United States Environmental Protection Agency
Air

Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

EPA-
September 2003

3-Year Quality Assurance Report

Calendar Years 1999, 2000 and 2001

The $PM_{2.5}$ Performance Evaluation Program

3-Year Quality Assurance Report

Calendar Years 1999, 2000 and 2001
The PM2.5 Performance Evaluation Program

Monitoring and Quality Assurance Group
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
RTP, NC 27711

Foreword

This document is available on hardcopy as well as accessible as a PDF file on the Internet under the Ambient Monitoring Technical Information Center (AMTIC) Homepage (http://www.epa.gov/ttn/amtic/pmqa.html). The document can be read and printed using Adobe Acrobat Reader software, which is freeware that is available from many Internet sites (including the EPA web site). Hardcopy versions are available by writing or calling:

OAQPS Library

RTP, NC 27711
(919)541-5514

Table of Contents

List of Figures

Figure Page

List of Tables

List of Acronyms

AIRS	Aerometric Information Retrieval System
AMTIC	Ambient Monitoring Technology Information Center
CEESI	Colorado Engineering Experimental Station, Inc.
CFR	Code of Federal Regulations
DQOs	data quality objectives
EPA	U.S. Environmental Protection Agency
ESAT	Environmental Services Assistance Team
FEM	federal equivalent method
FRM	federal reference method
FS	field scientist
NAAQS	National Ambient Air Quality Standards
NIST	National Institute of Standards and Technology
OAQPS	Office of Air Quality Planning and Standards
OERR	Office of Emergency and Remedial Response
PED	Performance Evaluation Database
PEP	Performance Evaluation Program
$PM_{2.5}$	particulate matter < 2.5 microns
QA/QC	quality assurance/quality control
QA	quality assurance
QAPP	quality assurance project plan
RTI	Research Triangle Institute
SAMWG	Standing Air Monitoring Work Group
SLAMS	state and local monitoring stations
SOPs	standard operating procedures
SOW	scope of work
TSA	technical systems audit
WAM	work assignment manager

1.0 Introduction

The Performance Evaluation Program (PEP) Quality Assurance (QA) Report is a 3-year evaluation to determine whether the PEP quality system, in general, is providing data of acceptable quality for its primary use, the evaluation of bias of routine ambient air quality $PM_{2.5}$ data from the State, local, and tribal air monitoring sites. The report evaluates adherence to the quality system implementation requirements described in the Code of Federal Regulations (40 CFR 58 Appendix A); the data quality indicators of completeness, precision, and bias; and the various quality control data collected for the calendar years 1999, 2000, and 2001. The report provides a retrospective view on data quality, offers a prospective view on what the more recent data quality is telling the data user, and identifies potential improvements to the program.

The report consists of three main sections:

- **Section 1:** Overview of the $PM_{2.5}$ Ambient Air Monitoring Program and the PEP
- **Section 2:** Implementation aspects of the PEP quality system relative to the QA requirements described in 40 CFR 58 Appendix A and the PEP QA Project Plan (QAPP)
- **Section 3:** Results of the data quality assessment and recommendations for program improvement.

1.1 $PM_{2.5}$ Program Overview

The criteria pollutant defined as "particulate matter" is a general term used to describe a broad class of pollutant substances that exist as liquid or solid particles over a wide range of sizes. As part of the Ambient Air Quality Monitoring Program, two particle size fractions are measured: those less than or equal to a nominal 10 micrometers (µm), and those less than or equal to a nominal 2.5 µm, hereafter referred to as PM_{10} or $PM_{2.5}$, respectively.

The sources of $PM_{2.5}$ include fuel combustion from automobiles, power plants, wood burning, industrial processes, and diesel powered vehicles such as buses and trucks. These fine particles are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds are transformed by chemical reactions. Such fine particles are detrimental to health and the environment. Scientific studies have suggested links between fine particulate matter and such health problems as asthma, bronchitis, acute and chronic respiratory symptoms such as shortness of breath and painful breathing, and premature deaths. These same fine particles are also a major cause of visibility impairment in most parts of the United States, and they contribute to acid rain.

Other background and rationale for the implementation of the $PM_{2.5}$ ambient air monitoring can be found in the *Federal Register* (40 CFR 50, July 18, 1997). In general, the measurement goal of the $PM_{2.5}$ monitoring-site network is to estimate the concentration, in units of micrograms per cubic meter ($\mu g/m^3$) of particulate matter less than or equal to a nominal 2.5 µm aerodynamic diameter collected over a 24-hour period. At present, there are approximately 1,030 routine SLAMS $PM_{2.5}$ monitors operating in the United States and its territories.

A major objective for the collection of the data is to compare $PM_{2.5}$ concentrations to the annual (15.0 $\mu g/m^3$ annual arithmetic mean concentration) and 24-hour (65 $\mu g/m^3$ 24-hour average concentration) National Ambient Air Quality Standards (NAAQS). A description of the NAAQS and their calculation can be found in the July 18, 1997, *Federal Register* notice. For this comparison, state, local, and tribal monitoring organizations are required to measure $PM_{2.5}$ concentrations using a federal reference method (FRM) or federal equivalent method (FEM). The description of the $PM_{2.5}$ FRM is included in 40 CFR 50, Appendix L, published as a final rule in the *Federal Register* on July 18, 1997. Descriptions of designated federal reference and equivalent method samplers in use at this time can be found on the Ambient Monitoring Technology Information Center (AMTIC) Web site (http://www.epa.gov/ttn/amtic/pmfrm.html). All $PM_{2.5}$ sampling sites that provide data for comparison to either the 24-hour or the annual $PM_{2.5}$ NAAQS to address attainment and nonattainment decisions must employ designated FRM/FEM sampling techniques.

The U.S. Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards (OAQPS) used the data quality objectives (DQOs) process to identify the quality of data needed by decision-makers when making comparisons to the NAAQS. DQOs are qualitative and quantitative statements that clarify the monitoring objectives, define the appropriate types of data, and specify the tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Based on the acceptable decision error of 5 percent, EPA identified DQOs for acceptable precision (10 percent coefficient of variation [CV]) and bias ($\pm$10 percent). Precision is estimated using the collocated precision data. Currently, 25 percent of every reporting organization’s routine $PM_{2.5}$ SLAMS monitoring sites are collocated with a second sampling instrument of the same method designation and provide a precision sample every 6 days.

The PEP provides the measurements upon which the bias component of the DQO is evaluated. In many environmental measurements, bias can be measured and evaluated by simply introducing standard reference material into a measurement phase and evaluating the results. Because currently there is no accurate way of introducing a known concentration of particles into a $PM_{2.5}$ FRM sampler, the PEP was developed to serve as closely as possible as a reference standard. In order to provide an adequate assessment of bias for a reporting organization over a 3-year period, 25 percent of routine monitoring sites are audited four times a year. Information regarding the sampling frequency requirements can be found in Section 7 of the PEP QAPP at (http://www.epa.gov/ttn/amtic/pmqainf.html).

The PEP performs the same data collection activities as the routine monitoring network and is required to meet or exceed the QA/quality control (QC) requirements specified for the routine monitoring network. These requirements are listed in Table 1-1. This report assesses the adherence to these measurement quality objectives.

Table 1-1. PEP Measurement Quality Objectives

Requirement	Frequency	Acceptance Criteria	40 CFR Reference	Lab/Field SOP Reference
Filter Holding Times				
Presampling	All filters	< 30 days before sampling	Part 50, App. L, Sec. 8.3	PEPL-4.01
Postsampling Weighing	All filters	< 10 days at 25°C from sample end date	Part 50, App. L, Sec. 8.3	PEPL-4.01
		< 30 days at 4°C from sample end date	Part 50, App. L, Sec. 8.3	PEPL-4.01
Reporting Units	All data	μg/m^3	Part 50.3	
Detection Limit				
Lower DL	All data	2 μg/m^3	Part 50, App. L, Sec. 3.1	
Upper Conc. Limit	All data	200 μg/m^3	Part 50, App. L, Sec. 3.2	
Data Completeness	Quarterly	75%	Part 50, App. N, Sec. 2.1	
Filter				
Visual Defect Check	All filters	See reference	Part 50, App. L, Sec. 6.0	PEPL-5.01
Filter Conditioning				
Environment	All filters	24 hours minimum	Part 50, App. L, Sec. 8.2	PEPL-6.01
Equilibration	All filters	20-23°C	Part 50, App. L, Sec. 8.2	PEPL-6.01
Temp. Range	All filters	± 2°C over 24 hours	Part 50, App. L, Sec. 8.2	PEPL-6.01
Temp. Control	All filters	30% – 40% RH	Part 50, App. L, Sec. 8.2	PEPL-6.01
Humidity Range	All filters	± 5% RH over 24 hours	Part 50, App. L, Sec. 8.2	PEPL-6.01
Humidity Control	3 filters per exposure lot	Less than 15 μg change between weighings	Part 50, App. L, Sec. 8.2	PEPL-6.01
Exposure Lot Blanks				

(continued)

Table 1-1. PEP Measurement Quality Objectives (continued)

Requirement	Frequency	Acceptance Criteria	40 CFR Reference	Lab/Field SOP Reference
Lab QC Checks				
Field Filter Blank	1/week/instrument	±30 µg change between weighings	Part 50, App. L, Sec 8.2	PEPF-10.01
Lab Filter Blank	10% or 1 per weighing session	±15 µg change between weighings ≤ 3 µg	Part 50, App. L, Sec 8.2	PEPL-8.01
Balance Check	Beginning/end of weighing session	±15 µg change between weighings		PEPL-8.01
Duplicate Filter Weighing	1 per weighing session, 1 carried over to next session			PEPL-8.01
Calibration/Verification				
Flow Rate (FR) Calibration	If multipoint failure	± 2% of transfer standard	Part 50, App. L, Sec. 9.2	PEPF-7.03
FR multipoint verification	1/yr	± 2% of transfer standard	Part 50, App. L, Sec. 9.2.5	PEPF-7.03
One-point FR verification	Every sampling event	± 4% of transfer standard		
External Leak Check	Every sampling event	80 mL/min	Part 50, App. L, Sec. 7.4	PEPF-6.04
Internal Leak Check	Upon failure of external	80 mL/min	Part 50, App. L, Sec. 7.4	PEPF-6.01
Temperature Calibration	If multi-point failure	± 2% of standard	Part 50, App. L, Sec. 9.3	PEPF-6.01
Temp Multipoint Verification	On installation, then 1/yr	± 2°C of standard	Part 50, App. L, Sec. 9.3	PEPF-7.02
One-point temp Verification	1/week	± 4°C of standard	Part 50, App. L, Sec. 9.3	PEPF-7.02
Pressure Calibration	1/yr, or one point failure	±10 mm Hg	Part 50, App. L, Sec. 9.3	PEPF-6.03
Pressure Verification	1/week	±10 mm Hg	Part 50, App. L, Sec. 9.3	PEPF-7.01
Clock/timer Verification	1/week	1 min/mo	Part 50, App. L, Sec. 7.4	PEPF-6.02
Accuracy				
Flow Rate Audit	4/yr (manual)	± 4% of audit standard	Part 58, App. A, Sec. 3.5.1	PEPF-10.01
External Leak Check	4/yr	< 80 mL/min	Not described	PEPF-10.01
Internal Leak Check	4/yr	< 80 mL/min	Not described	PEPF-10.01
Temperature Audit	4/yr	± 2°C	Not described	PEPF-10.01
Pressure Audit	4/yr	±10 mm Hg	Not described	PEPF-10.01
Balance Audit	1/yr	Manufacturers specs.	Not described	PEPF-10.01

(continued)

Table 1-1. PEP Measurement Quality Objectives (continued)

Requirement	Frequency	Acceptance Criteria	40 CFR Reference	Lab/Field SOP Reference
Precision				
Collocated samples				
Paired	1/month	CV $\leq$ 10%		PEPF-10.01
All samplers in Region	1/yr	CV $\leq$ 10%		PEPF-10.01
Calibration & Check Standards				
Flow Rate Transfer Std.	1/yr	$\pm$2% of NIST-traceable Std.	Part 50, App. L, Sec. 9.1 and 9.2	PEPF-10.01
Field Thermometer	1/yr	$\pm$ 0.1° C resolution	Not described	PEPF-10.01
		$\pm$ 0.5° C accuracy	Not described	
Field Barometer	1/yr	$\pm$ 1 mm Hg resolution	Not described	
		$\pm$ 5 mm Hg accuracy	Not described	PEPF-10.01
Working Mass Stds.	3-6 months	0.025 mg	Not described	PEPL-7.01
Primary Mass Stds.	1/yr	0.025 mg	Not described	PEPL-7.01

1.2 The National Performance Evaluation Program

A performance evaluation is defined as an audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory. In the case of the PEP, the goal is to evaluate total measurement system bias, which includes measurement uncertainties from the field and the laboratory activities. The pertinent regulations for this performance evaluation are found in 40 CFR Part 58, Appendix A, Section 3.5.3. The strategy is to collocate a portable FRM $PM_{2.5}$ air sampling instrument within 1 m to 4 m of a routine SLAMS air monitoring instrument, operate both monitors as required by the FRM and standard operating procedures (SOPs), and compare the results.

Implementation of the PEP is a state/local responsibility. However, in response to a number of comments made during the review period for the December 13, 1996, $PM_{2.5}$ NAAQS proposal, EPA assessed the PEP and

- Modified the system to include an independent FRM performance evaluation
- Reduced the burden of this program by changing the audit frequency from all sites to 25 percent of the $PM_{2.5}$ sites
- Reduced the audit frequency from six times per year to four times per year
- Made allowances to shift the implementation burden from the state, local, and tribal agencies to the federal government.

From August through October 1997, EPA discussed the possibility of federal implementation with the EPA Regions, Standing Air Monitoring Work Group (SAMWG), and various state and local monitoring organizations. The majority of the responses from these organizations favored federal implementation of the PEP.

EPA investigated potential contracting mechanisms to assist in the implementation of this activity and used the Environmental Services Assistance Team (ESAT) contract, currently in place in each Region, to provide the necessary field and laboratory activities. The ESAT contract is implemented by EPA’s Office of Emergency and Remedial Response (OERR) and has the capacity and scope to serve in the audit function. OAQPS entered into a memorandum of agreement with OERR to use the ESAT contract, which was signed by both parties in June 1999. Each EPA Region implements the field component of this activity; Regions 4 and 10 also operate the laboratory component. Section 2 provides additional information on the training and certification aspects of the ESAT field and laboratory personnel.

Prior to any PEP implementation activities, EPA developed an Implementation Plan (August 1998), field and laboratory SOPs (November 1998), and a QAPP (March 1999). These documents are posted at (http://www.epa.gov/ttn/amtic/pmqainf.html) and provide the details of this program.

The FRM performance evaluation includes both a field component and a laboratory component. The following information provides a brief description of these activities. Detailed SOPs have been developed for all field and laboratory activities and have been distributed to all field and laboratory personnel. Figure 1-1 shows the five basic steps of the PEP:

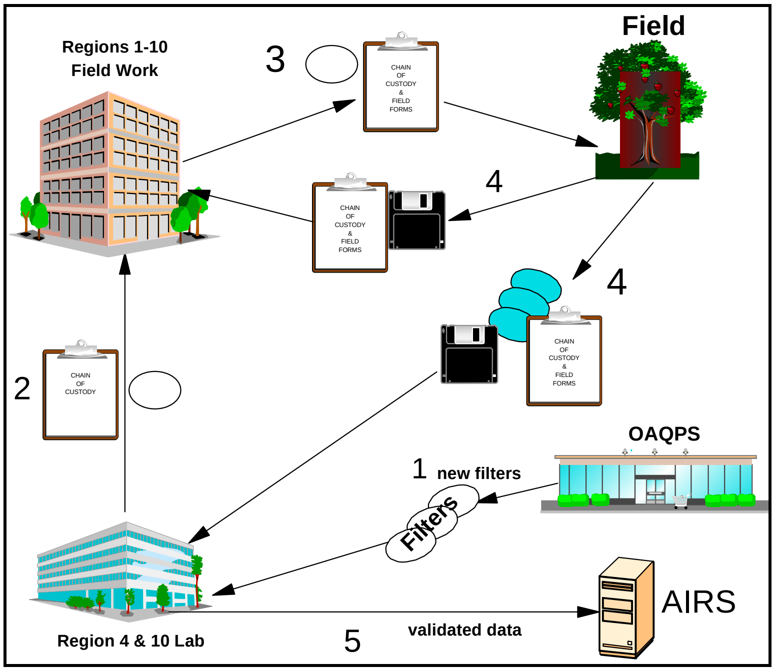

Figure 1-1. Performance Evaluation Program implementation summary.

1. EPA sends filters to Region 4 and Region 10 laboratories, where they are inventoried, inspected, equilibrated, weighed, and prepared for the field.

2. Region 4 and Region 10 laboratories ship or deliver the filters and accompanying chain-of-custody documents to all Regions.

3. Field scientists take the filters, field forms, and chain of custodies to the field and operate the portable FRM monitor.

4. Field scientists send the filters, data, field forms, and chain-of-custody documents back to the appropriate laboratory, while keeping a set of data and records.

5. Region 4 and Region 10 laboratories receive, equilibrate, and weigh filters; validate data; and upload data into the EPA's Aerometric Information Retrieval System (AIRS) database.

1.3 PEP Field Activities

The FRM portable audit samplers are used in a collocated manner to perform the evaluations. These samplers have been approved by EPA as a FRM sampler and are designed to be durable, rugged, and capable of frequent transport. These samplers are constructed in sections, with each section weighing no more than 40 pounds. Although these samplers have been specifically designed to perform these evaluations, precautions must still be taken to ensure the quality of the data. Detailed instructions are found in the SOPs that were developed specifically for this program.

The following activities are covered in detail in the field SOPs:

- A trained operator transports a portable $PM_{2.5}$ FRM performance evaluation sampling device to an established SLAMS $PM_{2.5}$ site within an EPA region.
- The operator assembles the instrument; collocates the sampler; performs time, barometric pressure, temperature, and flow verifications; installs a filter; and operates the instrument from midnight to midnight on the same scheduled sampling day as the SLAMS primary sampler.
- If scheduling permits, the operator leaves this location to set up additional 24-hour performance evaluations at other sampling locations. If the schedule does not allow for sampling other sites, the operator performs additional activities at the original site.
- At the conclusion of the 24-hour sampling time, the operator reviews the run data, downloads the stored electronic monitoring data, removes and properly stores the filter for transport, and disassembles the sampling instrument.
- The operator properly packages the filter and data for shipment to the laboratory.

1.4 Laboratory Activities

The PEP also requires extensive laboratory activities, including filter handling, inspection, equilibration, weighing, data entry/management, and archiving. Regions 4 and 10 implement the laboratories for this program.

The presampling weighing SOPs in the laboratory are as follows:

- Filters are received from EPA and examined for integrity.
- Filters are enumerated for data entry.
- Filters are equilibrated and weighed.
- Filters are prepared for field activities or stored.
- The laboratory develops and maintains shipping/receiving equipment, including containers, cold packs, max/min thermometers, and chain-of-custody requirements/documentation.

Postsampling weighing SOPs in the laboratory include the following:

- Filters are received in the laboratory, checked for integrity (damage, temperature, etc.) and logged in.
- Filters are archived (cold storage) until ready for weighing.

- Filters are brought into the weighing facility and equilibrated for 24-hours.
- Filters are weighed and data are entered.
- Field data are entered into the data entry system in order to calculate a concentration.
- Filters are archived for 3 years.
- Required data are transferred to the AIRS database.

This page intentionally left blank.

2.0 Implementation Aspects

2.1 Training and Certification

Once ESAT contract personnel are assigned to the PEP, training courses are utilized to instruct field and laboratory personnel using the respective field and laboratory SOPs as prescribed by the $PM_{2.5}$ Monitoring Implementation Plan. These courses involve four phases:

- **Classroom Lecture.** This lecture provides an overall review of the $PM_{2.5}$ program, its relation to the PEP, and relevant information about the SOPs.

- **Hands-On Activities.** After the classroom lecture, trainees view demonstrations of field and laboratory activities. They then perform these activities under supervision and instruction.

- **Certification by Written Examination.** Trainees take a written test that covers the activities of importance in each of the SOP sections.

- **Certification by Performance Evaluation.** Trainees perform hands-on activities and are evaluated on the actual field/lab activities.

During training, each trainee reviews relevant documents, including the SOPs and other required binders and forms.

2.1.1 Field Training

All personnel expected to perform field activities, including supervisors of field personnel (work assignment managers, or WAMs), are required to be PEP certified. Typically, field training lasts 3 days: 2 days of lecture and hands-on training, and 1 day of testing. The training regimen stresses the importance of strict adherence to SOPs in order to maintain data quality, consistency, and comparability. Relatively tight measures are implemented to minimize the potential for contamination, operator error, or other mechanisms that may lead to inaccurate data. Field training is provided on the following discrete modules:

- Planning and Preparation
- Filter Cassette Receipt, Storage, and Handling
- Sampler Transport and Siting
- Sampler Assembly and Maintenance
- Verifications and Calibrations
- Sample Filter Handling
- Chain of Custody and Field Data Sheets

- Quality Assurance and Quality Control
- Information Retention.

2.1.2 Laboratory Training

All personnel expected to perform laboratory activities, including supervisors of laboratory personnel (WAMs), are required to be PEP certified. Typically, training lasts 3 days: 2 days of lecture and hands-on training, and 1 day of testing. The training regimen stresses the importance of strict adherence to SOPs. Consequently, the PEP is a reliable and repeatable auditing operation. Relatively tight measures are implemented to minimize the potential for contamination, operator error, or other mechanisms that may lead to inaccurate data. Laboratory training is provided on the following discrete modules:

- General Laboratory Preparation
- Equipment Inventory and Maintenance
- Communications
- Filter Handling
- Filter Conditioning
- Calibrations
- Filter Weighing
- Filter Shipping
- Chain of Custody
- Data Entry and Data Transfer
- Quality Assurance and Quality Control
- Storage and Archiving.

2.1.3 Certifications

Certifications are required in order to ensure that field and laboratory personnel are sufficiently trained to perform the necessary PEP activities at a level that does not compromise data quality and also inspires confidence in the PEP from state, local, and tribal agencies.

Both the written exam and the performance test are required for certification. The written exam reviews critical aspects of the PEP and is designed to identify where individuals need additional training. The written test requires a grade of 90 percent or higher to pass. The performance evaluation focuses on whether the individual understands and follows the SOPs.

The intent of certification activities is to ensure that the PEP is implemented comparably across the nation. If many trainees fail a particular module, their failure may indicate that the classroom and hands-on training for that module is inadequate or is not appropriate. In any case, trainees who fail a module are required to attend additional training on that module. If the certification or retraining activities identify individuals who appear incapable of performing the field laboratory activities, the ESAT Regional Project Officers is notified and appropriate action taken.

In addition to scheduled certification training, other training opportunities are available to address the need to train new personnel due to employee turnover:

- Because WAMs are trained and certified, they are allowed to provide training when necessary
- OAQPS at the EPA facility in Research Triangle Park, NC, provides individual training
- OAQPS occasionally conducts a 3-day training course when demand is sufficient.

2.1.4 Certified Personnel Information

Since implementation in 1999, the PEP has provided seven OAQPS-led training courses, five for field scientists and two for laboratory analysts. Approximately 95 people have been trained and certified for field or laboratory activities, or both. PEP also has provided individual training, allowing new personnel to become certified promptly. In addition to the OAQPS-led training for individuals, regional WAMs have trained new personnel hired as the result of staff turnover. These training options have prevented disruption of PEP activities due to lack of qualified personnel.

In addition to initial training, OAQPS held a mandatory “re-certification” course in April 2002 at the Region 6 offices in Houston, TX. During this course, 27 field and laboratory personnel were briefed on changes made to their field SOPs and participated in lectures and discussions about the overall operations of the PEP. The personnel were also required to pass a revised written exam and performance evaluation, in the same manner as when they were initially trained.

2.2 Laboratory QA Requirements

The $PM_{2.5}$ PEP laboratories in Regions 4 and 10 are the primary support facilities for $PM_{2.5}$ filter analysis. Additional facility space is dedicated at each lab to long-term archiving of filters. The weigh room/laboratory is used for both presampling weighing and postsampling weighing of each $PM_{2.5}$ filter sample. The facilities in Regions 4 and 10 have been constructed to minimize contamination from dust or other potential contaminants, and they have restricted access, limited to laboratory analysts who wear appropriate laboratory attire at all times.

Specific requirements for environmental control of the conditioning/weigh room laboratory are described in 40 CFR Part 50 Appendix L. Temperature is controlled, maintained between 20°C and 23°C with a standard deviation within ± 2°C. Humidity is also controlled, ranging from 30 percent to 40 percent relative humidity with a standard deviation of ± 5 percent. Between preweighing and postweighing sessions, humidity must not differ by more than 5 percent. Temperature and relative humidity are measured and recorded continuously during equilibration. The balance, which has readability and repeatability of 1 µg, is located on a vibration-free table and is protected from air drafts. Filters are inspected for visual defects before use. Filters are conditioned before both the presampling and the postsampling weighing sessions. Filters must be conditioned for at least 24 hours prior to weighing to allow for equilibration to laboratory conditions. During this process, the temperature cannot change more than ± 2°C.

2.2.1 Laboratory QC Checks

To ensure the quality of the data coming from the laboratory, mainly targeting measurement uncertainties, QC procedures are used on a daily basis through the use of various check samples or instrumentation for comparison. These procedures are included in the laboratory SOPs and cover five major areas:

- **Blanks –** Blanks are used to determine contamination arising from four main sources: the environment from which the sample was collected/analyzed; the reagents used in analysis; the apparatus used; and the operator/analyst performing the operation. To cover these issues, the PEP uses five types of blanks:

  Lot blanks are used to reference a group (lot) of filters manufactured from the same stock with similar properties. For each lot received by the laboratory, three boxes are randomly selected. Each box contains 50 filters, and 3 filters from each box are then selected to become lot blanks. The lot blanks are weighed every 24 hours for a minimum of 1 week to determine the length of time it takes to condition the filters, after which the lot of filters may be used for routine laboratory operations (these filters never leaves the laboratory).

  Lot exposure blanks are similar to lot blanks. They are used to determine whether a specific set of filters to be conditioned at one time are stable for weighing. These filters never leave the laboratory.

  Lab blanks provide an estimate of contamination occurring at the weighing facility or during other laboratory operations and are used during every weighing session. These filters never leave the laboratory.

  Field blanks provide an estimate of measurement system contamination. By comparing information from laboratory blanks against field blanks, one can assess contamination from field activities.

  Trip blanks provide an estimate of measurement system contamination, except for contamination from field operations, allowing an assessment of contamination from all laboratory and shipping activities. A trip blank is sent from laboratory to the field and back to the lab without ever being opened or used in the field. Otherwise, it is subjected to the same conditions as all other filters used in routine operations.

- **Calibration/verification –** By comparing measurement standards or instruments with those used in daily laboratory operations, the bias of the laboratory instruments is determined. The purpose of these calibrations is to minimize bias from instrument inaccuracies. The laboratory instrumentation is verified against National Institute of Standards and Technology (NIST) traceable standards to determine the bias, and if needed, a laboratory instrumentation is calibrated to ensure accurate measurements. This procedure is applied annually to the balance and quarterly to the temperature and relative humidity instrumentation used in the laboratory.

- **Accuracy –** Accuracy is determined by performing an annual balance audit and by performing balance checks every time the laboratory analyst begins and ends weighing a batch of filters.

- **Calibration standards –** Use of these standards assure that the balance is consistent. This is done by comparing the working standards to the primary standards on a quarterly basis. Also, the primary standards are verified annually, along with the working standards, by a certified third party using NIST traceable standards.

- **Precision –** Precision is determined by a duplicate filter-weighing procedure, in which a filter weighed during a weighing session is weighed again at the end, in order to compare two readings that should be approximately the same. In the PEP, a filter from a previously weighed batch is weighed at the end of the next batch as another way to demonstrate precision. In addition, a single set of filters is weighed at another facility to allow for interlaboratory comparisons, which can be used to determine precision.

2.2.2 Laboratory Technical Systems Audits

The ideal assessment schedule for the PEP, as specified in the QAPP, is for each region to have audits and reviews on a regular schedule. Technical systems audits (TSAs) performed by the WAM occur twice a year, while TSA performed by OAQPS occurs once a year. A laboratory TSA addresses program management and laboratory operations. Program management includes:

- Organization, staffing, and training
- Documentation
- Facilities.

Laboratory operations included in a TSA are the following:

- Lab preparation
- Equipment inventory, procurement, and maintenance
- Communication
- Filter handling, inventory, and inspection
- Filter conditioning
- Calibrations
- Filter weighing
- Shipping
- Chain of custody
- QA/QC
- Filter archive.

Data and Data Management

The Region 4 and Region 10 laboratories were each audited once during the 3-year period from 1999 to 2001 to ensure that they were properly addressing any remaining implementation issues and following standard operating procedures. The audits took place soon after personnel had been trained and before any staff turnover had occurred. Since the original audits, some staff turnover has occurred, and this turnover has either maintained or improved laboratory compliance with SOPs. Each laboratory was audited again in 2002, but the results of those audits are outside the scope of this report.

The most common issue uncovered by the initial laboratory audits was a lack of standardized processes being followed to record, maintain, and file data (in some cases, laboratories used slightly different methods for these tasks, and in some cases, they failed to perform these tasks altogether). Once the results of the audits were released, the laboratories corrected the problems to bring themselves into compliance with SOPs and OAQPS guidance. The only exception was that Region 10 lacked recorded data for standard deviation for temperature and humidity until 2001 when an automated data logger was installed.

Another common issue during the initial startup phase of program implementation was maintaining laboratory controls. The laboratories sometimes failed to follow proper procedures for using equipment and ensuring appropriate filter equilibration times in the laboratory. As laboratories became more familiar with the procedures, however, initial control problems were rectified, and after initialization, the laboratories performed well.

2.2.3 Data Validation

Data validation is a combination of determining that data processing operations have been carried out correctly, as well as monitoring the quality of the field and laboratory operations. Data validation can identify problems in either of these areas. The primary tool used to validate data is the Performance Evaluation Database (PED). The PED is where all $PM_{2.5}$ PEP data are stored, and it includes a large array of validation checks to aid during data review. Additional methods such as trend charting and spreadsheet analysis are also implemented. Once field or laboratory problems are identified, the data can be corrected or invalidated, and corrective actions can be taken accordingly. Flags denoting error conditions or QA status are saved as separate fields in the database, allowing recovery of the original data. Stored and archived PEP numerical data are never internally overwritten by condition flags. The following functions are carried out to ensure the quality of data entry and data processing operations:

- **A 100 percent data review –** All filter weight reports, field data sheets, and chain of custody sheets are reviewed by the laboratory analyst or EPA. Random oversight reviews by EPA occur once a month. Both electronic and hard copy materials are reviewed.
- **Range checks –** Almost all monitored parameters are checked by the PED for simple range checks. Examples include sample run times and temperatures. The data entry operator is notified immediately when an entry is out of typical or acceptable ranges. The operator has the option of correcting the entry or overriding the range limit. The specific values used for range checks may vary depending on the season and other factors. Because the range limits are not

regulatory requirements, the appropriate QA officers may occasionally adjust range limits to meet quality goals better.

- **Completeness checks –** When the data are processed, certain completeness criteria must be met. For example, each filter must have a start time, an end time, an associated average flow rate, dates of weighing, operator names, and so forth. At a minimum, field data sheets, chain of custody forms, and preweighing or postweighing data entry forms must be filled out completely.

- **Internal consistency and other checks –** Several other internal consistency checks are built into the PEP $PM_{2.5}$ database. For example, the end time of a filter must be later than the filter's start time. Computed filter volume (integrated flow) must be approximately equal to the exposure time multiplied by the nominal flow.

- **Data retention –** Raw data sheets are retained on file in the laboratory files for a minimum of 3 years and are readily available for audits and data verification activities. After 3 years, hardcopy records and computer backup media are cataloged and boxed for storage at the OAQPS. The laboratory analyst will request instructions from OAQPS on the disposition of archived sample filters.

- **Statistical data checks –** Errors found during statistical screening are traced back to original data entry files and to the raw data sheets, if necessary. These checks are run on a monthly schedule and before any data submission to AIRS. Data validation is the process by which raw data are screened and assessed before they can be included in the main database.

- **Sample batch data validation –** This process associates flags that are generated by QC values outside of acceptance criteria with a sample batch. Batches containing too many flags are rerun or invalidated.

- **Regional audit comparisons –** Comparisons of the PEP collected concentrations against the state or local site concentrations during an audit may reveal large percentage differences and coefficients of variation signifying a potential problem. Re-weighs of suspect filters, run data reviews, and weighing session data reviews may be needed to investigate. PEP values are not invalidated based on state and local comparisons, but these comparisons can be a useful screening tool for identifying data problems.

2.3 Field QA Requirements

As soon as filters arrive at a field office from the laboratory, the field scientist (FS) is responsible for minimizing measurement uncertainties until any particular filter is shipped back to the laboratory for analysis. This responsibility includes storage and use of unused preweighed filters; proper filter field handling and sampling operations; proper use of tracking forms and associated sample run data; and proper shipment of used filters, run data, and forms back to the laboratory.

2.3.1 Field QC Checks

To ensure the quality of the data coming from the field, mainly targeting measurement uncertainties, QC procedures are used on a regular basis through the implementation of various checks, verifications, and comparison work. These procedures are included in the field SOPs and cover four major areas:

- **Verification and Calibration Standards –** Prior to using the sampler, the FS uses a NIST traceable flow-rate transfer standard, temperature standard, and barometric pressure standard to verify that a particular $PM_{2.5}$ monitor is within acceptable ranges for sensing flow rate, temperature, and barometric pressure. This is important because $PM_{2.5}$ monitors control flow rates with active flow control, which uses ambient temperature and pressure to determine flow rates. All three of these NIST traceable standards are recertified annually (see Section 2.3.2) and have the following acceptance criteria for use in the field:

    1. Flow rate transfer standard: ± 2 percent of NIST traceable standard
    2. Temperature standard: ± 0.1°C resolution and ± 0.5°C accuracy
    3. Barometric pressure standard: ± 1 mmHg resolution and ± 5 mmHg accuracy.

