

A. PROJECT MANAGEMENT

1.0 QA Project Plan Identification and Approval

Title: *Tampa Bay Region Air Toxics Study (TBRATS) Quality Assurance Project Plan for the ambient air toxics monitoring program.*

The attached QAPP for the Tampa Bay Region's air toxics monitoring study is hereby recommended for approval and commits the organizations identified herein to follow the elements described within.

Pinellas County Department of Environmental Management

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- 2) Signature: _____ Date: _____
Thomas Stringfellow, Environmental Program Manager
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Environmental Protection Commission of Hillsborough County

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Tom Tamanini, Chief, Ambient Monitoring Section
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EPA Region 4

- 1) Signature: _____ Date: _____
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- 2) Signature: _____ Date: _____
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3.0 Distribution

A hardcopy of the TBRATS QAPP has been distributed to the individuals in Table 3.1, below. This document is also available on the Pinellas County Department of Environmental Management web site at: <http://www.pinellascounty.org/environ/> and at the Environmental Protection Commission of Hillsborough County web site at: <http://epchc.org/air.htm>.

Table 3.1 TBRATS QAPP Distribution List

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4.0 Project/Task Organization

4.1 Roles and Responsibilities

Federal, State, Tribal and local agencies all have important roles in developing and implementing satisfactory air monitoring programs. As part of the planning effort, EPA is responsible for developing National Ambient Air Quality Standards (NAAQS), and identifying a minimum set of QC samples from which to judge data quality. The State and local organizations are responsible for taking this information and developing and implementing a quality system that will meet the data quality requirements. Then, it is the responsibility of both EPA and the State and local organizations to assess the quality of the data and take corrective action when appropriate. The responsibilities of each organization, as they pertain to the TBRATS pilot city project, are discussed below.

4.1.1 Air Toxics Monitoring Steering Committee

The US Environmental Protection Agency (EPA), in coordination with state and local air programs, is developing a national air toxics strategy to improve the understanding of the health risks posed by hazardous air pollutants in urban areas. As part of the strategy, the Air Toxics Monitoring Steering Committee¹ (the Steering Committee) provides coordination, consistency and guidance to the four (4) urban area pilot projects and six (6) small community pilot projects engaged in the Urban Air Toxics Monitoring Program (UATMP) Pilot City Studies. In addition, the Steering Committee provides direction to the overall data assessment and data analysis plan.

4.1.2 Office of Air Quality Planning and Standards (OAQPS)

OAQPS is the organization charged under the authority of the Clean Air Act (CAA) to protect and enhance the quality of the nation's air resources. OAQPS sets standards for pollutants considered harmful to public health or welfare and, in cooperation with EPA's Regional Offices and the States, enforces compliance with the standards through state implementation plans (SIPs) and regulations controlling emissions from stationary sources. The OAQPS evaluates the need to regulate potential air pollutants especially air toxics. The OAQPS develops national standards and works with State and local agencies to develop plans for meeting these standards. In addition, OAQPS monitors national air quality trends and maintains a database of information on air toxics and controls; provides technical guidance and training on air pollution control strategies; and monitors compliance with air pollution standards.

¹ The Air Toxics Monitoring Steering Committee consists of a group of EPA and State, interstate and local agency organizations that drafted guidance for the National Air Toxics Monitoring Pilot Program, April 2000.

Within the OAQPS Emissions Monitoring and Analysis Division (EMAD), the Monitoring and Quality Assurance Group (MQAG) is responsible for the oversight of the Ambient Air Quality Monitoring Network. MQAG has the following responsibilities:

- ensuring that the methods and procedures used in making air pollution measurements are adequate to meet the programs objectives and that the resulting data are of satisfactory quality;
- operating the National Performance Audit Program (NPAP);
- evaluating the performance, through technical systems audits and management systems reviews, of organizations making air pollution measurements of importance to the regulatory process;
- implementing satisfactory quality assurance programs for EPA's Ambient Air Quality Monitoring Network;
- ensuring that national regional laboratories are available to support toxics and QA programs;
- ensuring that guidance pertaining to the quality assurance aspects of the Ambient Air Program are written and revised as necessary; and
- rendering technical assistance to the EPA Regional Offices and air pollution monitoring community.

