  Ozone is a very reactive gas. For this reason, high concentrations of ozone can cause respiratory distress and disease in humans, decreased yields of agricultural crops and forests, and damage to some rubber products, plastics, and paints used outdoors. National crop losses from ozone exposure are estimated at $3 billion to $5 billion annually. Forest losses are harder to estimate.
- **What are the health effects?**
  Ozone can cause coughing and throat irritation, make deep vigorous breathing more difficult, and increase the chance of respiratory infections. It increases sensitivity to allergens and can trigger asthma attacks. The damage it causes to the lungs heals within a few days, but repeated or prolonged exposure may cause permanent damage.
- **What can I do about it?**
  If ozone levels are high and you have a respiratory condition or are normally active outdoors, try to limit your outdoor exertion.

  In the United States, management of ozone and other photochemical oxidants has been a major goal of federal and state clean air legislation (Clean Air Act). Although many of the pollution control efforts required by the CAA have been implemented, efforts to decrease ozone pollution have been only partially successful.

  In the Puget Sound region the ozone trend is flat and is marginally within the Federal standards.

- **Where is it measured?**
  Unlike other pollutants monitored here in the Puget Sound, ozone is formed by precursors that react in the atmosphere. Winds transport ozone and chemical emissions from one area to another. For the Puget Sound, ozone precursors are emitted into the air in industrial areas of the Everett-Seattle-Tacoma urban corridor and subsequently travel southeasterly to more rural areas as they react to form ozone. The highest concentrations are measured downwind in areas such as North Bend, Enumclaw, and Eatonville. As a result, for the Puget Sound air shed the majority of sites that measure ozone are located in rural areas south to southeast of Seattle and Tacoma. See the map of the Puget Sound measuring locations. The Department of Ecology maintains all ozone-monitoring stations.

For additional information on ozone, visit www.epa.gov/air/urbanair/ozone/index.html.

Particulate Matter ($PM_{2.5}$ and PM_{10})

- **What is it?**
  "Particulate matter" (PM) includes both solid matter and liquid droplets suspended in the air. Particles smaller than 2.5 micrometers in diameter are called "fine" particles, or $PM_{2.5}$. Particles between 2.5 and 10 micrometers in diameter are called "coarse" particles. PM_{10} includes both "fine" and "coarse" particles. The Agency considers $PM_{2.5}$ one of the major air pollution concerns affecting our community.

- **How is it caused?**
  - $PM_{2.5}$ comes from all types of combustion, including diesel trucks and buses, power plants, and wood burning, and from some industrial processes. It can also be formed in the atmosphere by chemical reactions of pollutant gases.
  - The "coarse" particles in PM_{10} typically come from crushing or grinding operations and dust from roads.

- **When does it happen?**
  Year round. However, levels are usually higher in the cooler months.

- **Who is affected?**
  People with asthma and heart or lung diseases, the elderly, and children. $PM_{2.5}$ also significantly affects visibility.

- **What are the health effects?**
  Fine particulates ($PM_{2.5}$) pose a greater risk to human health than coarse particulates, because they penetrate deeper into the respiratory system.
  - $PM_{2.5}$ exposure can have serious health effects. People with heart or lung diseases are at increased risk of attacks or premature death. Children and the elderly are more likely to develop heart or lung problems.
  - PM_{10} can aggravate respiratory conditions such as asthma.

- **What can I do about it?**
  - If $PM_{2.5}$ levels are high, people with respiratory or heart disease, the elderly, and children should avoid outdoor exertion.
  - If PM_{10} levels are high, people with respiratory conditions should avoid outdoor exertion.
- **Where is it measured?**
  Due to the health risks associated with PM, both $PM_{2.5}$ and PM_{10} are monitored throughout the Puget Sound. The majority of PM monitoring stations is maintained by the Agency.

For additional information on PM, visit www.epa.gov/air/urbanair/pm/index.html.

Carbon Monoxide (CO)

- **What is it?**
  CO is an odorless, colorless gas that can enter the bloodstream through the lungs and reduce the amount of oxygen that reaches organs and tissues.
- **How is it caused?**
  Carbon monoxide forms when the carbon in fuels doesn't burn completely. 60% of all CO comes from vehicle exhaust, and up to 95% in cities.
- **When does it happen?**
  CO pollution is worst in cold weather because fuels burn less efficiently in low temperatures. It is usually at its peak during morning and evening rush hours.
- **Who is affected?**
  People with cardiovascular disease, such as angina, or cardiovascular or respiratory problems; also possibly fetuses and young infants.
- **What are the health effects?**
  Chest pain and increased cardiovascular symptoms, particularly while exercising. High levels of CO can affect alertness and vision even in healthy individuals.
- **What can I do about it?**
  If CO levels are high, limit exertion and avoid sources of CO such as heavy traffic.
- **Where is it measured?**
  CO monitoring stations are located in areas with heavy traffic congestion. These include central business areas, roadsides, and shopping malls. Department of Ecology conducts all CO monitoring.

For additional information on CO, visit www.epa.gov/air/urbanair/co/index.html.

Sulfur Dioxide (SO_2)

- **What is it?**
  Sulfur dioxide is a colorless, reactive gas.

- **How is it caused?**
  SO_2 is produced by burning sulfur-containing fuels such as coal and oil, and by industrial processes.
- **Where does it happen?**
  The highest concentrations of SO_2 are usually near large industrial sources.
- **Who is affected?**
  People with asthma who are active outdoors.
- **What are the health effects?**
  Bronchoconstriction, which can cause wheezing, shortness of breath, and tightening of the chest. When exposure to SO_2 ends, the symptoms should clear up within an hour.
- **What can I do about it?**
  If SO_2 levels are high, limit your outdoor exertion.
- **Where is it measured?**
  Because the large primary sources of SO_2 in the Puget Sound no longer exist, the Agency has not monitored for SO_2 since the end of 1999.

For additional information on SO_2, visit www.epa.gov/air/urbanair/so2/index.html.

Lead (Pb)

- **What is it?**
  Lead is a highly toxic metal that was used for many years in household products, automobile fuel, and industrial chemicals.
- **How is it caused?**
  Locally, airborne lead is associated primarily with automobile exhaust and lead smelters. Since the phase-out of lead in fuels, however, cars and trucks are no longer a significant source of lead. Also, Seattle's Harbor Island lead smelter ceased operation at the end of 1998.
- **When does it happen?**
  Lead concentrations are likely to be highest near sources where current or former lead smelting/ processing operations caused particle fallout, especially in nearby soils such as unpaved parking lots.
- **Who is affected?**
  Everyone. Children 6 years and younger are most at risk.
- **What are the health effects?**
  Lead can have health effects ranging from behavioral problems and learning disabilities to seizures and death.
- **What can I do about it?**
  According to the U.S. Environmental Protection Agency (USEPA), the primary sources of lead exposure are lead-based paint, lead-contaminated dust, and lead-contaminated residual soils. Refer to the EPA website (linked above) for ways to limit your exposure to these lead sources.