- **Accuracy –** In order to ensure accurate operation of the $PM_{2.5}$ instrument, certain verifications are performed each time the instrument is set to perform a sampling event. If these verifications fail, calibrations to the sampler may be necessary. The FS uses the NIST traceable verification and calibration standards to verify the sampler readings. These activities include the following:

    Clock/timer verification is performed prior to every sampling event; the sampler clock/timer must be within 1 minute of local standard time.

    External leak check is performed prior to every sampling event; the sampler must not leak more than 80 mL/min in order to be usable for sampling.

    Ambient and filter temperature verification is performed prior to every sampling event; the sampler must sense temperatures within ± 2°C of the standard in order to be usable for sampling.

    Ambient pressure verification is performed prior to every sampling event; the sampler must sense pressure within ± 10 mmHg of the standard in order to be usable for sampling.

    Flow rate verification is performed prior to every sampling event; the sampler must draw a flow rate that is within ± 4 percent of the standard indicated flow rate and 5% of target flow rate (16.67 Lpm) in order to be usable for sampling.

    Internal leak check is performed diagnostically after failure of external leak check; the sampler must not leak more than 80 mL/min.

    Pressure sensor calibration is performed after failure of pressure verification; sampler sensors calibrated to match readings of standard.

Temperature sensor calibration is performed after failure of temperature verification; sampler sensors calibrated to match readings of standard.

Flow rate calibration is performed after failure of flow rate verification; sampler flow rate calibration adjusted to target 16.67 Lpm as indicated by flow rate standard.

- **Blanks –** In the field, there are two types of blanks that may be used: field blanks and trip blanks. Field blanks are used once per week per FS. The field blank is handled as any other routine filter except that once it is placed inside the sampler, it is immediately removed and bagged and placed in a safe place, typically inside the sampler housing, until routine filter recovery. Upon recovery, the field blank is treated as any other routine filter and shipped back to the lab. The field blank allows checking for contamination that may occur while a filter is handled during any aspect of field operations. A trip blank is a filter shipped from the lab to the field and then back to the lab without ever being opened while in the field. This blank allows checking for contamination that may occur during handling while in the lab.

  Figure 2-1 and Figure 2-2 present the filter weight differences for the field blanks from Regions 4 and 10. The data have been grouped into quarterly intervals and presented in a box-and-whisker format. In the charts, the high-low lines indicate the 95^{th} and 5^{th} percentiles. The top and bottom of the boxes represent the 75^{th} and 25^{th} percentiles. For calendar years 1999 to 2001, the 25^{th} through 75^{th} percentile range for the field blanks stayed within the QC limit of $\pm$ 30 µg. Appendix B presents additional charts for the field blanks, along with summary statistics.

- **Precision checks –** To review the precision of the PEP, there are monthly, quarterly, and annual collocations of PEP instruments. Monthly, it is prescribed that any set of monitors be paired together while a field scientist is auditing a state or local site. Quarterly, it is prescribed that all monitors of the same make (if applicable) in a PEP region be collocated for three 24-hour periods. Annually, it is prescribed that all monitors used in a PEP region be collocated for three 24-hour periods. These collocations should provide precision data that should not have a coefficient of variation greater than 10 percent.

2.3.2 Standards Certifications

Establishment of the PEP for EPA's ambient $PM_{2.5}$ air monitoring network requires specialized field equipment. This equipment is used by field scientists to calibrate and verify $PM_{2.5}$ samplers for temperature, barometric pressure, and volumetric flow measurements. By verifying that these measurements are within acceptance criteria, the field scientists can ensure that the $PM_{2.5}$ data are of high quality.

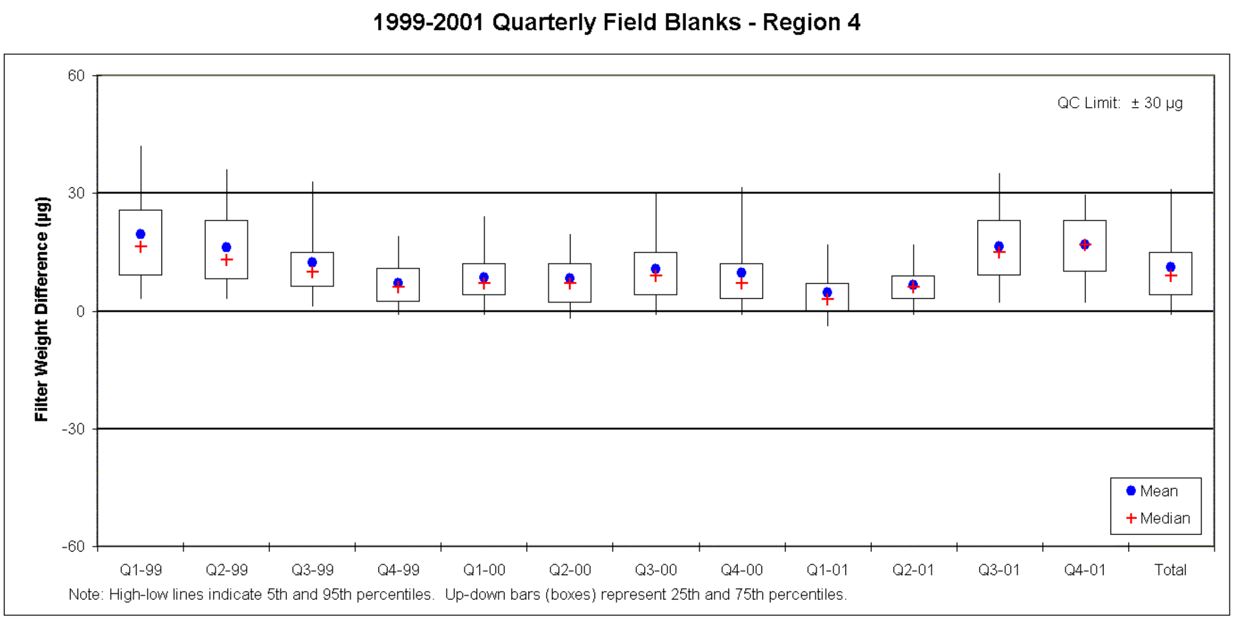

Figure 2-1. Field blank data from Region 4 weighing laboratory.

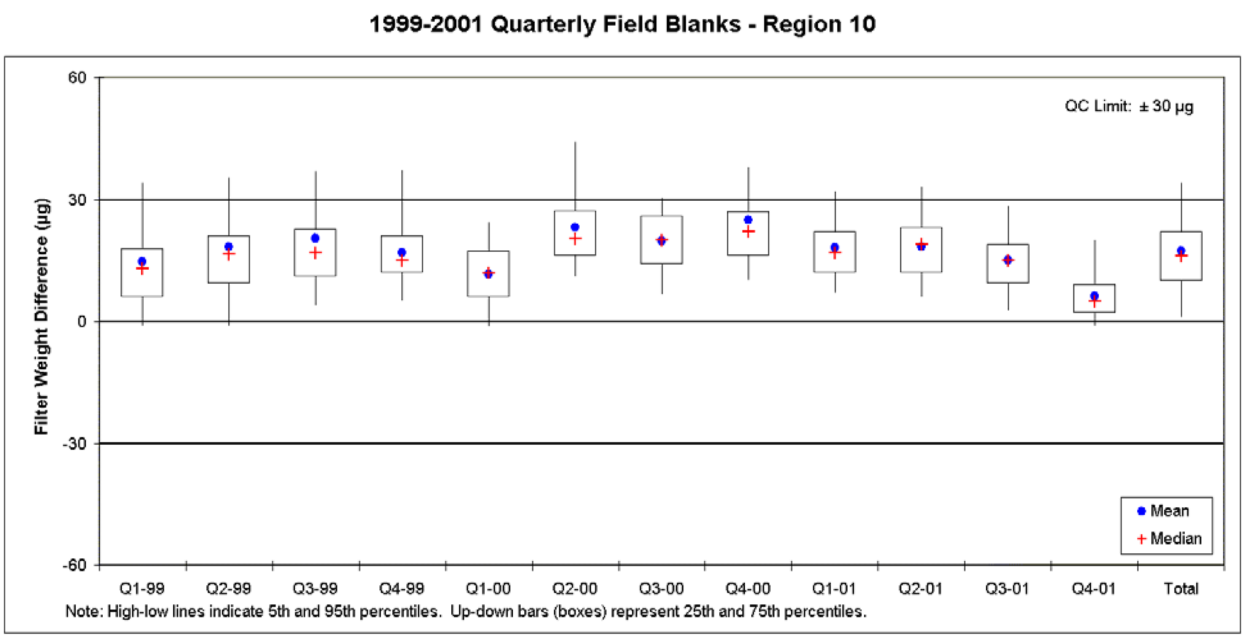

Figure 2-2. Field blank data from Region 10 weighing laboratory.

Each field scientist possesses a primary standard and a verification standard for measuring temperature, barometric pressure, and volumetric flow rate. The verification standards are used in the field by the scientist to perform single point verifications and are collectively designated as "calibration standards" for this discussion. The primary standards are maintained in the field scientist's laboratory to perform annual multipoint verifications of the samplers and calibrations, if there is field verification failure.

The calibration standards require annual recertification and NIST traceability. The purpose of requiring NIST traceability is to ensure that $PM_{2.5}$ measurements are accurate (within the uncertainties of the measurement and the calibration standard). NIST certifies a calibration standard by providing calibration values accompanied by the uncertainties associated with its reference standards, the comparison methods, the operators, and the physical environment (e.g., pressure, temperature, and humidity) in which the measurements are made at NIST.

Table 2-1 displays three measurement parameters, the types of calibration standards that are used by the field scientists, and the QA acceptance criteria established by EPA for the calibration standards. The acceptance criteria were established by EPA to ensure that the combined uncertainty of the standards themselves and the calibrations and verifications in the field do not exceed the allowable uncertainty for the measurement parameters in the $PM_{2.5}$ samplers in the national network.

Table 2-1. QA Acceptance Criteria for the PEP Calibration Standards

Parameter	Type of Calibration Standard	QA Objective Acceptance Criterion[a]
Temperature	Digital thermometer and probe	±0.5°C
Pressure	Digital pressure gauges, pressure calibrators, and pressure verification devices	±0.7%[b]
Flow rate	Flow transfer standards, dry gas meters, and primary flow meters	±2%

[a] Acceptance criteria from Table 16-1 of Element 16 in the February 1999 edition of the *Quality Assurance Project Plan for the $PM_{2.5}$ Performance Evaluation Program*.
[b] The pressure criteria (±5 mm Hg) given in the February 1999 edition of the *Quality Assurance Project Plan for the $PM_{2.5}$ Performance Evaluation Program* is ±0.7% (5 mm/760 mm) at 1 atmosphere.

The main advantage of the annual recertification program is that it enhances the defensibility of PEP audits and $PM_{2.5}$ measurements by eliminating one source of measurement uncertainty. The centralized recertification of all audit standards helps to ensure that $PM_{2.5}$ measurements across the country are comparable and traceable to NIST. Additionally, there is an economy of scale advantage associated with recertifying many audit standards in the same metrology laboratory.

Program Implementation

The following metrology laboratories participated in the recertification program: ORD Metrology Laboratory, Colorado Engineering Experimental Station, Inc. (CEESI), Chinook Engineering, and Thermo Andersen (formerly Andersen Instruments, Inc.). Under contract to

EPA OAQPS, Research Triangle Institute (RTI) evaluated commercial and governmental metrology laboratories that provide NIST traceability for instrumentation. The selection criteria are included in Appendix A.

During 1999, the ORD Metrology Laboratory performed recertifications on the digital pressure gauges, digital thermometers/probes, pressure verification devices, and pressure calibration devices. Thermo Andersen conducted recertifications on the dry gas meters, and Chinook Engineering performed recertifications on the flow transfer standards and electronic manometers.

During 2000, EPA used CEESI instead of Chinook Engineering to perform recertifications on the flow transfer standards and the electronic manometers. CEESI was the laboratory that recertified the critical flow venturis used by Chinook Engineering as its reference standards. EPA decided to select CEESI to reduce the uncertainty of flow measurements of the flow transfer standards. The ORD Metrology Laboratory performed recertifications on the digital pressure gauges, digital thermometers/probes, pressure verification devices, and pressure calibration devices. Thermo Andersen conducted recertifications on the dry gas meters.

Prior to 2001, the ORD Metrology Laboratory purchased a flow rate reference standard that satisfied the $PM_{2.5}$ PEP acceptance criteria. Based on the August 1999 report, *Strategy Plan for Recertification of Calibration Standards for the EPA $PM_{2.5}$ Performance Evaluation Program*, plans called for the ORD Metrology Laboratory to conduct all the recertifications if it could increase its manpower and if the laboratory could obtain a flow rate measuring standard. The laboratory addressed those concerns. Thus, EPA decided that the ORD Metrology Laboratory would perform all of the recertifications of the calibration standards.

Recertification Procedures and Schedule

Two rounds of recertifications occurred each year to allow the field scientists to have at least one of each type of calibration standard on hand at all times. A schedule to accommodate two rounds of recertifications and an inventory were sent to the regional contact person, who submitted any corrections to the inventory. Revised inventories were generated and submitted to the regional contacts, accompanied with a schedule for shipping the calibration standards. A list of the calibration standards based on each round, along with a tentative schedule, was sent to the metrology laboratories.

After EPA made arrangements with the metrology laboratories, coolers were shipped with a cover letter, packing slips, FedEx return shipping form, and packing material to the 10 regional contacts and OAQPS (which maintained some spare calibration standards). The cover letter explained the recertification plan and included instructions for packing and shipping the standards. The packing slip identified each standard by type, manufacturer, model number, and serial number, and had basic contact information. The contact person was required to initial and date the packing slip, verify the FedEx tracking number, add any comments about standards being sent, pack the cooler securely with packing material, and return the equipment to be recertified.

Within a 10-day period, equipment was received from the 10 Regions and OAQPS. The information regarding each standard was entered into a Microsoft Access database. The standards were grouped by instrument type and packed into coolers with packing slips. The standards were then shipped to the appropriate metrology laboratory.

After approximately a month, the metrology laboratories returned the newly recertified standards with updated certificates. Relevant data were entered into a Microsoft Access database. The calibration standards were regrouped into their appropriate Regions and prepared for shipping. The newly recertified standards, their certificates, and additional information from the metrology laboratories were sent back to the regional contacts to conclude Round 1 of the recertification process.

An envelope containing a cover letter, packing slip, and a return shipping form for Round 2 calibration standards was included with the Round 2 shipment. Within 10 days, the Round 2 calibration standards were received from the 10 Regions and OAQPS and entered the information into the recertification database and the recertification procedure was implemented similar to Round 1.

Recertification Database

The recertification database was created using calibration standard inventories from the 10 EPA Regions and OAQPS. Relevant data included the certification date, expiration date, and the name, address, and telephone number for the company that certified the calibration standard. A contact person was assigned from each Region and OAQPS to handle the shipping and receiving of the calibration standards. Contact information for each regional contact person was also entered.

The recertification database was used for creating the reports and inventories for EPA. The database documents that audit standards are traceable to NIST. This allows EPA to monitor the standards certification status and helps to ensure that they are recertified at proper intervals. The database tracks shipments to ensure that each standard is returned to the correct regional office. It can also be used to store test results from each recertification that might assist in evaluating any trends or anomalies, such as the flow transfer standards shifting response from the initial certificate to 2001 recertifications.

Results in Brief

Over the past 3 years, the recertification of the $PM_{2.5}$ PEP calibration standards experienced some transition. Three metrology laboratories performed the initial recertification in 1999. The recommendations at that time were to find a metrology laboratory that could handle the different types of calibration standards and have the laboratory provide an “as-received” reading. This reading could be used to establish any change in the standards from the previous certification or recertification. It would also let EPA know at the end of a recertification period (1 year) if the standard was still operating inside the $PM_{2.5}$ PEP acceptance criteria.

After the 2000 recertifications were completed, a problem was diagnosed with the digital pressure gauges. During 1999, six of the 10 gauges failed to meet $PM_{2.5}$ PEP acceptance criteria.

After 2000, seven of the 12 gauges were outside the criteria. The pattern continued during 2001 with six of the 12 gauges outside the specifications. The calibration standard does not seem to hold its calibration. When and how this occurs is uncertain.

From 1999 through 2001, there were 407 evaluations for recertification of the PEP calibration standards (see Table 2-2) of which 397 recertifications successfully met acceptance criteria. During 1999, 106 of the 112 calibration standards listed on the inventory were recertified successfully. Of the six calibration standards that were not recertified, one digital pressure gauge and one pressure verification device were not sent to RTI for recertification, the LCD readout of three digital thermometers/probes were broken when received at RTI, and one temperature probe was not working properly when received at the metrology laboratory.

Table 2-2. Manufacturer and Model Numbers of PM$_{2.5}$ PEP Standards Successfully Recertified from 1999 to 2001

			Number of Standards		
Type of Instrument	**Manufacturer**	**Model Number**	**1999**	**2000**	**2001**
Digital pressure gauges	Psi-Tronix	PG2000	10	9	12
Pressure verification devices	Druck	DPI 705 & DPI 740	5	15	17
Pressure calibration devices	Meriam	LP200I	13	13	13
Flow transfer standards	Chinook	Streamline FTS	25	30	31
Electronic manometers	Dwyer	Series 475 Mark III	24	29	30
Dry gas meters	Schlumberger	Galus 1.6	11	13	13
Primary flow meters	BIOS	DC-L40K	[a]	[a]	11
Digital thermometers	Control Company	4000	18	27	28
Temperature probes	Control Company	61220-604	[b]	[b]	[b]
Max/min digital thermometers[c]	Control Company	4121	133	133	133
		Total[d]	106	136	155

[a] The primary flow meters were not recertified during 1999 and 2000.
[b] The digital thermometers and probes act as a single system and are considered as one calibration standard.
[c] The max/min thermometers were not recertified during any of the 3 years.
[d] This total represents the number of successful recertifications excluding the max/min thermometers.

During 2000, 139 calibration standards were tested for recertification, of which 136 were recertified successfully. Three digital pressure gauges were not recertified because they would not maintain the calibration after zero and span adjustments were performed. During 2001, 156 calibration standards were tested, of which 155 were recertified successfully. One pressure verification device was not recertified because a sensor was damaged during calibration—the sensor support inside the standard failed when a connection fitting was being removed. Please refer to Attachment A for a complete breakdown of recertification results.

2.3.3 Field Technical Systems Audits

The ideal assessment schedule for the PEP, as specified in the QAPP, is for each region to have audits and reviews on a regular schedule. TSAs performed by the WAM occur twice a year, while TSAs performed by OAQPS occur yearly. A field TSA addresses program management and field operations.

Program management issues include the following:

- Organization, staffing and training
- Documentation
- Facilities.

Field operations issues in the TSA include the following:

- Equipment inventory, procurement, and maintenance
- Site visit preparation
- Filter cassette receipt, storage, and handling
- Sampler transport and placement
- Sampler assembly/disassembly
- Verifications/calibrations
- Sampler filter handling
- QA/QC procedures
- Information retention.

Data and Data Management

In 1999, each region was audited by OAQPS staff at least once, with a total of 11 audits performed that year. In 2000 there were six audits performed; and in 2001 there were 5 audits performed on alternate regions from the previous year except for region 10. In most cases, the audit was performed as the field scientists from a region went out on routinely scheduled audit trips near their home bases. The auditor typically watched actual field activities and then returned to the field scientist's office to review paperwork and other procedures not necessarily done in the field.

Audit findings over the 3-year period were quite varied. Safety is always a primary concern, although most audits found no outstanding problems with safety. In every audit, there were usually at least one or two findings in which the field scientists could improve upon their actions while already following SOPs, particularly those involved with minimizing the potential to contaminate filters and those involved with preparing or using verification equipment. Overall, the PEP audits found no major problems and showed that field scientist did a good job following the prescribed procedures.

This page intentionally left blank.

3.0 Data Quality Assessments

This section provides an assessment of the data quality activities implemented as part of the PEP during calendar years 1999, 2000, and 2001. Laboratory and field quality activities are described in separate sections below. Certain control charts have been included within this text, however the full set of graphs along with summary statistics are in Appendix B.

3.1 Laboratory Data

PEP laboratory quality activities include evaluations of facility control, filter checks and stability, laboratory balance control, intra-weigh session control, and inter-weigh session control. Each activity is described below.

3.1.1 Laboratory Facility Control

The measured weight of a Teflon filter is influenced by its recent temperature and humidity history (due to adsorption of water vapor and buoyancy effects). To minimize the difference between filter presampling and postsampling weight measurements, it is necessary to ensure that the preweighing and postweighings have been performed under similar temperature and humidity conditions. The temperature and humidity of the weighing and equilibration chambers are continually monitored with a data logger and are reviewed to ensure that temperature and humidity controls are maintained. The review of temperature and humidity controls are discussed below.

Temperature

During a filter weigh session, the lab analyst must verify that the mean temperature in the conditioning environment has remained within the acceptance criteria (between 20°C and 23°C) and that the temperature during the weigh session is controlled to within ±2°C. If the conditioning environment has not remained within these conditions over the previous 24-hour period, the filters cannot be weighed. The lab analyst must take appropriate corrective actions in that event.

Figures 3-1 and 3-2 present mean temperatures for Region 4 and 10 weighing laboratories. Standard deviations for the Region 4 weighing laboratory are presented by quarter in Figure 3-3. Standard deviations for Region 10 were not collected in the PED due to hardware deficiencies, since rectified.

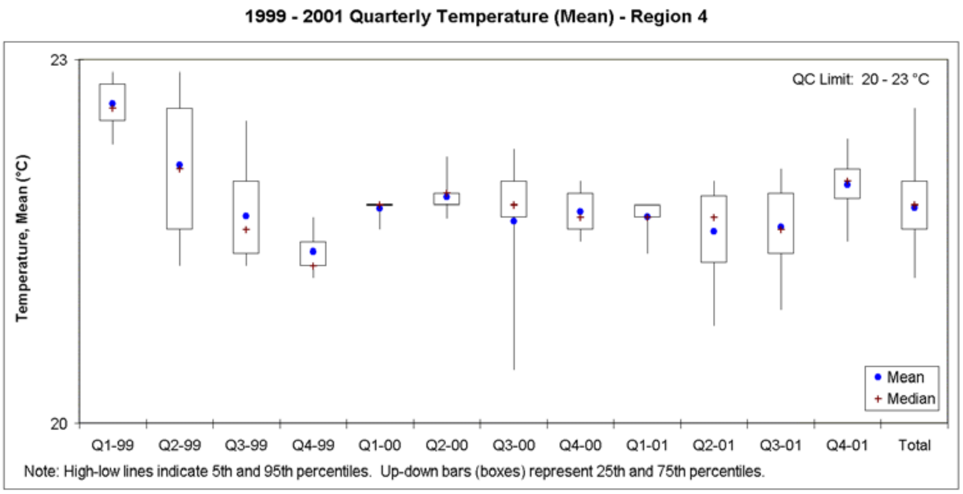

Figure 3-1. Mean temperature in Region 4 weighing laboratory.

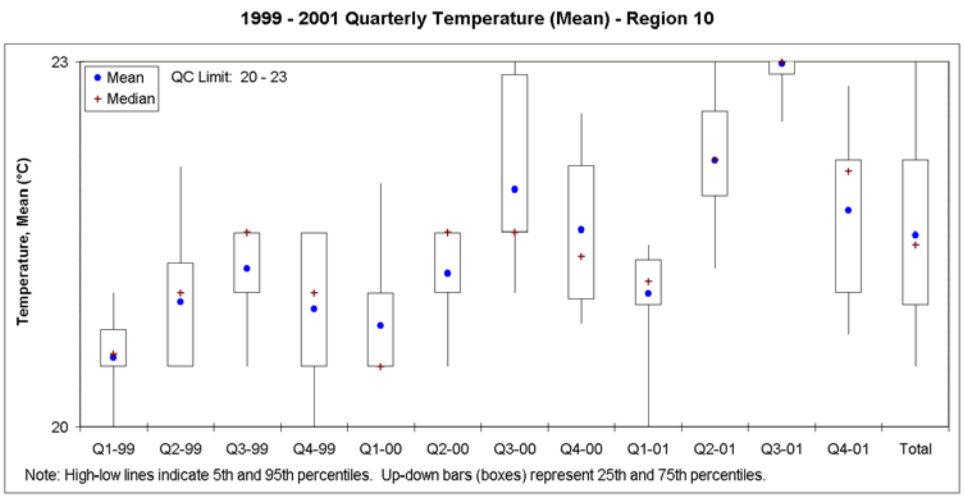

Figure 3-2. Mean temperature in Region 10 weighing laboratory.

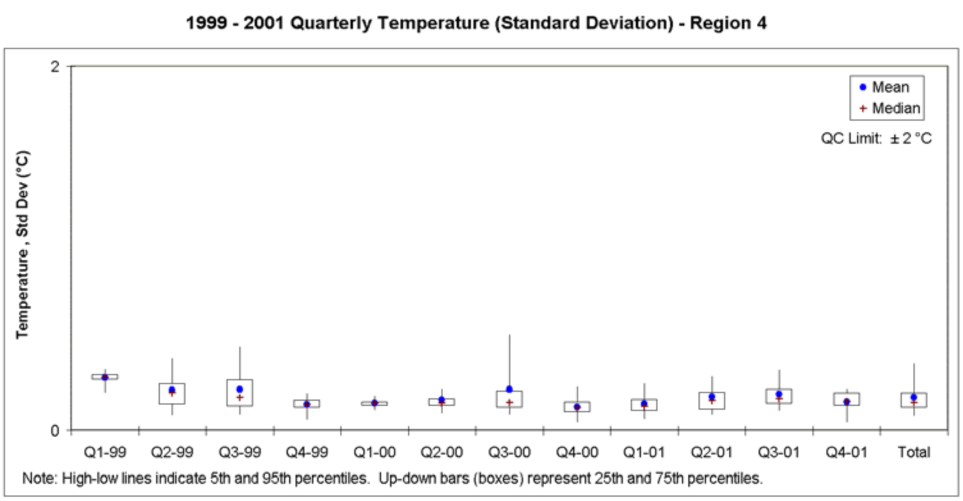

Figure 3-3. Standard deviation for temperature in Region 4 weighing laboratory.

Seasonal changes in temperature are apparent in the graphs, especially in Region 10. Note that the PEP began in 1999, and some variability or lack of control was most likely due to inexperience and problems encountered during program startup within both labs. Since startup, Region 4 remained within acceptance criteria limits with one exception, during the first quarter of 1999. Region 10 was heavily influenced by ambient conditions, as illustrated by the wider ranges in quarterly data and seasonal fluctuation.

Refer to the section below for a continued discussion of temperature and humidity control problems and corrections in Region 10.

Relative Humidity

During a filter weigh session, the lab analyst must verify that the mean relative humidity in the conditioning environment has remained within the acceptance criteria (from 30 percent to 40 percent) and that the temperature during the weigh session is controlled to within ±5 percent. If the conditioning environment has not remained within these conditions over the previous 24-hour period, the filters cannot be weighed. The lab analyst must take appropriate corrective actions in that event.

Figures 3-4 and 3-5 show the mean relative humidity values in Region 4 and 10 weighing laboratories. Standard deviations for the Region 4 weighing laboratory are presented by quarter in Figure 3-6. Standard deviations for Region 10 were not collected in the PED due to hardware deficiencies, since rectified.

Some seasonal influence is apparent, with more variability in Region 10. Neither lab exceeded acceptance criteria limits during the 3-year period. However, humidity control was more difficult for Region 10. In Region 10, it was necessary to bring a portable humidifier into the lab in the first quarter of 1999. In addition, temperature and humidity were recorded from a graphical control chart. In third quarter 2000, a Dickson data logger was installed, explaining the apparent change in spread of data points (see scatter-plot on page B-3 of Appendix B).

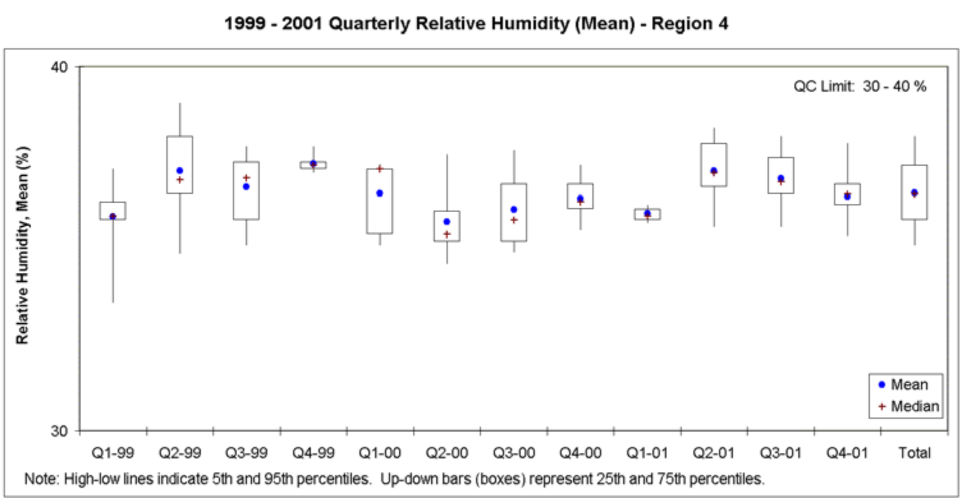

Figure 3-4. Mean relative humidity in Region 4 weighing laboratory.

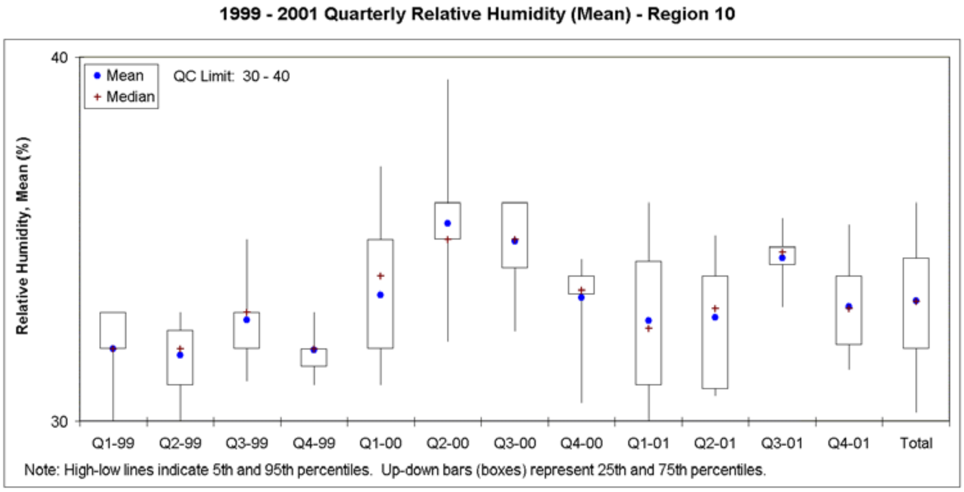

Figure 3-5. Mean relative humidity in Region 10 weighing laboratory.

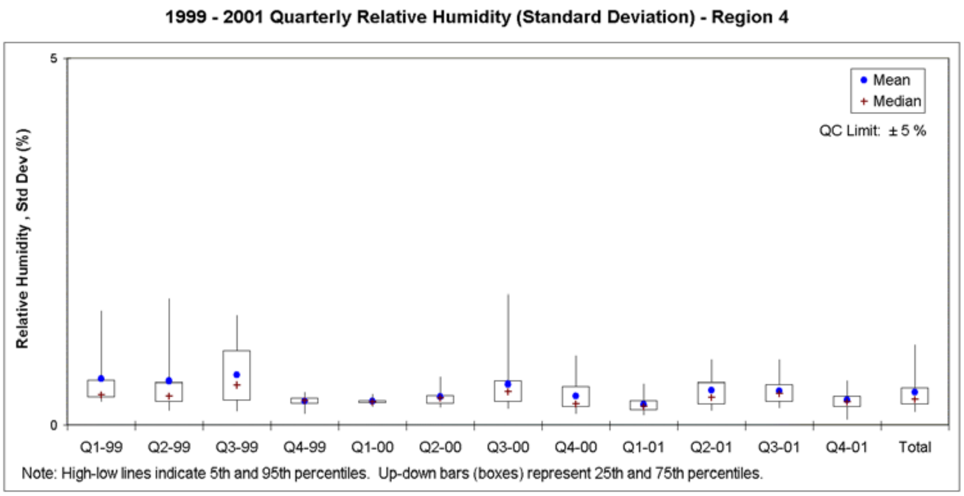

Figure 3-6. Standard deviation for relative humidity in Region 4 weighing laboratory.

It was discovered in first quarter 2001 that the HVAC in the Region 10 lab was operating on an energy-saving mode during weekends (from 6 p.m. Fridays to 7 a.m. Mondays). This may have contributed to the higher variability in both temperature and humidity in Region 10 as compared to Region 4. The problem was promptly rectified.

Equilibration Period

To ensure stable weighings, filters must be allowed to equilibrate in the conditioning environment for at least 24 hours prior to weighing for both the presample and postsample weigh sessions. The laboratories maintained records of equilibration time to ensure that this criterion was met.

3.1.2 Filter Checks and Stability

Filters that are used in the PEP are inspected to ensure that they meet manufacturing specifications. Once visual inspection has been performed, a representative sample of the acceptable filters are checked for consistent weights over time while in the lab (lot blanks and batch stability).