4.1.3 EPA Region 4 Office

EPA Regional Offices have been developed to address environmental issues related to the states within their jurisdiction and to administer and oversee regulatory and congressionally mandated programs. The major quality assurance responsibilities of EPA's Region 4 Office, in regards to the Ambient Air Quality Program, are the coordination of quality assurance matters at the Regional levels with the State and local agencies. This is accomplished by the designation of EPA Regional Project Officers who are responsible for the technical aspects of the program including:

- reviewing QAPPs by Regional QA Officers who are delegated the authority by the Regional Administrator to review and approve QAPPs for the Agency;
- supporting the air toxics audit evaluation program;
- evaluating quality system performance, through technical systems audits and network reviews whose frequency is addressed in the Code of Federal Regulations and Section 20;
- acting as a liaison by making available the technical and quality assurance information developed by EPA Headquarters and the Region to the State and local agencies, and making EPA Headquarters aware of the unmet quality assurance needs of the State and local agencies.

The principals for the TBRATS pilot project will direct all technical and QA questions to EPA Region 4.

4.1.4 Pinellas County Department of Environmental Management, Division of Air Quality

The Pinellas County Department of Environmental Management, Division of Air Quality is an Approved Local Program pursuant to §403.183 of the Florida Statutes and implemented by state rule under Chapter 17-209, Florida Administrative Code. The agency's roles include surveillance of ambient air quality under 40 CFR Part 58, and support for the national objectives on air toxics characterization.

4.1.5 Environmental Protection Commission of Hillsborough County

The EPC was created by special acts passed in 1967 through 1973, later superseded by Chapter 84-446, Laws of Florida and functions under the provisions of Section 403.182, Florida Statutes and Chapter 62-209, Florida Administrative Code. The agency's roles include surveillance of ambient air quality under 40 CFR Part 58, and support for the national objectives on air toxics characterization.

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5.0 Problem Definition/Background

5.1 Problem Statement and Background

5.1.1 Background

There are currently 188 hazardous air pollutants (HAPs), or air toxics, regulated under the Clean Air Act (CAA) that have been associated with a wide variety of adverse health effects, including cancer, neurological effects, reproductive effects and developmental effects, as well as ecosystem effects. These air toxics are emitted from multiple sources, including major stationary, area, and mobile sources, resulting in population exposure to these air toxics as they occur in the environment. While in some cases the public may be exposed to an individual HAP, more typically people experience exposures to multiple HAPs and from many sources. Exposures of concern result not only from the inhalation of these HAPs, but also, for some HAPs, from multi-pathway exposures to air emissions. For example, air emissions of mercury are deposited in water and people are exposed to mercury through their consumption of contaminated fish.

5.1.2 Air Toxics Program

In order to address the concerns posed by air toxics emissions and to contribute to national emission reductions, the PCDEM and the EPC/HC developed air toxic monitoring programs designed to characterize, prioritize, and equitably address the impacts of HAPs on the public health and the environment. The agencies seek to address air toxics problems through a strategic combination of activities and authorities, including regulatory approaches and voluntary partnerships.

5.1.3 The Role of Ambient Monitoring

Emissions data, ambient concentration measurements, modeled estimates, and health impact information are all needed to fully assess air toxics impacts and to characterize risk. Specifically, emissions data are needed to quantify the sources of air toxics impacts and aid in the development of control strategies. Ambient monitoring data are then needed to understand the behavior of air toxics in the atmosphere after they are emitted. Since ambient measurements cannot practically be made everywhere, modeled estimates are needed to extrapolate our knowledge of air toxics impacts into locations without monitors. Exposure assessments, together with health effects information, are then needed to integrate all of these data into an understanding of the implications of air toxics impacts and to characterize air toxics risks.