- **Where is it measured?**
  Due to the phase-out of leaded fuels and the closure of Seattle's lead smelter in 1998, the Agency no longer monitors for airborne lead.

For additional information on lead, visit www.epa.gov/air/urbanair/lead/index.html.

Nitrogen Dioxide (NO_2)

- **What is it?**
  Nitrogen dioxide (NO_2) is a reddish brown, highly reactive gas that forms from the reaction of nitrogen oxide (NO) and oxygen in the atmosphere. NO_2 will react with VOCs and can result in the formation of ozone.
- **How is it caused?**
  High temperature combustion sources such as power plants and automobiles are major producers of NO. Home heaters and gas stoves can also produce NO.
- **When does it happen?**
  NO_2 pollution is greatest in cold weather. It follows a similar trend to CO.
- **Who is affected?**
  People with respiratory diseases such as asthma; also children.
- **What are the health effects?**
  NO_2 can cause respiratory symptoms such as coughing, wheezing, and shortness of breath. Long-term exposure can lead to respiratory infections.
- **What can I do about it?**
  Since the 1970s, motor vehicle manufacturers have been required to reduce NO emissions from cars and trucks. It is not a significant pollution problem in the Puget Sound area.
- **Where is it measured?**
  Because NO_2 is not a major concern of the Puget Sound region, it is measured at only one location, Beacon Hill. The Department of Ecology conducts all NO_2 monitoring.

For additional information on NO_2, visit www.epa.gov/air/urbanair/nox/index.html.

Pollution Sources

Area Sources

Countywide categories of pollution sources, in which each individual source emits pollutants below the thresholds for a point source facility.

Biogenics

Natural sources such as trees, plants, grass, crops, and soils. The world-wide emission rate of these natural hydrocarbons has been estimated to exceed that of non-methane hydrocarbons originating from human sources. Isoprene, one of the major constituents of biogenic emissions, is very photoreactive, and would seem to make biogenic VOC a contributor in the formation of ozone. The study of hydrocarbon emissions from plants is therefore of key importance to our understanding of the global effects of naturally produced hydrocarbons.

Emission Factor

A value derived from source tests, material balance calculations, or engineering comparisons with similar processes. Used to estimate emissions from process quantities.

Hazardous Air Pollutant (HAP)

An air contaminant identified as toxic in the Federal Clean Air Act, Section 112(b).

Off-road Mobile Sources

Farm vehicles, on-site construction/industrial vehicles, logging equipment, small marine craft, aircraft, trains, ocean-going ships, tugs and ferries, lawn and garden equipment.

On-road Mobile Sources

Cars, trucks and buses.

Point Sources

Facilities that have annual air contaminant emissions equal to or exceeding one hundred tons per year of CO; twenty-five tons per year of nitrogen oxides (NO_x), PM_{10}, $PM_{2.5}$, sulfur oxides (SO_x) such as SO_2 and sulfur trioxide (SO_3), or volatile organic compounds (VOC); or two tons per year of a any single HAP or six tons per year of facility total HAP.

Registered Facility

The total of all pollutant-emitting activities located on adjacent or contiguous properties owned or operated by one person or corporate entity. It includes all of the pollutant-emitting buildings, processes, structures, equipment, control apparatuses, and storage areas at a facility. The annual fees for large and small registered emission sources are based on Regulation I, 5.07(c)(1) and 5.07(c)(2), respectively.

Stationary Area Sources

Sources include wood stoves/fireplaces, outdoor burning, architectural surface coating, automobile painting, commercial/consumer solvents, dry cleaning, printing, stationary diesel engines, and small utility engines, and construction activities.

Temperature Inversions

The earth gains and loses most of its energy at its surface. It is warmed by solar heating during the day and cooled by radiation emissions at night. During the late morning and afternoon hours, the air near the surface is warmer than the air aloft and allows for good pollutant dispersion (vertical mixing may be 1,500 meters or more). At night with clear skies, the surface radiates heat into outer space, creating cooler air at the surface and warmer air aloft. Warmer air above cooler air (temperature inversion) is a stable condition and limits the upward movement of pollution because the warmer air acts as a barrier. With little or no wind, pollutants are trapped near the surface (vertical mixing may be 200 meters or less) and can reach high levels of concentration.

Toxic Air Contaminant (TAC)

An air contaminant listed in Regulation III, Appendix A.

Volatile Organic Compound (VOC)

An organic compound that participates in atmospheric photochemical reactions. This excludes all compounds determined to have negligible photochemical reactivity by the EPA and listed in 40 CFR 51.100(s) in effect July 1, 1998.

Visibility/Regional Haze

Visibility is often explained in terms of visual range and light extinction. *Visual range* is the maximum distance—usually miles or kilometers—that you can see a black object against the horizon. *Light extinction* is the sum of light scattering and light absorption by fine particles and gases in the atmosphere. The more light extinction you have, the shorter your visual range will be. Reduced visibility (or visual range) is caused by weather (clouds, fog, and rain) and air pollution (fine particles and gases). The major pollution contributor is fine particulate matter ($PM_{2.5}$) emissions, which are transported aloft and may remain suspended for a week or longer. Fine particles have a greater impact than coarse particles at locations far from the emitting source because they remain suspended in the atmosphere longer and travel further. $PM_{2.5}$ also presents some of the most serious health hazards to the public, so you can roughly assume that the worse the visibility, the unhealthier the air is to breathe.

For additional information on Visibility/Regional Haze, visit www.epa.gov/air/visibility/index.html.