Visual Inspection

Prior to initial weighing, the laboratory visually inspects each filter for the presence of such defects as pinholes, separation, chaffing, loose material, discoloration, or filter nonuniformity. If any defect is noticed, the laboratory discards the filter.

Upon receipt of exposed filters, the laboratory visually reinspects each filter for defects. Defective filters are noted on the custody form and in the database. If a filter is so damaged that it cannot be analyzed or if a filter is later rejected, then a filter defect flag is applied in the database for that filter. These filter flags are used to exclude rejected filters from data analyses and control charting.

Table 3-1 shows the number of filters which were flagged defective and compares them to the total number of filters used by each Region. These numbers were obtained from the data recorded by each laboratory in the Performance Evaluation Database. The total number of filters was determined from the number of filters loaded into cassettes, along with those rejected due to filter defects. The most common visual defect recorded in the PED was filter nonuniformity.

Table 3-1. Filter Defects

	Region 4			Region 10		
Year	Total Filters	Filters with Defects	% with Defects	Total Filters	Filters with Defects	% with Defects
1999	1,613	90	6	1,186	41	3
2000	2,036	124	6	1,392	9	1
2001	2,383	122	5	1,637	77	5
Total	6,032	336	6	4,215	127	3

Lot Blanks

New Teflon filters are identified by a manufacturer's production lot number. Each new filter lot is checked for weight stability before acceptance in the PEP. The lot stability check is done by selecting a representative sample of filters from the new lot and weighing these filters over time.

Three filter boxes are randomly selected from the new lot. Three filter lot blanks are then randomly chosen from each box for stability testing (nine filters total). These nine filters are allowed to condition for 24 hours, after which they are weighed every 24 hours for a minimum of 5 days and until the difference between consecutive weights for each of the filters is less than 15 µg.

If the lab analyst notes a continuous upward or downward trend during the acceptance test, he or she may decide to continue weighing the lot blanks beyond the 5-day period (even if the consecutive weight differences are < 15 µg). The analyst may continue the acceptance test until the trend stops or is negligible (≤ 5 µg difference per day). A trend indicating weight loss suggests additional outgasing from the filters, and may indicate a need for a longer initial conditioning of the filters within the lot before use. An increasing weight trend may indicate laboratory contamination, which must be rectified before laboratory weighings may continue. An example lot blank chart is shown in Figure 3-7. Additional charts are shown in Appendix B.

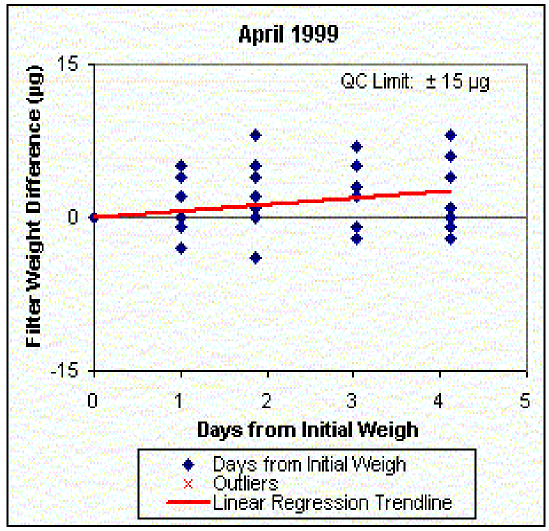

Figure 3-7. Example lot blank chart.

Region 4 used five sets of lot blanks over the 3-year period. Region 10 used nine sets. Lot blank stability tests for both labs indicated that all used filter lots throughout the period met the acceptance criteria.

Presample Batch Stability

Presample batch stability filters, also known as lot exposure blanks, are used to determine whether a batch of filters has been sufficiently conditioned (stable) that the lab analyst can proceed with weighing them before shipment to the field.

From a batch of unexposed filters that have been conditioned together, three are selected at random as the lot exposure blanks. The initial weights are recorded, along with temperature and relative humidity. The lot exposure blanks are reweighed 24 hours later. The lab analyst records the difference in micrograms from the consecutive weights. The lot exposure blanks are weighed every 24 hours until the average difference between all three weights is ≤ 5 µg and no consecutive filter weight difference is > 15 µg. Once this occurs, the filters associated with the lot exposure blanks are ready for weighing.

For both regions, 95 percent of the pre-sample batch stability filters had met the acceptance criteria within 4 days. However, approximately 90 percent of Region 4's filters met the criteria within 2 days, while only 54 percent of Region 10's met the criteria in the same time. This difference may be attributable to the temperature and humidity control problems experienced in Region 10.

Postsample Batch Stability

After exposed filters have returned from the field, they are again conditioned as a batch for a post-sample weighing session. A batch stability test is conducted to ensure that the filters have been properly conditioned and are stable before weighing.

The filter batching for exposed filters includes about 10 routine filters (3 of which are selected for batch stability testing), at least one field blank, at least one lab blank, a filter from a previous batch, QC samples, and a collocated sample filter (optional).

Because these filters and the containers are probably colder or warmer and are probably significantly more or less humid than the conditioning area or room, the lab analyst is instructed not to place them immediately upon receipt into the conditioning environment, since they might affect the temperature or humidity requirements of filters being conditioned. Because the filters are still in their plastic shipping bags, they will not be contaminated by dust or moisture during the time between receipt and conditioning.

The exposed filters are conditioned for at least 24 hours under the same environmental conditions as existed during pre-sample conditioning. Three routine filters are selected at random for the batch stability test. The initial weights are recorded, along with temperature and relative humidity. A minimum of 8 hours later, the filters are reweighed. The lab analyst records the difference in micrograms from the consecutive weights. The filters are re-weighed every 12 to 24 hours until the difference between two out of three filters' consecutive weights is less than 15 μg. Once this occurs, the filters associated with the batch stability test are ready for weighing.

For both regions, 95 percent of the postsample batch stability filters had met the acceptance criteria within 4 days. By comparison, 89 percent of Region 4's filters met the criteria within 2 days and 83 percent of Region 10's met the criteria in the same time.

3.1.3 Laboratory Balance Control

Traceability of Standards

All primary and transfer standards are recertified every year to NIST-traceable standards. Agreements with vendors are set up to provide this certification activity. OAQPS works with the regional offices to schedule appropriate time frames to achieve recertifications.

External Calibration of Micro Balance

An external calibration should only be performed when routine quality control checks (e.g., microbalance verifications using working standards, replicate filter weighings) indicate that the microbalance may be out of calibration and is approved by the regional WAM. This external calibration of the microbalance using a mass reference standard (ASTM Class 1). The microbalance's software is set so that weighing a 5 g primary mass reference standard with NIST traceability will produce a digital display of 5 g.

Routine Calibration

The analytical instrument used for gravimetric analysis in the PEP is the Sartorious MC-5 microbalance, which has a readability of 1 µg and a repeatability of 1 µg. The microbalance is calibrated annually (and mass standard check weights recertified) by a technician under a service agreement between the regional laboratories and the microbalance vendor. The service technician performs routine maintenance and makes any balance response adjustments that the calibration shows to be necessary. During the visit by the service technician, both the in-house primary and secondary (working) standards are checked against the service technician's standards to ensure acceptability. All of these actions are documented in the service technician's report, a copy of which is provided to the regional WAM, which is filed after review.

Quarterly Standard Verifications

Every 3 months, the working standards are compared against the laboratory primary standards to ensure that the working standards are still within the acceptance criteria of their certified weight using a double-substitution procedure. The working and primary standard weights are each weighed twice. First the working standard is weighed, and then the primary standard is weighed; then the primary weighing is repeated; and finally the working standard is weighed again. All weighings are made at regularly spaced time intervals to average out any effects of instrument drift. This procedure and method for calculating the apparent mass correction (Cw) is described in the FRM PEP Lab SOP.

3.1.4 Intra-Weigh Session Control

Duplicate Weighing

During laboratory preweighing and postweighing sessions, the first routine sample filter is weighed a second time at the end of the weighing session (see PEPL-8.01). These are referred to as "batch duplicates" and serve as an indicator for the stability of the conditioning environment and the consistency of the microbalance within a weigh session. The difference between these filter weights must be $\leq$15 µg.

Failure of the acceptance criteria may be due to transcription errors, microbalance malfunction, or that the routine samples have not reached equilibrium. Other QC checks (balance standards and lab blanks) help to eliminate microbalance malfunction. If the duplicate does not meet the criteria, the second and third routine samples are selected and reweighed as a second and third duplicate check. If either one of these samples fails the acceptance criteria and the possibility of balance malfunction and transcription errors have been eliminated, all samples in the batch are equilibrated for another 12 hours and reweighed. Corrective actions continue until duplicate weights for the batch meet acceptance criteria.

Figures 3-8 and 3-9 display the batch duplicate data for Regions 4 and 10, respectively. Additional charts and summary data are included in Appendix B. During the 3-year period, only one duplicate weighing exceeded the acceptance criteria for Region 4. All duplicate weighings were within acceptance criteria for Region 10.

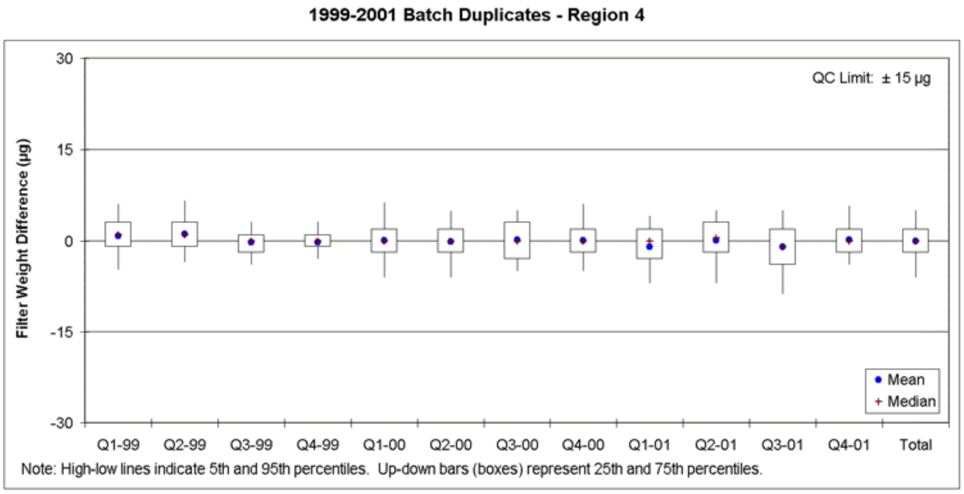

Figure 3-8. Batch duplicates from Region 4 weighing laboratory.

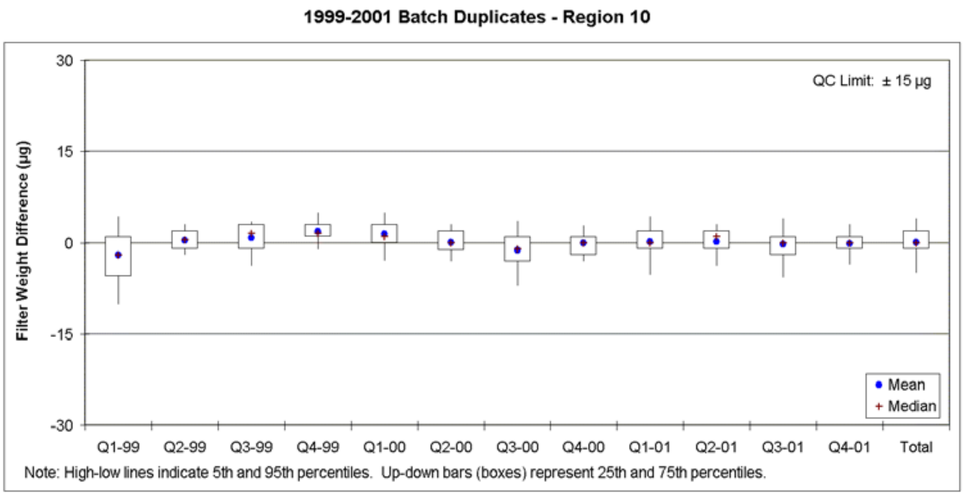

Figure 3-9. Batch duplicates from Region 10 weighing laboratory.

Balance Checks

Balance checks are frequent checks of the balance working standards against the balance to ensure that the balance is within acceptance criteria throughout the presample and postsample weighing sessions. The 100-mg standards are referred to as “low mass” standards and the 200-mg standards are referred to as “high mass” standards. The PEP uses ASTM Class 1 weights for its primary and working standards. The high mass and low mass standards are both measured at the beginning and end of a filter batch weighing session (a batch is approximately 15 routine filters).

The difference between the reported weight and the certified weight must be $\leq$3 µg. Since this is the first check before any presample or postsample weighings, if the acceptance criteria is not met, corrective actions are initiated. Corrective actions may be as simple as allowing the balance to perform internal calibrations or to warm up sufficiently, which may require checking the balance weights a number of times. If the acceptance criteria are still not met, the laboratory technician is required to verify the working standards to the primary standards. Finally, if it is established that the balance does not meet acceptance criteria for both the working and primary standards, and other trouble-shooting techniques fail, a microbalance service technician is contacted to perform corrective action.

If the balance check fails acceptance criteria during a run, the QC check samples are reweighed. If the balance check continues to fail, trouble shooting, as described above, is initiated. The weights recorded during the weigh session are flagged FIS, but the filter samples remain with the unweighed samples to be reweighed when the balance meets acceptance criteria.

Figures 3-10 and 3-11 display the routine balance checks for high mass and low mass standards for Region 4. Figures 3-12 and 3-13 display the routine balance checks for high mass and low mass standards for Region 10.

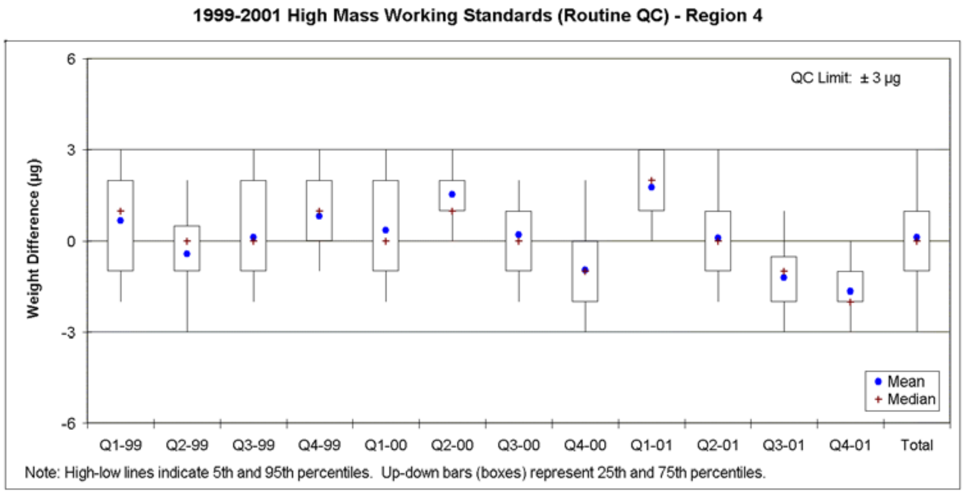

Figure 3-10. Routine balance checks in Region 4 lab using 200 mg working standard.

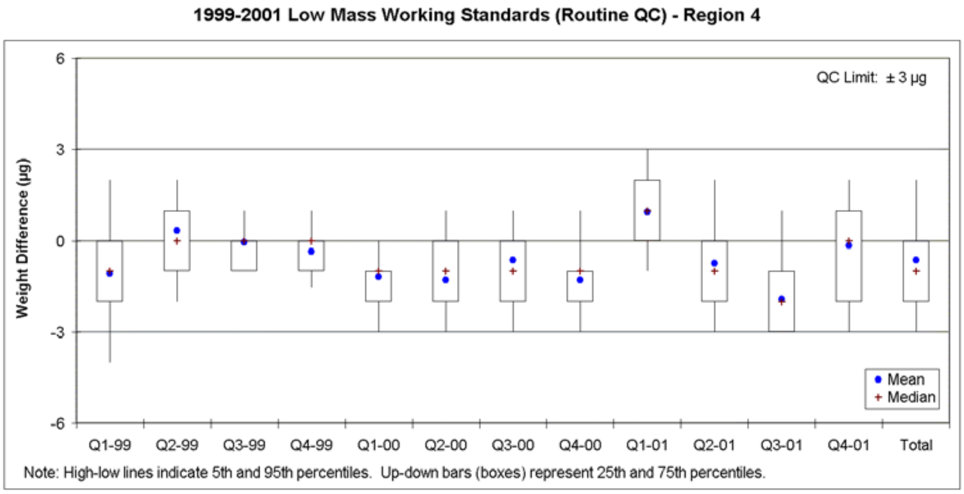

Figure 3-11. Routine balance checks in Region 4 lab using 100 mg working standard.

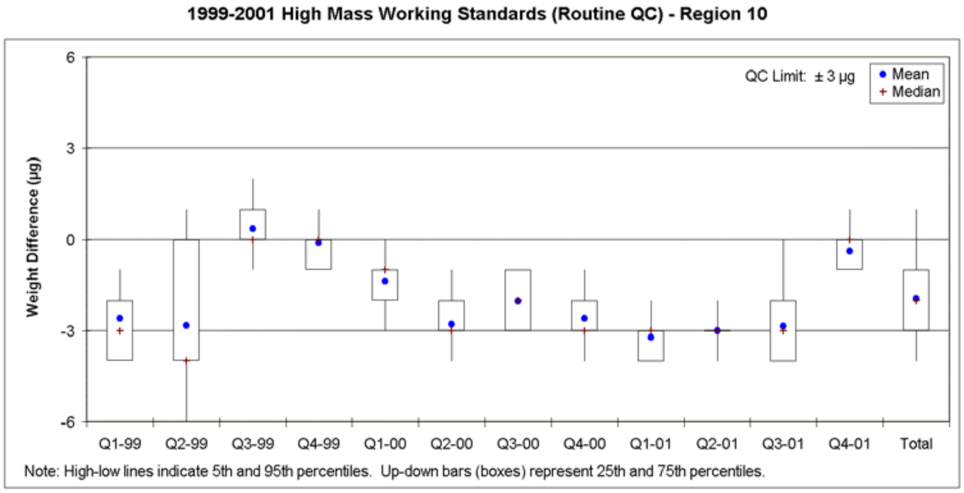

Figure 3-12. Routine balance checks in Region 10 lab using 200 mg working standard.

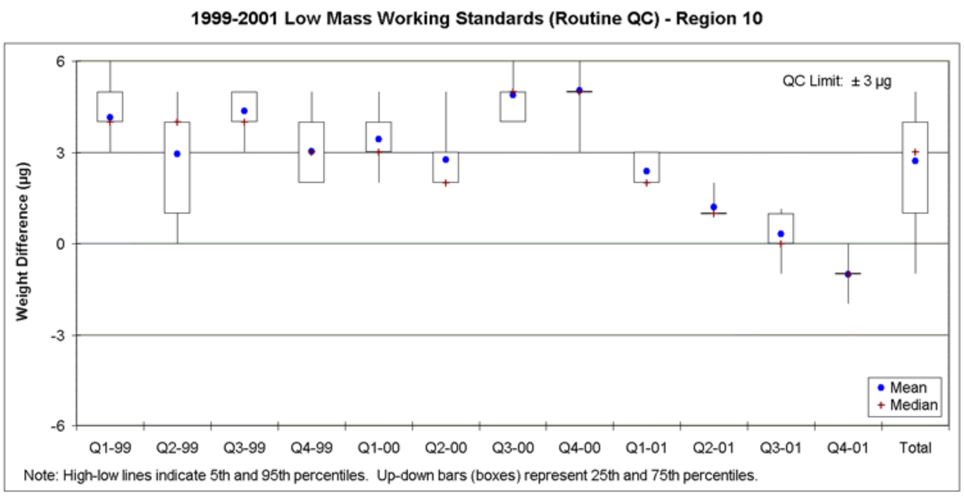

Figure 3-13. Routine balance checks in Region 10 lab using 100 mg working standard.

The high mass working standards for Region 4, as indicated by balance checks, were within the acceptance criteria for the entire 3-year period. The acceptance criteria for low mass working standards in Region 4 were exceeded several times during the first quarter of 1999 and once during the third quarter of 2000.

Both high and low mass working standards for Region 10, as indicated by the balance checks, experienced difficulty meeting acceptance criteria throughout the 3-year period. The acceptance criteria for high mass were exceeded many times during the first two quarters of 1999 and consistently exceeded from the second quarter of 2000 through the third quarter of 2001. The low mass standard exceeded the acceptance criteria from the first quarter of 1999 through the first quarter of 2001. This problem was detected during a data validation trip by OAQPS. A weight calibration issue was determined to be a potential cause of the problem. All other weighing session QA/QC criteria such as duplicate weighings, laboratory blanks, and stability testing were found to be in control demonstrating repeatability with the balance.

The high numbers of exceedances seen throughout the 3-year period prompted a recent thorough review of the Region 10 data to investigate precision and accuracy in weighing the working standards. This recent review revealed very good precision in weighing the working standards, but the accuracy was poor when compared to the calculated corrected weight of the working standard. The exercise led to an investigation of the weight verification procedure. The corrected weights of both high and low mass working standards were calculated quarterly using a double substitution method found in SOP No. 4 in the NIST Handbook No.145. This NIST method should be used for comparing the standards quarterly to determine if there is a shift in the weight difference between the primary and working standards over time. It was used in the PEP to determine the corrected weight of the working standards and then used in the performance evaluation database (PED) as a surrogate certified or verified weight, which is most likely the problem. It was also found that the ASTM class 1 weights were a factor. It is suspected that using ASTM class 0 standards will lower the potential weight difference between the calculated corrected weight and the certified weight of the working standards to a great enough degree that use of the double substitution method with weights at opposite ends of the ASTM acceptance range would likely pass PEP QA checks, even if the calculated corrected weight were used instead of a certified weight in the PED. This possibility is suggested by the fact that Region 4, using ASTM class 0 standards, was using the calculated corrected weight in the PED and still was able to pass PEP QA requirements.

A graphical review of the actual weighing of both working standards in Region 10 to their certified weights from the certification vendor throughout the 3-year period showed a tight scatter demonstrating good precision and accuracy. To correct this issue, the PEP will likely switch to procedures calling for the use of the standards' certified weight in the PED, as given by the NIST traceable, annual third-party verification in lieu of the calculated corrected weight. It is also likely that standards certified to ASTM class 0 standards, which are tighter than ASTM class 1 standards, will be required to be used. The calculation of the corrected weight will likely still be required, but it will be used as a quantitative tool to further indicate control problems in the laboratory. Detailed study results and recommendations from the investigation are presented in Appendix C.

3.1.5 Inter-weigh Session Control

Lab Blanks

Lab blanks are conditioned, unsampled filters used to determine any weight change between presampling and postsampling weighings due to contamination in the microbalance and conditioning environment. The weights must not fluctuate more than 15 µg between the presample and postsample weighing sessions. Figures 3-14 and 3-15 display the quarterly lab blank results for Regions 4 and 10, respectively.

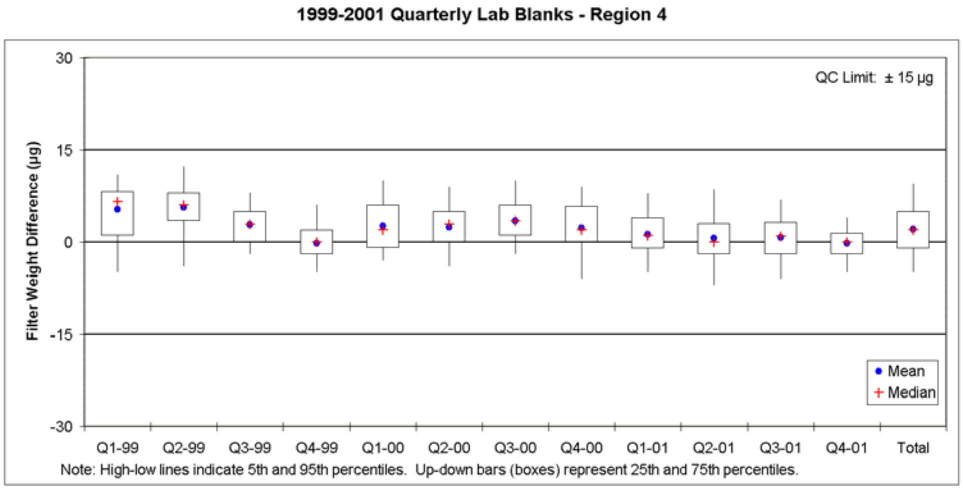

Figure 3-14. Lab blanks from Region 4 weighing laboratory.

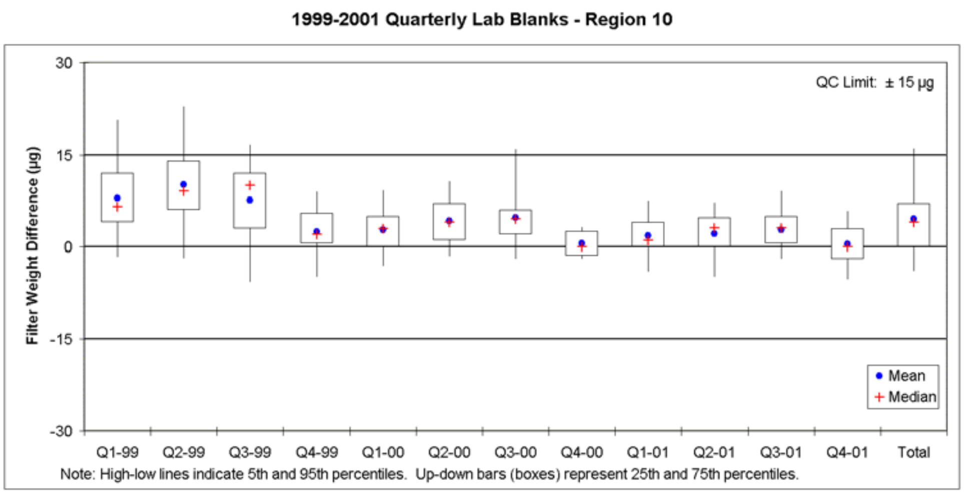

Figure 3-15. Lab blanks from Region 10 weighing laboratory.

In the first year of operation, contamination in the laboratory was more prevalent in Region 10 than Region 4. Note that the PEP began in 1999, and some variability or lack of control within both labs was most likely due to inexperience and problems encountered during program startup. In subsequent years, contamination controls proved more effective as exceedance of criteria rarely occurred in either lab.

Previous Batch Duplicate

Once a weigh session is completed, the routine sample used as the batch duplicate is placed with the next batch. This filter should not be weighed as one of the first three filters in the next batch. These are sometimes referred to as “previous batch duplicates” and serve as indicators for the stability of the conditioning environments and the consistency of the microbalances between weigh sessions. The difference between these filter weights must be $\leq$15 µg. Figures 3-16 and 3-17 display the quarterly results for previous batch duplicates for Regions 4 and 10, respectively.

1999-2001 Previous Batch Duplicates - Region 4

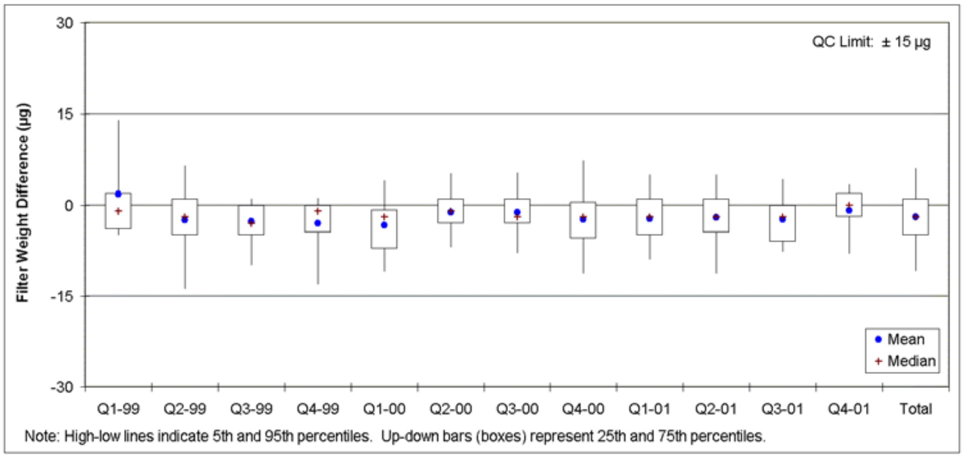

Figure 3-16. Previous batch duplicates from Region 4 weighing laboratory.

1999-2001 Previous Batch Duplicates - Region 10

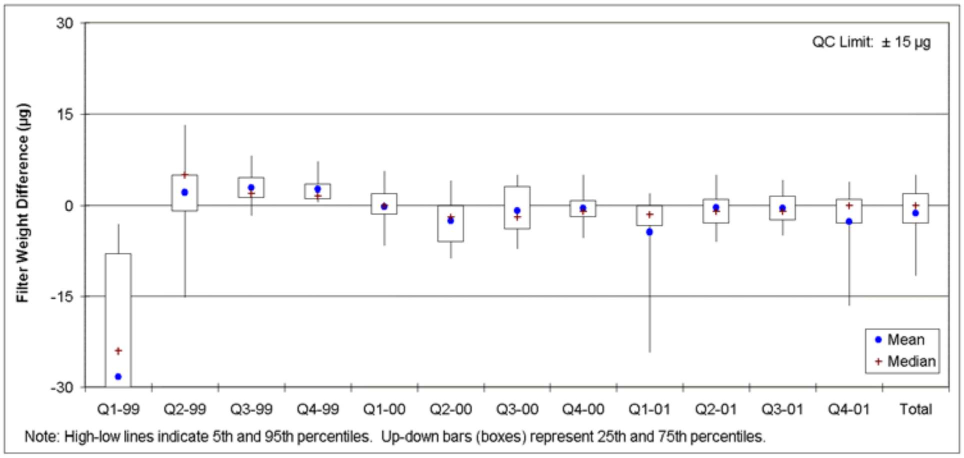

Figure 3-17. Previous batch duplicates from Region 10 weighing laboratory.

Data show that overall there was good repeatability between weigh sessions, as indicated by the previous batch duplicate. In 1999, Region 4 had three exceedances and Region 10 had four. In years 2000 and 2001, Region 4 had a total of two exceedances and Region 10 had three. During the first quarter 1999, Figure 3-17 shows filter weight differences dropping below −30 µg. In this instance, there were only four data points, two of which were outliers at −38 and −63 µg.

3.2 Field Data

PEP field quality control activities include checks for filter holding times, field quality control, sampling operation, precision, completeness, and detection limit and upper concentration limit. Each activity is described below.

3.2.1 Filter Holding Times in Field

The permissible holding times for the $PM_{2.5}$ sample are clearly detailed in both 40 CFR Part 50, Appendix L and Section 2.12 of the Quality Assurance Guidance Document. The PEP requires a more restrictive holding time than is required in regulation.

Preweigh to Beginning of Sampling

The holding time for a preweighed filter (from the date of preweigh to the date of sample) is $\leq$30 days. If this time constraint is exceeded, the filter is voided and returned unused to the laboratory for reprocessing.

Sample Recovery

Regulations state that the holding time for recovery of a $PM_{2.5}$ filter (from completion of sample period to time of sample recovery) is $\leq$96 hours. The PEP requirement for sample recovery is $\leq$48 hours. If this constraint is exceeded, the sample is flagged and is considered invalid.

Sample Recovery to Postweigh with Consideration for Temperature of Sample Transport

The required holding time for transport of a filter is ideally $<$24 hours from time of recovery to time placed in a laboratory conditioning room. In reality, the samples are cooled immediately upon recovery and shipped to the laboratory for conditioning as soon as possible. If the postsample filter is transported at $<$4°C, then regulation requires the time between end of sampling and date of postweigh to be $\leq$30 days; the PEP requirement is $\leq$10 days. If the postsample filter is transported at $<$25°C, then both regulation and PEP require the time between end of sampling and date of post weigh to be $\leq$10 days. Due to shipment problems, where samples arrived at the laboratory between 4°C and 25°C, it became necessary to develop a sliding scale (see Figure 3-18). This scale associates the arrival temperature (up to 25°C) with the available days for weighing (up to 30 days) in order to expand the validation This scale only applies to filters arriving to the lab above the 4°C criteria.

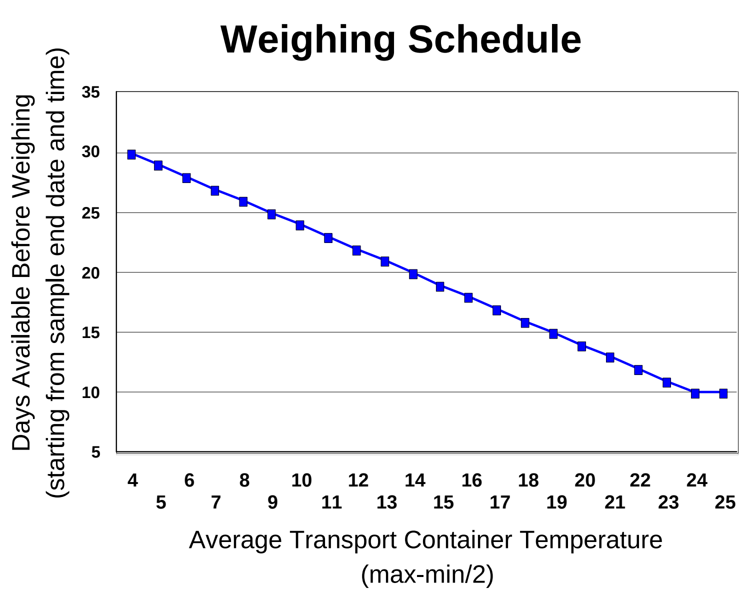

Figure 3-18. Sliding scale for filter holding time.

