Puget Sound Georgia Basin Ecosystem Indicators Report
Technical Background Document
http://www.epa.gov/region10/psgb/indicators/

Air Quality Indicator

Indicator Name
Air Quality from Fine Particulates

Data Set Name
Puget Sound Annual Mean PM10 and PM2.5 Trends
Georgia Basin

Data Type
Indicator data

SCOPE

I. BRITISH COLUMBIA

1. Geographic Coverage

This data in this indicator was collected from monitoring sites in the Georgia Basin, mostly in the Greater Vancouver and Lower Fraser Valley areas but also from the Sea-to-Sky Highway corridor, Campbell River, Powell River, Nanaimo, the Gulf Islands and Victoria.

2. Length of Data Series

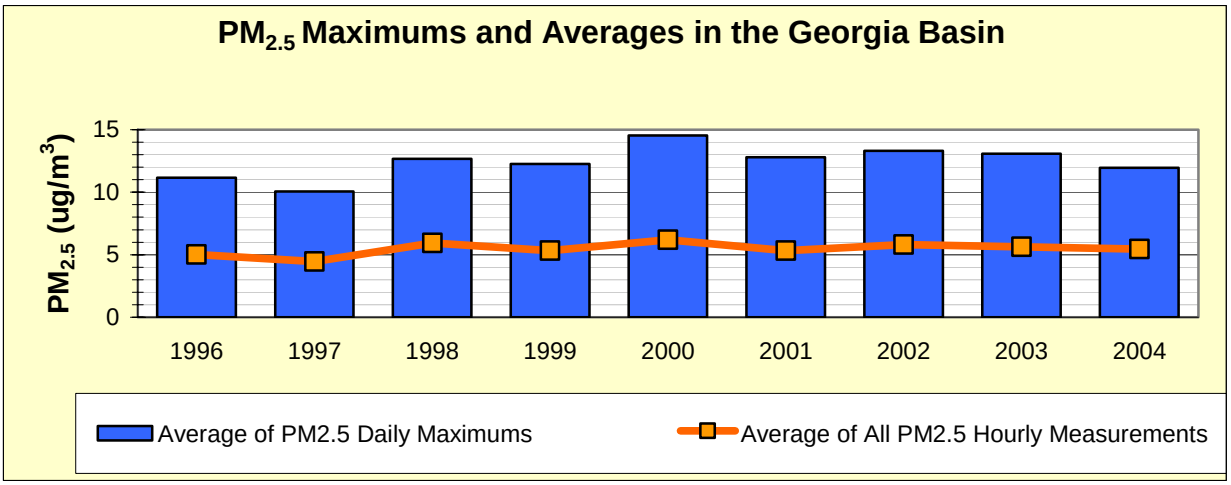
These data are the arithmetic annual averages of the PM2.5 daily maximums and the averages of all PM2.5 hourly measurements. As noted in the indicator, all measured communities in the Georgia Basin are below the Canada-Wide Standard (CWS) for PM2.5.

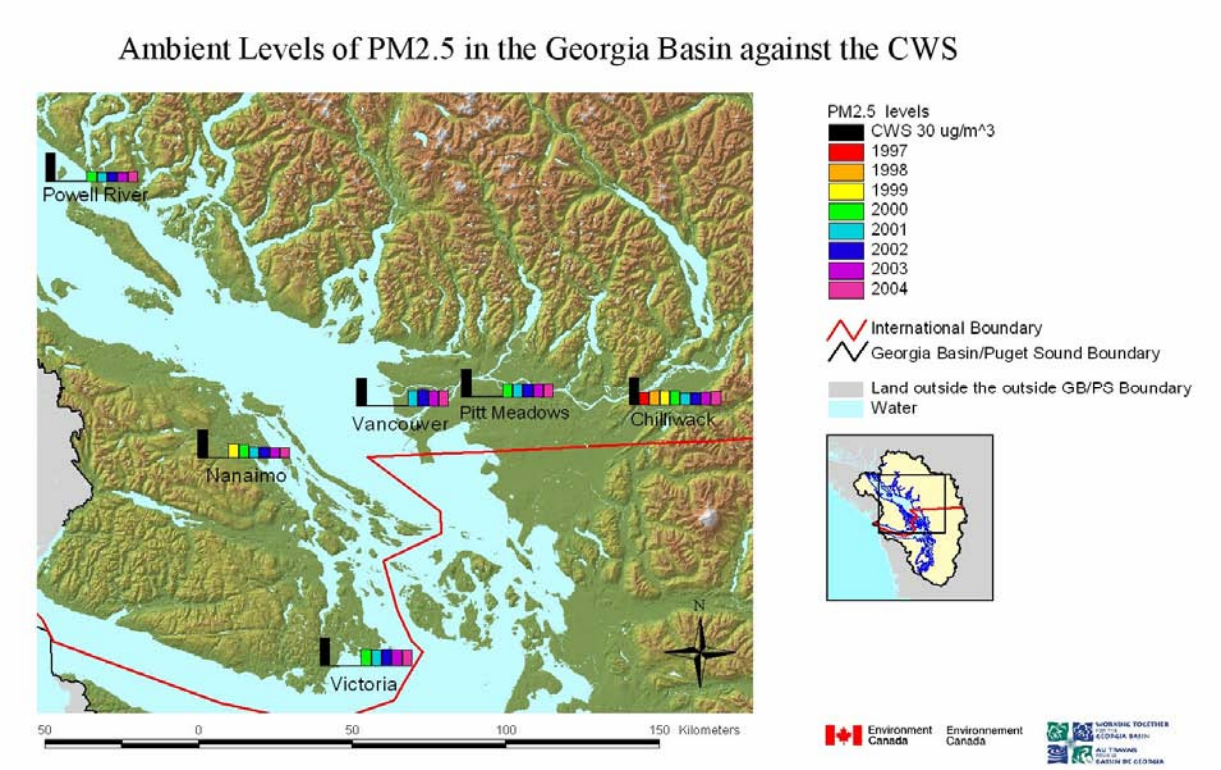
The available data period is from 1996 to 2004.