110 Union Street, Suite 500
Seattle, Washington 98101

2002

Air Quality
Data Summary

Appendix

Data Tables

August 2003

Working Together for Clean Air

OZONE
(Parts per Million)
2002

Location / Continuous Sampling Period(s)	Six Highest Daily Maximum 1 Hour Averages Value	Date	End Time	Estimated No. of Days Daily Maximum 1 Hour Average Exceeded .12 ppm 2000	2001	2002	No. of Days Daily Maximum 1 Hour Average Expected to Exceed .12 ppm
Beacon Hill, 15th S & Charlestown	.055	10 Jul	1400	0.0	0.0	0.0	0.0
Seattle, Wa	.054	13 Jul	1700				
1 May-30 Sep	.053	16 May	1600				
	.053	12 Jun	2300				
	.052	21 Jun	1600				
	.050	14 Sep	1600				
20050 SE 56th	.080	10 Jul	1600	0.0	0.0	0.0	0.0
Lake Sammamish State Park, Wa	.071	22 Jul	1700				
1 May-30 Sep	.069	23 Jul	1600				
	.063	12 Jun	1600				
	.063	26 Jun	1500				
	.062	25 Jun	1800				
42404 SE North Bend Way,	.097	10 Jul	1700	0.0	0.0	0.0	0.0
North Bend	.092	23 Jul	1700				
1 May-30 Sep	.089	26 Jun	1400				
	.085	25 Jun	1900				
	.073	21 Jun	1700				
	.073	24 Jul	1800				
30525 SE Mud Mountain Road,	.099	22 Jul	1700	0.0	0.0	0.0	0.0
Enumclaw	.093	23 Jul	1700				
1 May-30 Sep	.085	13 Aug	1700				
	.080	26 Jun	1400				
	.077	10 Jul	1400				
	.077	21 Jul	1800				
Charles L Pack Forest	.088	25 Jun	1800	0.0	0.0	0.0	0.0
La Grande, Wa	.087	13 Jun	1700				
1 May-30 Sep	.083	13 Aug	1800				
	.077	10 Jul	1900				
	.075	22 Jul	1700				
	.075	22 Jul	1800				
71 E Campus Dr,	.084	10 Jul	1700			0.0	0.0
Belfair, Wa	.083	10 Jul	1800				
1 May-30 Sep	.075	13 Jun	1900				
	.074	13 Jun	1700				
	.073	13 Jun	1600				
	.073	13 Jun	1800				
709 Mill Road SE,	.086	25 Jun	1700	0.0	0.0	0.0	0.0
Yelm, Wa	.083	25 Jun	1600				
1 May-30 Sep	.077	25 Jun	1500				
	.077	27 Jun	1800				
	.076	23 Jul	1600				
	.073	10 Jul	1800				

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.

OZONE

(Parts per Million)
2002

Location / Continuous Sampling Period(s)	2002 Six Highest Daily 8-Hour Concentrations Value	Date	End Time	4^{th} Highest Daily 8-Hour Concentration 2000	2001	2002	3-Year Average of 4^{th} Highest 8-Hour Concentration 2000 - 2002
Beacon Hill, 15th S & Charlestown	.047	16 May	2300				
Seattle, Wa	.044	21 Jun	1900				
1 May-30 Sep	.043	10 Jul	1800				
	.042	20 May	1500	.047	.041	.042	.043
	.042	17 May	1700				
	.040	4 May	1800				
20050 SE 56^{th}	.058	10 Jul	2000				
Lake Sammamish State Park, Wa	.058	22 Jul	1900				
1 May-30 Sep	.056	12 Jun	1900				
	.054	13 Jun	1900	.057	.052	.054	.054
	.053	21 Jun	1900				
	.053	23 Jul	1800				
42404 SE North Bend Way,	.078	10 Jul	2000				
North Bend, Wa	.077	23 Jul	1900				
1 May-30 Sep	.075	26 Jun	1900				
	.069	25 Jun	1900	.063	.066	.069	.066
	.068	24 Jul	1900				
	.065	21 Jun	2000				
30525 SE Mud Mountain Road,	.084	22 Jul	2000				
Enumclaw, Wa	.081	23 Jul	2000				
1 May-30 Sep	.072	10 Jul	2000				
	.070	26 Jun	1900	.071	.065	.070	.069
	.069	13 Aug	1900				
	.065	21 Jul	2000				
Charles L Pack Forest	.074	25 Jun	2000				
La Grande, Wa	.073	13 Jun	2000				
1 May-30 Sep	.072	10 Jul	2000				
	.068	22 Jul	1900	.059	.064	.068	.064
	.065	23 Jul	1900				
	.062	21 Jun	1900				
71 E Campus Dr,	.071	25 Jun	1900				
Belfair, Wa	.067	23 Jul	1700				
1 May-30 Sep	.066	10 Jul	2000				
	.062	22 Jul	1900			.062	
	.061	21 Jun	1900				
	.061	11 Jul	2000				
709 Mill Road SE,	.071	13 Jun	1900				
Yelm, Wa	.067	10 Jul	2000				
1 May-30 Sep	.058	12 May	1900				
	.058	21 Jun	2000	.056	.060	.058	.058
	.057	12 Jul	2000				
	.057	22 Jul	2000				

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.

PARTICULATE MATTER ($PM_{2.5}$)

Micrograms per Cubic Meter

Reference Sampling Method: R&P Partisol 2025 Sampler Teflon Filter

2002

Location	Number of Values	Quarterly Arithmetic Averages 1st	2nd	3rd	4th	Year Arith Mean	98th Percentile	Max Value
Marysville JHS, 1605 7th St, Marysville	121	11.3	7.1	8.9	18.0	11.3	43	45
6120 212th St SW, Lynnwood	120	9.8	6.2	8.0	16.0	10.0	37	48
17171 Bothell Way NE, Lake Forest Park	116	12.6	6.5	7.5	16.4	10.8	35	39
Duwamish, 4752 E Marginal Way S, Seattle	356	10.6	7.9	8.7	18.0	11.3	30	45
South Park, 8025 10th Ave S, Seattle	343	10.0	7.0	8.7	15.7	10.4	30	47
Beacon Hill, 15th S & Charlestown, Seattle	359	7.2	6.8	7.8	12.7	8.6	25	31
305 Bellevue Way NE, Bellevue	118	7.9	5.8	7.0	12.3	8.3	22	25
City Hall, 15670 NE 85th St, Redmond	121	7.1	5.9	7.0	11.5	7.9	23	25
42404 SE North Bend Way, North Bend	118	4.0	5.0	6.5	7.0	5.6	17	18
James St & Central Ave, Kent	151	10.1	7.2	9.0	16.2	10.6	29	38
Port of Tacoma, 2301 Alexander Ave, Tacoma	343	10.5	7.4	8.3	14.2	10.1	28	34
7802 South L St, Tacoma	350	11.5	6.2	7.1	17.5	10.6	43	61
South Hill, 9616 128th St E, Puyallup	120	11.2	6.2	7.9	15.3	10.2	34	38

Notes
(1) Sampling occurs for a 24 hour period from midnight to midnight.
Quarterly averages are shown only if 75 percent or more of the data is available.
(2) Annual averages are shown only if there are at least three quarterly averages.