The scale uses the assumption that the longer a filter remains in ambient or near ambient conditions, the more likely it is that the filter will lose collected semi-volatiles. Thus, the time required for weighing the affected filters should decrease in order to obtain the most accurate concentration possible. In this scale, available days to weigh decreases as arrival temperature increases creating a line where the analyst may find a new weighing time limit for affected filters. Implementing this scale effectively expanded the validation criteria to make concessions for shipping problems. If the holding time exceeds the limit determined by the sliding scale, then the filter is voided.

3.2.2 Field Quality Control Checks

Field quality control checks include leak tests, checks for barometric pressure, ambient temperature, filter temperature, flow rate, and filter inspection. Each of these checks is described in a separate section below. Control charts for the field QC checks are organized by EPA region and are presented in Appendix B.

Leak Tests

The leak check procedure is used to verify that the air handling system in the sampler is adequate, free from leakage that could cause either the flow rate to be measured incorrectly or filtration artifacts. The BGI PQ200A sampler determines leakage by pulling a vacuum on the internal air volume of the sampler, sealing the volume by closing valves, and monitoring the internal pressure change for a period of 10 minutes. If the internal pressure increases too rapidly, a leak is indicated, and troubleshooting procedures are followed to stop the leak. If another type of portable FRM sampler is used, vendor-specified leak check procedures are followed.

The leak check must be successful before flow rate verification can be performed. If trouble-shooting does not solve the problem, that sampler is not to be used for the audit. Leak check results may also be an indicator of the degree of maintenance performed on any individual monitor. Overall, leak check data indicate that performance is generally good throughout the program, as there were relatively few documented exceedances (see Table 3-2).

Table 3-2. Leak Tests by Region, 1999 to 2001

EPA Region	Total Observations	Number of Exceedances	Comments
1	343	1	
2	305	0	No samples taken between June 18 and October 5, 1999.
3	320	2	Note that in the latter half of 2001, there was a noticeable decrease in pressure differential.
4	784	1	
5	675	15	End of 2000 through mid-2001, concentrated number of exceedances.
6	604	0	
7	306	6	Small number of exceedances in November and December 2000.
8	292	3	Small number of exceedances in February-April 2000.
9	407	1	
10	332	1	

Barometric Pressure

The BGI PQ200A sampler has a built-in atmospheric pressure sensor whose output is processed to allow control of the sampling flow rate to the design value of 16.7 L/min under actual ambient conditions of temperature and pressure.

To perform a routine verification, the barometric pressure sensor reading is verified at ambient pressure by comparison to the reading from an external standard of known accuracy. If a pressure difference of more than 10 mmHg is observed, a multipoint verification/calibration of the pressure-sensing and display system is required before the FRM sampler may be used to perform an evaluation. If verifications fail, after any calibration or troubleshooting, the monitor may not be used for valid sampling. Table 3-3 shows the numbered barometric pressure readings by region form 1999 to 2001.

Table 3-3. Barometric Pressure Observations by Region, 1999 to 2001

EPA Region	Total Observations	Number of Exceedances	Comments
1	346	6	Exceedances in May, June, and August 1999. Re-occurring seasonal trends match Region 2 (monitor readings are lower in winter).
2	305	0	Re-occurring seasonal trends match Region 1 (monitor readings are lower in winter). No samples taken between June 18 and October 5, 1999.
3	263	1	Only reported readings from a BP standard three times during February to September 1999.
4	793	2	Early 2000, data scatter reduced.
5	656	3	Re-occurring seasonal trends (monitor readings are higher in winter).
6	606	0	Slight re-occurring seasonal trends (monitor readings are higher in winter).
7	303	3	Exceedances in May and June 1999.
8	295	4	Low monitor readings in November 2000 through February 2001.
9	410	8	Concentrated exceedances from May to December 2000.
10	310	4	Scattered exceedances. Note lack of data (unreported on sample days) in early 1999.

Ambient Temperature

The portable sampler has an ambient and internal (filter) temperature probe. Temperature sensors are verified at a single point using an external temperature standard of known, NIST-traceable accuracy. If an excessive difference is observed, a multi-point verification/calibration of the temperature sensor may need to be conducted. The response of the two temperature sensors is verified each time the BGI PQ200A portable sampler is set up at a new location. If verifications fail, after any calibration or troubleshooting, the monitor may not be used for valid sampling. Table 3-4 shows the number of ambient temperature readings by region between 1999 and 2001.

Table 3-4. Ambient Temperature Observations by Region, 1999 to 2001

EPA Region	Total Observations	Number of Exceedances	Comments
1	346	0	
2	305	1	No samples taken between June 18 and October 5, 1999.
3	324	1	
4	799	0	
5	677	1	
6	606	0	
7	306	2	
8	295	2	
9	408	1	
10	353	0	

Filter Temperature

Temperature requirements for the sampling and postsampling periods are detailed in 40 CFR Part 50, Appendix L Section 7.4.10. These requirements state that the temperature of the filter cassette during sampler operation and in the period from the end of sampling to the time of sample recovery shall not exceed that of the ambient temperature by more than 5°C for more than 30 minutes. Table 3-5 shows the number of filter temperature observations by region between 1999 and 2001.

Table 3-5. Filter Temperature Observations by Region, 1999 to 2001

EPA Region	Total Observations	Number of Exceedances	Comments
1	346	5	
2	305	1	No samples taken between June 18 and October 5, 1999.
3	322	0	
4	799	0	
5	677	6	
6	606	0	
7	306	2	
8	294	3	
9	407	3	
10	352	0	

Flow Rate

Each reference or Class I equivalent $PM_{2.5}$ sampler includes a specially designed sample air inlet, a size-fractionating impactor, and a sample flow rate control system. The particle size discrimination characteristics of both the inlet and the impactor are critically dependent on specific internal air velocities; a change in velocity will result in a change in the distribution of the nominal particle sizes collected. These velocities are determined by the actual volumetric flow rate of the sampler.

In addition, the total volume of air sampled is determined from the measured volumetric flow rate and the sampling time. The mass concentration of $PM_{2.5}$ in the ambient air is computed as the total mass of collected particles in the $PM_{2.5}$ size range divided by the total volume of air sampled.

Therefore, in order to control the size-fractionating cutpoints and to measure the total volume correctly, the sampler's flow rate must be maintained at a constant value that is within ±4 percent of the verification flow rate. The flow rate of the portable FRM sampler must be verified at each site before the PE samples are taken. If the verification check is outside the tolerance of ±4 percent, and no reason can be found for the discrepancy, a multipoint verification/calibration of the sampler is performed. After the multipoint verification/calibration, the flow rate is verified again to confirm that the ±4 percent tolerance has been achieved. If verifications fail, after any calibration or troubleshooting, the monitor may not be used for valid sampling. Table 3-6 shows the flow rate observations by region from 1999 to 2001.

Table 3-6. Flow Rate Observations by Region, 1999 to 2001

EPA Region	Total Observations	Number of Exceedances	Comments
1	346	1	Gradual trend from negative to positive percent difference from late 1999 through 2001.
2	305	2	No samples taken between June 18 and October 5, 1999.
3	322	11	Groups of exceedances in December 1999 and latter half of 2001.
4	798	10	Scattered exceedances.
5	673	6	Scattered exceedances.
6	606	0	
7	304	7	Scattered exceedances.
8	294	6	Scattered exceedances.
9	410	2	
10	346	6	Exceedances occurred in months of October and December each year.

Filter Inspection

A visual inspection of each filter is conducted prior to installation in a sampler. If any defects are noted, the field scientist will describe the imperfection on the chain-of-custody form. Defects include: loose or improperly fitting cassette, filter offset or wrinkled, pinhole, loose material, discoloration, filter nonuniformity, or other imperfections that could affect the filter's weight or cause sampled air to bypass the filter medium. If the imperfection is judged to be significant, the filter is voided. Any filters with visible damage or imperfections are returned to the weighing laboratory along with the “voided” chain-of-custody form. A spare filter is used in place of the defective filter. Please refer to Section 3.1.2 and Table 3-1 for a summary of filter defects.

3.2.3 Sampling Operation

Field data quality activities related to sampling operation include checks for sample period and flow rate operation and variability. Each of these are discussed below.

Sample Period

Portable FRM monitors are sited within 1-4 m of routine monitors, set-up and verified per the SOPs. Filters are then installed and the monitor is set up to run on a midnight-to-midnight (local standard time) schedule. Data validation procedures check to make sure that the sample duration is within 1380 to 1500 minutes (23 to 25 hours). If the filter fails this acceptance criteria, then the PE for that filter is rejected.

Flow Rate Operation and Variability

The PEP implements a flow rate verification with each setup. The verification is implemented by measuring the sampler’s normal operational flow rate using a certified flow rate transfer standard. The calculated flow as determined by the audit flow rate device and the flow rate indicated by the sampler are reported.

A single-point verification of the sampler flow rate is performed prior to each use of the BGI sampler in a PE. If the verification check is outside the tolerance of ± 4 percent of the indicated reading or ± 5 percent of the design flow rate (16.67 Lpm), then the sampler is not used or is recalibrated prior to use. The flow rate coefficient of variation (CV) must be ≤ 2 percent and there must be no flow rate excursions > 5 percent lasting long than 5 minutes. If the CV check fails, then the PE for that filter is rejected.

3.2.4 Assessment of Consistency among PEP Samplers

Consistency among the PEP samplers is determined by collocating all of the PEP samplers in a region each quarter. This collocation is commonly referred to as the quarterly collocations or parking lot collocations. The parking lot collocations require that all of the PEP samplers be simultaneously collocated to a single site (e.g., a parking lot) for at least 3 days (not necessarily consecutive) on a quarterly basis. This allows assessment of both repeatability and bias among the samplers in each region and in each quarter. The purpose of the parking lot collocations is two-fold. One purpose is to determine if there is a PEP sampler that is producing concentrations that are consistently higher or lower than the concentrations from the other PEP samplers, and therefore, should not be used in the performance evaluation process until this anomalous behavior is corrected. The second purpose is to determine whether the samplers as a whole produce approximately the same concentrations, indicating that the PEP samplers are precise or repeatable. If the PEP samplers are not repeatable, the entire set of PEP samplers should not be used for performance evaluations until this lack of repeatability is understood and corrected.

Repeatability of samplers as represented by the square root of the mean square error (√MSE) should not exceed about 5 percent. Note that this level is slightly arbitrary. In the routinely operated network of PM2.5 samplers, the goal is for imprecision to be less than 10 percent. Since the PE program is used to evaluate the routine network, the PE program should achieve a higher level of precision, hence the decision for imprecision to be less than 5 percent. Table 3-7 presents the repeatability among samplers within each region for each quarter. An "✘" indicates that no parking lot collocation was conducted. A "✔" indicates that a parking lot collocation was conducted and the resulting estimate of imprecision was less than 5 percent. The region/quarters with percentages listed are those for which the imprecision estimate exceeds 5 percent. Most of the imprecision estimates are less than 5 percent and few exceed 10 percent. There were four cases during the 3-year period where the repeatability exceeded 10 percent during a quarter. In the fourth quarter of 2001, Region 5 showed repeatability equal to 25 percent, however review of data indicated a possible data entry error which if corrected would drop the repeatability to less than 10 percent. Region 8 had repeatability of 13 percent during the first quarter of 1999. Region 10 had repeatability of 13 percent and 19 percent in the second quarter 2000 and second quarter 2001, respectively, and overall seems to have the most difficulty with repeatability. Note that Region 9 has conducted multiple parking lot studies; however, the data submitted was incorrectly labeled and unrevealed until after this statistical analysis was performed. Region 3 has never conducted a parking lot collocation but has been performing paired collocations.

Table 3-7. Repeatability of PEP Samplers by Region and Quarter

EPA Region	1999				2000				2001				No. Qtrs of Completed Studies	No. Qtrs with Low Repeatability
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
1	✘	✔	✘	✘	✔	✔	✔	✔	✔	✔	✔	✔	9	0
2	✘	✘	✘	✔	✘	✔	✔	✔	✔	✔	✔	H 7%	8	1
3	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	0	0
4	✘	✔	✔	H 9%	✔	✔	✔	✔	H 7%	✔	✔	✔	11	2
5	✘	✘	✘	✘	✘	✔	✘	✘	H 5%	✔	✔	H[1] 25%	5	2
6	✔	✘	✘	✔	✘	✔	✔	✔	✔	✔	✔	H 7%	9	1
7	✔	✘	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	11	0
8	H 13%	✘	✘	✘	✘	H 9%	✔	H 11%	✔	H 6%	✔	✔	8	4
9	✘	✘	✘	✘	✘	✔	✘	✘	✘	✘	✘	✘	1	0
10	✘	H 8%	✘	✘	H 5%	H 13%	✔	✔	H 6%	H 19%	H 5%	✔	9	6

[1] Review of data indicated a possible data entry error, which if corrected would drop the repeatability to less than 10%.

✘ = No study done

✔ = Study completed with √MSE < 5%

H = Study completed with √MSE ≥5% (high variability)

Highlights indicate √MSE > 10%

Table 3-8 presents a summary of the PEP samplers that appear to be biased relative to the other PEP samplers in the parking lot collocation. The table also shows the direction in which the anomalous sampler differs from the rest. For example, sampler B182 in Region 4 produced concentrations that were lower than the concentrations from the other samplers for both the third and fourth quarters of 1999. From this table it can be seen that the same sampler often shows up in more than one quarter although the direction of bias can change. For example, returning to sampler B182 in Region 4, in the second quarter of 2001, this samplers gave concentrations higher than the other PEP samplers. There is one region/quarter where the data appear to be wrong. In Region 5 for the fourth quarter of 2001, there are 2 sampling days. For one of the days, the concentrations are nearly identical; for the other day, two samplers have concentrations near 10 $\mu g/m^3$ and the other samplers have concentrations half that, near 5 $\mu g/m^3$.

Appendix D contains the raw data used in these analyses.

Table 3-8. PEP Samplers that Appear Biased Relative to Others in Parking Lot Collocations

EPA Region	1999				2000				2001			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1		BGI0212 Low					BGI0242 High			BGI0210 Low BGI0242 High		
2				BGI0238 High					BGI0207 Low			
3												
4			BGI0182 Low	BGI0182 Low		BGI0206 High BGI0232 Low	BGI0204 High			BGI0182 High BGI0225 High		AND00006 High BGI0225 High
5											BGI0200 High	Data look wrong
6	BGI0181 High								BGI0241 Low BGI0184 High	BGI0308 High		BGI0308 High
7						BGI0285 High					BGI0285 Low	
8												
9						BGI0187 Low						
10		BGI0919 High				BGI0214 High						BGI0191 Low AND00011 High

High/Low = Indicates that the relative difference for the listed sampler is high or low compared to other collocated samplers.

3.2.5 Completeness and Bias for PEP and Routine Data Pairs

The completeness goal of the PEP was to collect data from 25 percent of each method designation in a reporting organization at a frequency of four times per year (once per quarter). Using the number of State, local, and tribal sites operating in each year (945 in 1999, 972 in 2000, and 1027 in 2001), about 236, 243, and 257 sites would require a performance evaluation in 1999, 2000, and 2001, respectively. The first column for each year in Figure 3-19 represents this site visit goal based on the data available in AIRS on July 8, 2002. This goal is slightly lower than the 25 percent selection procedure at the reporting organization level, but is considered acceptable for the national estimate.

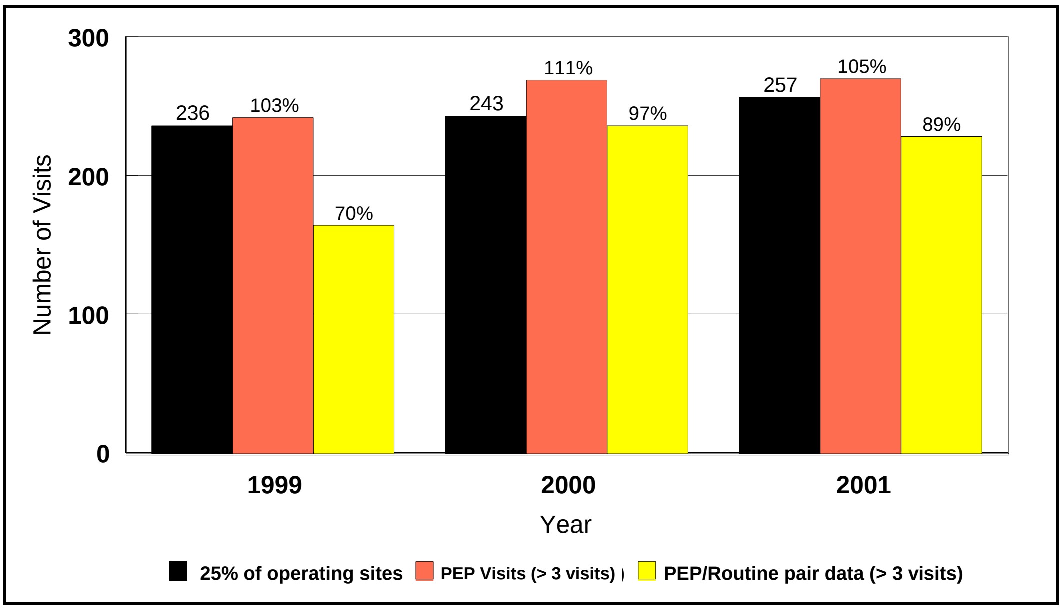

Figure 3-19. Annual completeness goals and percentages for the PM2.5 Performance Evaluation Program.

The bias data completeness estimate is based on two different organizations collecting the data: ESAT contractors, who collect the PEP data; and the monitoring organizations, which collect the routine data. Therefore, completeness is discussed based on PEP data completeness and completeness of the PEP/routine data bias pairs. A complementary 3-year QA report for the PEP will provide more detailed information on data completeness. Detailed completeness information at the state level of aggregation can be found in Appendix E.

PEP Data Completeness – The PEP completeness goal requires that 25 percent of the routine State, local, and tribal sites be sampled and that 75 percent of the samples (three out of the four expected samples) be valid for each site. Visiting the sites in all four quarters was another goal. The second column for each year in Figure 3-19 represents the number of unique sites that collected at least three valid PEP samples. Completeness percentages over 100 percent mean that the PEP was able to visit more sites than were required based on the national goal. These extra visits are due to the fact that the 25 percent goal is based on reporting organizations that tend to increase the number of site visits slightly over the national estimate. Table 3-9 provides the PEP site completeness information for calendar years 1999, 2000 and 2001.

Table 3-9. PEP Site Completeness

1999	Number of Sites Visited						
Frequency	Only 1 Quarter	In 2 Quarters	In 3 Quarters	In all 4 Quarters	Total	Sites with ≥ 3 Visits	Valid Samples[1]
1 or 2 PEP visits	15	21	NA	NA	36		58
3 PEP visits	0	7	67	NA	74		222
4 PEP visits	0	0	33	122	155		620
> 4 PEP visits	0	0	3	10	13		67
Total Sites	15	28	103	132	**278**	**242** (103% of goal)	
Total Samples	16	63	348	540			**967**
2000	**Number of Sites Visited**						
Frequency	**Only 1 Quarter**	**In 2 Quarters**	**In 3 Quarters**	**In all 4 Quarters**	**Total**	**Sites with ≥ 3 Visits**	**Valid Samples**
1 or 2 PEP visits	6	8	NA	NA	14		23
3 PEP visits	0	0	37	NA	37		222
4 PEP visits	0	2	26	183	211		844
> 4 PEP visits	0	0	1	20	21		108
Total Sites	6	10	64	203	**283**	**269** (111% of goal)	
Total Samples	7	24	220	835			**1086**
2001	**Number of Sites Visited**						
Frequency	**Only 1 Quarter**	**In 2 Quarters**	**In 3 Quarters**	**In all 4 Quarters**	**Total**	**Sites with ≥ 3 visits**	**Valid Samples**
1 or 2 PEP visits	16	16	NA	NA	15		49
3 PEP Visits	2	4	25	NA	31		93
4 PEP Visits	0	2	34	185	221		884
> 4 PEP Visits	0	0	2	20	22		112
Total Sites	18	22	61	205	**306**	**270** (105% of goal)	
Total Samples	23	52	221	842			**1138**

[1] Number of valid samples are used to calculate bias data loss (see Table 3-11).
Highlights indicate data used for comparison to PEP completeness goals.

PEP/Routine Sample Completeness

In order to calculate bias, for every PEP sample there must be a corresponding valid routine value. The third column for each year in Figure 3.19 represents the number of unique sites that had at least three valid PEP/routine sample pairs. Completeness for the 3 years was 70 percent, 97 percent and 89 percent, respectively, meaning the calendar year 1999 completeness was short of the 75 percent completeness goal. Table 3-10 provides the PEP/routine pair completeness for calendar years 1999, 2000, and 2001.

Table 3-10. PEP/Routine Pair Completeness

1999	**Number of Sites Visited**						
Frequency	**Only 1 Quarter**	**In 2 Quarters**	**In 3 Quarters**	**All 4 Quarters**	**Total**	**Sites with ≥ 3 Pairs**	**Valid Samples[1]**
1 or 2 pairs	27	50	NA	NA	77		127
3 pairs	0	7	59	NA	62		198
4 pairs	0	0	17	79	96		384
> 4 pairs	0	0	0	3	3		15
Total Sites	27	57	76	82	**242**	**165** (70% of goal)	
Total Samples	27	121	245	331			724
2000	**Number of Sites Visited**						
Frequency	**Only 1 Quarter**	**In 2 Quarters**	**In 3 Quarters**	**All 4 Quarters**	**Total**	**Sites with ≥ 3 Pairs**	**Valid Samples**
1 or 2 pairs	3	21	NA	NA	24		45
3 pairs	0	1	77	NA	78		234
4 pairs	0	2	26	126	154		616
> 4 pairs	0	0	1	3	4		20
Total Sites	3	24	104	129	**260**	**236** (97% of goal)	
Total Samples	3	53	340	517			**915**
2001	**Number of Sites Visited**						
Frequency	**Only 1 Quarter**	**In 2 Quarters**	**In 3 Quarters**	**All 4 Quarters**	**Total**	**Sites with ≥ 3 Pairs**	**Valid Samples**
1 or 2 pairs	9	21	NA	NA	30		51
3 pairs	2	8	58	NA	68		204
4 pairs	0	1	24	135	160		640
> 4 pairs	0	0	0	1	1		5
Total Sites	11	30	82	136	**259**	**229** (89% of goal)	
Total Samples	15	70	270	545			**900**

[1] Number of valid samples are used to calculate bias data loss (see Table 3-11).
Highlights indicate data used for comparison to PEP completeness goals.

The drop in the completeness percentage from the PEP completeness to the PEP/routine completeness means that there were no corresponding state routine sample concentrations to be paired with the PEP sample concentration. Table 3-11 illustrates the loss of bias data values. These data losses can be attributed to PEP visits on the wrong day, data entry problems in either monitoring program (usually problems with sample date or AIRS site ID), or data invalidation or subsequent loss of data from the routine monitoring program (which constitute the majority of the losses). Over the 3-year period, the total data loss (652 values), compared to the total valid PEP values (3,191), accounts for a 20 percent loss of valid PEP data. However, as is illustrated in Figure 3.19, even with these losses, the majority of the sites visited by the PEP for the years 2000 and 2001 were at least 75 percent complete.

Table 3-11. Bias Data Loss

Year	Valid PEP Samples	Valid PEP/Routine Sample Pairs	Data Loss	Loss %	Sample < 6 $\mu g/m^3$	< 6 $\mu g/m^3$ loss %
1999	967	724	243	25%	141	19%
2000	1086	915	171	16%	163	18%
2001	1138	900	238	21%	213	24%
Total	3191	2539	652	20%	517	20%

In addition to the sample losses mentioned above, bias is estimated only when both the PEP and routine sample concentrations for the pair are above 6 $\mu g/m^3$. This criterion is the same for the collocated precision estimates and was instituted because of the sensitivity of the bias estimate to small absolute differences at concentrations nearing the detection limit. The last two columns in Table 3-11 represent the loss of valid sample pairs that had one or both concentrations below 6 $\mu g/m^3$. Over the 3-year period, the total data loss (517 paired values), compared to the total valid PEP/routine sample pairs (2,539), accounts for a 20 percent loss of valid PEP data. Both of these types of data losses have an effect on the confidence limits around the mean bias estimates, especially when estimating bias at the reporting organization level of aggregation.

4.0 Summary, Findings, and Program Future

A review of the 1999 to 2001 PEP data revealed that the PEP met its major goals and helped to ensure that OAQPS would have the best possible data available to use in determining bias as part of the data quality objectives process. The PEP exceeded its completeness requirement for site visits by 3 percent in 1999, 11 percent in 2000, and 5 percent in 2001. The PEP also attained a good level of precision (repeatability), falling well within the acceptance criteria of 10 percent on the whole. The PEP’s completeness and precision could still be improved, however, in several ways. First, precision could be improved by applying procedures more consistently in the quarterly and annual parking lot collocation studies. Second, the field and laboratory data management processes could be improved by expediting validation and data turnaround. By speeding up validation and turnaround between field and lab personnel and laboratory personnel, problems could be identified and addressed more quickly.

The PEP revealed that field and lab operations have steadily improved since start-up in 1999. Field scientists have been performing duties according to SOPs, with no major problems. Laboratory analysts have successfully established control in their respective laboratories by effectively controlling contamination, maintaining temperature and relative humidity, and using appropriate procedures to perform filter-weighing duties. The problems with the HVAC system and balance standards in the Region 10 laboratory were resolved as quickly as possible and did not adversely affect laboratory operations. A thorough evaluation of the data that could have been incorrect as a result of those problems revealed that the Region 10 data were in fact good.

OAQPS will continue to maintain and improve the PEP by providing ongoing training and annual review courses. OAQPS is currently upgrading and replacing equipment to improve operations. Also, to avoid problems similar to those uncovered with Region 10’s standards and balance checks, OAQPS and Regional staff will review and audit laboratory data on a more regular basis. Finally, OAQPS is assessing ways to improve the speed and efficiency of data review and validation in order to expedite preparation and entry of PEP data into AQS.

This page intentionally left blank.

Appendix A
Standard Certifications: Selection of Metrology Laboratories

Program Implementation

Selection of Metrology Laboratories – The metrology laboratories that have participated in the recertification program are listed in Table A-1. Under Work Assignment (WA) 1-07 of EPA Contract No. 68-D-98-102, RTI evaluated commercial and governmental metrology laboratories that provide NIST traceability for instrumentation. After a thorough investigation, RTI considered four possible methods for recertification of the calibration standards. These four methods were to have (1) NIST recertify the calibration standards, (2) the standards' manufacturers recertify them, (3) a commercial metrology laboratory recertify them, or (4) the EPA ORD Metrology Laboratory recertify them.

Table A-1. Metrology Laboratories that Recertified $PM_{2.5}$ PEP Audit Standards

Metrology Laboratory	1999	2000	2001	Audit Standard Recertified
ORD Metrology Laboratory U.S. Environmental Protection Agency Mail Drop 91 86 T. W. Alexander Drive Research Triangle Park, NC 27711	✔	✔	✔	Digital pressure gauges Digital thermometer/probes Dry gas meters Flow transfer standards Electronic manometers Pressure calibration devices Pressure verification devices Primary flow meters
Colorado Engineering Experimental Station (CEESI) 54043 County Road 37 Nunn, CO 80648		✔		Flow transfer standards Electronic manometers
Chinook Engineering 555 Abasaraka Sheridan, WY 82801	✔			Flow transfer standards Electronic manometers
Thermo Andersen 500 Technology Court Smyrna, GA 30082-5211	✔	✔		Dry gas meters

Each metrology laboratory was asked several questions concerning its recertification procedures. RTI reviewed the results from the questionnaires and made a recommendation based on the following nine selection criteria:

- Test methods were traceable to NIST

- Enough calibration points were analyzed during the recertification to represent the full working range of the calibration standard
- The uncertainty of the measured calibration points was within the acceptance criteria established by the QAPP for the $PM_{2.5}$ PEP
- The reference standards used in the recertification were kept at the calibration laboratories except when being recertified
- The recertification period lasted at least a year
- The recertification was performed at the laboratory and not farmed out to another laboratory
- Turnaround time
- Cost
- The possibility of performing any necessary recalibrations or basic repairs.

All metrology laboratories satisfied the first six criteria listed. The turnaround time, the cost, and the possibility of performing necessary recalibrations or basic repairs are the criteria that distinguished the metrology laboratories from one another. It was determined that NIST was not the best choice because its turnaround time was too long and cost was too high, and because it did not offer recalibrations or repair service. The manufacturers who initially certified the calibration standards had a turnaround time ranging from 10 days to 3 weeks, had much lower costs than NIST, and had the capability to recalibrate or conduct basic repairs on a received calibration standard if it did not pass the initial recertification. Commercial metrology laboratories could only provide NIST traceability for temperature. RTI was unable to identify a commercial metrology laboratory that could provide NIST traceability for the pressure verification devices, pressure calibrators, dry gas meters, flow transfer standards, primary flow meters, or digital pressure gauges. The commercial metrology laboratories were rated on performing recertifications on only digital thermometers and probes. None of the commercial metrology laboratories gave better results for turnaround time, cost, or the ability to perform recalibrations or basic repairs.

The case for the ORD Metrology Laboratory was strengthened by these three criteria. By far, its strongest criterion was turnaround time. The ORD Metrology Laboratory needed only 3 to 4 weeks to complete the recertification, provided that there was no backlog of work in the laboratory. The turnaround time was based on two people working in the ORD Metrology Laboratory but could be reduced by increasing the manpower in the laboratory. This represents the lowest total turnaround time of all of the methods. It was apparent that the ORD Metrology Laboratory had the potential to be the best method. The cost was lower than the overall cost of the manufacturer laboratories for performing the recertifications, and because the ORD Metrology Laboratory was in close proximity of RTI, the shipping costs were greatly reduced. The ORD Metrology Laboratory could perform recalibrations but could not perform basic repairs.

The plan would be for the ORD Metrology Laboratory to conduct all future recertifications if it could increase its manpower and the laboratory obtained a flow rate measuring standard that would provide uncertainty errors acceptable to PEP. A comparison of the acceptance criteria for the standards and the uncertainties of the metrology laboratories recertifications is given in Table A-2.

Table A-2. Comparison of Acceptance Criteria and the Uncertainty of Recertification

Audit Standard	Acceptance Criterion	Metrology Laboratory Reference Standard Type	Uncertainty of Recertification by Metrology Laboratory
Temperature	±0.5°C	Platinum resistance thermometer	±0.2°C (Model 4000) (ORD)
			±0.1°C (Model 61220-604) (ORD)
Pressure	±0.7%[a]	Dead weight piston	±0.10% full scale (ORD)
Flow Rate	±2%	Spirometer (bell prover)	±1.5% (Thermo Andersen)
		Critical flow venturis	±2% (Chinook)
		Critical flow venturis	±0.5% (CEESI)
		Laminar flow element	±0.5% (ORD)

[a] The acceptance criterion (±5 mm Hg) given in the PEP QAPP is ±0.7% at 1 atmosphere (760 mm Hg).

Recertification Procedures and Schedule

Since 1999, RTI has arranged for the annual recertification of the $PM_{2.5}$ PEP calibration standards. The annual recertifications have been performed in two rounds through a central location, RTI. The records of all shipping/receiving, tracking, and scheduling have been entered into a recertification database.

In the strategy plan report, RTI recommended two rounds of recertifications during each year to allow the field scientists to have at least one of each type of calibration standard on hand at all times. The first round would include the verification standards such as digital pressure gauges, pressure calibration devices, dry gas meters, one-half of the flow transfer standards and accommodating electronic manometers, and one-half of the digital thermometers and accommodating probes. The second round would include the primary standards and the remainder of the verification standards, including pressure verification devices, primary flow meters, the remaining one-half of the flow transfer standards and accommodating electronic manometers, and the remaining one-half of the digital thermometers and accommodating probes.

Once all the calibration standards were recertified, RTI generated two booklets and wrote a summary report for EPA. The first booklet, *Recertification of Calibration Standards for the EPA* $PM_{2.5}$ *Performance Evaluation Program for Fiscal Years 2000-2003,* was divided into 11 tabbed sections corresponding to the 10 EPA Regional Offices and OAQPS. Each summary sheet (inventory for the Regional Office, see Figure A-1) displayed the instrument type, manufacturer, model number, serial number, and status.

EPA Region 1

Instrument Type	Manufacturer	Model Number	Serial Number	Status
Digital pressure gauge	PSI-Tronix	PG2000	K6372	3
Digital thermometer	Control Company	4000	325794	1
Digital thermometer	Control Company	4000	326139	1
Digital thermometer	Control Company	4121	98191236	8
Digital thermometer	Control Company	4121	98191243	8
Digital thermometer	Control Company	4121	98191263	8
Digital thermometer	Control Company	4121	98232911	8
Digital thermometer	Control Company	4121	98232957	8
Digital thermometer	Control Company	4121	98233006	8
Digital thermometer	Control Company	4121	99116512	8
Digital thermometer	Control Company	4121	99177347	8
Digital thermometer	Control Company	4121	99213042	8
Digital thermometer	Control Company	4121	99213053	8
Dry gas meter	Schlumberger	Galus 1.6	100845	1
Electronic Manometer	Dwyer	Series 475 Mark III	N/A (981041)	1
Electronic Manometer	Dywer	Series 475 Mark III	N/A (981034)	1
Flow transfer standard	Chinook	Streamline FTS	981034	1
Flow transfer standard	Chinook	Streamline FTS	981041	1
Pressure calibrator	Meriam	LP200I	D0710M06	1
Pressure verification	Druck	DPI 705	1628/99-01	1
Pressure verification	Druck	DPI 705	2971/99-06	1
Primary flow meter	BIOS	DC-L40K	1017	1
Temperature probe	Control Company	61220-604	20267711	1
Temperature probe	Control Company	61220-604	98197090	5
Temperature probe	Control Company	61220-604	98197117	1

Status
1 = operational, within annual certification period
2 = operational, within 2-year certification period
3 = operational, but needs to be recalibrated
4 = malfunctioning, needs to be repaired
5 = malfunctioning, cannot be repaired
6 = no status information available
7 = operational, out of annual certification period
8 = not in the recertification program

Figure A-1. Example of the summary sheet developed by the recertification database.