3. Smallest Geographic Units

The data generally represent neighbourhood scale areas where the data is collected.

Ambient values are summarized for larger areas.





RELIABILITY

1. The data network (NAPS)

Relevant data are collected in the Georgia Basin through the National Air Pollution

Surveillance (NAPS) program. This program has been in existence since 1970 and it is a cooperative partnership of federal, provincial, territorial and some regional governments measuring air quality throughout Canada. The NAPS program supports many air quality programs across Canada designed to protect human health and the environment.

The NAPS network in the Georgia Basin is operated by the Greater Vancouver Regional District within its jurisdiction (roughly the Greater Vancouver area) and the BC Ministry of Environment in the other areas of the Basin.

The goal of the NAPS program is to provide accurate and long-term air quality data of a uniform standard throughout Canada. Data from the NAPS program are included in the Canada-wide Air Quality Database and are published in annual air quality data summary reports, which are available on the internet at: http://www.etc-cte.ec.gc.ca/publications/napsreports_e.html.

In 2003, the NAPS network and associated provincial/territorial/regional monitoring networks reporting data to the Canada-wide Air Quality database consisted of approximately 290 monitoring stations in over 175 communities in Canada, equipped with approximately 600 continuous monitors measuring sulphur dioxide, carbon monoxide, nitrogen dioxide, ozone, and particulate matter, and over 160 air samplers measuring components of particulate matter, volatile organic compounds and other toxics substances.

The Analysis and Air Quality Division of Environment Canada coordinates operation of the NAPS program, provides air monitoring instrumentation and reference standards, operates a laboratory for the chemical speciation of NAPS samples, directs a national quality assurance program, coordinates the development of equipment specifications for the monitoring network as a whole and maintains the Canada-wide Air Quality Database.

The provincial, territorial and regional governments share in overall management of the NAPS Program, support the development of standardized methods, and are responsible for the ongoing operation and maintenance of monitoring stations and instrumentation, data acquisition and validation, and reporting within their jurisdictions.

Key objectives of the NAPS program include:

1. Determining the nature and levels of air pollutants affecting human health and the environment in Canada
2. Supporting near real-time reporting of air quality information to the public
3. Supporting air quality prediction and forecasting programs
4. Assessing long-term trends in air contaminants across Canada
5. Tracking the occurrence and extent of new contaminants in ambient air
6. Providing data to support scientific research into the effects of air pollution on health and environment
7. Supporting the development of air quality standards and objectives
8. Supporting evaluation of the success of pollution control strategies procedures
9. Supporting national and international air quality agreements and initiatives
10. Supporting the development and evaluation of new monitoring technologies, and the development and application of quality assurance/quality control.

The NAPS network supports data needs for joint air quality initiatives including the National Air Quality Objectives, the Air Toxics Program, the Canada-Wide Standards, the Canada-U.S. Air Quality Agreement, the Quality Prediction Program, Special Studies, and other initiatives that may arise.

2. Assumptions and Caveats

3. Quality Assurance Procedures

NAPS Network Quality Assurance and Quality Control (QA/QC) Objectives

1 It is the policy of the NAPS network agencies to provide sufficient quality assurance and quality control to ensure that the ambient air monitoring data collected from the NAPS network are of acceptable precision, accuracy, completeness, comparability and representativeness. Every NAPS agency has in place a quality assurance and control program that is supplemented by a federal quality assurance and control program. These programs are intended to support the policy that the data generated from the NAPS network be within ±15% of true values.

2 All data shall be traceable to a primary standard. All calibration standards (including zeros and spans) used in the NAPS network are certified traceable to primary standards of the U.S. National Institute of Standards and Technology (NIST) or Canada's Institute for National Measurement Standards (INMS).

3 All data shall be of a known and documented quality.

4 All data shall be comparable, meaning that the data shall be produced in a similar and scientific manner using standard methodologies for sampling, calibration, auditing, and collection of data. Where possible, methods used in the NAPS network are or pending to be designated reference or equivalent methods by the United States Environmental Protection Agency.

5 All data shall be representative of the parameters being measured with respect to time, location, and the conditions from which the data are obtained. The use of standard methodologies contained in this manual should insure that the data generated is representative.

Purpose of the NAPS Network QA/QC Guidelines

The QA/QC components specified are the minimum requirements and network agencies may have more stringent specifications or more elaborate QA/QC procedures, as they deem appropriate for their jurisdictional requirements. This manual will be reviewed and revised

periodically to reflect changing needs and concerns to be addressed by air quality monitoring programs in Canada.