This QAPP focuses on the role of ambient measurement data as one key element of the full air toxics assessment process. The rest of this section describes the specific uses of ambient

monitoring data and outlines the key considerations for focusing the spatial, temporal, and measurement aspects of a national air toxics monitoring effort.

The anticipated uses of ambient monitoring data should be kept in mind when designing the measurement network. In order to better focus the data collection activities on the final use of the data, a DQO process was performed in Chapter 7 of this QAPP. From that process, the following objective was determined for the ATMP.

- Determine the highest concentrations expected to occur in the urban setting covered by the network, i.e., to verify the spatial and temporal characteristics of HAPs within the greater metropolitan region.

Since it is not possible to monitor everywhere, we must develop a monitoring network which is representative of air toxics problems on a neighborhood scale and which provide a means to obtain data on a more localized basis as appropriate and necessary. The appropriateness of a candidate monitoring site with respect to the data uses described above.

5.2 List of Pollutants

There are 33 HAPs identified in the draft Integrated Urban Air Toxics Strategy (UATS). They are a subset of the 188 toxics identified in Section 112 of the CAA which are thought to have the greatest impact on the public and the environment in urban areas. The TBRATS planning team reviewed the 33 HAPs list and consulted with EPA Region 4. After several consultations, a final list of compounds was selected. The list is based on:

- The EPA's Concept Paper
- The portion of the 33 Unified Air Toxics Strategy (UATS) HAPs that can be measured with available field and lab systems;
- The limitations of the State-of-the-Science with respect to the instruments.

A number of compounds on the UATS list are difficult to characterize or the methods have not been developed at this time. These compounds will not be included in the pollutant list.

Table 5.1 TBRATS HAP List

EPA Method	Pollutants on the UATS List	Additional HAPS
TO-14A/15	Benzene 1,3-butadiene Carbon tetrachloride Chloroform 1,2-dichloropropane	Methyl chloride methyl bromide ethyl chloride 1,1-dichloroethene 1,1-dichloroethane

EPA Method	Pollutants on the UATS List	Additional HAPS
	Methylene chloride Tetrachloroethene Trichloroethene vinyl chloride Acrylonitrile 1,2 dibromoethane cis-1,3-dichloropropene trans-1,3-dichloropropene 1,2-dichloroethane 1,1,2,2-tetrachloroethane	1,1,1-trichloroethane 1,1,2-trichloroethane toluene chlorobenzene ethylbenzene m-xylene p-xylene styrene o-xylene 1,4-dichlorobenzene 1,2,4-trichlorobenzene hexachloro-1,3-butadiene
IO-3	Arsenic Beryllium Cadmium Chromium Lead Manganese Nickel	antimony cobalt selenium
TO-11A	Acetaldehyde Formaldehyde	propionaldehyde methyl ethyl ketone

As can be seen from Table 5-1, there are a number of additional HAPs on the list. These are HAPs that the current analytical systems can measure. Although the additional compounds are not considered to be as hazardous as the pollutants on the UATS list. Data will be collected on these compounds as well because, at some future date, these compounds may be deemed hazardous.

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6.0 Project/Task Description

6.1 Description of Work to be Performed

The measurement goal of the TBRATS project is to estimate the concentration, in units of nanograms per cubic meter (ng/m^3), parts per billion/volume (ppbv), picograms per microliter (pg/ul) of air toxic compounds of particulates and volatile organic gases. This is accomplished by three separate systems: canister sampling with passivated canisters, dinitrophenylhydrazine (DNPH) cartridges, and high volume sampling on an 8 x 10" quartz glass filter. The data is collected for the USEPA Urban Air Toxics Monitoring Program and submitted to the Aerometric Informational Retrieval System (AIRS) for spatial and temporal analyses.

Ambient air quality measurements are taken for toxic metal compounds, volatile organic compounds, and carbonyls during the one-year study period. The ECP/HC laboratory performs chemical analyses of all toxic metal samples using the EPA Compendium method, IO-3. The PCDEM laboratory performs chemical analyses of all VOC samples using the EPA Compendium method, TO-14A/15. Finally, all carbonyl samples are analyzed under the EPA national laboratory contract with Eastern Research Group, Inc. (ERG) using the Compendium method, TO-11A.