Summary of Maximum Observed Concentrations and Values >40

Location	Method	Mar 3 Sun	Jul 4 Thu	Oct 20 Sun	Oct 26 Sat	Nov 1 Fri	Nov 2 Sat	Nov 3 Sun	Nov 4 Mon	Nov 22 Fri	Nov 24 Sun	Nov 25 Mon	Nov 26 Tue	Nov 27 Wed	Nov 28 Thu	Dec 7 Sat	Dec 9 Mon	Dec 23 Mon
Marysville JHS, 1605 7th St Marysville			43				--	--	--	--	--	44	--	--	45	42	--	--
6120 212th St SW, Lynnwood						42	--	--	48		--		--	--			--	--
17171 Bothell Way NE, Lake Forest Park							--	--	39		--		--	--			--	--
Duwamish, 4752 E Marginal Way, Seattle									44					45				
South Park, 8025 10th Ave S, Seattle										--	--	--	--	47				
Beacon Hill, 15th S & Charlestown									31					31				--
305 Bellevue Way NE, Bellevue				25	25		--				--							--
City Hall, 15670 NE 85th St, Redmond					25		--				--							--
42404 SE North Bend Way, North Bend							--			18	--	18						--
James St & Central Ave, Kent							--	--			--		--	--	38		--	--
Port of Tacoma, 2301 Alexander Ave, Tacoma						--	--	--	--				34	--	--		34	
7802 South L St, Tacoma		43					55	56	61		45		46	--	--			47
South Hill, 9616 128th St E, Puyallup							--	--			--		--	--	38		--	--

-- Indicates no sample on specified day

Air Quality Index Summary

Location	Good	Moderate	Unhealthy for Sensitive Groups
Marysville JHS, 1605 7th St, Marysville	96	21	4
6120 212th St SW, Lynnwood	99	19	2
17171 Bothell Way NE, Lake Forest Park	91	25	0
Duwamish, 4752 E Marginal Way S, Seattle	285	69	2
South Park, 8025 10th Ave S, Seattle	281	61	1
Beacon Hill, 15th S & Charlestown, Seattle	320	39	0
305 Bellevue Way NE, Bellevue	105	13	0
City Hall, 15670 NE 85th St, Redmond	109	12	0
42404 SE North Bend Way, North Bend	114	4	0
James St & Central Ave, Kent	125	26	0
Port of Tacoma, 2301 Alexander Ave, Tacoma	284	59	0
7802 South L St, Tacoma	280	63	7
South Hill, 9616 128th St E, Puyallup	96	24	0

PARTICULATE MATTER ($PM_{2.5}$) - Continuous
Micrograms per Cubic Meter

Equivalent Sampling Methods: T - Mass Transducer R&P TEOM 1400a Tef-coat Glass Fiber
B - BetaAtten ANDERSEN FH62I-N Glass Fiber strip

2002

Location	Method	Number of Values	Quarterly Arithmetic Averages 1st	2nd	3rd	4th	Year Arith Mean	98th Percentile	Max Value
Marysville JHS, 1605 7th St, Marysville	T	321	12.3	7.7	8.3	19.1	11.9	35	44
6120 212th St SW, Lynnwood	T	356	10.2	6.5	7.0	16.2	10.0	33	43
17171 Bothell Way NE, Lake Forest Park	T	364	12.9	7.3	7.7	17.5	11.3	33	43
Duwamish, 4752 E Marginal Way S, Seattle	T	360	11.6	8.3	8.7	16.4	11.3	27	40
601 143rd Ave NE, Bellevue	T	359	7.9	6.5	6.7	11.6	8.2	20	24
*42404 SE North Bend Way, North Bend	T	223	6.5	9.5	12.8	6.9	8.9	16	18
James St & Central Ave, Kent	T	358	11.3	7.8	8.6	15.7	10.8	29	46
Port of Tacoma, 2301 Alexander Ave, Tacoma	T	358	12.1	8.0	8.7	16.9	11.4	30	49
7802 South L St, Tacoma	T	329	12.3	6.6	7.2	20.3	11.6	47	77
South Hill, 9616 128th St E, Puyallup	B	364	11.3	6.4	7.9	15.7	10.3	28	54
*Meadowdale, 7252 Blackbird Dr NE, Kitsap Co	B	363	9.1	7.7	8.1	14.0	9.7	25	29
*10955 Silverdale Way NW, Silverdale	B	360	7.6	7.6	8.6	10.2	8.5	16	18

Notes
(1) Sampling occurs continuously for 24 hours each day.
Quarterly averages are shown only if 75 percent or more of the data is available.
(2) Annual averages are shown only if there are at least three quarterly averages.
(3) All data values are adjusted using seasonal site-specific relationships with Federal Reference Method samplers except those marked with an asterisk.

Summary of Maximum Observed Concentrations and Values >40

Location	Method	Mar 3 Sun	Jul 4 Thu	Jul 5 Fri	Jul 13 Sat	Nov 1 Fri	Nov 2 Sat	Nov 3 Sun	Nov 4 Mon	Nov 24 Sun	Nov 26 Tue	Nov 27 Wed	Nov 28 Thu	Nov 29 Fri	Dec 1 Sun	Dec 2 Mon	Dec 8 Sun	Dec 23 Mon
Marysville JHS, 1605 7th St, Marysville	T		41				44	44	44	--	--	--	--	--	--	--	--	--
6120 212th St SW, Lynnwood	T						42		43									
17171 Bothell Way NE, Lake Forest Park	T						42										43	
Duwamish, 4752 E Marginal Way S, Seattle	T											40						
601 143rd Ave NE, Bellevue	T											24						
*42404 SE North Bend Way, North Bend	T				18		--	--	--						18			
James St & Central Ave, Kent	T			42								46						
Port of Tacoma, 2301 Alexander Ave, Tacoma	T								42			49						
7802 South L St, Tacoma	T	41				42	58	56	61	47	47	77	55				--	47
South Hill, 9616 128th St E, Puyallup	B			54								44						
*Meadowdale, 7252 Blackbird Dr NE, Kitsap Co	B						29											
*10955 Silverdale Way NW, Silverdale	B						--	--	--					18		18		