NAPS Network QA/QC Program Elements

The NAPS network is a cooperative program with shared responsibilities between Environment Canada and the network agencies. The elements of the NAPS quality assurance program are described below:

1 Plan, establish, develop and manage monitoring network programs
   a. Measurement Methodology, Equipment Selection, Operating Conditions
2 Site Selection
   a. Spatial Scale of Representativeness
   b. Site Classification, Distribution, Location, Separation
3 Sampling System
   a. Shelter Requirements
   b. Probe Siting Criteria
4 Manifold Design Station and Analyzer Operation
   a. Station Visits
   b. Operating Procedures
5 Preventive Maintenance Calibration
   a. Calibration Frequency
   b. Calibration Procedures
6 Zero and Span Verifications Calibration and Reference Standards
7 Station Performance and System Audits, and Inter-agency Verifications
8 Data Validation and Formats
9 Documentation
   a. Site Documentation
   b. Station Activities Log Book
   c. Analyzer Operation and Maintenance Manual
10 Quality Assurance and Quality Control Manual Personnel Training and Technical Support

3. Data Confidence Limits

Station and Analyzer Operation

Station and Analyzer Operation Station and analyzer operation is the responsibility of the network agencies and is overseen by the network manager. Operation of the station includes regularly scheduled station visits, instrument zero and span verifications, calibrations,

preventive maintenance and documentation. The following table summarizes the recommended minimum frequency of NAPS Station Work Activities. Summary of NAPS Station Work Activities

Tasks in the Operation of NAPS Station	***Work Performed By***	***Minimum Frequency for this Work***
Regular Site Visitation	Station Operator	Weekly
Zero and Span Verification	Station Operator or Calibration technician	Weekly
Analyzer Calibration	Calibration Technician	Every 6 months; after repairs are made to the analyzer; and when an analyzer is installed at the station
Internal Performance and System Audit	Agency Auditor or Technician other than the operator of the station	Every 6 months
External Performance and System Audit	Auditors from Environment Canada or other agency	Every two years

Station Visits

One of the main purposes of monitoring station visits is to verify the proper operation of the monitoring equipment and of data acquisition systems to ensure the collection of valid and complete data. A second important purpose is to verify the continued safe and secure environment at the station. Regular visits on a minimum weekly basis are recommended to verify the safe unattended operation of the monitoring equipment using pumps and compressed gas cylinders and to verify the outdoor sampling and monitoring equipment. Diagnostic tests, which can be performed remotely on various monitoring equipment and station parameters, complement the station visit verifications.

Station visits should be documented in the site logbook. The following is a list of activities to be performed at the station:

• Examine the external station conditions including the inlet probe for damage or blockage. Periodically review the station characteristics for any change or modification to the station.

• Examine the manifold, the transfer lines and the inlet filters for dirt buildup and replace or clean as required. Examine the seals in the sampling system, the scrubbing and drying agents and replace as required.

• Perform zero and span verifications on analyzers. Record values on the control chart. Note abnormal deviations. Calibration is required when the instrument is out of control. Manual zero adjustments are acceptable when an appropriate zero source is used and the adjustments are documented and the telemetry system is re-configured as required. Refer to Appendix III for the construction of control charts.

• Replace zero and span cylinders when pressure is below 1,500 kPa (215 psig).

• Perform preventive maintenance as prescribed in the operations and maintenance manuals.

Analyzer Operation

Monitoring and sampling instruments are to be operated according to procedures described in the operation manuals. The procedures are requirements of the Quality Assurance and Quality Control guidelines. The general operating specifications of the analyzers are listed in the table above.

Data Acquisition

Air quality data are collected using data acquisition systems. Some systems simply log data while others also display data numerically and graphically which serves as a diagnostic tool for analyzing unusual analyzer responses.

Preventive Maintenance

Preventive maintenance as specified in the operation and maintenance manuals should be followed. Some of the procedures should be preceded by and followed by a zero and span verification. Preventive maintenance increases data capture, improves system reliability, and assists in identifying any potential problems and corrections before failures occur.

Traceability of Calibration and Reference Standards

Materials and devices used for calibrating NAPS analyzers, samplers and monitors must be certified for accuracy against reference standards that are traceable to recognized national primary standards. Standard Reference Materials (SRMs) for gaseous pollutants, and traceable reference standards for ozone, temperature, pressure, flow rate, and voltage are maintained by the Analysis and Air Quality Division (AAQD) at Environment Canada's Environmental Technology Centre (ETC). These serve as NAPS program reference standards, and periodic recertification of field standards against these reference standards is required in order for the field standards to serve as traceable NAPS transfer standards.

Recertification of transfer standards for sulphur dioxide, carbon monoxide and nitric oxide against appropriate SRMs is required every two years. Recertification of field calibrators, ozone transfer standards, flow meters and other flow devices against NAPS reference standards is required annually.

Environment Canada's SRMs for gaseous pollutants, except ozone, are acquired from the United States National Institute of Standards and Technology (NIST). Traceability of a standard reference photometer (SRP) for ozone measurement is maintained by periodic direct intercomparison to other, equivalent ozone photometers manufactured by NIST. Traceability of all other NAPS program reference standards is maintained by periodic recertification of these standards against higher level standards. NAPS reference standards for temperature, pressure,

flow rate (low flow) and voltage are traceable to the corresponding national primary standards at the National Research Council of Canada's Institute for National Measurement Standards (NRC-INMS). A high flow rate volumetric standard is referenced to a transfer standard at Industry Canada, which is traceable to the Industry Canada national primary standard.