The following sections will describe the measurements required for the routine field and laboratory activities for the network. All future references to, or quality assurance requirements for, carbonyl sampling or analysis of aldehyde and ketone compounds are addressed under the ERG QAPP, "Support for NMOC/CNMOC, UATMP, and PAMS Networks", contract number: 68-D-99-007, unless specifically stated otherwise.

6.2 Field Activities

The filters used for ambient measurement of toxic metals are obtained directly from EPA for sampling total suspended particulates (TSP) under 40 CFR 58. Therefore, the filters utilized in the TBRATS pilot project meet the design and performance criteria for ambient TSP monitoring, at a minimum. Likewise, the filters used for ambient measurement of aldehyde and ketone compounds are received and analyzed through the EPA national laboratory contract with ERG and therefore, meet the design and performance criteria specified under that contract.

Table 6.1, 6.2, and 6.3 summarize some of the more critical performance requirements.

Table 6.1 Design/Performance Specifications - Toxic Metals (TSP)

Equipment	Frequency	Acceptance Criteria	Reference
Filter Design Specs. Size Medium Pore size Filter thickness Max. pressure drop Collection efficiency Alkalinity	1 in 6 days	See Reference 1 203 x 254 mm. Quartz Glass Fiber Filter 0.3 μm 0.50 mm 600 mm Hg @ 1.13 m ³ /min 99.95% 6.5 < pH <7.5	See Reference 1 "IO-1 Sec 6.1.1 " Sec 1.1 " Sec 5.6 "Sec 6.1.3.2 "Sec 7.3.1 "Sec 5.6 "Sec 6.1.3
Sampler Performance Specs. Sample Flow Rate Flow Regulation Flow Rate Precision Flow Rate Accuracy External Leakage Internal Leakage Clock/Timer	1 in 6 days	1.1-1.7 m ³ /min. 0.1 m ³ /min. ±10% ±10% Vendor specs Vendor specs 24 hour ± 2 min accuracy	"Sec 6.1 " " NA NA "Sec 6.1.8

Table 6.2 Design/Performance Specifications – Volatile Organic Compounds (Canister)

Equipment	Frequency	Acceptance Criteria	Reference
Canister Design Specs. Size Medium Max Pressure Max. pressure drop Collection efficiency Detection Limit	1 in 6 days (2x 12hr*)	See Reference 2 6 liters spherical Passivated electro- polished Stainless Steel Canister or fused silica lined 40 psig 14 psig. 99% compound specific, usually >0.1 ppbv	"Vender Spec. " " " " TO-15
Sampler Performance Specs. Sample Flow Rate Flow Rate Precision Flow Rate Accuracy External Leakage Internal Leakage Clock/Timer	1 in 6 days (2x 12hr*)	3.5 cc/min. ±10% ±10% ± 2 psi over 24 hrs ± 2 psi over 24 hrs 24 hour ± 2 min accuracy	"TO15 " " " " " "Sec 6.1.8

*The 1 in 6 day frequency at one site will consist of two 12-hour samples.

Table 6.3 Design/Performance Specifications - Carbonyl Compounds

Equipment	Frequency	Acceptance Criteria	Reference
Filter Design Specs. Size Sample Media	1 in 6 days	See Reference 4 100 mm Cylindrical Silica Gel cartridge coated with 2,4-dinitro-phenyl hydrazine	See Reference 3 "TO-11 Sec 7.1 " "

Equipment	Frequency	Acceptance Criteria	Reference
Sampler Performance Specs.			
Sample Flow Rate		0.20 m ³ /min.	"Vender Spec.
Flow Regulation		0.2 m ³ /min.	"
Flow Rate Precision	1 in 6 days	±10%	"
Flow Rate Accuracy		±10%	"
External Leakage		Vendor specs	NA
Internal Leakage		Vendor specs	NA
Clock/Timer		24 hour ± 2 min accuracy	"Vender Spec.