-- Indicates no sample on specified day

Air Quality Index Summary

Location	Method	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Marysville JHS, 1605 7th St, Marysville	T	261	56	4	
6120 212th St SW, Lynnwood	T	300	54	2	
17171 Bothell Way NE, Lake Forest Park	T	285	77	2	
Duwamish, 4752 E Marginal Way S, Seattle	T	297	63	0	
601 143rd Ave NE, Bellevue	T	338	21	0	
*42404 SE North Bend Way, North Bend	T	214	9	0	
James St & Central Ave, Kent	T	292	64	2	
Port of Tacoma, 2301 Alexander Ave, Tacoma	T	285	71	2	
7802 South L St, Tacoma	T	274	45	9	1
South Hill, 9616 128th St E, Puyallup	B	297	65	2	
*Meadowdale, 7252 Blackbird Dr NE, Kitsap Co	B	323	40	0	
*10955 Silverdale Way NW, Silverdale	B	348	12	0	

PARTICULATE MATTER ($PM_{2.5}$) - Continuous

Micrograms per Cubic Meter

Sampling Method: Equivalent - Radiance Research M903 Nephelometer

2002

Location	Number of Values	Quarterly Arithmetic Averages				Year Arith Mean	98^{th} Percentile	Max Value
		1st	2nd	3rd	4th			
Marysville JHS, 1605 7th St, Marysville	365	11.8	7.5	8.4	19.3	11.7	40	52
6120 212th St SW, Lynnwood	365	9.4	6.1	6.8	16.7	9.8	35	47
17171 Bothell Way NE, Lake Forest Park	345	10.9	6.3	7.0	16.9	10.3	34	45
Queen Anne Hill, Seattle	328	5.2	4.6	6.5	9.3	6.4	18	23
Duwamish, 4752 E Marginal Way S, Seattle	365	10.1	8.8	9.6	16.9	11.3	34	42
South Park, 8025 10^{th} Ave S, Seattle	338	10.0	8.6	9.9	21.1	12.4	35	43
601 143rd Ave NE,, Bellevue	360	5.2	4.8	6.4	9.9	6.6	20	29
James St & Central Ave, Kent	363	9.5	7.1	9.1	17.1	10.7	33	44
Port of Tacoma, 2301 Alexander Ave, Tacoma	364	10.3	7.9	8.8	17.8	11.2	34	43
7802 South L St, Tacoma	354	10.5	5.1	5.8	18.4	9.9	42	66
South Hill, 9616 128th St E, Puyallup	361	11.4	5.9	7.2	16.5	10.3	32	43

Notes
(1) Sampling occurs continuously for 24 hours each day.
Quarterly averages are shown only if 75 percent or more of the data is available.
(2) Annual averages are shown only if there are at least three quarterly averages.
(3) All data values are correlated using site-specific relationships with Federal Reference Method samplers.

Summary of Maximum Observed Concentrations and Values >40

Location	Mar 3 Sun	Oct 25 Fri	Oct 26 Sat	Nov 1 Fri	Nov 2 Sat	Nov 3 Sun	Nov 4 Mon	Nov 24 Sun	Nov 25 Mon	Nov 26 Tue	Nov 27 Wed	Nov 28 Thu	Nov 29 Fri	Dec 7 Sat	Dec 8 Sun	Dec 23 Mon
Marysville JHS, 1605 7th St, Marysville						42	42		47	52	48	46				
6120 212th St SW, Lynnwood			41	41	46		47							41	41	
17171 Bothell Way NE, Lake Forest Park															45	
Queen Anne Hill, Seattle		--	--				23									
Duwamish, 4752 E Marginal Way S, Seattle							42									
South Park, 8025 10^{th} Ave S, Seattle											41		43	--	--	--
601 143rd Ave NE,, Bellevue		29														
James St & Central Ave, Kent											44					
Port of Tacoma, 2301 Alexander Ave, Tacoma							42				43					
7802 South L St, Tacoma	42				48	50	55	47		41	66	57				44
South Hill, 9616 128th St E, Puyallup				--	--	--				41	43					

-- Indicates no sample on specified day

Air Quality Index Summary

Location	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Marysville JHS, 1605 7th St, Marysville	282	77	6	
6120 212th St SW, Lynnwood	308	51	6	
17171 Bothell Way NE, Lake Forest Park	281	63	1	
Queen Anne Hill, Seattle	310	18	0	
Duwamish, 4752 E Marginal Way S, Seattle	300	64	1	
South Park, 8025 10^{th} Ave S, Seattle	276	60	2	
601 143rd Ave NE,, Bellevue	339	21	0	
James St & Central Ave, Kent	298	64	1	
Port of Tacoma, 2301 Alexander Ave, Tacoma	291	71	2	
7802 South L St, Tacoma	284	61	8	1
South Hill, 9616 128th St E, Puyallup	282	77	2	

PARTICULATE MATTER (PM_{10})
Micrograms per Cubic Meter

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

2002

Location	Number of Values	Quarterly Arithmetic Averages				Year Arith Mean	99th Percentile	Max Value
		1st	2nd	3rd	4th			
Duwamish, 4752 E Marginal Way S, Seattle	61	25.0	19.9	21.1	29.6	23.9	75	75
James St & Central Ave, Kent	61	16.8	18.1	17.6	22.7	18.8	53	53
Port of Tacoma, 2301 Alexander Ave, Tacoma	60	18.1	23.6	19.3	26.4	21.8	99	99

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 Observed Concentrations and Values > 60

Location	Feb 13 Wed	May 2 Thu	Oct 17 Thu	Nov 4 Mon
Duwamish, 4752 E Marginal Way S, Seattle	62			75
James St & Central Ave, Kent		53		
Port of Tacoma, 2301 Alexander Ave, Tacoma		99	61	73

-- Indicates no sample on specified day

Air Quality Index Summary

Location	Good	Moderate	Unhealthy for Sensitive Groups
Duwamish, 4752 E Marginal Way S, Seattle, Wa	58	3	0
James St & Central Ave, Kent, Wa	60	1	0
Port of Tacoma, 2301 Alexander Ave, Tacoma	57	3	0

PARTICULATE MATTER (PM_{10}) - Continuous

Micrograms per Cubic Meter

Equivalent Sampling Methods: B - BetaAtten ANDERSEN FH62I-N Glass Fiber strip
T - Mass Transducer R&P TEOM 1400a Teflon Coated Glass Fiber

2002

Location	Method	Number of Values	Quarterly Arithmetic Averages 1st	2nd	3rd	4th	Year Arith Mean	99th Percentile	Max Value
Marysville JHS, 1605 7th St, Marysville	B	321	12.3	7.7	8.3		9.4	41	44
17171 Bothell Way NE, Lake Forest Park	B	365	17.0	10.6	11.9	21.5	15.3	43	47
Duwamish, 4752 E Marginal Way S, Seattle	T	339	28.1	20.7	22.0	31.8	25.7	66	85
James St & Central Ave, Kent	T	364	18.4	16.6	18.4	22.1	18.9	48	58
Port of Tacoma, 2301 Alexander Ave, Tacoma	B	363	20.1	20.6	18.3	27.1	21.5	66	161

Notes
(1) Sampling occurs continuously for 24 hours each day.
Quarterly averages are shown only if 75 percent or more of the data is available.
(2) Annual averages are shown only if there are at least three quarterly averages.
(3) All data values are adjusted using seasonal site-specific relationships with Federal Reference Method samplers.