Inter-agency Testing and Audits

Inter-agency Testing

The purpose of inter-agency testing and performance audits is to detect any systematic bias in the measurements of the network agencies.

An inter-agency testing program for gas concentration measurement is conducted periodically. Gas mixtures of NO, SO2 and CO are sent to all network agencies for blind analyses. The gas mixture concentrations being higher than the analyzer range requires the network agencies to use gas dilution systems for the analyses. The gas mixture concentrations which are verified against the NIST standards at the NAPS QA laboratory are used as benchmarks for data comparisons. The results from these analyses provide a performance measure of the network agencies' calibration systems and procedures. Deviations within ±6% of benchmark values are considered acceptable.

Inter-agency Testing Procedures

Test gases in aluminum cylinders are certified in the NAPS QA Laboratory against primary SRMs and their concentrations are verified for stability after storage at room temperature for one month. Values within ±3% of the test gases are considered of sufficient stability for the program.

Test gases of NO in N_2, SO^2 in N_2 and CO in N2 are used. Gases are certified once again before shipping to the network agencies. These values are taken as the out concentrations. Network agencies are requested to analyze the gases within a two week time frame and return the cylinders to the ETC in Ottawa immediately after analysis. Upon return, each test gas is re-verified to obtain the in concentration. The benchmark concentration is the average of the out and in concentrations.

The set up requirements for the test are detailed in the Inter-agency Test Procedures that accompany the test gases. All network agencies are required to use this set up to avoid any procedural variation.

Analyzer Performance Audits

Performance audits are independent evaluations of data quality and are performed in addition to the normal quality control activities of the network agencies. In addition to auditing instrument performance, system audits are conducted at the site to verify compliance with siting criteria and sampling system requirements.

Analyzer Performance Audit Procedures

The audit procedures consist of challenging the analyzers with known gas concentrations at the zero and four upscale levels normally at 20%, 40%, 60% and 80% of the analyzer measurement range. No adjustments are made on the analyzer and inlet filters are not changed before the audit.

The data collected by the data acquisition system during the audit is either flagged or not logged. The operator is informed of the time intervals during which the instruments were audited.

The audit gases and measurement devices used for auditing are certified against the SRM and reference standards maintained in the NAPS QA laboratory. Analyzer measurements are taken at the analyzer output terminals using a certified digital voltmeter and are compared with the data logger readings. Measurements are taken after a stabilization period of 20 minutes for each audit point.

The audit points are used for regression analysis where the slope, intercept and correlation coefficient are calculated. A copy of the results is left with at the site for the operator. A more detailed report with observations by the auditors on the overall condition of the site and recommendations for corrective action if required, is sent to the operating agency normally within one month of the audit.

The Pass/Fail criteria of the analyzer performance are a slope within the range of 0.85 to 1.15 and an intercept of within ±3% of range. The Pass/Fail criteria of particulate matter samplers and monitors are flow rates within ±10% of the specified value. Performance outside these ranges requires corrective action which is investigated jointly by Environment Canada and the operating agency, and documented.

Normally, two to three sites from each operating agency are audited at two-year intervals and so scheduled to maximize the effectiveness of the Quality Assurance program.

System Audits

A system audit is performed concurrently with the performance audit and is a review of the site parameters that may be used for site characterization and site documentation and may also include a review of quality control activities. .

Data Review and Validation

Documentation

Site Documentation

The following site parameters will be updated in the NAPS database:

- Station identification.
- Station name and address.

- City, including the borough or municipality.
- Analyzer type and ownership.
- Site description including scale of representativeness, land use, elevation, average building height, air flow restrictions, manifold, and the nearest meteorological station.
- Site influences including localized sources, roadway influences and major point sources.
- Site map or aerial photograph of the area.
- Photographs from the manifold inlet showing the north, east, south and west directions.

The information in the NAPS database supersedes the information published in a document titled Site Documentation for NAPS Network Air Monitoring Stations, Environment Protection Directorate, Environment Canada, January 1988, (reference 6).

Station Log Book

A logbook and/or log sheets should be used to record any activity at the site or events and occurrences that may affect the air quality data.

Analyzer Operation and Maintenance Manuals

The operation and maintenance procedures described in the operation manuals are a requirement of the QA/QC guidelines. A copy of the manuals should be kept at the station.

Training Requirements

There is no formal training program specifically for NAPS network staff. Often, more experienced staff will provide training to newer staff. Most equipment manufacturers offer training classes and seminars in Canada or at their manufacturing facility. A host of air quality related training courses are offered through EPA's Air Pollution Distance Learning Network (APDLN). The Analysis and Air Quality Division of Environment Canada periodically coordinates seminars in Canada offered by manufacturers or their Canadian distributors and offer some limited training more specifically on the installation and operation of new types of monitoring equipment.

Personnel Qualifications

Personnel assigned to ambient air monitoring activities are expected to have met the educational, work experience, responsibility, personal attributes and training requirements for their positions.

Training

Adequate education and training are integral to any monitoring program that strives for reliable and comparable data. Training is aimed at increasing the effectiveness of employees and their organization. Appropriate training should be available to employees supporting the Ambient Air Quality Monitoring Program, commensurate with their duties. Such training may consist of

classroom lectures, workshops, teleconferences and on-the-job training.