The Project Team assumes the sampling instruments to be adequate for the sampling for air toxics. All of the instruments operated in the field are vendor supplied. The descriptions of the samplers are similar to the instruments described in the references noted above. Section 7.0 discusses the Measurement Quality Objectives of each of the systems listed in Tables 6-1 through 6-3.

6.3 Laboratory Activities

Laboratory activities for the air toxics program include preparing the filters, canisters and cartridges for the routine field operator, which includes three general phases:

Pre-Sampling

- Receiving filters, canisters or cartridges from the vendors;
- Checking sample integrity;
- Conditioning filters, storing canisters and cartridges;
- Weighing filters;
- Storing prior to field use;
- Packaging filters, canisters and cartridges for field use;
- Associated QA/QC activities;
- Maintaining microbalance and analytical equipment at specified environmental conditions;
- Equipment maintenance and calibrations.

Shipping/Receiving

- Receiving filters, canisters and cartridges from the field and logging into database;
- Storing filters, canisters and cartridges;
- Associated QA/QC activities.

Post-Sampling

- Checking filter integrity;
- Stabilizing/weighing filters;
- Analysis of VOCs from canisters
- Extraction of metals from quartz filter using hot acid/microwave extraction;
- Analysis of DNPH compounds;
- Analysis of sample extracts;
- Data entry/upload to AIRS;
- Storing filters/archiving;
- Cleaning canisters;
- Associated QA/QC activities.

The details for these activities are included in various sections of this document as well as References 1- 4.

6.4 Project Assessment Techniques

An assessment is an evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: an audit, performance evaluation (PE), management systems review (MSR), a peer review, inspection, or surveillance. Definitions for each of these activities can be found in the glossary (Appendix A). Section 20 will discuss the details of the Department's assessments.

Table 6.5 provides information on the parties implementing the assessment and their frequency.

Table 6.4 Project Assessment Schedule

Assessment Type	Assessment Agency	Schedule
Technical Systems Audit	EPA Regional Office	June 2001
Network Review	EPA Regional Office	June 2001
Performance Evaluation	TBRATS Planning Team	25% of sites/year/4 times per year
Data Quality Assessment	TBRATS Planning Team	Quarterly

6.5 Schedule of Activities

Table 6.5 contains a list of the critical activities required to plan, implement, and assess the air toxics program.

Table 6.5 Schedule of Critical Air Toxics Activities

Activity	Due Date	Comments
Network development	June 15, 2000	Preliminary list of sites and samplers required
Sampler order	October 1, 2000	Samplers ordered from vendors
Laboratory design/upgrade	August 12, 2000	Listing of laboratory requirements
Laboratory procurement	September 1, 2000	Ordering/purchase of all laboratory and miscellaneous field equipment
Personnel Requirements	September 1, 2000	Advertising for field and laboratory personnel (if required)
QAPP development	Sept- Dec. 2000	Development of the QAPP
Network design completion	July 1, 2000	Final network design
Samplers arrive	November 15, 2000	Received in Shipping and Receiving Department
Sampler siting/testing	December 15, 2000	Establishment of sites and preliminary testing of samplers
Field/Laboratory Training	December 2000	Field and laboratory training activities and certification
QAPP Submittal	December 1, 2000	QAPP submittal to EPA
QAPP Approval	December 31, 2000	Approval by EPA
Pilot testing	November-December 2000	Pilot activities to ensure efficiency of measurement system
Final Installation of 2000 sites	December 22, 2000	Sites must be established and ready to collect data
Routine Sampling Begins	January 1, 2001	Routine activities must start

6.6 Project Records

The parties to the TBRATS project will establish and maintain procedures for the timely preparation, review, approval, issuance, use, control, revision and maintenance of documents and records. Table 6.6 represents the categories and types of records and documents that are applicable to document control for air toxics information. Information on key documents in each category is explained in more detail in Section 9.