Summary of Maximum Observed Concentrations and Values >60

Location	Method	Feb 13 Wed	Mar 4 Mon	Apr 22 Mon	May 1 Wed	May 2 Thu	Oct 17 Thu	Nov 1 Fri	Nov 2 Sat	Nov 3 Sun	Nov 4 Mon	Nov 27 Wed
Marysville JHS, 1605 7th St, Marysville	B								44	44	44	--
17171 Bothell Way NE, Lake Forest Park	B								47			
Duwamish, 4752 E Marginal Way S, Seattle	T	66	66				64	64	61		77	85
James St & Central Ave, Kent	T											58
Port of Tacoma, 2301 Alexander Ave, Tacoma	B			161	65	100	63				66	72

-- Indicates no sample on specified day

Air Quality Index Summary

Location	Method	Good	Moderate	Unhealthy for Sensitive Groups
Marysville JHS, 1605 7th St, Marysville	B	321	0	0
17171 Bothell Way NE, Lake Forest Park	B	365	0	0
Duwamish, 4752 E Marginal Way S, Seattle	T	327	12	0
James St & Central Ave, Kent	T	362	2	0
Port of Tacoma, 2301 Alexander Ave, Tacoma	B	357	5	1

CARBON MONOXIDE

(Parts per Million)
2002

Location / Continuous Sampling Period(s)	Six Highest Concentrations: 1 Hour Average Value	1 Hour Average Date	1 Hour Average End Time	8 Hour Average Value	8 Hour Average Date	8 Hour Average End Time	Number of 8 Hour Averages Exceeding 9 ppm	Number of Days 8 Hour Average Exceeded 9 ppm
2939 Broadway Ave Everett 1 Jan-31 Dec	7.7	24 Jan	1500	3.3	27 Nov	2400	0	0
	4.9	6 Dec	2400	3.1	2 Nov	0100		
	4.8	17 Oct	2000	2.6	4 Nov	2200		
	4.8	27 Nov	1900	2.6	6 Dec	2400		
	4.6	4 Nov	1800	2.4	26 Nov	2200		
	4.5	30 Oct	1900	2.3	9 Jan	2400		
44th Ave W & 196th St SW Lynnwood 1 Jan-31 Dec	6.2	27 Nov	1900	5.0	3 Nov	0100	0	0
	6.2	4 Nov	1900	4.2	9 Jan	2400		
	6.0	2 Nov	2400	4.1	23 Dec	0100		
	5.7	2 Nov	2100	4.0	15 Jan	0100		
	5.6	9 Jan	1800	4.0	27 Nov	2400		
	5.2	4 Nov	2000	3.8	1 Nov	2400		
NE 8th St & 108th Ave NE Bellevue 1 Jan-31 Dec	6.2	4 Nov	1800	4.2	27 Nov	2200	0	0
	5.4	4 Nov	1900	3.5	7 Dec	0100		
	5.2	4 Feb	1800	3.4	11 Jan	2100		
	5.0	27 Nov	1700	3.4	4 Nov	2200		
	4.7	2 Nov	1800	3.3	4 Feb	2300		
	4.6	27 Nov	1800	3.1	17 Oct	2300		
2421 148th Ave NE Bellevue 1 Jan-31 Dec	6.6	4 Nov	1900	4.0	27 Nov	2300	0	0
	6.6	27 Nov	1800	4.0	7 Dec	0100		
	5.9	17 Oct	1900	3.9	4 Nov	2400		
	5.5	17 Oct	2000	3.8	4 Feb	2400		
	5.3	4 Feb	2000	3.5	11 Jan	2200		
	5.3	4 Nov	1800	3.5	10 Feb	0100		
Northgate, 310 NE Northgate Way Seattle 1 Jan-31 Dec	9.8	31 Dec	1000	3.6	3 Nov	0100	0	0
	9.5	2 Apr	1400	3.4	4 Feb	2200		
	5.1	4 Nov	1900	3.4	8 Dec	2400		
	4.9	4 Nov	2100	3.3	4 Nov	2400		
	4.4	4 Nov	2000	3.1	27 Nov	2400		
	4.3	2 Nov	1900	3.0	7 Dec	0300		
University District, 1307 NE 45th St Seattle 1 Jan-31 Dec	7.5	2 Nov	2200	5.6	3 Nov	0200	0	0
	7.0	17 Oct	2100	5.0	4 Nov	2100		
	6.5	4 Nov	1900	4.2	9 Feb	2400		
	6.4	2 Nov	2100	4.0	17 Oct	2300		
	6.4	4 Nov	2100	4.0	27 Nov	2400		
	6.3	9 Feb	2300	3.9	8 Dec	2400		
1424 4th Ave Seattle 1 Jan-31 Dec	7.0	19 Mar	1000	3.4	3 Nov	0300	0	0
	5.9	31 Aug	2000	3.2	29 Nov	2400		
	4.8	18 Nov	2100	2.9	27 Nov	2400		
	4.7	2 Nov	2400	2.5	1 Jan	0200		
	4.1	2 Nov	2300	2.5	27 Nov	1300		
	3.8	29 Nov	2200	2.4	11 Jan	1800		
Beacon Hill, 15th S and Charlestown Seattle 1 Jan- 31 Dec	2.4	27 Nov	2400	2.0	9 Dec	0500	0	0
	2.3	8 Dec	2400	1.8	28 Nov	0200		
	2.2	27 Nov	2300	1.7	8 Dec	1800		
	2.2	28 Nob	0100	1.6	27 Nov	1400		
	2.2	8 Dec	2300	1.6	29 Nov	2400		
	2.1	4 Nov	2100	1.6	4 Nov	2300		
Georgetown, 6431 Corson Ave S Seattle 1 Jan-30 Aug	6.4	14 Feb	0700	3.9	14 Feb	0900	0	0
	6.2	14 Feb	0800	3.8	13 Feb	1000		
	6.0	13 Feb	0700	2.9	4 Feb	1300		
	6.0	13 Feb	0900	2.7	14 Feb	0100		
	4.7	11 Feb	0900	2.6	1 Jan	0200		
	4.6	13 Feb	0800	2.4	5 Jan	0100		
1101 Pacific Ave Tacoma 1 Jan-31 Dec	9.8	4 Nov	1800	5.9	4 Nov	2400	0	0
	9.3	15 Feb	1800	4.5	28 Nov	0100		
	8.9	4 Nov	1900	4.0	3 Nov	0100		
	7.3	4 Nov	2000	4.0	15 Feb	0100		
	7.2	15 Feb	1900	3.8	15 Feb	2100		
	6.2	4 Nov	2100	3.6	9 Dec	1800		