Suggested Training Courses

Over the years, a number of courses have been developed for personnel involved with ambient air monitoring and quality assurance aspects. Formal QA/QC training is offered through the following organizations:

- Air Pollution Training Institute (APTI)
  http://www.epa.gov/airprogm/oar/oaqps/eog/apti.html
- Air & Waste Management Association (AWMA) http://www.awma.org
- American Society for Quality Control (ASQC)
  http://www.asqc.org/products/educat.html
- EPA Institute EPA Quality Assurance Division (QAD) http://es.epa.gov/ncerqa/qa/

The following provides a suggested sequence of core QA-related ambient air monitoring courses for ambient air monitoring staff, and QA managers (marked by asterisk). The suggested course sequences assume little or no experience in QA/QC or air monitoring.

Course Title
1* Air Pollution Control Orientation Course (Revised), SI:422 APTI
2* Principles and Practices of Air Pollution Control, 452 APTI
3* Orientation to Quality Assurance Management QAD
4* Introduction to Ambient Air Monitoring (Under Revision 7/98), SI:434 APTI
5* General Quality Assurance Considerations for Ambient Air Monitoring (Under Revision 9/98), APTI SI:471
6* Quality Assurance for Air Pollution Measurement Systems (Under Revision 8/98), 470 APTI
7* Data Quality Objectives Workshop QAD
8* Quality Assurance Project Plan QAD
9 Atmospheric Sampling (Under Revision 7/98), 435 APTI
10 Analytical Methods for Air Quality Standards, 464 APTI
11 Chain Of Custody Procedures for Samples and Data, SI:443 APTI
* Data Quality Assessment QAD
* Management Systems Review QAD
* Beginning Environmental Statistical Techniques (Revised), SI:473A APTI
* Introduction to Environmental Statistics, SI:473B APTI
* Quality Audits for Improved Performance AWMA
* Statistics for Effective Decision Making ASQC
SI = self instructional

DATA SOURCES & CONTACTS

Data Sources

The data source is the National Air Pollution Surveillance (NAPS) network, as operated by the Greater Vancouver Regional District and BC Ministry of Environment. For general online information, please see: http://www.etcentre.org/NAPS/index_e.html.

Contact Name

General queries regarding related air data in the Georgia Basin: Jennifer Hay, Environment Canada, E: Jennifer.Hay@ec.gc.ca

General queries regarding data in the Greater Vancouver Regional District (GVRD): Ken Reid, GVRD, E: Ken.Reid@gvrd.bc.ca

General queries regarding data in the Georgia Basin but outside the GVRD: Natalie Suzuki, BC Ministry of Environment, E: Natalie.Suzuki@gov.bc.ca

II. WASHINGTON

1. Geographic Coverage

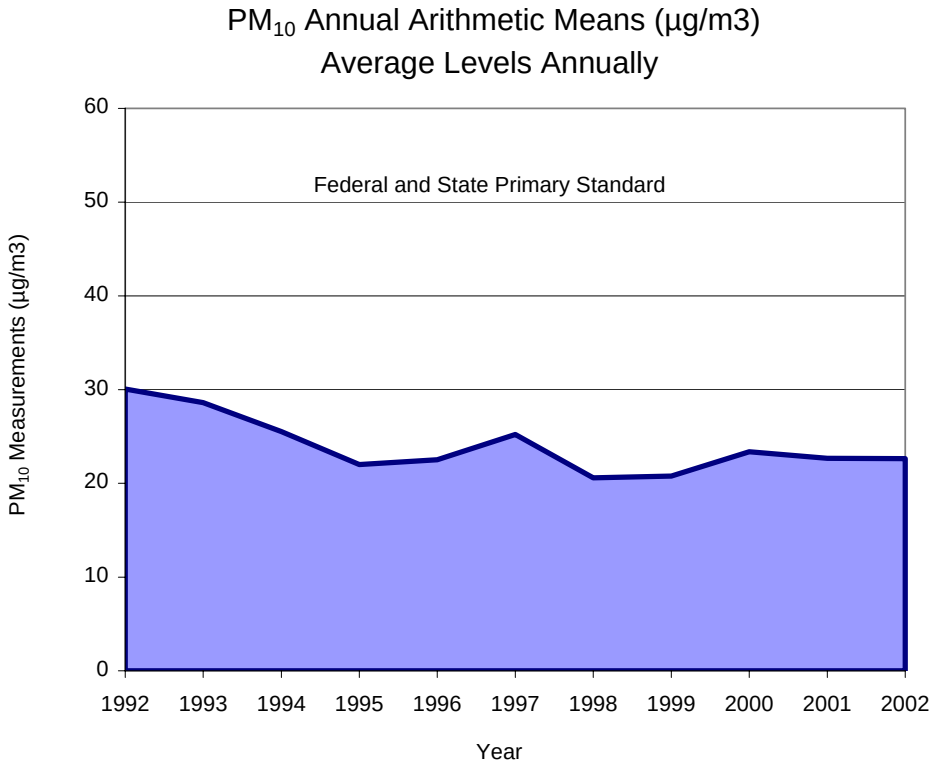
This data in this indicator was collected from monitoring sites in the central Puget Sound region, from Tacoma north to Marysville.