Recertification Database

In the strategy plan report, RTI also recommended that controlling the schedule, tracking, and shipping/receiving of the calibration standards should be maintained at a central location. The method of maintaining the input and output of information was accomplished using a Microsoft Access database.

The information sheets (see Figure A-2) for each standard follow the summary sheet. These printouts were made using the recertification database and have been updated to reflect the most recent recertifications. At the beginning of the tabbed sections was a summary table of all operational calibration standards recertified during that fiscal year.

The second booklet prepared for EPA, *Recertification of Calibration Standards for the EPA* $PM_{2.5}$ *Performance Evaluation Program for Fiscal Years 2000-2003 Certificate Booklet*, contains all the certificates for calibration standards listed on the inventories for each regional office. This booklet was also divided into 11 sections to represent the 10 EPA regional offices and OAQPS. Each section begins with a summary sheet (inventory) as described earlier. Following the summary sheet are the certificates (see Figure A-3) in protective pockets.

The summary report was divided into six sections that discuss different aspects of the steps taken to recertify the calibration standards used in the $PM_{2.5}$ PEP. Section 1 gives a brief introduction to the recertification process and also describes the content of the other five sections. Section 2 describes the types of calibration standards and the metrology laboratory that performed the recertifications. Section 3 details the schedule for the two rounds and events that occurred during each round to complete the recertification of the standards. Section 4 lists the results from the metrology laboratory, and Section 5 provides a statistical analysis of the calibration standard's results. Section 6 provides a list of recommendations that could be used for the next recertification.

EPA Region:	1	**Instrument Type:**	Digital thermometer
Manufacturer:	Control Company	**Supplier:**	VWR
Model Number:	4000	**Initial Certification:**	8/24/1998
Serial Number:	326139	**Current Status:**	1

Initial Certification Information

Organization Name	**Control Company**
Address	**308 West Edgewood**
City, State Zip Code	**Friendswood, TX 77546**
Phone	**(281) 482-1714**

Certification Date	Expiration Date	Certification Location
8/24/1998	8/24/2000	Control Company, 308 West Edgewood, Friendswood, TX 77546
2/2/2000	2/2/2001	U.S. ORD Metrology Laboratory, 86 Alexander Drive, Room P-103, RTP, NC 27711
12/28/2000	12/28/2001	U.S. ORD Metrology Laboratory, 86 Alexander Drive, Room P-103, RTP, NC 27711
2/13/2002	2/13/2003	U.S. ORD Metrology Laboratory, 86 Alexander Drive, Room P-103, RTP, NC 27711

Field Scientist/OAQPS comments:

Status

1 = operational, within annual certification period, 2 = operational, out of annual certification period,
3 = operational, but needs to be recalibrated, 4 = malfunctioning, needs to be repaired,
5 = malfunctioning, cannot be repaired, 6 = no status information available

Figure A-2. Example of the information sheet generated by the recertification database.

Device Under Test (DUT)	Flow Standard (FTS and manometer)	**Calibration Date**	4/22/2002
Met. Lab ID	211/211A	**Note Book**	1889, p. 59
Mfg. / model	Chinook Engineering/FTS, Dwyer/475 III		
Serial Number	981047	**Ambient Conditions During Calibration**	
		T, °C	22
		RH, %	31
EPA Office	OAQPS	**BP, hPa**	996
Report File	Flow 211 4-22-02 qa.xls	**(BP, torr)**	746.9

Comments

Flow was regulated through a DH Instruments Molbloc standard and flow was determined by a DH Instruments Molbox1. Differential pressure readings across the Chinook FTS were read off of the Dwyer 475 Mark III manometer. The manometer reading would often fluctuate between several adjacent numbers in the smallest digit. The most prevalent number was chosen when this occurred.
The Molbloc/Molebox1 system has a combined accuracy of 0.5% of reading (k=2, 95%) including repeatability and histeresis. It is traceable to NIST via NIST test report number 822/265296-01.

Calibration Equation**

To calculate a corrected Flow from the sqrt(dP*T/Pabs), use the following equation -

y = mx + b where
y = Reference value (Actual Liters/Min)
x = DUT Dimensionless ([dP*T/Pabs]½)

m = slope of the correction equation = 0.4131
b = intercept of the correction equation = -0.8078

Pt.	Pressure (ATM)	Differential pressure (inches of water)	Temperature (K)	Actual Flow (L/min)
1	1.00	2.62	295.9	10.69
2	1.00	4.15	295.9	13.68
3	1.00	6.20	295.9	16.89
4	1.00	7.39	295.9	18.52
5	1.00	9.99	295.9	21.62
6	1.00	8.33	295.8	19.69
7	1.00	6.67	295.8	17.55
8	1.00	5.25	295.8	15.47
9	1.00	3.25	295.9	11.99

List of Equipment Used in the Calibration of the DUT

Device	Last Calibrated	SN	Accuracy
DHI Molbox1	23-Jul-01	633	0.2% reading
DHI Molbloc, 30 lpm A	19-Oct-01	1975	0.3% reading
CL521, QAL T2	14-Jan-02	QAL T2	±0.1 °C
Heise HQS-2, 0-15 PSIA	16-Oct-00	16760	± 0.025% of span

Calibrations performed in the EPA APPCD Metrology Laboratory
Paul Groff, EPA (919) 541-0979
Mike Tufts, ARCADIS (919) 541-1357

USEPA
Mail Code E343-03
RTP, NC 27711

** These equations have been derived from a least squared residual regression and can be used to remove linear bias in the raw measurements of the DUT.

Figure A-3. Example of the recertification certificate.

Data Assessment

Pressure Calibration Standards – The digital pressure gauge, electronic manometer, pressure verification device, and pressure calibration device are the pressure measuring calibration standards used by the field scientists. During the 3 years of conducting recertifications, the Psi-Tronix PG2000 digital pressure gauges were the most problematic standard. The ORD Metrology Laboratory takes an as-received reading (barometric pressure) when the standards arrive at the laboratory. From FY2000 to FY2002, 19 of the 34 as-received readings (see Figure A-4) were outside of the acceptance criteria (±5 mm Hg). Three of these 19 digital pressure gauges could not be recalibrated and were sent to the manufacturer for repairs.

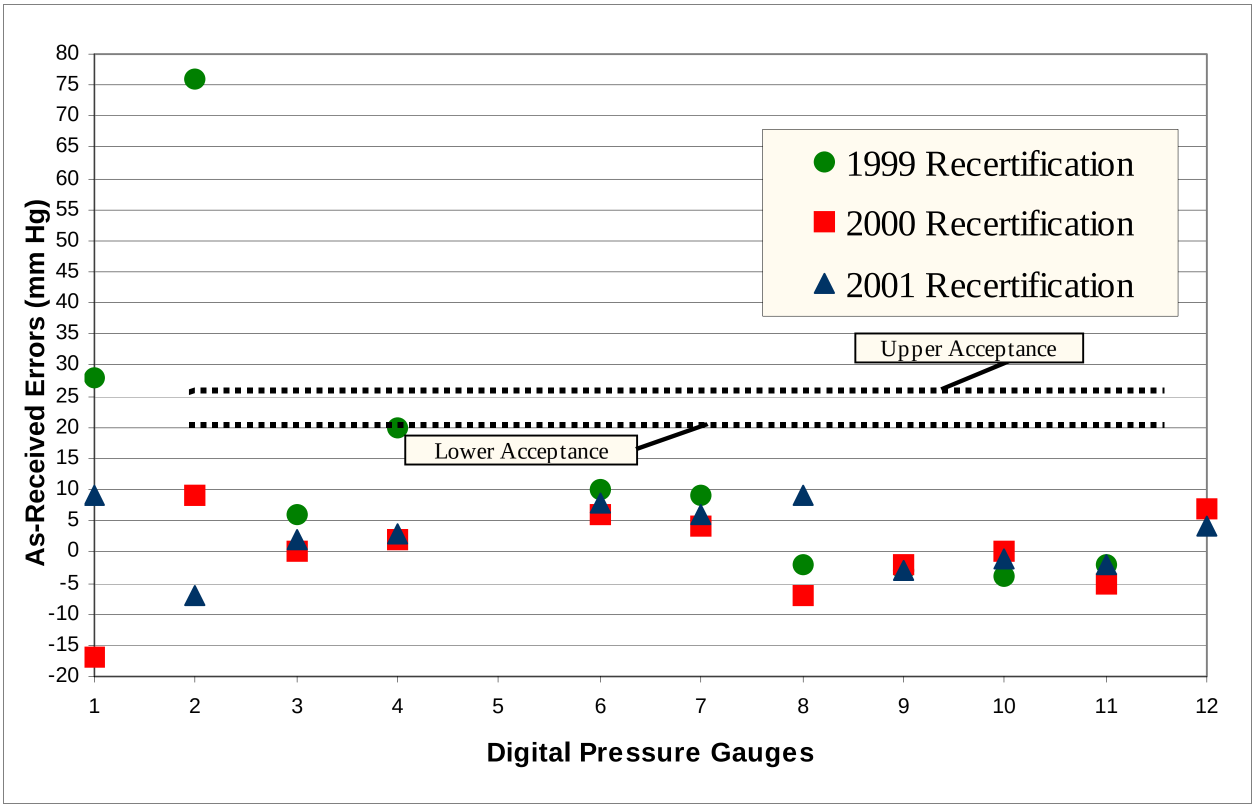

Figure A-4. Control chart comparing as-received pressure reading errors of the $PM_{2.5}$ PEP Psi-Tronix PG2000 for 1999–2001.

In general, there were no reports of problems with the Dwyer Series 475 Mark III electronic manometer, the Meriam LP200I pressure calibration devices, and the Druck DPI 705 and DPI 740 pressure verification devices during recertifications. During 1999, one pressure verification device was not sent for recertification. During 2001, one pressure verification device was not recertified because a sensor was damaged during calibration when the sensor support inside the standard failed while a connection fitting was being removed.

Flow Rate Calibration Standards – The flow transfer standard, dry gas meter, and primary flow meter were the calibration standards used to make flow measurements. The BIOS

DC-L40K primary flow meters were only recertified during 2001. There were no apparent problems, and all 11 were successfully recertified. The Schlumberger Galus 1.6 dry gas meters were recertified by Thermo Andersen during 1999 and 2000, and by the ORD Metrology Laboratory during 2001. The dry gas meter coefficient values changed slightly for each of the 13 dry gas meters, but were well within the acceptance criteria established by the 40 CFR 60, Appendix A, Method 5, Section 7.

In general, all the flow transfer standards performed satisfactorily during the 3 years of recertifications. During 1999, Chinook Engineering performed the recertifications of 25 Chinook Streamline flow transfer standards. CEESI conducted the recertification of 30 flow transfer standards during the 2000 recertifications. The ORD Metrology Laboratory performed the 2001 recertifications of 31 flow transfer standards. During the 2000 recertification, two flow transfer standards performed outside the $PM_{2.5}$ PEP acceptance criterion from 1999 to 2000 recertifications. One flow transfer standard had a shift in flow rate from the initial 1998 certificate to 1999 recertification of -4.32%. Then, from the 1999 to 2000 recertification, the percentage shift in flow rate was 4.08%. The other flow transfer standard had a percentage shift in flow rate from the initial 1998 certificate to 1999 recertification of -3.31%. Then from the 1999 to 2000 recertification, the percentage shift in flow rate was 4.25%. Both flow transfer standards appeared to return to agreement with the initial certification. Thus, the percentage shift in flow rate from the initial 1998 certification to 1999 recertification performed by Chinook Engineering was questionable. This indicated a problem for these two flow transfer standards during the 1999 recertification. The 2001 recertification agreed with the initial certificate and the 2000 recertification.

Temperature Calibration Standards – The temperature measuring system consists of a digital thermometer and a temperature probe. When the calibration standards are recertified, these devices are evaluated as a system. Over the past 3 years, the major problem with the temperature measuring system was the vulnerability of the LCD readout. The Control Company 4000 digital thermometer does not come equipped with a carrying case. The LCD readout is exposed, and on three occasions during 1999 recertifications, the readout was broken when received at RTI. Also during 1999, a temperature probe was not working properly, thus failing the temperature measuring system. For the 3-year period, 73 of the 77 digital thermometer/temperature probe measuring systems were successfully recertified. The calibration standards that failed the recertification were replaced.

This page intentionally left blank.

Appendix B
Control Charts, 1999–2001

This page intentionally left blank.

Appendix C
Investigation of Region 10 Balance Checks

Statement of Problem

Throughout 1999 and into mid-2001, the Region 10 PEP weighing laboratory in Port Orchard, WA experienced significant problems meeting the balance checks specified in the Quality Assurance Project Plan for the $PM_{2.5}$ Performance Evaluation Program. Both high and low mass working standards for Region 10 were affected, but the problem was not seen at the other PEP filter weighing laboratory in Region 4 at Athens, GA. However, both regions met the specified acceptance criteria for all other quality assurance checks related to filter weighing. In Region 10, the balance checks for both high and low mass working standards exceeded the specified limits many times and did not display any logical pattern. In addition, a high variance was observed when the quarterly verified weights were compared to the certified weight of the standard. This high variance was not seen at the Region 4 laboratory.

In Figures C-1 and C-2, the balance check issue is represented graphically. The low mass working standards, illustrated in Figure C-1, display a large number of exceedances above the ± 3 µg acceptance criteria while the high mass working standards in Figure C-2 show many exceedances below the acceptance criteria. All other quality control parameters involved in weighing sessions demonstrated control, but the balance checks suggested a problem.

EPA OAQPS traveled to Region 10 in mid-2001 to assist in data validation and discovered the working standard weight issue. The issue was not seen previously in Region 10 because of a lingering problem with the Performance Evaluation Database used to manage the performance evaluation data and its associated acceptance criteria. The PED was originally designed to only store the current verified weight for comparison with the working standards. The database has since been modified so that it tracks the changes in verified weights over time. The working standard weight issue was investigated and it was suggested that the weights be cleaned and recertified to meet acceptance criteria. This was completed and initial indications seemed to yield good results.

This additional review was initiated to determine the effect on the Region 10 dataset, review the effects of the OAQPS recommendation, and to explore any other possible problems that may have contributed to the weighing standard issue.

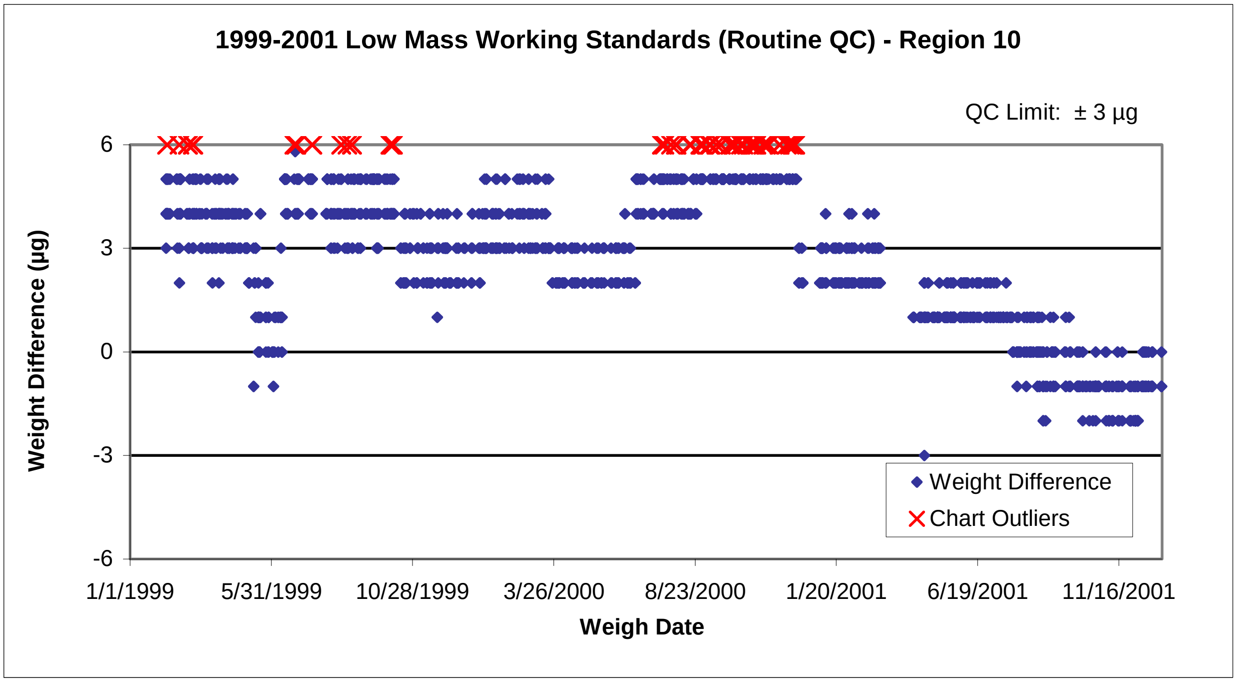

Figure C-1. Region 10 low mass working standards for 1999-2001

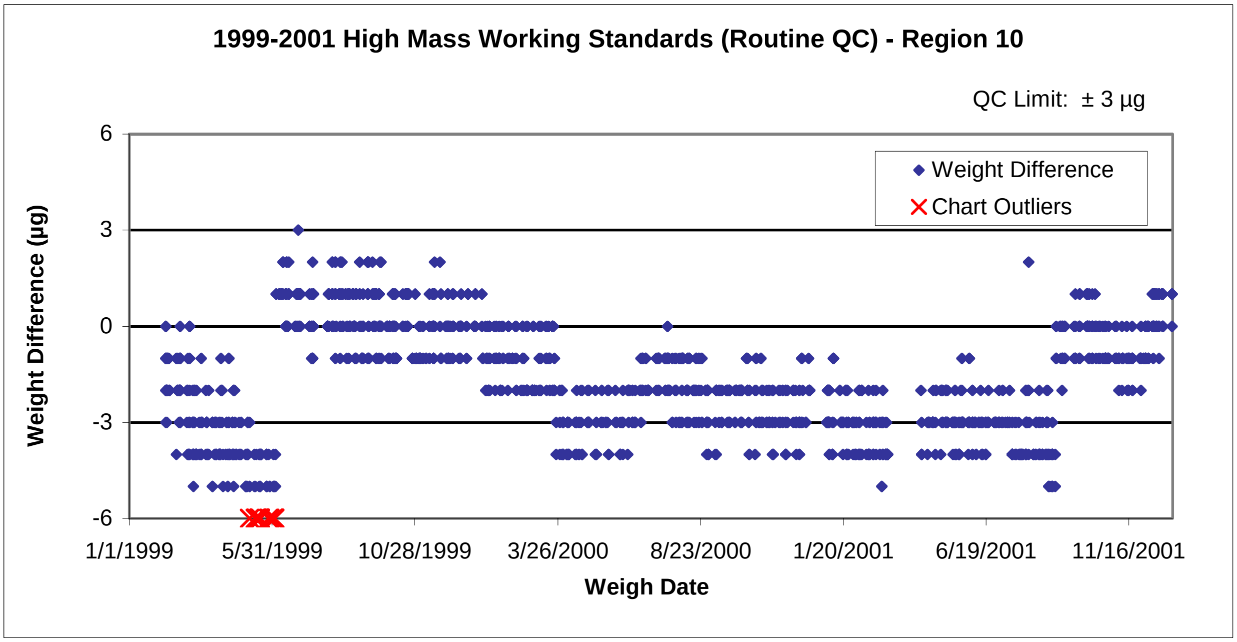

Figure C-2. Region 10 high mass working standards for 1999-2001

Investigation

The Region 10 working standard question was addressed by:

- Reviewing working and primary standard weight certifications
- Comparing certified weights and measured weights over time
- Comparing primary and working standard weighing precision in both Region 10 and Region 4
- Investigating the quarterly weight verification procedure and calculations

To begin the investigation, all certificates for the primary and working standards were requested from Region 10 by EPA. The initial certificate for the working standards, purchased in 1998, was not found, and were not re-certified until April 2001. Certificates for the primary standards were found, but they were not re-certified until April 2001 as well. After April 2001, all standards, working and primary, have been re-certified at least annually. The standards were re-certified according to ASTM class 1 specifications.

Because of the missing certificate for the working standards, no comparison of actual weights to the initial certified weights could be performed. However, using the April 2001 weight re-certification values for the working standards, an estimate of the standard's previous weight was made. When the working standard weights were cleaned and re-certified in April 2001, the mass of the 100-mg weight was measured at 99.998 mg and the 200-mg weight was measured at 199.994 mg. Since the standards were not replaced, it can be assumed that the mass prior to the re-certification would be similar. Figures C-3 and C-4 plot all 100-mg and 200-mg working standard weights from the weighing sessions during 1999 through 2001; these graphs show very similar trends. In Figure C-3, the majority of the weights lie between 99.998 mg and 100.000 mg with shifts in early 1999 and later in 2001. The higher weights in the first two quarters of 1999 could be attributed to implementation problems experienced early in the program such as weighing chamber control problems, static control issues, and familiarization with the microbalance and method. Late in 2001, the shift to lower weights averaging 99.997 mg is most likely a result of the cleaning and re-certification of the working standards. Figure C-4 shows essentially the same trends and the same explanations may apply.

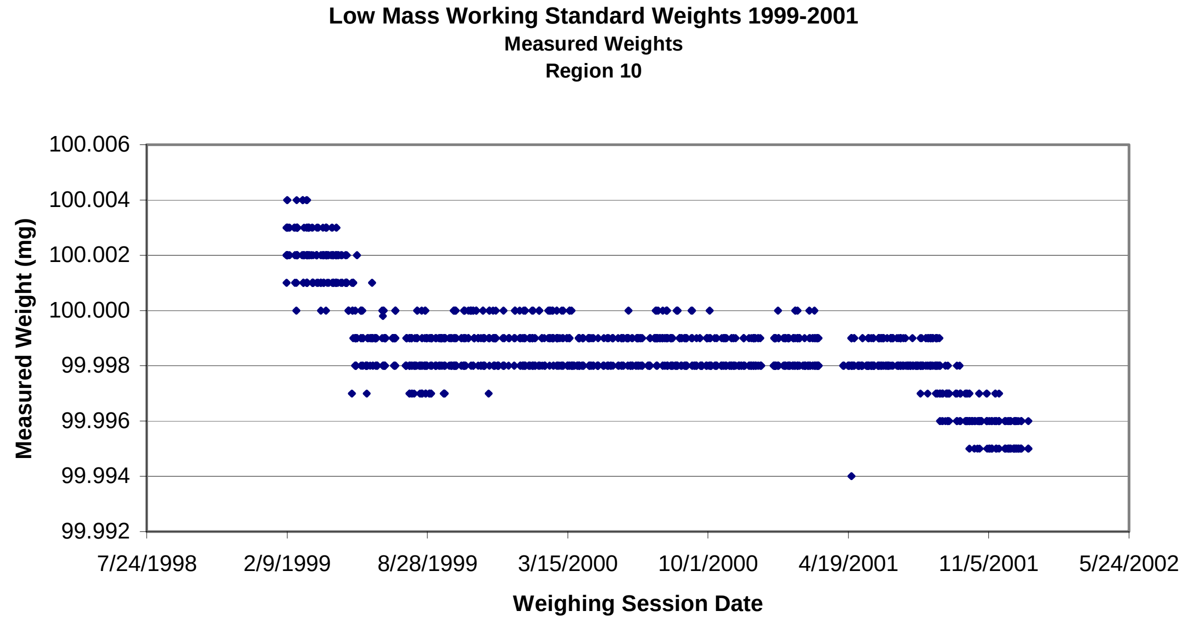

Figure C-3. Region 10 low mass working standard routine weighings

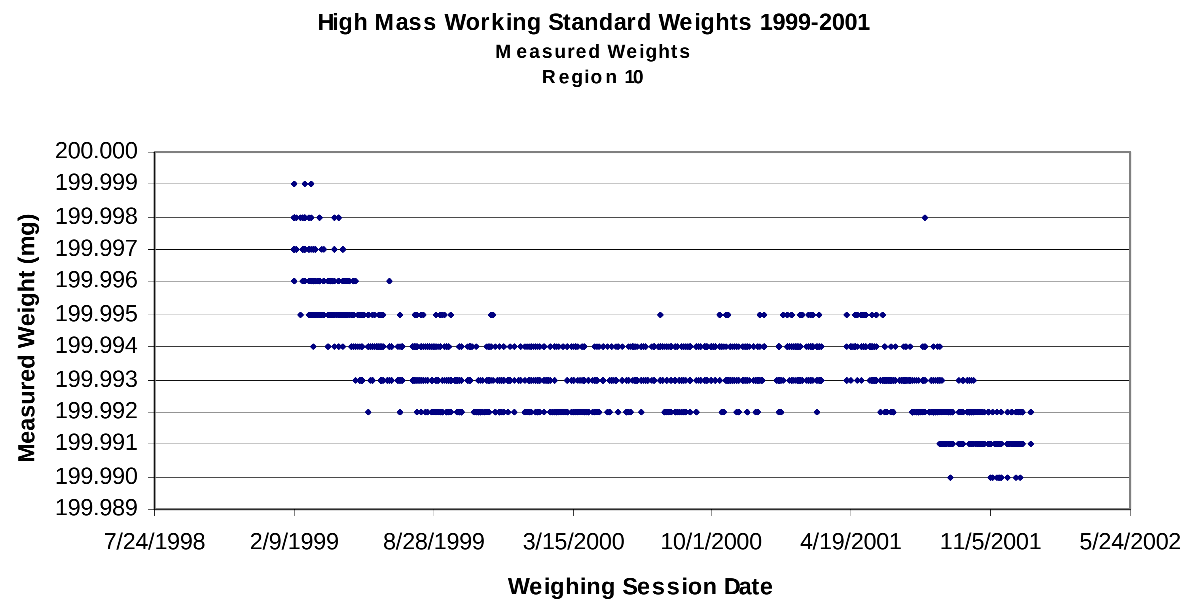

Figure C-4. Region 10 high mass working standard routine weighings

From June 1999 to April 2001 where there is no record of certified weights, the 100-mg working standard averaged approximately 99.999 mg, and the 200-mg working standard averaged between 199.993 mg and 199.994 mg. The working standard weights after cleaning and re-certification were 99.998 mg for the 100-mg working standard and 199.994 mg for the 200-mg working standard. If the re-certification weights and the average weights from June 1999 to April 2001 are compared, the weights are very close (as shown in Table C-1). Weights prior to June 1999 were not included in this comparison due to implementation issues that could have caused variation in the measurements.

Table C-1. Comparison of Average and Re-certified Weights from April 2001

Working Standard	Average Weight from June 99 to April 01	Re-certified Weight in April 01	Weight Difference (avg re-cert)
100 µg	99.999	99.998	0.001
200 µg	199.993	199.994	-0.001

The 100-mg and 200-mg working standard weights for Region 4 were also plotted in Figures C-5 and C-6 for comparison purposes and show very similar results. In the first two quarters of 1999, implementation problems were experienced in Region 4 similar to that of Region 10 and the data shows a similar trend. Similar trends can be observed at the end of 2001 as well, but these observations are the result of the purchase of new weights. The new weights were purchased to replace an old set of standards that were out of tolerance for NIST certification.

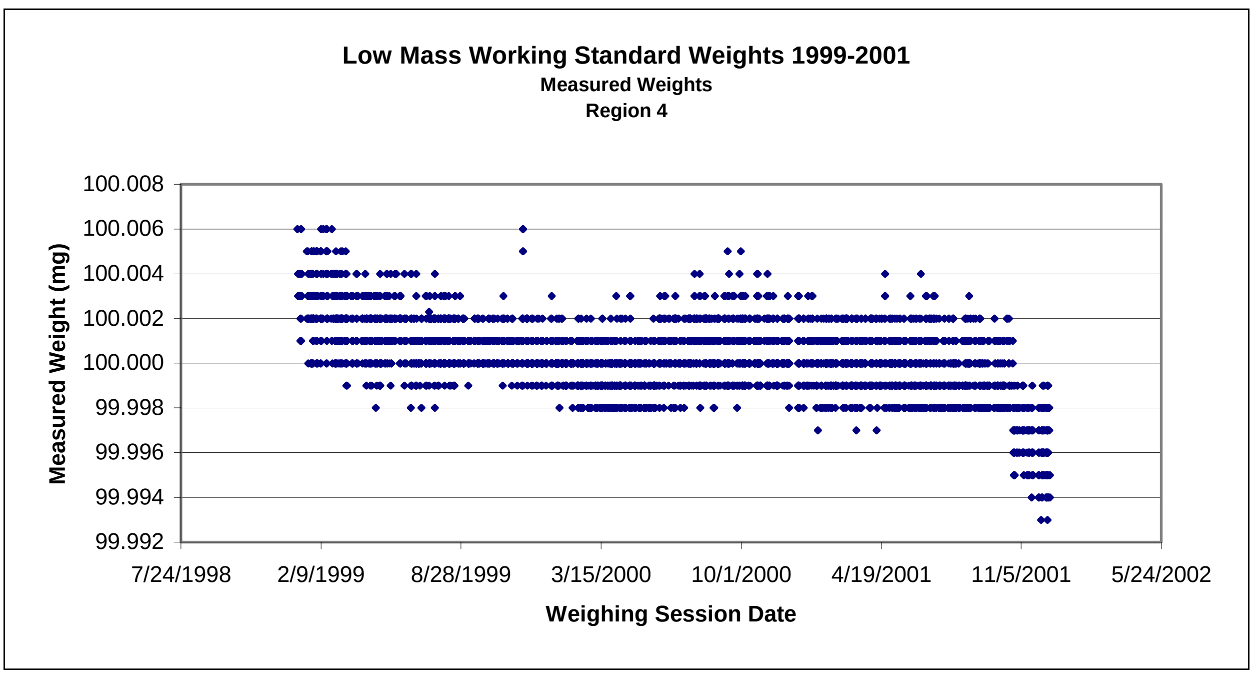

Figure C-5. Region 4 low mass working standard routine weighings

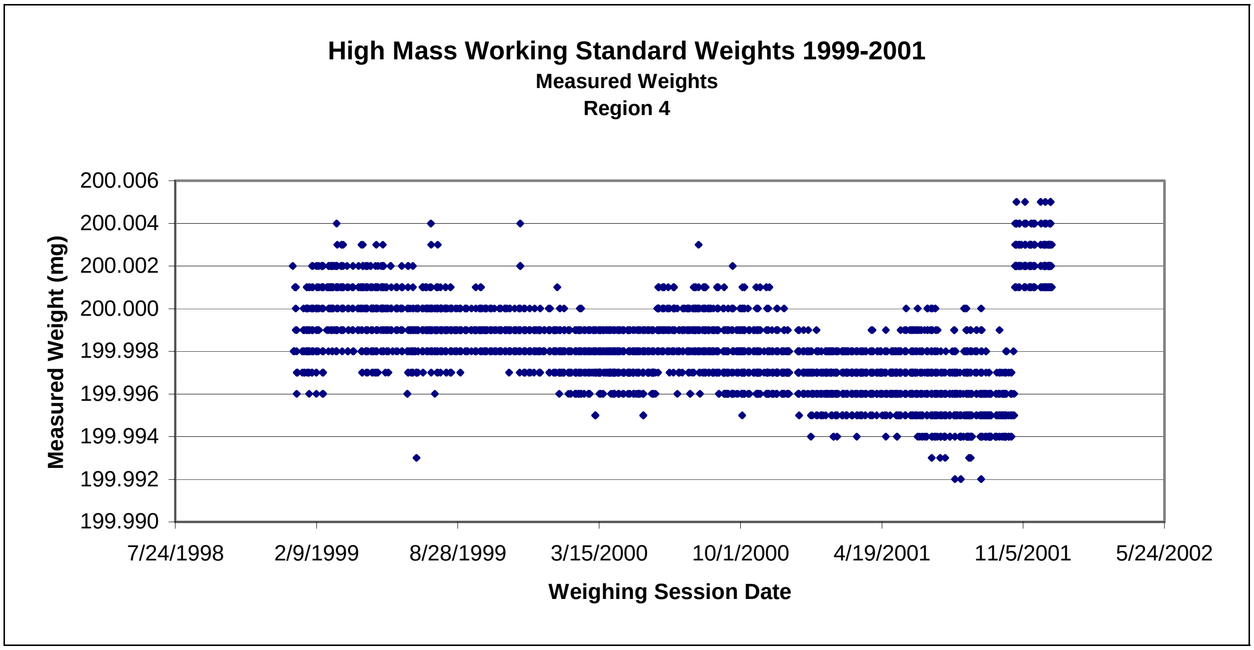

Figure C-6. Region 4 high mass working standard routine weighings

Before the working standards can be used in the weighing laboratory, a verification must be performed to compare the working standards against the primary standards to ensure that the working standards are still within the acceptance criteria of their certified weight. This verification is performed quarterly until time for the required annual certification. The method required by the $PM_{2.5}$ Performance Evaluation Program Standard Operating Procedure is the double substitution method in which a standard (primary standard) and an unknown weight (working standard) are inter-compared twice to determine the average difference between the two weights. The procedure can be found in the NIST Handbook No.145, Standard Operating Procedure No.4. The formula used is:

$$C_w = C_p + [(O_1 - O_2 + O_4 – O_3) / 2] + N_p - N_w$$

C_w = Apparent mass correction of working standard
C_p = Apparent mass correction of primary standard
O = Weighing observation
N_p = Primary standard nominal value
N_w = Working standard nominal value

The PEP SOP for the weighing laboratory implies that this calculated corrected weight of the working standard should be used as the certified weight of the working standard in the respective weighing laboratory environment. From this corrected working standard weight, the analyst will have a ± 3 µg range as the acceptance criteria for the working standard balance check. In reality, the formula, from NIST Handbook No.145, Standard Operating Procedure No.4, should be used to determine shifts in weight between the primary and working standards; for example, it should be used if the working standard is showing a shift from its routinely measured weight in consecutive weighing sessions. Two of these quarterly comparisons will result in a mass correction outside of the ± 2 µg acceptance requirement and will initiate corrective action. Therefore, the PEP was in fact using the equation for corrected weight to determine a surrogate certified weight, and incorrectly using that value as a true certified weight in the PED. The use of the calculated corrected weight should only be used as a tool to indicate control problems with the weights and/or the balance in the laboratory, whereas the certified weight from the NIST traceable third party should be used as the weight to which the standards are compared.