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.

SULFUR DIOXIDE

(Parts per Million)

2002

Monthly and Annual Arithmetic Averages

Location	Monthly Arithmetic Averages							No of 1 Hour Samples	Year Arith Mean
	Jan	Feb Aug	Mar Sep	Apr Oct	May Nov	Jun Dec	Jul		
Beacon Hill, 15th S & Charlestown, Seattle	.002	.003 .004	.002 .003	.002 .005	.002 .003	.002 .002	.003	8760	.003

Maximum and Second Highest Concentrations 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
Beacon Hill, 15th S & Charlestown, Seattle 1 Jan-31 Dec	.078 .049	12 Sep 12 Sep	0200 0400	.055 .030	12 Sep 17 Jul	0400 2300	.016 .015	12 Sep 10 Oct	1100 1900

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) Sulfur dioxide was measured using the continuous ultraviolet fluorescence method.

NITROGEN DIOXIDE

(Parts per Million)

2002

Monthly and Annual Arithmetic Averages

Location	Monthly Arithmetic Averages Jan	Feb Aug	Mar Sep	Apr Oct	May Nov	Jun Dec	Jul	No of 1 Hour Samples	Year Arith Mean
Beacon Hill, 15th S & Charlestown, Seattle	.019	.022 .020	.015 .020	.019 .023	.017 .023	.015 .018	.016	7766	.019
Georgetown, 6431 Corson Ave S, Seattle	.021	.025 .019	.020	.020	.017	.015	.016	5115	.019

Maximum and Second Highest Concentrations

Location / Continuous Sampling Periods(s)	1 Hour Average Value	Date	End Time
Beacon Hill, 15th S & Charlestown, Seattle	.071	13 Jun	2100
1 Jan-31 Dec	.061	22 Jul	2100
Georgetown, 6431 Corson Ave S, Seattle	.070	14 Feb	0800
1 Jan-15 Aug	.064	12 May	1900

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 nitrogen dioxide was measured using the continuous chemiluminescence method.

ATMOSPHERIC PARTICLES

Method: Light Scattering by Dry Particles with Heated Nephelometer   Units: $(b_{sp} \times 10^{-4})$/Meter

2002

Location	Monthly Arithmetic Averages												No of 1 Hour Samples	1 Hour Max	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Marysville JHS, 1605 7th St, Marysville	.41	.46	.42	.30	.25	.20	.30	.29	.29	.73	.86	.62	8746	8.83	.43
6120 212th St SW, Lynnwood	.37	.33	.29	.24	.20	.19	.23	.25	.23	.64	.71	.45	8745	7.02	.34
17171 Bothell Way NE, Lake Forest Park	.44	.46	.31	.25	.21	.21	.25	.26	.23	.64	.71	.45	8442	3.47	.37
Queen Anne Hill, Seattle	.22	.21	.19	.17	.19	.19	.22	.28	.24	.43	.45	.26	8281	1.85	.25
Duwamish, 4752 E Marginal Way S, Seattle	.31	.28	.25	.26	.24	.23	.25	.31	.27	.56	.61	.36	8756	1.89	.33
South Park, 8025 10th Ave S, Seattle	.30	.31	.19	.24	.22	.23	.25	.31	.28	.63	.73		8009	2.40	.34
Beacon Hill, 15th S & Charlestown, Seattle							.20	.25	.17	.47	.47	.26	4299	1.82	
City Hall, 15670 NE 85th, Redmond	.21	.25	.22	.22	.21	.19	.23	.24	.20	.49	.47	.27	8349	2.14	.27
601 143rd Ave NE, Bellevue	.21	.22	.19	.21	.19	.19	.25	.29	.22	.49	.43	.27	8658	1.58	.26
305 Bellevue Way NE, Bellevue					.21	.19	.21	.25	.21	.57	.53	.37	5778	2.39	
42404 SE North Bend Way, North Bend	.16	.15	.16	.17	.16	.18	.23	.22	.15	.36	.29	.13	8434	2.12	.20
James St & Central Ave, Kent	.35	.36	.25	.24	.25	.19	.31	.31	.27	.64	.73	.42	8756	7.71	.36
Port of Tacoma, 2301 Alexander Ave, Tacoma	.34	.39	.25	.26	.24	.23	.26	.30	.27	.61	.73	.44	8740	2.60	.36
7802 South L St, Tacoma	.38	.47	.33	.27	.21	.20	.25	.28	.24	.69	1.07	.58	8574	5.72	.41
South Hill, 9616 128tn St E, Puyallup	.43	.55	.31	.27	.23	.22	.32	.29	.24	.65	.79	.49	8679	6.83	.40

VISUAL RANGE

Method: Light Scattering by Dry Particles with Heated Nephelometer   Units: Miles