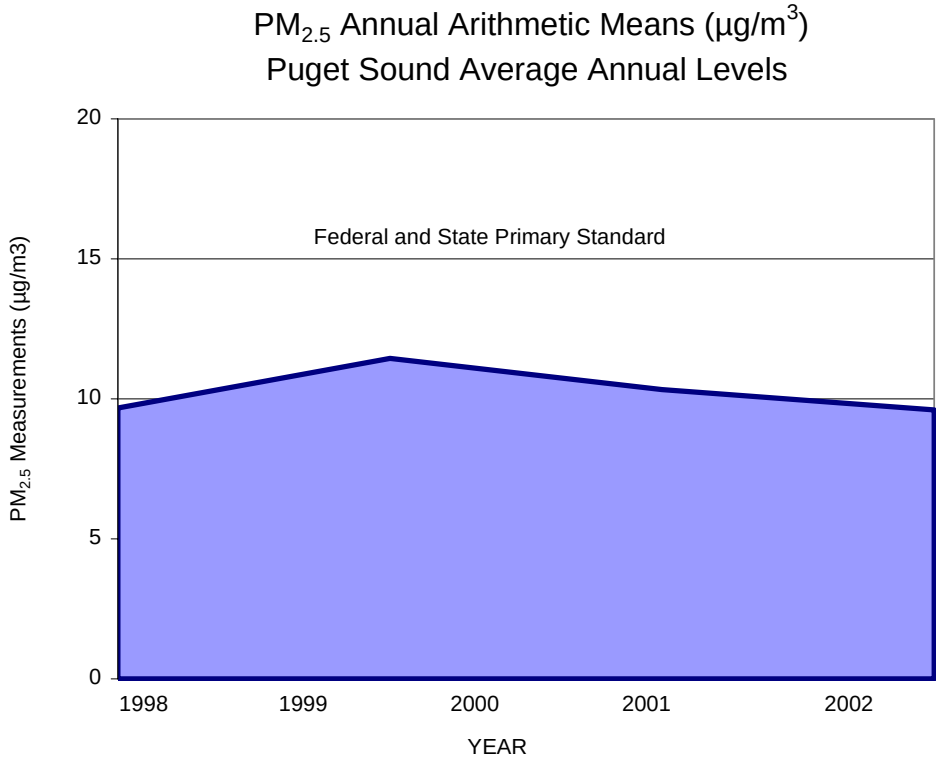
2. Length of Data Series

These data are the arithmetic average of the annual mean values of fourteen fine particulate (PM2.5) monitors covering the years 1998 through 2002. Data showing the arithmetic average of the annual mean values of fourteen PM10 particulate monitors covering the years 1992 through 2002 are also included for historical trend purposes since PM2.5 sampling has occurred since only 1998.

3. Smallest Geographic Units

The data generally represent neighborhood scale areas where the data is collected.


PM10 Annual Arithmetic Means (µg/m3)
Average Levels Annually
Federal and State Primary Standard
PM10 Measurements (µg/m3)
60
50
40
30
20
10
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Year



RELIABILITY

1. **Assumptions and Caveats**

Particulate data is routinely collected throughout Washington State as part of The Washington State Department of Ecology's ambient air monitoring network. This network is operated and quality assured following US federal procedures and standards. Please see 40 Code of Federal Regulations (CFR) Part 58, Appendix A.

The Federal Reference Methods (FRMs) for particulates (PM2.5 and PM10) are manual methods which are similar to a vacuum cleaner that draws outside air first through an inlet that removes particulates larger than 2.5 micrometers (or 10 micrometers) and then through a filter that collects the remaining particulate matter (PM2.5 or PM10). Sampling for a single measurement continues for 24 hours from midnight-to-midnight. After the sampling has been completed, the pre-weighed, sampled filter must be manually removed. Following conditioning in a controlled environment for 24 hours to remove moisture effects, the sampled filter is weighed again on a precision balance and the weight of particulate matter collected during the sample period is calculated.

The volume of air sampled is calculated from the flow rate and sampling time. The ambient PM2.5 (or PM10) concentration is calculated by dividing the weight (mass) of collected particulate by the volume of air sampled. The concentration is reported in micrograms per cubic meter.

In practical terms, the time it takes to get a concentration value may be anywhere from three to 14 days depending on how soon the filters are retrieved after the sampling has occurred.

Continuous Methods

In the State of Washington, the goal is to have timely FRM-like measurements to inform the public of current air quality based on the AQI. Three continuous methods are currently used for reporting particulates: Tapered Element Oscillating Microbalance (Teom), Beta-ray Attenuation Monitor (Bam), and Light-Scattering by Dry Particles (Nephelometer). Some sites have more than one continuous method and provide the opportunity to understand the effect of pollutants and environmental conditions on measurement processes (http://fortress.wa.gov/ecy/aqp/Public/faqs_pm25.shtml#FRM).

2. Quality Assurance Procedures

This data has been routinely quality assured using approved US EPA ambient air quality procedures, methods and standards. Please see 40 CFR Part 58, Appendix A.