When a difference is calculated between both sets of certified weight values and the working standard indicated weights from routine weighing sessions in the Region 10 laboratory, the charts show a dramatic difference. Figures C-7 and C-8 illustrate this comparison showing much better precision with most weight differences falling within the acceptance criteria. A negative bias of approximately 1 µg is seen in the high mass graph, while a positive bias of approximately 1 µg is seen in the low mass graph. Although these biases are small and most weight differences fall within acceptance criteria, the bias may be explained by different weighing room conditions. If weighing conditions in the certification laboratory are different from those in the Region 10 laboratory, then the weights will change slightly depending on the humidity and temperature that affect the operation of the balance. If a correction or validation of the working standards is conducted in the Region 10 laboratory, it is reasonable to suggest that the bias will become smaller, assuming the certified weights of the working standards are accurate.

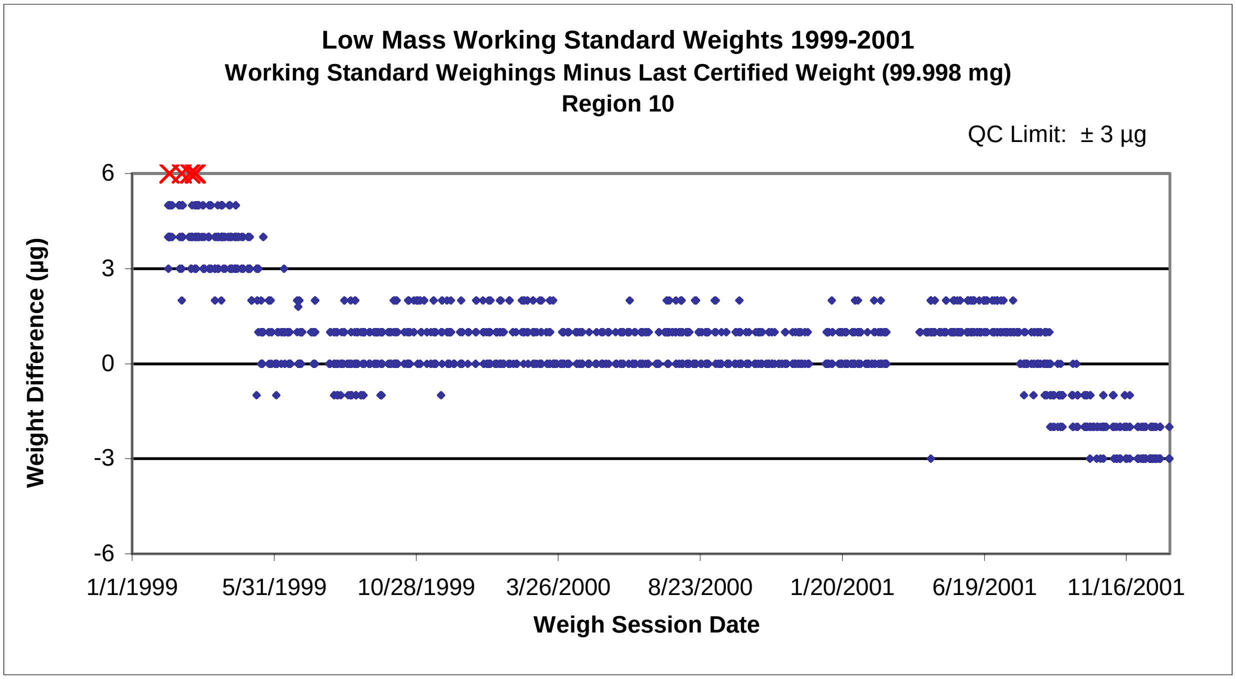

Figure C-7. Region 10 comparison of low mass working standard weighings versus certified weight

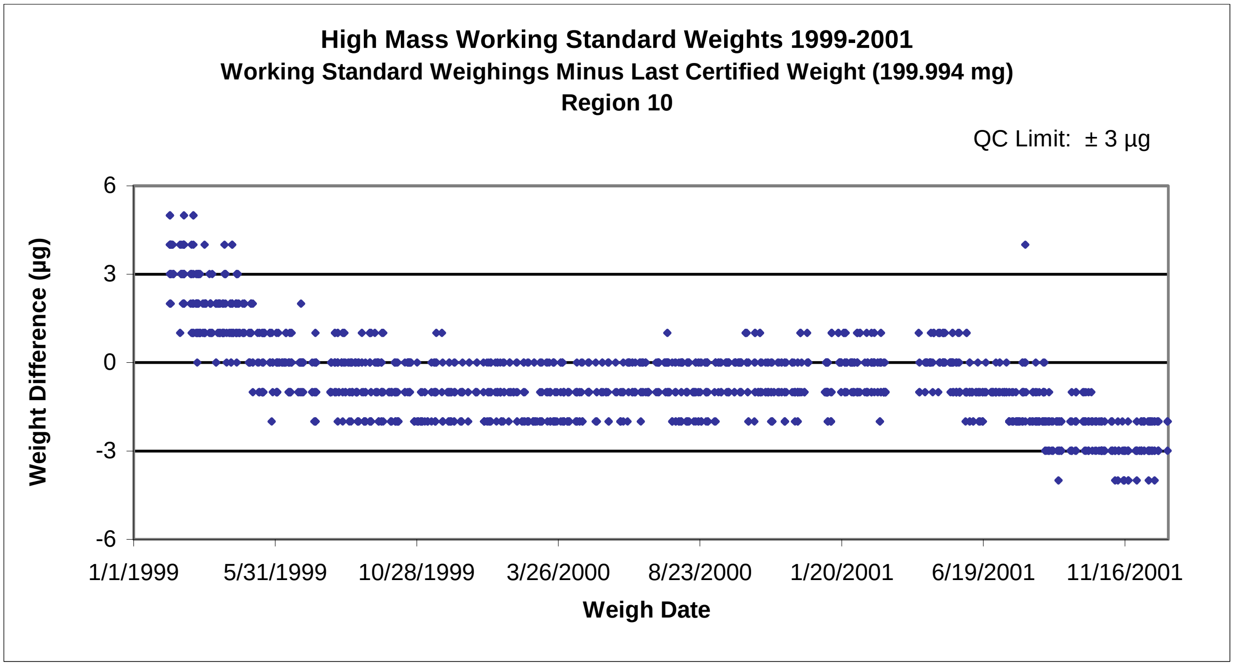

Figure C-8. Region 10 comparison of low mass working standard weighings versus certified weight

The Region 4 weighing laboratory did not show balance checks outside the acceptance criteria because the primary and the working standard weights for both low and high mass were almost identical. When the double substitution formula was used, the difference was generally one microgram or less, essentially the same as its certified weight. Good control in the Region 4 weighing lab allowed for adequate precision showing little effect of using the NIST double substitution equation in an inappropriate application. On the other hand, the Region 10 laboratory's primary standard and working standard weights differed by 6 µg for the low mass weight, and 4 µg for the high mass weight. These differences produced corrected weights that ranged from 2 to 3 µg off the certified weight. This difference, assuming weight change due to a different weighing environment is negligible, shifted the ± 3 µg range outside what the weight would consistently weigh giving the impression that the balance checks were outside acceptance criteria.

Results and Recommendations

The results of the investigation indicate that the precision of the Region 10 balance checks is very good and shows acceptable balance control, but the correct method needs to be used to properly show precision for the balance. Plotting the routine weights against the certified weights, demonstrated in Figures C-7 and C-8, shows very good precision and control. However, using the formula in NIST Handbook No.145, Standard Operating Procedure No.4, to determine the corrected weight as a surrogate certified weight may show the balance checks out of control. The NIST Handbook No.145, Standard Operating Procedure No.4, should only be used as a quantitative tool for determining shifts between the working and primary standards. As a result, procedures will likely be changed so that the certified weight is used in determining accuracy, whereas the calculated corrected weight is only used as a quantitative tool for determining problems in the laboratory with either the weights or the balance.

Another method should be developed or identified and used to determine the corrected weights of the high and low mass working standards. No method has been identified at this time, but work has begun to identify an appropriate statistical method to determine a standard weight corrected for a specific laboratory's weighing conditions. When the correct method is implemented, precision may be accurately demonstrated.

This page intentionally left blank.

Appendix D

Quarterly PEP Samplers Collocating Data by Region, 1999–2001

This page intentionally left blank.

THE 1999 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
1	2	06/02/1999	BGI0210	3.19	24.3
		06/02/1999	BGI0211	3.21	24.7
		06/02/1999	BGI0212	3.14	23.2
		06/30/1999	BGI0210	2.02	7.5
		06/30/1999	BGI0211	2.04	7.7
		06/30/1999	BGI0212	1.98	7.2
1	4	12/28/1999	BGI0210	1.98	7.2
		12/28/1999	BGI0211	2.06	7.9
		12/28/1999	BGI0212	1.96	7.1
		12/28/1999	BGI0242	1.98	7.2
2	1	03/24/1999	BGI0207	1.99	7.3
		03/24/1999	BGI0208	1.98	7.2
2	2	05/30/1999	BGI0207	2.42	11.3
		05/30/1999	BGI0208	2.38	10.8
		05/30/1999	BGI0209	2.38	10.8
2	3	08/18/1999	BGI0207	2.30	10.0
		08/18/1999	BGI0208	2.34	10.4
		08/18/1999	BGI0238	2.33	10.3
2	4	10/25/1999	BGI0208	2.51	12.3
		10/25/1999	BGI0238	2.52	12.4
		12/21/1999	BGI0207	1.83	6.2
		12/21/1999	BGI0208	1.86	6.4
		12/21/1999	BGI0238	1.93	6.9
4	1	02/28/1999	BGI0182	1.92	6.8
		02/28/1999	BGI0204	1.60	5.0
		02/28/1999	BGI0206	1.68	5.4
		02/28/1999	BGI0225	1.60	5.0
4	2	04/29/1999	BGI0182	1.45	4.2
		04/29/1999	BGI0204	1.46	4.3
		04/29/1999	BGI0225	1.47	4.3
		05/04/1999	BGI0203	3.05	21.2
		05/04/1999	BGI0205	3.07	21.6
		05/04/1999	BGI0206	3.06	21.4
		05/04/1999	BGI0232	3.06	21.4
		05/23/1999	BGI0182	3.23	25.2
		05/23/1999	BGI0204	3.24	25.5
		05/23/1999	BGI0225	3.26	25.9
		06/22/1999	BGI0182	2.96	19.3

THE 1999 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
4	2	06/22/1999	BGI0203	2.92	18.5
		06/22/1999	BGI0204	2.94	18.8
		06/22/1999	BGI0205	2.93	18.8
		06/22/1999	BGI0206	3.00	20.2
		06/22/1999	BGI0232	2.99	19.8
4	3	07/27/1999	BGI0182	3.61	37.0
		07/27/1999	BGI0203	3.65	38.3
		07/27/1999	BGI0204	3.63	37.7
		07/27/1999	BGI0205	3.62	37.2
		07/27/1999	BGI0206	3.61	37.1
		07/27/1999	BGI0225	3.65	38.4
		08/24/1999	BGI0182	2.61	13.6
		08/24/1999	BGI0204	2.63	13.9
		08/24/1999	BGI0205	2.63	13.9
		08/24/1999	BGI0225	2.64	14.1
		08/26/1999	BGI0203	3.45	31.4
		08/26/1999	BGI0206	3.45	31.5
		09/22/1999	BGI0182	2.39	10.9
		09/22/1999	BGI0203	2.41	11.2
		09/22/1999	BGI0204	2.38	10.9
		09/22/1999	BGI0205	2.40	11.0
		09/22/1999	BGI0206	2.42	11.2
		09/22/1999	BGI0225	2.43	11.4
		09/22/1999	BGI0232	2.42	11.2
4	4	10/13/1999	BGI0182	2.71	15.1
		10/13/1999	BGI0203	2.77	16.0
		10/13/1999	BGI0205	2.74	15.5
		10/13/1999	BGI0206	2.77	15.9
		10/13/1999	BGI0225	2.78	16.2
		10/13/1999	BGI0232	2.77	15.9
		11/09/1999	BGI0182	3.32	27.8
		11/09/1999	BGI0203	3.33	28.0
		11/09/1999	BGI0204	3.34	28.2
		11/09/1999	BGI0205	3.34	28.1
		11/09/1999	BGI0206	3.35	28.4
		11/09/1999	BGI0225	3.35	28.5
		11/09/1999	BGI0232	3.31	27.4
		12/16/1999	AND00111	1.67	5.3
		12/16/1999	BGI0182	1.63	5.1
		12/16/1999	BGI0203	1.68	5.4
		12/16/1999	BGI0204	1.62	5.0
		12/16/1999	BGI0205	2.05	7.7
		12/16/1999	BGI0206	1.63	5.1

THE 1999 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
4	4	12/16/1999	BGI0225	1.67	5.3
		12/16/1999	BGI0232	1.68	5.4
		12/16/1999	RP202849807	1.85	6.3
		12/16/1999	RP869807	1.79	6.0
		12/16/1999	RP919807	1.85	6.4
6	1	01/27/1999	BGI0181	2.23	9.3
		01/27/1999	BGI0183	2.16	8.7
		01/27/1999	BGI0184	2.21	9.2
		01/27/1999	BGI0185	2.19	8.9
		01/27/1999	BGI0186	2.16	8.7
		01/27/1999	BGI0217	2.18	8.9
		02/02/1999	BGI0181	2.39	10.9
		02/02/1999	BGI0183	2.37	10.7
		02/02/1999	BGI0184	2.31	10.1
		02/02/1999	BGI0185	2.38	10.8
		02/02/1999	BGI0186	2.37	10.7
		02/02/1999	BGI0217	2.34	10.4
6	4	12/13/1999	BGI0181	2.56	13.0
		12/13/1999	BGI0183	2.56	13.0
		12/13/1999	BGI0184	2.55	12.9
		12/13/1999	BGI0185	2.58	13.2
		12/13/1999	BGI0186	2.56	13.0
		12/13/1999	BGI0217	2.39	10.9
		12/13/1999	BGI0241	2.55	12.9
		12/14/1999	BGI0181	1.53	4.6
		12/14/1999	BGI0183	1.59	4.9
		12/14/1999	BGI0184	1.57	4.8
		12/14/1999	BGI0185	1.60	5.0
		12/14/1999	BGI0186	1.58	4.9
		12/14/1999	BGI0241	1.64	5.2
		12/16/1999	BGI0181	2.58	13.2
		12/16/1999	BGI0183	2.59	13.3
		12/16/1999	BGI0184	2.57	13.1
		12/16/1999	BGI0185	2.57	13.1
		12/16/1999	BGI0186	2.58	13.2
		12/16/1999	BGI0217	2.58	13.2
		12/16/1999	BGI0241	2.56	12.9
7	1	03/20/1999	BGI0192	3.09	22.1
		03/20/1999	BGI0215	3.11	22.4
		03/25/1999	BGI0193	2.43	11.3
		03/25/1999	BGI0215	2.38	10.8
		03/27/1999	BGI0193	3.03	20.7

THE 1999 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
7	1	03/27/1999	BGI0215	3.08	21.8
7	2	05/31/1999	BGI0192	2.14	8.5
		05/31/1999	BGI0215	2.05	7.8
		06/27/1999	BGI0193	2.21	9.1
		06/27/1999	BGI0215	2.14	8.5
7	3	08/25/1999	BGI0192	3.29	26.7
		08/25/1999	BGI0193	3.26	26.2
		08/25/1999	BGI0215	3.23	25.2
		09/30/1999	BGI0192	2.53	12.6
		09/30/1999	BGI0193	2.52	12.4
		09/30/1999	BGI0215	2.54	12.6
7	4	10/30/1999	BGI0192	2.24	9.4
		10/30/1999	BGI0193	2.25	9.5
		12/01/1999	BGI0192	2.55	12.8
		12/01/1999	BGI0193	2.54	12.7
		12/29/1999	BGI0192	2.98	19.6
		12/29/1999	BGI0193	3.00	20.1
8	1	02/18/1999	BGI0197	1.46	4.3
		02/18/1999	BGI0198	1.76	5.8
		02/18/1999	BGI0199	1.40	4.0
		03/30/1999	BGI0197	2.16	8.7
		03/30/1999	BGI0198	2.20	9.0
		03/30/1999	BGI0199	2.21	9.1
8	2	06/27/1999	BGI0197	2.31	10.1
		06/27/1999	BGI0198	2.26	9.6
		06/27/1999	BGI0199	2.25	9.4
9	4	10/09/1999	AND00016	2.41	11.1
		10/09/1999	BGI0187	2.37	10.7
		10/09/1999	BGI0190	2.29	9.9
		10/09/1999	BGI0235	2.29	9.9
		12/02/1999	BGI0190	2.21	9.2
10	2	05/01/1999	BGI0189	0.93	2.5
		05/01/1999	BGI0191	1.26	3.5
		05/01/1999	BGI0214	0.95	2.6
		05/31/1999	BGI0189	2.06	7.8
		05/31/1999	BGI0214	2.05	7.7
		06/30/1999	BGI0189	1.98	7.2
		06/30/1999	BGI0191	2.03	7.6
		06/30/1999	BGI0214	1.93	6.9

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
1	1	02/14/2000	BGI0210	2.08	8.0
		02/14/2000	BGI0211	2.10	8.2
		02/14/2000	BGI0212	2.10	8.2
		02/14/2000	BGI0242	2.08	8.0
		02/15/2000	BGI0210	2.61	13.7
		02/15/2000	BGI0211	2.64	14.0
		02/15/2000	BGI0212	2.64	14.1
		02/15/2000	BGI0242	2.63	13.8
		02/16/2000	BGI0210	2.10	8.2
		02/16/2000	BGI0211	2.08	8.0
		02/16/2000	BGI0212	2.08	8.0
		02/16/2000	BGI0242	2.09	8.1
1	2	05/08/2000	BGI0210	3.10	22.2
		05/08/2000	BGI0211	3.11	22.4
		05/08/2000	BGI0212	3.12	22.6
		05/08/2000	BGI0242	3.13	22.9
		05/09/2000	BGI0210	1.93	6.9
		05/09/2000	BGI0211	1.90	6.7
		05/09/2000	BGI0212	1.93	6.9
		05/09/2000	BGI0242	1.95	7.0
		05/10/2000	BGI0210	1.07	2.9
		05/10/2000	BGI0211	1.07	2.9
		05/10/2000	BGI0212	0.98	2.7
		05/10/2000	BGI0242	1.07	2.9
		06/06/2000	BGI0210	1.39	4.0
		06/06/2000	BGI0211	1.40	4.0
		06/06/2000	BGI0212	1.44	4.2
		06/06/2000	BGI0242	1.48	4.4
1	3	09/18/2000	BGI0210	2.93	18.7
		09/18/2000	BGI0211	2.94	18.9
		09/18/2000	BGI0212	2.92	18.5
		09/18/2000	BGI0242	2.98	19.7
		09/19/2000	BGI0210	2.05	7.7
		09/19/2000	BGI0211	2.08	8.0
		09/19/2000	BGI0212	2.05	7.8
		09/19/2000	BGI0242	2.08	8.0
		09/20/2000	BGI0210	2.87	17.6
		09/20/2000	BGI0211	2.87	17.6
		09/20/2000	BGI0212	2.85	17.3
		09/20/2000	BGI0242	2.90	18.1
1	4	12/11/2000	BGI0210	2.87	17.6
		12/11/2000	BGI0211	2.89	18.0

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
1	4	12/11/2000	BGI0212	2.88	17.9
		12/11/2000	BGI0242	2.84	17.1
		12/12/2000	BGI0210	1.06	2.9
		12/12/2000	BGI0211	1.11	3.0
		12/12/2000	BGI0212	1.10	3.0
		12/12/2000	BGI0242	1.16	3.2
		12/13/2000	BGI0210	2.33	10.3
		12/13/2000	BGI0211	2.35	10.4
		12/13/2000	BGI0242	2.34	10.4
2	2	04/03/2000	BGI0207	2.64	14.0
		04/03/2000	BGI0208	2.63	13.9
		04/03/2000	BGI0209	2.65	14.1
		04/03/2000	BGI0238	2.62	13.7
		06/27/2000	BGI0207	2.50	12.2
		06/27/2000	BGI0208	2.51	12.3
		06/27/2000	BGI0209	2.52	12.4
		06/27/2000	BGI0238	2.52	12.4
		06/28/2000	BGI0207	2.42	11.2
		06/28/2000	BGI0208	2.42	11.3
		06/28/2000	BGI0209	2.40	11.0
		06/28/2000	BGI0238	2.42	11.2
2	3	09/25/2000	BGI0207	1.85	6.3
		09/25/2000	BGI0208	1.84	6.3
		09/25/2000	BGI0238	1.84	6.3
		09/26/2000	BGI0207	1.79	6.0
		09/26/2000	BGI0208	1.81	6.1
		09/26/2000	BGI0238	1.80	6.0
		09/27/2000	BGI0207	2.55	12.9
		09/27/2000	BGI0208	2.58	13.1
		09/27/2000	BGI0238	2.55	12.8
2	4	11/27/2000	BGI0207	2.02	7.5
		11/27/2000	BGI0208	2.02	7.5
		11/27/2000	BGI0209	2.00	7.4
		11/27/2000	BGI0238	2.00	7.4
		11/28/2000	BGI0207	2.93	18.8
		11/28/2000	BGI0208	2.96	19.3
		11/28/2000	BGI0209	2.95	19.0
		11/28/2000	BGI0238	2.96	19.4
		11/29/2000	BGI0207	2.80	16.4
		11/29/2000	BGI0208	2.81	16.7
		11/29/2000	BGI0209	2.82	16.8
		11/29/2000	BGI0238	2.83	17.0

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
3	4	12/28/2000	BGI0202	1.99	7.3
		12/28/2000	BGI0226	1.98	7.2
		12/28/2000	BGI0239	1.95	7.0
4	1	01/06/2000	BGI0182	2.62	13.7
		01/06/2000	BGI0203	2.64	14.0
		01/06/2000	BGI0204	2.60	13.5
		01/06/2000	BGI0205	2.62	13.7
		01/06/2000	BGI0206	2.63	13.9
		01/06/2000	BGI0225	2.67	14.4
		01/07/2000	BGI0182	2.46	11.7
		01/07/2000	BGI0203	2.47	11.8
		01/07/2000	BGI0205	2.47	11.8
		01/07/2000	BGI0206	2.47	11.9
		01/07/2000	BGI0225	2.48	12.0
		01/07/2000	BGI0232	2.46	11.7
		01/08/2000	BGI0182	2.80	16.5
		01/08/2000	BGI0203	2.81	16.6
		01/08/2000	BGI0205	2.77	16.0
		01/08/2000	BGI0206	2.80	16.4
		01/08/2000	BGI0225	2.82	16.7
		01/08/2000	BGI0232	2.79	16.3
		03/27/2000	BGI0182	1.96	7.1
		03/27/2000	BGI0203	1.91	6.8
		03/27/2000	BGI0204	1.91	6.7
		03/27/2000	BGI0205	1.97	7.2
		03/27/2000	BGI0206	1.92	6.8
		03/27/2000	BGI0225	1.94	7.0
		03/27/2000	BGI0232	1.90	6.7
		03/28/2000	BGI0182	1.66	5.2
		03/28/2000	BGI0203	1.68	5.4
		03/28/2000	BGI0204	1.67	5.3
		03/28/2000	BGI0205	1.70	5.5
		03/28/2000	BGI0206	1.67	5.3
		03/28/2000	BGI0225	1.69	5.4
		03/28/2000	BGI0232	1.64	5.2
		03/29/2000	BGI0182	2.40	11.0
		03/29/2000	BGI0203	2.37	10.7
		03/29/2000	BGI0204	2.35	10.5
		03/29/2000	BGI0205	2.35	10.5
		03/29/2000	BGI0206	2.44	11.5
		03/29/2000	BGI0225	2.36	10.6
		03/29/2000	BGI0232	2.34	10.4
4	2	05/31/2000	BGI0182	2.89	18.0

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
4	2	05/31/2000	BGI0203	2.90	18.2
		05/31/2000	BGI0204	2.90	18.1
		05/31/2000	BGI0205	2.90	18.1
		05/31/2000	BGI0206	2.90	18.2
		05/31/2000	BGI0225	2.90	18.2
		05/31/2000	BGI0232	2.87	17.6
		05/31/2000	BGI0279	2.87	17.6
		05/31/2000	BGI0283	2.87	17.7
		06/01/2000	BGI0182	3.38	29.3
		06/01/2000	BGI0203	3.36	28.7
		06/01/2000	BGI0204	3.38	29.3
		06/01/2000	BGI0205	3.38	29.2
		06/01/2000	BGI0206	3.39	29.7
		06/01/2000	BGI0225	3.38	29.5
		06/01/2000	BGI0232	3.35	28.6
		06/01/2000	BGI0279	3.35	28.6
		06/01/2000	BGI0283	3.36	28.9
		06/02/2000	BGI0182	3.53	34.3
		06/02/2000	BGI0203	3.52	33.7
		06/02/2000	BGI0204	3.53	34.2
		06/02/2000	BGI0205	3.54	34.5
		06/02/2000	BGI0206	3.54	34.6
		06/02/2000	BGI0225	3.53	34.2
		06/02/2000	BGI0232	3.50	33.2
		06/02/2000	BGI0279	3.52	33.6
		06/02/2000	BGI0283	3.51	33.6
4	3	08/29/2000	BGI0204	3.15	23.4
		08/29/2000	BGI0205	3.12	22.6
		08/29/2000	BGI0225	3.12	22.6
		08/29/2000	BGI0279	3.08	21.8
		08/29/2000	BGI0283	3.11	22.4
		08/30/2000	BGI0182	2.51	12.3
		08/30/2000	BGI0203	2.46	11.7
		08/30/2000	BGI0204	2.53	12.6
		08/30/2000	BGI0205	2.50	12.1
		08/30/2000	BGI0225	2.51	12.3
		08/30/2000	BGI0232	2.50	12.2
		08/30/2000	BGI0279	2.48	11.9
		08/30/2000	BGI0283	2.47	11.9
		08/31/2000	BGI0182	2.78	16.2
		08/31/2000	BGI0203	2.78	16.1
		08/31/2000	BGI0204	2.82	16.8
		08/31/2000	BGI0205	2.80	16.4
		08/31/2000	BGI0225	2.75	15.7

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
4	3	08/31/2000	BGI0232	2.77	16.0
		08/31/2000	BGI0279	2.77	15.9
		08/31/2000	BGI0283	2.80	16.4
4	4	12/12/2000	BGI0205	1.99	7.3
		12/12/2000	BGI0206	1.98	7.3
		12/12/2000	BGI0225	1.96	7.1
		12/12/2000	BGI0232	1.99	7.3
		12/12/2000	BGI0279	1.93	6.9
		12/12/2000	BGI0283	2.02	7.6
		12/13/2000	BGI0182	2.35	10.5
		12/13/2000	BGI0203	2.35	10.5
		12/13/2000	BGI0205	2.36	10.6
		12/13/2000	BGI0206	2.29	9.9
		12/13/2000	BGI0225	2.40	11.0
		12/13/2000	BGI0232	2.33	10.3
		12/13/2000	BGI0279	2.37	10.7
		12/13/2000	BGI0283	2.30	9.9
		12/14/2000	BGI0182	2.43	11.4
		12/14/2000	BGI0203	2.46	11.7
		12/14/2000	BGI0205	2.46	11.7
		12/14/2000	BGI0206	2.42	11.3
		12/14/2000	BGI0225	2.43	11.4
		12/14/2000	BGI0232	2.45	11.6
		12/14/2000	BGI0279	2.39	10.9
		12/14/2000	BGI0283	2.46	11.6
5	2	04/03/2000	BGI0179	2.09	8.1
		04/03/2000	BGI0180	2.08	8.0
		04/03/2000	BGI0194	2.06	7.9
		04/03/2000	BGI0195	2.06	7.9
		04/03/2000	BGI0196	2.02	7.5
		04/04/2000	BGI0179	2.79	16.2
		04/04/2000	BGI0180	2.80	16.5
		04/04/2000	BGI0194	2.81	16.6
		04/04/2000	BGI0196	2.78	16.2
		04/04/2000	BGI0200	2.84	17.2
		04/04/2000	BGI0240	2.80	16.4
		04/05/2000	BGI0179	2.39	10.9
		04/05/2000	BGI0180	2.33	10.3
		04/05/2000	BGI0195	2.38	10.8
		04/05/2000	BGI0196	2.38	10.8
		04/05/2000	BGI0200	2.40	11.0
		04/05/2000	BGI0240	2.43	11.4

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
6	2	04/18/2000	BGI0181	2.31	10.1
		04/18/2000	BGI0183	2.33	10.3
		04/18/2000	BGI0184	2.30	10.0
		04/18/2000	BGI0185	2.33	10.3
		04/18/2000	BGI0186	2.31	10.0
		04/18/2000	BGI0217	2.31	10.1
		04/18/2000	BGI0241	2.29	9.9
		04/19/2000	BGI0181	2.40	11.1
		04/19/2000	BGI0183	2.43	11.4
		04/19/2000	BGI0184	2.41	11.1
		04/19/2000	BGI0185	2.41	11.2
		04/19/2000	BGI0186	2.42	11.2
		04/19/2000	BGI0217	2.43	11.3
		04/19/2000	BGI0241	2.44	11.5
		04/23/2000	BGI0181	2.92	18.6
		04/23/2000	BGI0183	2.91	18.3
		04/23/2000	BGI0184	2.90	18.2
		04/23/2000	BGI0185	2.93	18.6
		04/23/2000	BGI0186	2.91	18.3
		04/23/2000	BGI0217	2.89	18.0
		04/23/2000	BGI0241	2.89	17.9
6	3	09/25/2000	BGI0181	1.56	4.7
		09/25/2000	BGI0183	1.79	6.0
		09/25/2000	BGI0184	1.57	4.8
		09/25/2000	BGI0185	1.60	5.0
		09/25/2000	BGI0186	1.61	5.0
		09/25/2000	BGI0217	1.63	5.1
		09/25/2000	BGI0241	1.61	5.0
		09/26/2000	BGI0181	2.25	9.5
		09/26/2000	BGI0183	2.25	9.5
		09/26/2000	BGI0184	2.23	9.3
		09/26/2000	BGI0185	2.22	9.2
		09/26/2000	BGI0186	2.27	9.7
		09/26/2000	BGI0217	2.26	9.6
		09/26/2000	BGI0241	2.21	9.2
		09/27/2000	BGI0181	2.63	13.9
		09/27/2000	BGI0183	2.63	13.9
		09/27/2000	BGI0184	2.63	13.9
		09/27/2000	BGI0185	2.64	14.0
		09/27/2000	BGI0186	2.66	14.2
		09/27/2000	BGI0217	2.63	13.9
		09/27/2000	BGI0241	2.60	13.5
6	4	12/11/2000	BGI0181	2.05	7.7

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
6	4	12/11/2000	BGI0183	2.06	7.9
		12/11/2000	BGI0184	2.05	7.8
		12/11/2000	BGI0185	2.07	7.9
		12/11/2000	BGI0217	2.07	7.9
		12/11/2000	BGI0241	2.04	7.7
		12/11/2000	BGI0308	2.06	7.8
		12/14/2000	BGI0181	3.28	26.7
		12/14/2000	BGI0183	3.27	26.2
		12/14/2000	BGI0184	3.25	25.9
		12/14/2000	BGI0185	3.27	26.3
		12/14/2000	BGI0217	3.28	26.6
		12/14/2000	BGI0241	3.26	26.1
		12/14/2000	BGI0308	3.30	27.0
		12/17/2000	BGI0181	2.10	8.2
		12/17/2000	BGI0183	2.09	8.1
		12/17/2000	BGI0184	2.10	8.2
		12/17/2000	BGI0185	2.08	8.0
		12/17/2000	BGI0186	2.10	8.2
		12/17/2000	BGI0217	2.14	8.5
		12/17/2000	BGI0241	2.07	7.9
		12/17/2000	BGI0308	2.09	8.1
7	1	01/12/2000	BGI0192	2.49	12.0
		01/12/2000	BGI0193	2.50	12.2
		03/02/2000	BGI0192	2.21	9.2
		03/02/2000	BGI0193	2.16	8.7
7	2	05/17/2000	BGI0192	2.85	17.3
		05/17/2000	BGI0285	2.86	17.5
		05/18/2000	BGI0193	1.87	6.5
		05/18/2000	BGI0285	2.04	7.7
		05/20/2000	BGI0192	2.45	11.6
		05/20/2000	BGI0193	2.44	11.4
		05/20/2000	BGI0285	2.49	12.1
7	3	08/08/2000	BGI0192	2.60	13.4
		08/08/2000	BGI0193	2.58	13.2
		08/08/2000	BGI0285	2.54	12.7
		08/09/2000	BGI0192	2.63	13.9
		08/09/2000	BGI0193	2.64	14.0
		08/09/2000	BGI0285	2.65	14.2
		08/11/2000	BGI0192	2.88	17.7
		08/11/2000	BGI0193	2.81	16.6
		08/11/2000	BGI0285	2.86	17.4