2002

Location	Monthly Arithmetic Averages												No of 1 Hour Samples	1 Hour Min	Daily Min	Year Arith Mean
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Marysville JHS, 1605 7th St, Marysville	73	64	64	73	72	80	66	61	62	36	50	53	8746	3	15	63
6120 212th St SW, Lynnwood	72	70	71	76	80	82	78	68	74	40	45	62	8755	3	16	68
17171 Bothell Way NE, Lake Forest Park	68	63	73	77	78	77	73	66	71	40	46	69	8378	7	17	67
Queen Anne Hill, Seattle	85	83	88	92	82	82		64		51	54	83	7991	12	24	76
Duwamish, 4752 E Marginal Way S, Seattle	65	72	72	69	71	71	68	58	66	41	44	68	8756	12	17	64
South Park, 8025 10th Ave S, Seattle	75	70	81	76	76	77	71	59	66	39	41		8121	10	16	66
Beacon Hill, 15th S & Charlestown, Seattle							82	68	86	50	54	85	4299	12	20	
City Hall, 15670 NE 85th, Redmond	85	77	79	81	79	82	77	69	79	47	55	85	8349	11	19	74
601 143rd Ave NE, Bellevue	91	84	88	84	84	85	72	63	74	48	61	83	8658	14	20	77
305 Bellevue Way NE, Bellevue					79	84	78	68	76	43	52	69	5802	10	17	
42404 SE North Bend Way, North Bend	109	106	95	96	91	87	76	75	91	61	80	110	8434	11	26	90
James St & Central Ave, Kent	67	63	75	74	71	82	67	59	65	38	40	63	8733	3	15	64
Port of Tacoma, 2301 Alexander Ave, Tacoma	70	62	77	73	70	74	70	60	66	40	42	64	8740	9	16	64
7802 South L St, Tacoma	74	65	79	76	81	82	75	63	73	42	39	56	8574	4	9	67
South Hill, 9616 128th St E, Puyallup	69	58	74	77	76	78	70	63	70	41	44	64	8679	3	16	65

Summary of Minimum Daily Visual Range and Values <20 Miles

Location	Oct 20 Sun	Oct 23 Wed	Oct 24 Thu	Oct 25 Fri	Oct 26 Sat	Nov 2 Sat	Nov 3 Sun	Nov 4 Mon	Nov 5 Tue	Nov 22 Fri	Nov 24 Sun	Nov 25 Mon	Nov 26 Tue	Nov 27 Wed	Nov 28 Thu	Nov 29 Fri	Nov 30 Sat	Dec 2 Mon	Dec 7 Sat	Dec 8 Sun	Dec 9 Mon	Dec 23 Mon
Marysville	16				18			18				18	15	16	15	17			18	19		
Lynnwood			18		16			17											18			
Lake Forest Park					18			19											19	17		
Queen Anne Hill, Seattle								24														
Duwamish, Seattle								17														
South Park, Seattle				18		18		18						16		16			--	--	--	--
Beacon Hill, Seattle				20																		
Redmond					19																	
Bellevue, 143rd Ave				20																		
Bellevue Way	19			17	18														19			
North Bend										26												
Kent					19			18						15	18	18						
Port of Tacoma					19			16						16	18							
South L St, Tacoma		16		18	18	14	14	11	19		15		16	9	12	17	17				17	16
Puyallup					19			16				19	18	16	16	19		19				

-- Indicates no sample on specified day

Air Quality Index
1980-2002

Snohomish County

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	All Days PM	All Days CO	All Days SO2	Unhealthy Days PM	Unhealthy Days CO	Unhealthy Days SO2	PSI	Date	Pollutant
	Days in Each Air Quality Category					Pollutant Determining the AQI						Highest Value		
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
1996	353	13		0	0	54	312	0	0	0	0	66	Jan 31	PM
1997	352	13		0	0	214	151	0	0	0	0	67	Jan 14	PM
1998	353	11		1	0	143	219	3	1	0	0	153	Dec 22	PM
1999	300	62	3	0	0	260	105	0	3	0	0	129	Jan 3	PM
2000	253	79	5	0	0	301	36	0	5	0	0	113	Jul 4	PM
2001	290	73	2	0	0	356	9	0	2	0	0	111	Nov 10	PM
2002	288	69	8	0	0	343	22	0	8	0	0	116	Nov 4	PM
Totals	6374	1948	18	20	0	3636	4488	236	19	19	0			

Air Quality Index
1980-2002

King County

	Days in Each Air Quality Category					Pollutant Determining the AQI						Highest Value		
			Unhealthy for Sensitive		Very	All Days			Unhealthy Days					
Year	Good	Moderate	Groups	Unhealthy	Unhealthy	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
1996	324	42		0	0	90	274	2	0	0	0	100	Oct 9	CO
1997	320	45		0	0	121	244	0	0	0	0	94	Jan 16	PM
1998	343	22		0	0	118	247	0	0	0	0	67	Oct 23 #	CO
1999	272	88	5	0	0	292	73	0	5	0	0	134	Jan 4	PM
2000	245	116	5	0	0	336	30	0	5	0	0	113	Nov 21	PM
2001	276	83	6	0	0	353	12	0	6	0	0	118	Nov 10	PM
2002	270	91	4	0	0	353	12	0	4	0	0	112	Nov 27	PM
Totals	4980	3297	20	98	6	3437	4903	61	41	83	0			

Air Quality Index
1980-2002

Pierce County

	Days in Each Air Quality Category					Pollutant Determining the AQI						Highest Value		
			Unhealthy for Sensitive		Very	All Days			Unhealthy Days					
Year	Good	Moderate	Groups	Unhealthy	Unhealthy	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
1996	340	26		0	0	224	119	23	0	0	0	78	Oct 9	CO
1997	328	37		0	0	274	75	16	0	0	0	84	Jan 16	PM
1998	353	12		0	0	228	112	25	0	0	0	78	Oct 21	CO
1999	268	94	3	0	0	363	1	1	3	0	0	139	Jan 4	PM
2000	242	110	13	1	0	363	3	0	14	0	0	153	Dec 6	PM
2001	271	82	12	0	0	363	2	0	12	0	0	139	Nov 10	PM
2002	269	85	10	1	0	364	1	0	11	0	0	157	Nov 27	PM
Totals	5427	2850	38	81	5	6009	2099	293	58	66	0			

Air Quality Index
1980-2002

Kitsap County

Year	Days in Each Air Quality Category: Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	Pollutant Determining the AQI: All Days PM	CO	SO2	Unhealthy Days PM	CO	SO2	Highest Value: PSI	Date	Pollutant
1990														
1991														
1992														
1993														
1994														
1995														
1996														
1997														
1998														
1999	333	32	0	0	0	365	0	0	0	0	0	81	Jan 5 #	PM
2000	290	75	0	1	0	366	0	0	1	0	0	159	Jul 4	PM
2001	320	42	0	0	0	362	0	0	0	0	0	91	Dec 31	PM
2002	324	41	0	0	0	365	0	0	0	0	0	77	Nov 2	PM
Totals	1267	190	0	1	0	1458	0	0	1	0	0			