3. Data Confidence Limits

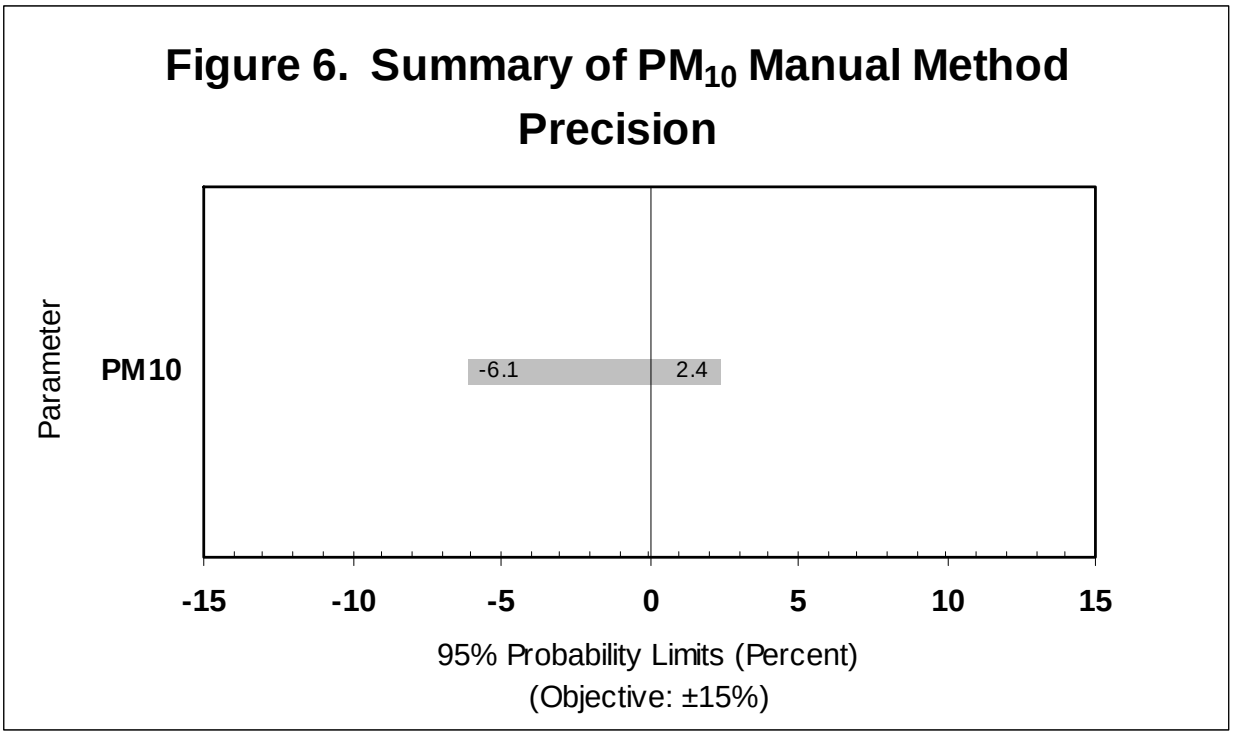
It is the policy of the Department of Ecology's Air Quality Program to provide for the generation, storage, and use of representative and comparable air monitoring data that meets the precision, accuracy, and completeness criteria described below. To ensure the data meets these criteria, it is reviewed and certified as valid by the Program's Quality Assurance Unit prior to being reported or used to make decisions concerning air quality, air pollution abatement, or control.

- Automated and manual method precision. Based on precision checks performed as specified in the Code of Federal Regulations, Title 40, Chapter 1, Part 58 (40 CFR 58), Appendix A, "Quality Assurance Requirements for State and Local Air Monitoring Stations (SLAMS)," individual instrument precision must be within ±10%, and the integrated probability intervals (95% probability limits) for each parameter should be within ±15%.

- Automated and manual method accuracy. Based on quality control checks and performance audits conducted as specified in 40 CFR 58, Appendix A, individual instrument accuracy results must be within ±10%, and the integrated probability intervals (95% probability limits) for each parameter should be within ±15%.

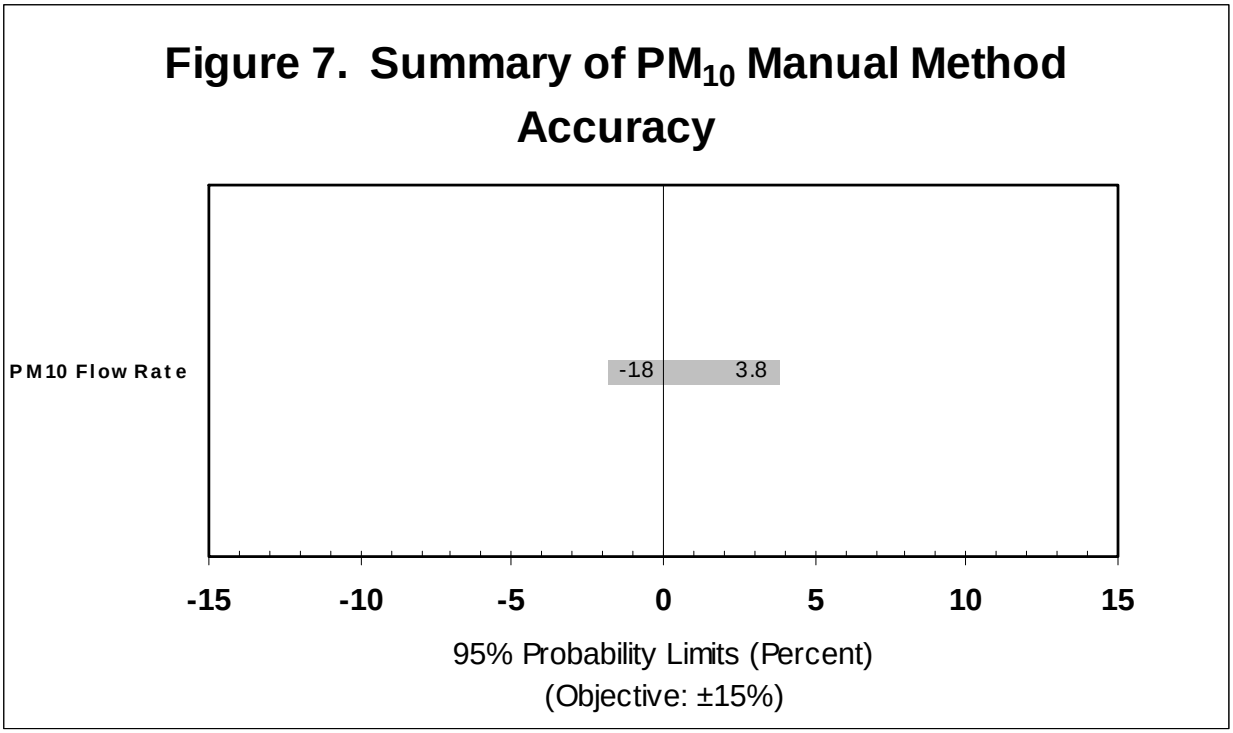
Utilizing the procedures and calculations specified in 40 CFR 58, Appendix A, Sections 3.3 and 5.3, duplicate, collocated sampling was conducted to evaluate manual method ($PM_{2.5}$ and PM_{10}) data precision, and an estimate of the precision is calculated for each parameter. $PM_{2.5}$ precision is expressed as bias, and is calculated for each monitoring station. This data is not presented