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
7	4	12/27/2000	BGI0192	3.75	42.5
		12/27/2000	BGI0193	3.74	41.9
		12/27/2000	BGI0215	3.75	42.4
		12/28/2000	BGI0192	2.81	16.5
		12/28/2000	BGI0193	2.83	16.9
		12/28/2000	BGI0215	2.87	17.6
		12/29/2000	BGI0192	2.33	10.3
		12/29/2000	BGI0193	2.32	10.2
		12/29/2000	BGI0215	2.39	10.9
8	2	04/24/2000	AND00012	1.83	6.3
		04/24/2000	BGI0197	1.62	5.1
		04/24/2000	BGI0198	1.70	5.5
		04/24/2000	BGI0199	1.91	6.8
		04/24/2000	RP20111	1.66	5.3
		06/25/2000	BGI0198	1.76	5.8
		06/25/2000	BGI0199	1.88	6.5
		06/25/2000	BGI0286	1.75	5.7
		06/28/2000	BGI0197	2.42	11.2
		06/28/2000	BGI0198	2.34	10.4
		06/28/2000	BGI0199	2.38	10.8
8	3	09/26/2000	BGI0197	1.70	5.5
		09/26/2000	BGI0198	1.75	5.7
		09/26/2000	BGI0199	1.69	5.4
		09/26/2000	BGI0286	1.80	6.1
		09/30/2000	BGI0197	1.72	5.6
		09/30/2000	BGI0198	1.77	5.9
		09/30/2000	BGI0199	1.73	5.6
		09/30/2000	BGI0286	1.72	5.6
8	4	12/27/2000	BGI0197	1.22	3.4
		12/27/2000	BGI0198	0.90	2.5
		12/27/2000	BGI0286	1.04	2.8
		12/31/2000	BGI0197	3.01	20.2
		12/31/2000	BGI0198	3.00	20.1
		12/31/2000	BGI0199	2.99	19.8
		12/31/2000	BGI0286	3.04	20.8
9	2	04/05/2000	BGI0187	2.20	9.0
		04/05/2000	BGI0188	2.34	10.4
		04/05/2000	BGI0190	2.29	9.9
		04/06/2000	BGI0187	2.27	9.7
		04/06/2000	BGI0188	2.34	10.4
		04/06/2000	BGI0190	2.33	10.3

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
9	2	04/06/2000	BGI0235	2.37	10.7
		05/21/2000	AND00016	2.65	14.1
		05/21/2000	BGI0188	2.73	15.4
		05/21/2000	BGI0284	2.71	15.1
10	1	02/28/2000	BGI0191	2.37	10.7
		02/28/2000	BGI0214	2.41	11.1
		02/29/2000	BGI0189	2.26	9.6
		02/29/2000	BGI0191	2.19	9.0
		02/29/2000	BGI0214	2.38	10.8
		03/01/2000	BGI0189	2.42	11.3
		03/01/2000	BGI0191	2.35	10.5
		03/01/2000	BGI0214	2.39	10.9
		03/02/2000	AND00011	2.56	12.9
		03/02/2000	BGI0191	2.54	12.6
		03/02/2000	BGI0214	2.54	12.7
10	2	04/04/2000	BGI0189	1.65	5.2
		04/04/2000	BGI0214	1.70	5.4
		04/05/2000	AND00011	0.85	2.3
		04/05/2000	BGI0189	0.71	2.0
		04/05/2000	BGI0191	1.14	3.1
		04/05/2000	BGI0214	1.18	3.2
		04/06/2000	AND00011	1.74	5.7
		04/07/2000	AND00011	2.14	8.5
		04/07/2000	BGI0189	2.08	8.0
		04/07/2000	BGI0191	2.14	8.5
		04/07/2000	BGI0214	2.38	10.8
		04/08/2000	BGI0189	2.25	9.5
		04/08/2000	BGI0191	2.23	9.3
		04/08/2000	BGI0214	2.25	9.5
10	3	08/16/2000	BGI0189	2.42	11.2
		08/16/2000	BGI0191	2.30	9.9
		08/16/2000	BGI0214	2.38	10.8
		08/17/2000	BGI0189	2.12	8.4
		08/17/2000	BGI0191	2.14	8.5
		08/17/2000	BGI0214	2.10	8.2
		08/18/2000	BGI0189	1.52	4.6
		08/18/2000	BGI0191	1.45	4.3
		08/18/2000	BGI0214	1.47	4.4
		08/19/2000	BGI0189	2.60	13.5
		08/19/2000	BGI0191	2.57	13.1
		08/19/2000	BGI0214	2.62	13.7

THE 2000 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
10	4	10/25/2000	BGI0189	2.96	19.3
		10/25/2000	BGI0191	2.92	18.6
		10/25/2000	BGI0214	2.95	19.1
		10/25/2000	BGI0309	2.91	18.3
		10/26/2000	BGI0189	2.93	18.7
		10/26/2000	BGI0191	2.94	19.0
		10/26/2000	BGI0214	2.92	18.5
		10/26/2000	BGI0309	2.92	18.6
		10/27/2000	BGI0189	2.11	8.2
		10/27/2000	BGI0191	2.05	7.8
		10/27/2000	BGI0214	1.98	7.2
		10/27/2000	BGI0309	2.05	7.8

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
1	1	02/06/2001	BGI0211	2.09	8.1
		02/06/2001	BGI0212	2.06	7.8
		02/07/2001	BGI0211	1.79	6.0
		02/07/2001	BGI0242	1.84	6.3
		02/08/2001	BGI0210	2.65	14.1
		02/08/2001	BGI0211	2.66	14.3
		02/08/2001	BGI0212	2.60	13.4
		02/08/2001	BGI0242	2.63	13.9
		02/27/2001	BGI0210	1.70	5.5
		02/27/2001	BGI0242	1.73	5.6
		02/28/2001	BGI0210	1.56	4.7
		02/28/2001	BGI0242	1.56	4.7
		03/01/2001	BGI0210	2.46	11.6
		03/01/2001	BGI0242	2.44	11.5
1	2	05/07/2001	BGI0210	1.65	5.2
		05/07/2001	BGI0211	1.70	5.5
		05/07/2001	BGI0212	1.70	5.4
		05/07/2001	BGI0242	1.75	5.7
		05/09/2001	BGI0210	2.04	7.7
		05/09/2001	BGI0211	2.08	8.0
		05/09/2001	BGI0212	2.08	8.0
		05/09/2001	BGI0242	2.10	8.2
		05/10/2001	BGI0210	2.55	12.9
		05/10/2001	BGI0211	2.60	13.5
		05/10/2001	BGI0242	2.66	14.3
1	3	08/06/2001	BGI0210	3.52	33.7
		08/06/2001	BGI0211	3.53	34.0
		08/06/2001	BGI0212	3.53	34.2
		08/06/2001	BGI0242	3.52	33.7
		08/07/2001	BGI0210	3.20	24.5
		08/07/2001	BGI0211	3.18	24.0
		08/07/2001	BGI0212	3.17	23.9
		08/07/2001	BGI0242	3.21	24.9
		08/08/2001	BGI0211	3.05	21.0
		08/08/2001	BGI0212	3.00	20.1
		08/08/2001	BGI0242	3.05	21.1
1	4	12/18/2001	BGI0210	1.38	4.0
		12/18/2001	BGI0211	1.37	4.0
		12/18/2001	BGI0212	1.33	3.8
		12/18/2001	BGI0242	1.34	3.8
		12/19/2001	BGI0210	2.76	15.9
		12/19/2001	BGI0211	2.75	15.6

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
1	4	12/19/2001	BGI0212	2.75	15.6
		12/19/2001	BGI0242	2.71	15.0
2	1	01/22/2001	BGI0208	3.63	37.8
		01/22/2001	BGI0209	3.61	36.9
		01/22/2001	BGI0238	3.62	37.2
		01/24/2001	BGI0207	3.76	42.9
		01/24/2001	BGI0208	3.79	44.2
		01/24/2001	BGI0209	3.78	43.7
		01/24/2001	BGI0238	3.79	44.4
		01/25/2001	BGI0207	2.21	9.1
		01/25/2001	BGI0208	2.25	9.5
		01/25/2001	BGI0209	2.25	9.5
		01/25/2001	BGI0238	2.27	9.7
2	2	06/20/2001	BGI0207	3.51	33.3
		06/20/2001	BGI0208	3.47	32.1
		06/20/2001	BGI0209	3.44	31.3
		06/20/2001	BGI0238	3.44	31.2
		06/21/2001	BGI0207	2.89	18.0
		06/21/2001	BGI0208	2.88	17.8
		06/21/2001	BGI0209	2.88	17.7
		06/21/2001	BGI0238	2.88	17.8
		06/22/2001	BGI0207	2.07	8.0
		06/22/2001	BGI0208	2.05	7.8
		06/22/2001	BGI0209	2.06	7.8
		06/22/2001	BGI0238	2.09	8.1
2	3	08/06/2001	BGI0207	3.89	48.8
		08/06/2001	BGI0208	3.90	49.5
		08/06/2001	BGI0209	3.88	48.7
		08/06/2001	BGI0238	3.89	49.1
		08/07/2001	BGI0207	3.59	36.2
		08/07/2001	BGI0208	3.55	34.8
		08/07/2001	BGI0209	3.63	37.9
		08/07/2001	BGI0238	3.56	35.2
		08/09/2001	BGI0207	3.84	46.7
		08/09/2001	BGI0208	3.83	46.0
		08/09/2001	BGI0209	3.81	45.0
		08/09/2001	BGI0238	3.82	45.6
2	4	10/01/2001	BGI0207	2.31	10.1
		10/01/2001	BGI0208	2.40	11.1
		10/01/2001	BGI0209	2.32	10.2
		10/01/2001	BGI0238	2.31	10.1

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
2	4	10/02/2001	BGI0207	3.11	22.5
		10/02/2001	BGI0208	3.14	23.0
		10/02/2001	BGI0209	3.17	23.9
		10/02/2001	BGI0238	3.16	23.7
		10/03/2001	BGI0207	3.38	29.4
		10/03/2001	BGI0208	3.40	30.1
		10/03/2001	BGI0209	3.39	29.7
		10/03/2001	BGI0238	3.41	30.4
		12/19/2001	BGI0207	2.80	16.5
		12/19/2001	BGI0208	2.80	16.5
		12/19/2001	BGI0209	2.79	16.2
		12/19/2001	BGI0238	2.81	16.7
		12/20/2001	BGI0207	1.23	3.4
		12/20/2001	BGI0208	1.12	3.1
		12/20/2001	BGI0209	1.18	3.2
		12/20/2001	BGI0238	1.29	3.6
		12/21/2001	BGI0207	1.25	3.5
		12/21/2001	BGI0208	1.30	3.7
		12/21/2001	BGI0209	1.27	3.6
		12/21/2001	BGI0238	1.01	2.7
3	1	01/29/2001	BGI0201	3.03	20.7
		01/29/2001	BGI0226	3.03	20.7
3	2	05/10/2001	BGI0201	3.16	23.7
		05/10/2001	BGI0202	3.17	23.9
		05/10/2001	BGI0226	3.18	24.1
3	3	09/07/2001	BGI0226	2.56	13.0
4	1	01/30/2001	BGI0182	1.42	4.1
		01/30/2001	BGI0203	1.44	4.2
		01/30/2001	BGI0204	1.42	4.1
		01/30/2001	BGI0205	1.45	4.2
		01/30/2001	BGI0206	1.38	4.0
		01/30/2001	BGI0225	1.50	4.5
		01/30/2001	BGI0232	1.46	4.3
		01/30/2001	BGI0283	1.43	4.2
		01/31/2001	BGI0182	1.91	6.7
		01/31/2001	BGI0203	1.57	4.8
		01/31/2001	BGI0205	1.92	6.8
		01/31/2001	BGI0206	1.91	6.7
		01/31/2001	BGI0225	1.95	7.0
		01/31/2001	BGI0232	1.91	6.8
		01/31/2001	BGI0279	1.90	6.7

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
4	1	01/31/2001	BGI0283	1.88	6.5
		02/01/2001	BGI0182	2.64	14.0
		02/01/2001	BGI0203	2.62	13.7
		02/01/2001	BGI0204	2.62	13.7
		02/01/2001	BGI0205	2.63	13.9
		02/01/2001	BGI0206	2.63	13.8
		02/01/2001	BGI0225	2.65	14.1
		02/01/2001	BGI0232	2.63	13.8
		02/01/2001	BGI0279	2.62	13.8
		02/01/2001	BGI0283	2.61	13.6
4	2	05/21/2001	AND00006	2.76	15.8
		05/21/2001	BGI0182	2.77	16.0
		05/21/2001	BGI0203	2.74	15.4
		05/21/2001	BGI0205	2.73	15.3
		05/21/2001	BGI0206	2.74	15.5
		05/21/2001	BGI0225	2.78	16.1
		05/21/2001	BGI0232	2.73	15.3
		05/21/2001	BGI0279	2.71	15.1
		05/21/2001	BGI0283	2.73	15.3
		05/22/2001	AND00006	1.95	7.0
		05/22/2001	BGI0182	2.04	7.7
		05/22/2001	BGI0203	1.92	6.8
		05/22/2001	BGI0205	1.95	7.0
		05/22/2001	BGI0206	1.97	7.2
		05/22/2001	BGI0225	2.00	7.4
		05/22/2001	BGI0232	1.96	7.1
		05/22/2001	BGI0279	1.91	6.8
		05/22/2001	BGI0283	1.91	6.8
		05/24/2001	AND00006	2.44	11.4
		05/24/2001	BGI0182	2.43	11.3
		05/24/2001	BGI0203	2.40	11.1
		05/24/2001	BGI0206	2.40	11.0
		05/24/2001	BGI0225	2.44	11.4
		05/24/2001	BGI0232	2.40	11.0
		05/24/2001	BGI0279	2.42	11.2
		05/24/2001	BGI0283	2.39	10.9
4	3	08/13/2001	AND00006	2.65	14.2
		08/13/2001	BGI0205	2.59	13.4
		08/13/2001	BGI0206	2.60	13.5
		08/13/2001	BGI0225	2.60	13.5
		08/13/2001	BGI0232	2.55	12.8
		08/13/2001	BGI0283	2.58	13.2
		08/13/2001	BGI0332	2.63	13.9

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
4	3	08/13/2001	BGI0333	2.60	13.5
		08/14/2001	AND00006	3.42	30.6
		08/14/2001	BGI0203	3.43	30.9
		08/14/2001	BGI0205	3.41	30.3
		08/14/2001	BGI0206	3.40	30.0
		08/14/2001	BGI0279	3.42	30.6
		08/14/2001	BGI0283	3.39	29.6
		08/14/2001	BGI0332	3.41	30.1
		08/14/2001	BGI0333	3.42	30.5
		08/16/2001	AND00006	3.18	24.0
		08/16/2001	BGI0182	3.23	25.4
		08/16/2001	BGI0203	3.16	23.5
		08/16/2001	BGI0204	3.15	23.2
		08/16/2001	BGI0205	3.19	24.3
		08/16/2001	BGI0206	3.19	24.2
		08/16/2001	BGI0225	3.19	24.2
		08/16/2001	BGI0232	3.17	23.8
		08/16/2001	BGI0279	3.16	23.6
		08/16/2001	BGI0283	3.19	24.3
4	4	12/03/2001	AND00006	2.96	19.3
		12/03/2001	BGI0182	2.86	17.5
		12/03/2001	BGI0203	2.86	17.5
		12/03/2001	BGI0204	2.87	17.6
		12/03/2001	BGI0205	2.85	17.3
		12/03/2001	BGI0206	2.86	17.4
		12/03/2001	BGI0225	2.91	18.4
		12/03/2001	BGI0232	2.86	17.4
		12/03/2001	BGI0279	2.89	18.1
		12/03/2001	BGI0283	2.86	17.5
		12/04/2001	AND00006	2.87	17.7
		12/04/2001	BGI0182	2.77	16.0
		12/04/2001	BGI0203	2.79	16.2
		12/04/2001	BGI0204	2.74	15.6
		12/04/2001	BGI0205	2.79	16.3
		12/04/2001	BGI0206	2.80	16.5
		12/04/2001	BGI0225	2.81	16.6
		12/04/2001	BGI0232	2.77	16.0
		12/04/2001	BGI0279	2.80	16.4
		12/04/2001	BGI0283	2.77	16.0
		12/06/2001	AND00006	2.69	14.7
		12/06/2001	BGI0182	2.64	14.0
		12/06/2001	BGI0203	2.68	14.6
		12/06/2001	BGI0204	2.65	14.1
		12/06/2001	BGI0205	2.61	13.7

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
4	4	12/06/2001	BGI0206	2.62	13.7
		12/06/2001	BGI0225	2.66	14.3
		12/06/2001	BGI0232	2.62	13.7
		12/06/2001	BGI0279	2.65	14.1
		12/06/2001	BGI0283	2.62	13.8
5	1	02/01/2001	BGI0179	2.48	12.0
		02/01/2001	BGI0180	2.38	10.9
		02/01/2001	BGI0194	2.38	10.8
		02/01/2001	BGI0195	2.56	13.0
		02/01/2001	BGI0196	2.42	11.2
		02/01/2001	BGI0200	2.46	11.7
		03/22/2001	BGI0179	2.85	17.3
		03/22/2001	BGI0194	2.86	17.4
		03/22/2001	BGI0195	2.85	17.4
		03/22/2001	BGI0200	2.86	17.4
5	2	04/12/2001	BGI0179	1.98	7.3
		04/12/2001	BGI0194	1.99	7.3
		04/12/2001	BGI0195	2.04	7.7
		04/12/2001	BGI0196	1.97	7.2
		04/12/2001	BGI0200	1.97	7.2
		04/12/2001	BGI0240	2.08	8.0
		04/15/2001	BGI0179	1.70	5.5
		04/15/2001	BGI0194	1.76	5.8
		04/15/2001	BGI0195	1.87	6.5
		04/15/2001	BGI0196	1.79	6.0
		04/15/2001	BGI0200	1.81	6.1
		04/15/2001	BGI0240	1.78	5.9
5	3	08/13/2001	BGI0179	1.46	4.3
		08/13/2001	BGI0180	1.46	4.3
		08/13/2001	BGI0194	1.48	4.4
		08/13/2001	BGI0196	1.48	4.4
		08/13/2001	BGI0200	1.56	4.7
		08/13/2001	BGI0240	1.43	4.2
		08/14/2001	BGI0179	2.32	10.2
		08/14/2001	BGI0180	2.31	10.1
		08/14/2001	BGI0194	2.19	8.9
		08/14/2001	BGI0196	2.28	9.7
		08/14/2001	BGI0200	2.35	10.5
		08/14/2001	BGI0240	2.27	9.7
5	4	11/08/2001	BGI0179	2.00	7.4
		11/08/2001	BGI0194	2.02	7.5

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
5	4	11/08/2001	BGI0195	1.98	7.2
		11/08/2001	BGI0196	2.02	7.5
		11/08/2001	BGI0200	2.00	7.4
		11/08/2001	BGI0240	2.00	7.4
		11/11/2001	BGI0179	2.36	10.6
		11/11/2001	BGI0194	1.72	5.6
		11/11/2001	BGI0195	1.60	5.0
		11/11/2001	BGI0196	2.37	10.7
		11/11/2001	BGI0240	1.60	5.0
6	1	03/20/2001	BGI0181	2.37	10.7
		03/20/2001	BGI0183	2.35	10.4
		03/20/2001	BGI0184	2.35	10.5
		03/20/2001	BGI0185	2.33	10.3
		03/20/2001	BGI0186	2.33	10.3
		03/20/2001	BGI0217	2.32	10.2
		03/20/2001	BGI0241	2.32	10.1
		03/20/2001	BGI0308	2.34	10.4
		03/21/2001	BGI0181	2.71	15.1
		03/21/2001	BGI0183	2.71	15.0
		03/21/2001	BGI0184	2.72	15.2
		03/21/2001	BGI0185	2.70	14.9
		03/21/2001	BGI0186	2.70	14.8
		03/21/2001	BGI0217	2.71	15.0
		03/21/2001	BGI0241	2.70	14.8
		03/21/2001	BGI0308	2.70	14.9
		03/25/2001	BGI0181	2.66	14.3
		03/25/2001	BGI0183	2.67	14.4
		03/25/2001	BGI0184	2.66	14.3
		03/25/2001	BGI0185	2.65	14.2
		03/25/2001	BGI0186	2.65	14.1
		03/25/2001	BGI0217	2.64	13.9
		03/25/2001	BGI0241	2.64	14.0
		03/25/2001	BGI0308	2.66	14.3
6	2	06/24/2001	BGI0181	2.94	18.9
		06/24/2001	BGI0183	2.94	18.9
		06/24/2001	BGI0184	2.91	18.3
		06/24/2001	BGI0185	2.95	19.1
		06/24/2001	BGI0186	2.94	18.9
		06/24/2001	BGI0217	2.93	18.7
		06/24/2001	BGI0241	2.93	18.8
		06/24/2001	BGI0308	2.96	19.3
		06/25/2001	BGI0181	3.03	20.7
		06/25/2001	BGI0183	3.03	20.6

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
6	2	06/25/2001	BGI0184	3.04	20.8
		06/25/2001	BGI0185	3.03	20.8
		06/25/2001	BGI0186	3.03	20.7
		06/25/2001	BGI0217	3.06	21.2
		06/25/2001	BGI0241	3.04	20.8
		06/25/2001	BGI0308	3.07	21.5
		06/26/2001	BGI0181	3.11	22.3
		06/26/2001	BGI0183	3.16	23.5
		06/26/2001	BGI0184	3.11	22.4
		06/26/2001	BGI0185	3.15	23.4
		06/26/2001	BGI0186	3.16	23.5
		06/26/2001	BGI0217	3.14	23.0
		06/26/2001	BGI0241	3.14	23.2
		06/26/2001	BGI0308	3.19	24.2
6	3	09/27/2001	BGI0181	2.83	17.0
		09/27/2001	BGI0183	2.89	18.0
		09/27/2001	BGI0184	2.82	16.8
		09/27/2001	BGI0185	2.84	17.1
		09/27/2001	BGI0186	2.85	17.3
		09/27/2001	BGI0217	2.83	17.0
		09/27/2001	BGI0241	2.77	16.0
		09/27/2001	BGI0308	2.90	18.2
		09/27/2001	BGI0346	2.77	16.0
		09/30/2001	BGI0181	2.98	19.7
		09/30/2001	BGI0183	2.87	17.6
		09/30/2001	BGI0184	2.94	19.0
		09/30/2001	BGI0185	3.04	20.8
		09/30/2001	BGI0186	2.92	18.5
		09/30/2001	BGI0217	2.93	18.7
		09/30/2001	BGI0241	2.91	18.4
		09/30/2001	BGI0308	2.90	18.2
		09/30/2001	BGI0346	2.89	18.0
		09/30/2001	BGI0347	2.94	18.8
6	4	10/02/2001	BGI0181	3.16	23.5
		10/02/2001	BGI0183	3.26	26.0
		10/02/2001	BGI0184	3.19	24.4
		10/02/2001	BGI0185	3.21	24.7
		10/02/2001	BGI0217	3.17	23.8
		10/02/2001	BGI0241	3.17	23.8
		10/02/2001	BGI0308	3.18	24.1
		10/02/2001	BGI0346	3.17	23.8
		10/02/2001	BGI0347	3.18	24.0
		12/16/2001	BGI0181	2.03	7.6

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
6	4	12/16/2001	BGI0183	2.09	8.1
		12/16/2001	BGI0184	2.05	7.7
		12/16/2001	BGI0185	2.00	7.4
		12/16/2001	BGI0186	2.12	8.4
		12/16/2001	BGI0217	2.08	8.0
		12/16/2001	BGI0241	2.01	7.5
		12/16/2001	BGI0308	2.27	9.7
		12/16/2001	BGI0346	2.13	8.5
7	1	01/07/2001	BGI0192	2.38	10.9
		01/07/2001	BGI0193	2.38	10.8
		01/07/2001	BGI0215	2.44	11.4
		01/08/2001	BGI0192	2.69	14.7
		01/08/2001	BGI0193	2.68	14.6
		01/08/2001	BGI0215	2.71	15.0
		01/09/2001	BGI0192	2.87	17.7
		01/09/2001	BGI0193	2.81	16.6
		01/09/2001	BGI0215	2.82	16.8
7	2	05/07/2001	BGI0192	2.32	10.2
		05/07/2001	BGI0193	2.35	10.5
		05/07/2001	BGI0215	2.33	10.2
		05/08/2001	BGI0192	2.43	11.4
		05/08/2001	BGI0193	2.41	11.2
		05/08/2001	BGI0215	2.48	11.9
		05/09/2001	BGI0192	2.57	13.1
		05/09/2001	BGI0193	2.56	12.9
		05/09/2001	BGI0215	2.59	13.3
7	3	08/06/2001	BGI0192	3.36	28.7
		08/06/2001	BGI0193	3.31	27.4
		08/06/2001	BGI0285	3.26	26.1
		08/07/2001	BGI0192	3.57	35.6
		08/07/2001	BGI0193	3.58	35.8
		08/07/2001	BGI0285	3.52	33.8
		08/08/2001	BGI0192	3.36	28.8
		08/08/2001	BGI0193	3.34	28.2
		08/08/2001	BGI0285	3.26	26.1
7	4	12/09/2001	BGI0192	2.24	9.4
		12/09/2001	BGI0193	2.28	9.8
		12/09/2001	BGI0215	2.31	10.1
		12/09/2001	BGI0285	2.15	8.6
		12/10/2001	BGI0192	2.72	15.2
		12/10/2001	BGI0193	2.74	15.5

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
7	4	12/10/2001	BGI0215	2.76	15.8
		12/10/2001	BGI0285	2.75	15.6
		12/11/2001	BGI0192	2.87	17.6
		12/11/2001	BGI0193	2.89	17.9
		12/11/2001	BGI0215	2.93	18.8
		12/11/2001	BGI0285	2.89	18.0
8	1	02/21/2001	BGI0197	2.91	18.4
		02/21/2001	BGI0199	2.91	18.4
		02/21/2001	BGI0286	2.91	18.3
		02/22/2001	BGI0197	2.77	16.0
		02/22/2001	BGI0199	2.80	16.4
		02/22/2001	BGI0286	2.85	17.3
8	2	05/08/2001	BGI0198	1.62	5.1
		05/08/2001	BGI0199	1.70	5.5
		05/08/2001	BGI0286	1.76	5.8
		05/09/2001	BGI0197	1.49	4.5
		05/09/2001	BGI0198	1.53	4.6
		05/09/2001	BGI0199	1.49	4.5
		05/09/2001	BGI0286	1.50	4.5
8	3	08/06/2001	BGI0197	1.99	7.3
		08/06/2001	BGI0198	1.88	6.5
		08/06/2001	BGI0199	1.99	7.3
		08/06/2001	BGI0286	1.94	7.0
		08/08/2001	BGI0197	1.61	5.0
		08/08/2001	BGI0198	1.58	4.9
		08/08/2001	BGI0199	1.63	5.1
		08/08/2001	BGI0286	1.58	4.9
8	4	12/19/2001	BGI0197	1.49	4.5
		12/19/2001	BGI0198	1.56	4.7
		12/19/2001	BGI0199	1.55	4.7
		12/19/2001	BGI0286	1.51	4.5
		12/25/2001	BGI0197	1.76	5.8
		12/25/2001	BGI0198	1.81	6.1
		12/25/2001	BGI0199	1.82	6.2
		12/25/2001	BGI0286	1.75	5.7
9	1	01/05/2001	AND00016	3.57	35.4
		01/05/2001	BGI0187	3.58	35.8
		01/05/2001	BGI0188	3.53	34.1
		01/05/2001	BGI0190	3.56	35.1
		01/05/2001	BGI0235	3.61	37.0

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
9	1	01/05/2001	BGI0284	3.54	34.6
10	1	01/30/2001	BGI0189	1.60	5.0
		01/30/2001	BGI0214	1.57	4.8
		01/30/2001	BGI0309	1.63	5.1
		01/31/2001	BGI0189	2.22	9.2
		01/31/2001	BGI0214	2.18	8.9
		02/02/2001	BGI0189	1.57	4.8
		02/02/2001	BGI0214	1.54	4.7
		02/03/2001	BGI0189	2.12	8.4
		02/03/2001	BGI0214	2.09	8.1
		02/03/2001	BGI0309	2.12	8.3
		03/04/2001	BGI0189	1.84	6.3
		03/04/2001	BGI0191	1.74	5.7
		03/04/2001	BGI0214	1.86	6.4
		03/04/2001	BGI0309	1.78	6.0
		03/09/2001	BGI0189	2.56	12.9
		03/09/2001	BGI0191	2.56	12.9
		03/09/2001	BGI0214	2.42	11.2
		03/09/2001	BGI0309	2.39	10.9
10	2	05/15/2001	BGI0191	1.66	5.3
		05/15/2001	BGI0214	1.51	4.5
		05/15/2001	BGI0309	1.63	5.1
		05/16/2001	BGI0191	1.64	5.2
		05/16/2001	BGI0214	1.75	5.8
		05/16/2001	BGI0309	1.73	5.6
10	3	09/04/2001	BGI0189	2.02	7.5
		09/04/2001	BGI0191	1.94	6.9
		09/04/2001	BGI0214	1.84	6.3
		09/04/2001	BGI0309	1.91	6.8
		09/12/2001	BGI0189	2.33	10.3
		09/12/2001	BGI0191	2.34	10.4
		09/12/2001	BGI0214	2.40	11.1
		09/12/2001	BGI0309	2.32	10.2
		09/13/2001	BGI0189	2.45	11.6
		09/13/2001	BGI0191	2.46	11.7
		09/13/2001	BGI0214	2.44	11.5
		09/13/2001	BGI0309	2.44	11.4
10	4	12/28/2001	AND00011	2.22	9.3
		12/28/2001	BGI0189	2.19	8.9
		12/28/2001	BGI0191	2.15	8.6
		12/28/2001	BGI0309	2.20	9.0

THE 2001 QUARTERLY PARKING LOT COLLOCATION DATA

REGION	QTR	pe_start	SAMP_ID	LOG_CONC	PM_CONC
10	4	12/28/2001	BGI0343	2.21	9.1
		12/28/2001	RP201069907	2.21	9.1
		12/30/2001	AND00011	2.74	15.4
		12/30/2001	BGI0189	2.70	14.8
		12/30/2001	BGI0191	2.65	14.1
		12/30/2001	BGI0309	2.72	15.1
		12/30/2001	BGI0343	2.71	15.0
		12/30/2001	RP201069907	2.70	14.9
		12/31/2001	AND00011	2.49	12.1
		12/31/2001	BGI0189	2.47	11.8
		12/31/2001	BGI0191	2.42	11.2
		12/31/2001	BGI0309	2.45	11.6
		12/31/2001	BGI0343	2.47	11.9
		12/31/2001	RP201069907	2.47	11.8

Appendix E

Completeness Information at Regional and State Levels of Aggregation

This page intentionally left blank.

Completeness of PEP Visits by Region/State/Site for 99-01 1

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
1	CT	1999	090010010	3	3
			090031003	3	3
			090091123	3	3
			090092123	3	3
1	CT	2000	090011123	4	4
			090012124	4	5
			090031018	4	4
			090090018	4	4
1	CT	2001	090010113	4	4
			090013005	4	4
			090099005	4	4
1	MA	1999	250092006	3	3
			250230004	3	3
			250250002	2	3
			250250027	2	3
			250270020	3	3
1	MA	2000	250130008	4	4
			250130016	4	4
			250132007	4	5
			250250042	4	6
			250272004	4	5
1	MA	2001	250052004	4	4
			250053001	4	4
			250170008	3	4
			250250043	3	3
			250270016	4	5
1	ME	1999	230031011	3	3
			230050027	3	3
			230110016	3	3
			230190002	3	3

Completeness of PEP Visits by Region/State/Site for 99-01 2

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
1	ME	2000	230010011	4	4
			230030013	4	4
			230052003	4	4
			230090103	4	4
1	ME	2001	230031011	2	2
			230050015	4	4
			230172011	4	4
			230194003	4	7
			230310008	4	4
1	NH	1999	330050007	2	3
			330111007	2	3
			330130003	3	3
1	NH	2000	330070014	4	6
			330150009	4	5
			330190003	4	4
1	NH	2001	330012004	3	3
			330110019	1	1
			330110020	3	3
			330135001	4	4
1	RI	1999	440070022	3	4
			440071010	3	4
1	RI	2000	440070020	4	4
			440071005	4	5
1	RI	2001	440030002	4	4
			440090007	4	5
1	VT	1999	500070012	2	3
			500210002	2	3

Completeness of PEP Visits by Region/State/Site for 99-01 3

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
1	VT	2000	500070007	4	4
			500230005	4	4
1	VT	2001	500030005	4	4
2	NJ	1999	340030003	4	4
			340070003	4	4
			340130004	1	1
			340130011	4	7
			340390004	3	4
2	NJ	2000	340171003	4	4
			340172002	4	4
			340218001	4	4
			340270004	4	4
			340273001	4	4
2	NJ	2001	340071007	4	4
			340130015	4	5
			340155001	4	4
			340292002	4	5
			340410006	4	4
2	NY	1999	360050083	4	5
			360290005	3	3
			360470011	4	4
			360556001	1	1
			360590008	2	2
			360671015	3	3
			360810094	4	4
			360850067	4	5
2	NY	2000	360010005	4	4
			360290002	4	4
			360310003	4	4
			360556001	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 4

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
2	NY	2000	360590013	4	4
			360610056	4	4
			360610062	4	4
			360893001	4	4
			361010003	4	4
2	NY	2001	360050080	4	4
			360050110	4	5
			360130011	4	4
			360271004	4	4
			360470076	4	4
			360610010	2	2
			360610079	3	4
			360632008	4	4
			360652001	4	4
			360810094	3	4
			360810096	3	4
			360810097	1	1
2	PR	1999	720570008	3	4
			720610005	3	4
			721270003	3	4
2	PR	2000	720210009	4	4
			720530003	1	1
			720590016	3	4
			721130004	4	4
2	PR	2001	720690001	4	4
			720810001	4	4
			720970003	4	4
2	VI	1999	780010012	3	5
2	VI	2000	780050008	3	3

Completeness of PEP Visits by Region/State/Site for 99-01 5

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
2	VI	2001	780010012	4	4
3	DC	1999	110010041	3	3
			110010043	4	4
3	DC	2000	110010042	4	4
			110010043	4	4
3	DC	2001	110010041	4	4
			110010042	4	4
3	DE	1999	100031003	3	3
			100031007	2	3
3	DE	2000	100010002	4	4
			100010003	4	4
3	DE	2001	100031012	4	4
			100032004	3	3
			100051002	2	2
3	MD	1999	240030019	3	3
			240330001	3	3
			245100038	4	4
			245100040	3	3
3	MD	2000	240032002	4	4
			240053001	4	4
			240430009	3	3
			245100035	4	4
3	MD	2001	240030014	4	4
			240031003	4	4
			240051007	4	4
			245100049	3	3

Completeness of PEP Visits by Region/State/Site for 99-01 6

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
3	PA	1999	420030064	2	2
			420031301	3	3
			420170012	4	4
			420430401	3	3
			420590121	1	1
			420950025	2	2
			421010004	4	4
			421010136	4	5
			421290008	3	3
			421330008	3	3
3	PA	2000	420030008	4	4
			420030021	4	4
			420030116	4	4
			420110009	4	4
			420692006	4	4
			420710007	4	4
			420791101	4	4
			421010020	4	4
			421010047	4	5
3	PA	2001	420030095	4	4
			420031008	4	4
			420033007	4	4
			420039002	4	4
			420450002	4	4
			420910013	4	4
			421010004	3	3
			421010024	3	3
			421250005	4	4
			421250200	4	4
3	VA	1999	510590030	3	3
			511071005	2	2
			517600020	4	4
			517750010	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 7

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
3	VA	1999	518100008	3	4
3	VA	2000	510130020	4	4
			510595001	4	4
			510870014	3	5
			516500004	4	5
			517700014	2	2
3	VA	2001	511390004	4	4
			515200006	4	4
			515500012	4	4
			517000013	4	4
			517100024	3	3
3	WV	1999	540390009	3	3
			540391005	3	3
			540610003	3	3
			540690008	2	2
			540890001	2	2
3	WV	2000	540030003	4	4
			540110006	4	4
			540291004	4	4
			540511002	4	4
			541071002	3	3
3	WV	2001	540330003	4	4
			540490006	4	4
			540810002	4	4
4	AL	1999	010730023	3	3
			011010007	4	4
			011170006	4	4
			011250003	4	4
			011270002	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 8

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
4	AL	2000	010690002	4	4
			010735002	4	4
			010890014	4	4
			011130001	3	3
			011190002	4	4
			011210002	4	4
4	AL	2001	010030010	4	4
			010270001	4	4
			010732003	4	4
			010970002	3	4
4	FL	1999	120111002	4	4
			120251016	4	4
			120256001	4	4
			120570030	4	4
			120571075	4	4
			120951004	4	4
			120992003	4	4
			121030018	3	3
			121031008	4	4
			121111002	4	4
4	FL	2000	120170005	3	4
			120310098	4	4
			120310099	3	3
			120830003	3	4
			120952002	3	4
			121056006	3	4
			121171002	3	4
			121275002	4	4
4	FL	2001	120090007	3	4
			120112004	4	4
			120113002	4	4
			120330004	3	4

Completeness of PEP Visits by Region/State/Site for 99-01 9

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
4	FL	2001	120330025	3	4
			120330026	3	4
			120990009	4	4
4	GA	1999	130510017	4	4
			130510091	4	4
			131270004	3	3
			131270006	1	1
			132450005	3	4
			132450091	3	4
4	GA	2000	130210007	3	4
			130210012	3	4
			130950007	3	4
			132150001	3	4
			132150011	3	4
4	GA	2001	130630091	3	4
			130670003	3	4
			131150005	3	4
			131210039	3	4
			131211001	3	4
			132230003	3	3
4	KY	1999	210190017	4	4
			210370003	4	4
			211110043	4	4
			211170007	4	4
			211950002	4	4
4	KY	2000	210470006	4	4
			210590014	3	3
			211010006	4	4
			211110044	4	4
			211451004	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 10

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
4	KY	2001	210290006	4	4
			210930006	4	4
			211110048	4	4
			212270007	4	4
4	MS	1999	280010004	3	3
			280490018	4	4
			281210001	4	4
			281490004	3	3
4	MS	2000	280110001	3	3
			280490010	4	4
			280750003	4	4
			281230001	4	4
4	MS	2001	280350004	4	4
			280470008	3	3
			280590006	4	4
			280670002	4	4
			280670006	1	1
			281090001	4	4
4	NC	1999	370210034	3	3
			370350004	4	4
			370710016	4	4
			371190010	4	4
			371190034	3	3
			371190040	4	4
			371190041	1	1
			371210001	2	2
			371730002	4	4
4	NC	2000	370010002	4	4
			370330001	4	4
			370370004	4	4
			370630001	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 11

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
4	NC	2000	370670022	4	4
			370670024	4	4
			370810009	4	4
			370811005	4	4
			371350007	4	4
4	NC	2001	370610002	4	4
			370990006	3	4
			371210001	2	3
			371330005	4	4
			371390001	1	1
			371390002	2	3
			371470005	4	4
			371910005	4	4
4	SC	1999	450630008	3	4
			450790007	3	4
			450790019	3	4
			450830010	3	4
4	SC	2000	450370001	3	4
			450450009	4	4
			450470003	3	4
			450730001	4	4
4	SC	2001	450130007	3	4
			450190048	3	4
			450190049	3	4
4	TN	1999	470930028	4	4
			471130004	4	4
			471570014	4	4
			471570047	4	4
			471631007	4	4
4	TN	2000	470370023	3	4

Completeness of PEP Visits by Region/State/Site for 99-01 12

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
4	TN	2000	470370036	3	4
			470650031	4	4
			470654002	4	4
4	TN	2001	470370025	4	4
			470650032	4	4
			470931017	4	4
			470931020	4	4
			471251009	4	4
			471650007	4	4
5	IL	1999	170310014	4	4
			170311016	4	4
			170311701	4	4
			170312001	4	4
			170313301	4	4
			170314201	4	4
			171430037	3	3
			171670012	3	3
5	IL	2000	170310022	4	4
			170310050	3	3
			170310052	3	3
			170434002	3	3
			170890003	3	3
			170890005	1	1
			170971007	4	4
			170990007	4	4
			171110001	4	4
			171971002	3	3
5	IL	2001	170310057	4	4
			170314007	1	1
			170316005	4	4
			171190023	4	4
			171191007	1	1

Completeness of PEP Visits by Region/State/Site for 99-01 13

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
5	IL	2001	171192009	4	4
			171193007	3	3
			171630010	4	4
			172010010	4	4
5	IN	1999	180190005	4	4
			180431004	4	4
			180891003	4	4
			180891016	4	4
			180892004	3	4
			180970043	4	4
			180970081	4	4
			181270024	4	4
5	IN	2000	180890006	4	4
			180890022	4	4
			180950009	3	3
			180970078	4	4
			180970079	4	4
			181410014	4	4
			181412004	3	3
			181630006	4	4
			181630016	4	4
5	IN	2001	180030004	4	4
			180030014	4	5
			180390003	2	2
			180890027	4	5
			180892010	4	5
			180970018	2	2
			180970023	2	2
			180970042	4	4
			180970066	4	4
			181270020	4	5
			181411008	2	2
			181670018	2	2

Completeness of PEP Visits by Region/State/Site for 99-01 14

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
5	IN	2001	181670023	2	2
5	MI	1999	260050003	1	1
			260210014	1	1
			260810020	4	4
			260990009	4	4
			261390005	4	4
			261470005	4	4
			261630015	4	4
			261630036	4	4
5	MI	2000	260050003	4	4
			260210014	4	4
			260490021	3	3
			260650012	4	5
			261250001	4	4
			261610007	3	3
			261630001	4	4
5	MI	2001	260170014	4	4
			260550003	2	2
			260610008	1	1
			261150005	4	4
			261450018	4	4
			261610008	3	3
			261630016	4	4
5	MN	1999	271230047	3	3
			271230868	3	3
			271377001	3	3
			271377550	3	3
5	MN	2000	270376018	3	3
			270530961	4	4
			270531007	2	2
			270532006	3	3

Completeness of PEP Visits by Region/State/Site for 99-01 15

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
5	MN	2000	271230871	3	3
			271390505	4	4
5	MN	2001	270370470	2	2
			270530963	3	3
			270953051	2	2
			271095008	3	3
			271230871	3	3
			271453052	1	1
5	OH	1999	390350060	3	3
			390350066	4	4
			390490024	4	4
			390490025	4	4
			390610014	3	3
			390617001	2	2
			390851001	3	3
			390950008	3	3
			390950024	4	4
			390950025	1	1
			390990005	4	4
			391130014	4	4
			391130031	4	4
			391450013	3	3
			391530017	3	3
			391530023	3	3
			391550007	4	4
5	OH	2000	390170003	4	4
			390350013	4	4
			390350027	4	4
			390350045	4	4
			390610041	2	2
			390618001	4	4
			390811001	2	2
			390851001	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 16

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
5	OH	2000	390870010	4	4
			390930016	1	1
			390932003	4	4
			390950026	3	3
			391330002	3	3
			391330003	1	1
			391351001	3	3
			391510017	4	4
			391550007	4	4
5	OH	2001	390090003	4	4
			390230005	3	3
			390350038	4	4
			390350065	3	3
			390351002	4	4
			390490025	1	1
			390490081	4	4
			390610040	4	4
			390610042	3	4
			390610043	2	3
			390851001	4	4
			390950025	3	3
			390990005	3	3
			391450013	4	4
			391510020	4	4
			391530023	4	4
5	WI	1999	550590019	4	4
			550790010	4	4
			550790043	3	3
			550790044	1	1
			550790050	4	4
			550790051	3	4
			550790059	3	3
5	WI	2000	550090005	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 17

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
5	WI	2000	550090026	4	4
			550710007	4	4
			550790026	4	4
			550790099	3	3
			550870009	4	4
			550890008	4	4
			551390011	4	4
5	WI	2001	550250025	4	4
			550250047	1	1
			550590019	3	4
			551050002	2	2
			551050024	1	1
			551330027	4	5
			551330034	4	4
6	AR	1999	050510002	3	4
			051190003	3	4
			051310008	3	4
			051430003	3	4
6	AR	2000	050350004	3	3
			050910004	4	4
			051070001	4	4
			051190007	4	4
			051191008	3	3
6	AR	2001	050010010	4	5
			050450002	4	4
			050690005	4	4
			051390004	3	4
			051390005	1	1
			051450001	4	4
6	LA	1999	220191002	4	4
			220330009	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 18

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
6	LA	1999	220511001	4	4
			220710010	4	4
			221210001	4	5
6	LA	2000	220171002	4	4
			220190009	4	4
			220470009	4	4
			220550005	4	4
			220710012	4	4
6	LA	2001	220330002	4	5
			220470005	4	4
			220512001	4	4
			220730004	4	4
			220870004	4	4
6	NM	1999	350010023	4	5
			350010024	4	5
			350130017	4	4
			350350060	1	1
			350430004	4	4
6	NM	2000	350010023	4	4
			350131006	4	4
			350439003	4	4
			350439004	3	3
			350450006	4	4
6	NM	2001	350010023	4	4
			350019004	3	3
			350050005	4	4
			350250007	4	4
			350439004	4	4
6	OK	1999	400310648	4	4
			401090035	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 19

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
6	OK	1999	401210415	4	4
			401430110	4	4
6	OK	2000	400219002	3	3
			400710602	3	3
			400719003	4	4
			401010169	4	4
			401091037	4	4
			401430131	3	3
6	OK	2001	400179001	4	4
			400190295	4	4
			400470554	4	4
			400719003	3	3
			400819005	4	4
			401091038	4	4
			401179007	4	4
			401190614	4	4
			401339006	4	4
6	TX	1999	480290034	3	3
			481130035	3	3
			481130050	4	4
			481410002	4	4
			481410037	4	4
			481410044	4	4
			481671005	3	5
			482010024	3	4
			482010026	3	4
			482011035	3	3
			482011039	3	3
			484393006	4	4
			484530020	4	4
6	TX	2000	480290052	4	4
			480370004	4	5

Completeness of PEP Visits by Region/State/Site for 99-01 20

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
6	TX	2000	480550062	4	4
			481410010	4	4
			481410038	3	4
			481670053	4	4
			481830001	4	4
			482010058	4	6
			482010062	4	4
			482450022	4	6
			483390089	4	4
			483611001	4	5
			484530021	4	4
6	TX	2001	480612002	3	3
			480850005	4	4
			481130020	4	4
			481130069	4	4
			481350003	4	4
			482010075	3	4
			482011037	1	1
			482150043	4	4
			482151042	3	3
			483030001	4	4
			483550020	4	4
			483550032	4	4
			483750005	4	4
			484790016	4	5
7	IA	1999	191032001	3	3
			191130036	2	2
			191532510	3	4
7	IA	2000	191390015	3	3
			191630015	3	3
			191630018	2	2
7	IA	2001	190630003	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 21

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
7	IA	2001	191530059	4	4
			191532520	4	4
			191550009	4	4
			191692530	4	4
			191930017	4	4
7	KS	1999	200910007	3	4
			201070002	3	4
			201730010	3	4
			202090022	3	4
7	KS	2000	201730009	3	4
			201770011	3	4
			202090021	3	4
7	KS	2001	200910008	4	4
			200910009	4	4
			201730008	4	4
			201910002	4	4
7	MO	1999	290950036	3	4
			290952002	3	4
			291831002	3	4
			291895001	3	4
			295100086	3	4
7	MO	2000	290910003	4	4
			290952002	3	4
			290990012	3	4
			291860006	3	4
			291892003	3	4
			295100085	3	4
7	MO	2001	290370003	3	4
			290390001	4	4
			290470041	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 22

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
7	MO	2001	290950037	4	4
			295100007	4	4
			295100087	4	4
7	NE	1999	310050019	2	2
			310550019	2	2
			311090022	3	4
7	NE	2000	310790003	2	4
			311090022	2	4
7	NE	2001	310250002	4	4
			310270001	4	4
			310310001	4	4
			310550051	4	4
			310550052	4	4
			311530007	3	4
			311770002	3	4
8	CO	1999	080010001	4	4
			080310002	2	2
			080410011	3	3
			080770003	3	3
			081230006	4	5
8	CO	2000	080050005	4	5
			080130012	4	4
			080410011	4	4
			080690009	4	4
			081010012	4	4
8	CO	2001	080130003	4	4
			080390001	4	5
			080410008	4	4
			081070003	4	4
			081230008	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 23

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
8	MT	1999	300630024	4	4
8	MT	2000	300470028	4	4
			300530018	4	4
			300870307	4	4
8	MT	2001	300290009	1	3
			300290039	1	1
			300290047	4	4
			300470013	4	4
			300870307	4	4
8	ND	1999	380150003	3	3
			380171004	3	3
			380570004	4	4
8	ND	2000	380350004	4	4
			380910001	4	4
8	ND	2001	380130003	4	4
			380890002	2	2
8	SD	1999	461030014	4	4
			461030016	3	3
			461030017	1	1
			461031001	3	3
8	SD	2000	460110002	4	4
			460990006	4	4
			460990007	4	4
8	SD	2001	460130003	4	4
			460930001	4	4
			461030017	4	4
8	UT	1999	490353006	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 24

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
8	UT	1999	490494001	4	4
			490570001	4	4
8	UT	2000	490350003	4	4
			490353007	4	4
			490490002	4	4
			490570007	4	5
8	UT	2001	490050004	4	4
			490350012	4	4
			490353003	3	3
			490495008	4	4
8	WY	1999	560330002	3	3
8	WY	2000	560210001	4	4
8	WY	2001	560330001	4	4
9	AZ	1999	040070008	3	3
			040139991	2	2
			040139992	1	1
			040139997	3	3
			040190011	3	4
9	AZ	2000	040031005	4	4
			040139997	4	4
			040191028	4	4
			040210001	4	4
9	AZ	2001	040051008	4	4
			040190011	4	4
			040213002	4	4
			040230004	4	4
9	CA	1999	060170011	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 25

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
9	CA	1999	060190008	4	4
			060250005	4	4
			060270002	1	1
			060271003	4	4
			060290012	2	2
			060290014	4	4
			060310004	4	4
			060370002	3	5
			060531002	4	4
			060590001	3	3
			060631008	4	4
			060652002	3	3
			060658001	4	4
			060670006	2	2
			060670010	4	6
			060731007	3	3
			060750005	4	4
			060850004	4	4
			061010003	4	4
			061112002	4	5
9	CA	2000	060011001	4	4
			060231002	4	4
			060251003	2	2
			060290010	4	4
			060290012	2	2
			060371002	4	4
			060371103	4	4
			060571001	4	4
			060674001	4	4
			060710014	1	1
			060710306	2	2
			060710308	1	1
			060712002	4	4
			060718001	4	4
			060730003	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 26

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
9	CA	2000	060731002	3	3
			060771002	4	4
			060798001	4	4
			060831007	4	4
			060852003	4	5
			061110007	4	4
			061131003	4	4
9	CA	2001	060010007	4	5
			060111002	4	5
			060170012	2	2
			060192025	3	3
			060195001	4	4
			060250003	4	4
			060251003	2	2
			060333001	4	4
			060371301	4	4
			060371601	4	5
			060372005	4	4
			060379002	4	4
			060510001	1	2
			060570005	4	4
			060610006	4	4
			060631006	4	4
			060650025	4	4
			060730001	4	4
			060811001	4	4
			060950004	4	4
			061072002	4	5
			061113001	4	4
9	HI	1999	150031001	4	4
9	HI	2000	150031004	4	4
			150032004	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 27

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
9	HI	2001	150090006	4	5
9	NV	1999	320030560	4	4
			320310016	4	4
9	NV	2000	320030298	4	4
			320032002	3	4
			320310016	4	4
9	NV	2001	320030022	4	4
			320310016	4	4
10	AK	1999	020200009	1	1
			020200018	2	2
			020900010	2	2
			021100004	2	2
			021700008	2	2
10	AK	2000	020200018	3	3
			020200044	3	3
			021100004	3	3
			021100026	3	3
10	AK	2001	020900010	2	4
			022900003	1	3
10	ID	1999	160010011	4	4
			160050015	4	4
			160170001	4	4
			160270004	4	4
			160830006	3	3
10	ID	2000	160550006	4	4
			160690009	4	5
			160790017	4	5

Completeness of PEP Visits by Region/State/Site for 99-01 28

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
10	ID	2001	160050006	4	4
			160190010	4	4
			160830010	4	4
10	OR	1999	410170113	4	4
			410330107	4	4
			410390060	4	4
			410510080	4	4
			410590121	4	4
10	OR	2000	410030013	4	5
			410391007	4	4
			410392013	4	4
			410430009	4	4
			410610117	3	4
			410650007	4	4
10	OR	2001	410090004	3	5
			410250002	3	4
			410291001	3	4
			410292129	3	4
			410330107	3	4
			410350004	3	5
			410370001	3	4
			410370003	3	4
10	WA	1999	530330016	2	2
			530330021	4	4
			530330057	2	2
			530530031	4	4
			530670013	4	4
			530770012	1	1
10	WA	2000	530050002	3	3
			530610005	4	4
			530611007	4	4

Completeness of PEP Visits by Region/State/Site for 99-01 29

Region	State	Year	Site	Total Number of Qtrs with PEP Visits	Total Num of PEP Visits
10	WA	2000	530630047	4	4
			530730015	4	4
10	WA	2001	530010003	4	4
			530110013	3	4
			530110020	2	3
			530150015	2	4
			530330017	4	4
			530330024	4	4
			530410006	1	1
			530530029	4	4
			530531018	3	4
			530570014	4	4
			530630016	3	4
			530750003	4	4

National Completeness of PEP Visits 30

-------------------------------- Year=1999 ---------------------------------

The FREQ Procedure

Table of numind by compind

numind(Num PEP Visits) / compind(Num Qtrs PEP Visits Occur) Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	15	21	0	0	36
3 PEP Visits	0	7	67	0	74
4 PEP Visits	0	0	33	122	155
> 4 PEP Visits	0	0	3	10	13
Total	15	28	103	132	278

National Completeness of PEP Visits 31

-------------------------------- Year=2000 ---------------------------------

The FREQ Procedure

Table of numind by compind

numind(Num PEP Visits) / Frequency	compind(Num Qtrs PEP Visits Occur) 1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	6	8	0	0	14
3 PEP Visits	0	0	37	0	37
4 PEP Visits	0	2	26	183	211
> 4 PEP Visits	0	0	1	20	21
Total	6	10	64	203	283

National Completeness of PEP Visits 32

-------------------------------- Year=2001 ---------------------------------

The FREQ Procedure

Table of numind by compind

numind(Num PEP Visits) Frequency	compind(Num Qtrs PEP Visits Occur) 1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	16	16	0	0	32
3 PEP Visits	2	4	25	0	31
4 PEP Visits	0	2	34	185	221
> 4 PEP Visits	0	0	2	20	22
Total	18	22	61	205	306

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 1 of numind by compind
Controlling for region=1

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	0	0	0	0
3 PEP Visits	0	6	12	0	18
4 PEP Visits	0	0	2	0	2
> 4 PEP Visits	0	0	0	0	0
Total	0	6	14	0	20

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 2 of numind by compind
Controlling for region=2

numind(Num PEP Visits)   compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	2	1	0	0	3
3 PEP Visits	0	0	2	0	2
4 PEP Visits	0	0	4	4	8
> 4 PEP Visits	0	0	1	3	4
Total	2	1	7	7	17

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 3 of numind by compind
Controlling for region=3

numind(Num PEP Visits) Frequency	compind(Num Qtrs PEP Visits Occur) 1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	5	0	0	6
3 PEP Visits	0	1	13	0	14
4 PEP Visits	0	0	1	6	7
> 4 PEP Visits	0	0	0	1	1
Total	1	6	14	7	28

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 4 of numind by compind
Controlling for region=4

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	2	1	0	0	3
3 PEP Visits	0	0	7	0	7
4 PEP Visits	0	0	6	32	38
> 4 PEP Visits	0	0	0	0	0
Total	2	1	13	32	48

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 5 of numind by compind
Controlling for region=5

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	4	1	0	0	5
3 PEP Visits	0	0	15	0	15
4 PEP Visits	0	0	2	30	32
> 4 PEP Visits	0	0	0	0	0
Total	4	1	17	30	52

Regional Completeness of PEP Visits 38

-------------------------------- Year=1999 ---------------------------------

The FREQ Procedure

Table 6 of numind by compind
Controlling for region=6

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	0	0	0	1
3 PEP Visits	0	0	4	0	4
4 PEP Visits	0	0	6	16	22
> 4 PEP Visits	0	0	1	3	4
Total	1	0	11	19	31

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 7 of numind by compind
Controlling for region=7

numind(Num PEP Visits) Frequency	compind(Num Qtrs PEP Visits Occur) 1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	3	0	0	3
3 PEP Visits	0	0	1	0	1
4 PEP Visits	0	0	11	0	11
> 4 PEP Visits	0	0	0	0	0
Total	0	3	12	0	15

-------------------------------- Year=1999 ---------------------------------

The FREQ Procedure

Table 8 of numind by compind
Controlling for region=8

numind(Num PEP Visits) / Frequency	compind(Num Qtrs PEP Visits Occur): 1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	1	0	0	2
3 PEP Visits	0	0	7	0	7
4 PEP Visits	0	0	0	7	7
> 4 PEP Visits	0	0	0	1	1
Total	1	1	7	8	17

Regional Completeness of PEP Visits 41

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 9 of numind by compind
Controlling for region=9

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	2	3	0	0	5
3 PEP Visits	0	0	5	0	5
4 PEP Visits	0	0	1	15	16
> 4 PEP Visits	0	0	1	2	3
Total	2	3	7	17	29

------------------------------- Year=1999 --------------------------------

The FREQ Procedure

Table 10 of numind by compind
Controlling for region=10

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	2	6	0	0	8
3 PEP Visits	0	0	1	0	1
4 PEP Visits	0	0	0	12	12
> 4 PEP Visits	0	0	0	0	0
Total	2	6	1	12	21

Regional Completeness of PEP Visits 43

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 1 of numind by compind
Controlling for region=1

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	0	0	0	0
3 PEP Visits	0	0	0	0	0
4 PEP Visits	0	0	0	13	13
> 4 PEP Visits	0	0	0	7	7
Total	0	0	0	20	20

Regional Completeness of PEP Visits 44

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 2 of numind by compind
Controlling for region=2

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	0	0	0	1
3 PEP Visits	0	0	1	0	1
4 PEP Visits	0	0	1	16	17
> 4 PEP Visits	0	0	0	0	0
Total	1	0	2	16	19

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 3 of numind by compind
Controlling for region=3

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	1	0	0	1
3 PEP Visits	0	0	2	0	2
4 PEP Visits	0	0	0	21	21
> 4 PEP Visits	0	0	1	2	3
Total	0	1	3	23	27

Regional Completeness of PEP Visits 46

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 4 of numind by compind
Controlling for region=4

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	0	0	0	0
3 PEP Visits	0	0	4	0	4
4 PEP Visits	0	0	14	27	41
> 4 PEP Visits	0	0	0	0	0
Total	0	0	18	27	45

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 5 of numind by compind
Controlling for region=5

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	3	3	0	0	6
3 PEP Visits	0	0	16	0	16
4 PEP Visits	0	0	0	34	34
> 4 PEP Visits	0	0	0	1	1
Total	3	3	16	35	57

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 6 of numind by compind
Controlling for region=6

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	0	0	0	0
3 PEP Visits	0	0	6	0	6
4 PEP Visits	0	0	1	23	24
> 4 PEP Visits	0	0	0	4	4
Total	0	0	7	27	34

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 7 of numind by compind
Controlling for region=7

numind(Num PEP Visits) / Frequency	compind(Num Qtrs PEP Visits Occur) 1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	1	0	0	1
3 PEP Visits	0	0	2	0	2
4 PEP Visits	0	2	8	1	11
> 4 PEP Visits	0	0	0	0	0
Total	0	3	10	1	14

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 8 of numind by compind
Controlling for region=8

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	0	0	0	0
3 PEP Visits	0	0	0	0	0
4 PEP Visits	0	0	0	16	16
> 4 PEP Visits	0	0	0	2	2
Total	0	0	0	18	18

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 9 of numind by compind
Controlling for region=9

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	2	3	0	0	5
3 PEP Visits	0	0	1	0	1
4 PEP Visits	0	0	1	23	24
> 4 PEP Visits	0	0	0	1	1
Total	2	3	2	24	31

------------------------------- Year=2000 --------------------------------

The FREQ Procedure

Table 10 of numind by compind
Controlling for region=10

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	0	0	0	0
3 PEP Visits	0	0	5	0	5
4 PEP Visits	0	0	1	9	10
> 4 PEP Visits	0	0	0	3	3
Total	0	0	6	12	18

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 1 of numind by compind
Controlling for region=1

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	1	0	0	2
3 PEP Visits	0	0	3	0	3
4 PEP Visits	0	0	1	11	12
> 4 PEP Visits	0	0	0	3	3
Total	1	1	4	14	20

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 2 of numind by compind
Controlling for region=2

numind(Num PEP Visits) / Frequency	compind(Num Qtrs PEP Visits Occur) 1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	1	0	0	2
3 PEP Visits	0	0	0	0	0
4 PEP Visits	0	0	3	13	16
> 4 PEP Visits	0	0	0	3	3
Total	1	1	3	16	21

-------------------------------- Year=2001 ---------------------------------

The FREQ Procedure

Table 3 of numind by compind
Controlling for region=3

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	1	0	0	1
3 PEP Visits	0	0	5	0	5
4 PEP Visits	0	0	0	21	21
> 4 PEP Visits	0	0	0	0	0
Total	0	1	5	21	27

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 4 of numind by compind
Controlling for region=4

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	2	0	0	0	2
3 PEP Visits	0	2	2	0	4
4 PEP Visits	0	0	14	24	38
> 4 PEP Visits	0	0	0	0	0
Total	2	2	16	24	44

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 5 of numind by compind
Controlling for region=5

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	7	10	0	0	17
3 PEP Visits	0	1	9	0	10
4 PEP Visits	0	0	2	24	26
> 4 PEP Visits	0	0	0	5	5
Total	7	11	11	29	58

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 6 of numind by compind
Controlling for region=6

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	2	0	0	0	2
3 PEP Visits	0	0	4	0	4
4 PEP Visits	0	0	2	28	30
> 4 PEP Visits	0	0	0	3	3
Total	2	0	6	31	39

-------------------------------- Year=2001 ---------------------------------

The FREQ Procedure

Table 7 of numind by compind
Controlling for region=7

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	0	0	0	0	0
3 PEP Visits	0	0	0	0	0
4 PEP Visits	0	0	3	20	23
> 4 PEP Visits	0	0	0	0	0
Total	0	0	3	20	23

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 8 of numind by compind
Controlling for region=8

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	1	0	0	2
3 PEP Visits	1	0	1	0	2
4 PEP Visits	0	0	0	15	15
> 4 PEP Visits	0	0	0	1	1
Total	2	1	1	16	20

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 9 of numind by compind
Controlling for region=9

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	2	0	0	3
3 PEP Visits	0	0	1	0	1
4 PEP Visits	0	0	0	20	20
> 4 PEP Visits	0	0	0	5	5
Total	1	2	1	25	29

------------------------------- Year=2001 --------------------------------

The FREQ Procedure

Table 10 of numind by compind
Controlling for region=10

numind(Num PEP Visits) compind(Num Qtrs PEP Visits Occur)

Frequency	1 Qtr	2 Qtrs	3 Qtrs	4 Qtrs	Total
1 or 2 PEP Visits	1	0	0	0	1
3 PEP Visits	1	1	0	0	2
4 PEP Visits	0	2	9	9	20
> 4 PEP Visits	0	0	2	0	2
Total	2	3	11	9	25

Number of PEP Visits for Nation and by Region 63

-------------------------------- year=1999 ---------------------------------

The FREQ Procedure

Quarter

quarter	Frequency
1	175
2	275
3	263
4	254

Table of region by quarter

region(Region) / Frequency	quarter(Quarter) 1	2	3	4	Total
1	0	15	22	25	62
2	11	20	16	17	64
3	9	26	25	26	86
4	43	44	50	40	177
5	38	47	48	46	179
6	19	39	30	33	121
7	0	22	17	14	53
8	14	15	14	14	57
9	27	28	23	25	103
10	14	19	18	14	65
Total	175	275	263	254	967

Number of PEP Visits for Nation and by Region 64

-------------------------------- year=2000 ---------------------------------

The FREQ Procedure

Quarter

quarter	Frequency
1	253
2	282
3	286
4	265

Table of region by quarter

region(Region) / Frequency	quarter(Quarter) 1	2	3	4	Total
1	20	24	22	23	89
2	18	18	19	17	72
3	26	28	26	27	107
4	42	46	53	35	176
5	47	49	53	49	198
6	35	33	34	34	136
7	1	22	14	15	52
8	20	18	18	18	74
9	29	28	28	27	112
10	15	16	19	20	70
Total	253	282	286	265	1086

Number of PEP Visits for Nation and by Region 65

-------------------------------- year=2001 --------------------------------

The FREQ Procedure

Quarter

quarter	Frequency
1	272
2	298
3	288
4	280

Table of region by quarter

region(Region)	quarter(Quarter)				
Frequency	1	2	3	4	Total
1	17	21	20	19	77
2	17	22	19	24	82
3	27	25	26	23	101
4	43	47	46	30	166
5	47	47	46	46	186
6	36	39	39	35	149
7	20	26	23	23	92
8	20	18	17	19	74
9	30	30	29	25	114
10	15	23	23	36	97
Total	272	298	288	280	1138

Number of Unique Sites Visited by PEP for Nation and by Region 66

-------------------------------- year=1999 --------------------------------

The FREQ Procedure

Quarter

quarter	Frequency
1	170
2	247
3	248
4	243

Table of region by quarter

region(Region) quarter(Quarter)

Frequency	1	2	3	4	Total
1	0	14	20	20	54
2	8	14	15	16	53
3	9	25	24	25	83
4	43	44	44	40	171
5	38	46	48	45	177
6	19	30	30	31	110
7	0	15	13	14	42
8	14	15	14	13	56
9	25	25	22	25	97
10	14	19	18	14	65
Total	170	247	248	243	908

Number of Unique Sites Visited by PEP for Nation and by Region 67

------------------------------- year=2000 -------------------------------

The FREQ Procedure

Quarter

quarter	Frequency
1	246
2	264
3	265
4	255

Table of region by quarter

region(Region) Frequency	quarter(Quarter) 1	2	3	4	Total
1	20	20	20	20	80
2	18	18	18	17	71
3	25	27	25	26	103
4	42	42	43	35	162
5	47	49	53	48	197
6	33	32	31	33	129
7	1	14	12	13	40
8	18	18	18	18	72
9	28	28	27	27	110
10	14	16	18	18	66
Total	246	264	265	255	1030

Number of Unique Sites Visited by PEP for Nation and by Region 68

-------------------------------- year=2001 --------------------------------

The FREQ Procedure

Quarter

quarter	Frequency
1	258
2	278
3	274
4	255

Table of region by quarter

region(Region) quarter(Quarter)

Frequency	1	2	3	4	Total
1	16	18	18	19	71
2	17	21	19	19	76
3	27	25	26	23	101
4	40	41	41	28	150
5	43	46	46	43	178
6	35	37	37	35	144
7	20	23	23	23	89
8	19	18	17	17	71
9	27	28	28	25	108
10	14	21	19	23	77
Total	258	278	274	255	1065