graphically, but is available on request. Figure 6 presents the resulting 95% probability limits for PM_{10} manual method precision.



Accuracy of Manual Methods

Utilizing the procedures and calculations specified in 40 CFR 58, Appendix A, Sections 3.4 and 5.4, the accuracy of the manual method, PM_{10} was audited, and an estimate of the accuracy calculated. Accuracy for $PM_{2.5}$ is expressed as bias to produce a single average for the network. The annual average was -0.27. Figure 7 presents the resulting 95% probability limits for PM_{10}.



COLLECTION INFORMATION

1. Data Methodology

This particulate data is prepared manually by collecting and weighing filters which have been exposed to known volume of ambient air for a period of twenty four hours. The validated data is entered into a national data base.

Continuous Sites:

$PM_{2.5}$ TEOM	530050002	Kennewick, VSC
$PM_{2.5}$ TEOM	530070006	Wenatchee, Columbia School
$PM_{2.5}$ TEOM	530110013	Vancouver, Moose Lodge
$PM_{2.5}$ TEOM	530330017	North Bend, USFS *

$PM_{2.5}$ TEOM	530330024	Lake Forest Park, Bothell Way *
$PM_{2.5}$ TEOM	530330057	Seattle, Duwamish Trailer *
$PM_{2.5}$ TEOM	530330080	Seattle, Beacon Hill *
$PM_{2.5}$ TEOM	530332004	Kent, Central & James *
$PM_{2.5}$ TEOM	530370002	Ellensburg, Hal Holmes Center
$PM_{2.5}$ TEOM	530530029	Tacoma, L Street *
$PM_{2.5}$ TEOM	530530031	Tacoma, Alexander Ave. *
$PM_{2.5}$ TEOM	530610005	Lynnwood, Snohomish PUD *
$PM_{2.5}$ TEOM	530611007	Marysville, J.H.S. *
$PM_{2.5}$ TEOM	530630016	Spokane, Crown Zellerbach
$PM_{2.5}$ TEOM	530670013	Lacey, Mt. View School *

FRM PM2.5 Sites:

$PM_{2.5}$	530050002	Kennewick, VSC 1/6
$PM_{2.5}$	530110013	Vancouver, Moose Lodge 1/3; 1/6
$PM_{2.5}$	530330024	Bothell Ave, Lake Forest Park 1/3 *
$PM_{2.5}$	530330057	Seattle, Duwamish Trailer 1/1; 1/3 *
$PM_{2.5}$	530330057	Seattle, Duwamish Trailer collocated 1/6 *
$PM_{2.5}$	530330080	Seattle, Beacon Hill 1/1 *
$PM_{2.5}$	530530029	Tacoma, L Street 1/1; 1/3 *

$PM_{2.5}$	530611007	Marysville, J.H.S. 1/3 *
$PM_{2.5}$	530630016	Spokane, Crown Zellerbach 1/1; 1/3
$PM_{2.5}$	530630016	Spokane, Crown Zellerbach collocated 1/6
$PM_{2.5}$	530630047	Spokane, Monroe Street 1/3

* Puget Sound data collection sites

2. Collection Frequency

Data is collected on a daily, once in three days or once in six days basis. This data is collected through an ongoing program.

DATA SOURCES & CONTACTS

Data Sources

The data source is the Washington State Department of Ecology Ambient Air Monitoring Program (http://www.ecy.wa.gov/programs/air/airhome.html)

Contact Name

Ambient Air Monitoring Data: Joan McMillen, Washington State Department of Ecology, Air Quality Program, (360) 407-7267 and jwol461@ecy.wa.gov

Quality Assurance Issues: Stan Rauh: Washington State Department of Ecology, Air Quality Program, (425) 649-7115 and sran461@ecy.wa.gov