Table 6.6 Critical Documents and Records

Categories	Record/Document Types
Management and Organization	State Implementation Plan Reporting agency information Organizational structure Personnel qualifications and training Training Certification Quality management plan Document control plan Grant allocations
Site Information	Network description Site characterization file Site maps Site Pictures
Environmental Data Operations	QA Project Plans Standard operating procedures (SOPs) Field and laboratory notebooks Sample handling/custody records Inspection/maintenance records
Raw Data	Any original data (routine and QC data) entry forms
Data Reporting	Air quality index report Annual SLAMS air quality information Data/summary reports
Data Management	Data algorithms Data management plans/flowcharts Air Toxics Data
Quality Assurance	Good Laboratory Practice Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site Audits

7.0 Quality Objectives and Criteria for Measurement Data

7.1 Data Quality Objectives (DQOs)

This section provides a description of the data quality objectives for the ambient air toxics characterization in the Tampa Bay Regional Air Toxics Study that is currently under development. Consistent with the planning team's requirement for systematic planning prior to a data collection effort, this document presents issues and discusses trade-offs related to budget and practical constraints. Due to limited resources, it is important to consider these trade-offs to plan an efficient and effective study design that collects high quality data that addresses the questions that need to be answered. The most efficient way to accomplish these goals is to establish criteria for defensible decision making before the study begins, and then develop a data collection design based on these criteria. By using the DQO Process to plan environmental data collection efforts, the project planning team can improve the effectiveness, efficiency, and defensibility of decisions in a resource-effective manner.

It is the policy of the TBRATS project planning team that all air toxics data generated for internal and external use shall meet specific qualitative requirements, referred to as Data Quality Objectives. The DQO performed in accordance to the guidelines as stated in "EPA Quality Manual for Environmental Programs". The DQO process is detailed in US-EPA's "Guidance for the Data Quality Objectives Process, EPA QA/G-4.

The DQOs are used to develop a resource-effective data collection design. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision errors for the study, and how many samples to collect. By using the DQO Process, the planning team will assure that the type, quantity, and quality of environmental data used in decision making will be appropriate for the intended application.

DQO Process

The DQO Process consists of seven steps. The output from each step influences the choices that will be made later in the process. During the first six steps of the DQO Process, the planning team developed the decision performance criteria that were used to develop the data collection design. The final step of the Process involves developing the data collection design based on the DQOs. Every step should be completed before data collection begins.

The seven steps of the DQO process are:

1. State the Problem
2. Identify the Decision
3. Identify the Inputs to the Decision

4. Define the Study Boundaries
5. Develop a Decision Rule
6. Specify Tolerable Limits on Decision Errors
7. Optimize the design

Each of these steps will be examined in the following section.

(1) State the Problem: There is a current Government Performance Results Act (GPRA) commitment to reduce air toxics emissions by 75% from the 1993 levels to significantly reduce the risk to Americans of cancer and other serious adverse health effects. The Tampa Bay Region has evidence that a number of the hazardous air pollutants regulated under the Clean Air Act are being emitted in the air shed of Tampa Bay. TBRATS has been funded to participate in the National Air Toxics Assessment (NATA) program whose initial ambient air monitoring focus is to:

- characterize ambient concentrations and deposition in representative monitoring areas; and
- provide data to support and evaluate dispersion and deposition models.

The TBRATS planning team, in coordination with the Steering Committee, feels that if it can characterize ambient concentrations and deposition in the Tampa Bay Region with adequate data quality, the data will support the modeling and trend analysis goals. This is consistent with the NATA *Concept Paper* goal of initially focusing on characterization (community wide concentrations in urban areas and ecosystem impacts, and to quantify conditions in the vicinity of localized hot spots or specific areas of concern like schools).

As mentioned in the NATA *Concept Paper* “initial new monitoring together with data analysis of existing measurements will be needed to provide a sufficient understanding of ambient air toxics concentration throughout the country in order to decide on the *appropriate quantity and quality of data needed*. Therefore the objective for TBRATS is consistent with this initial goal.

The current problem is:

TBRATS Project Planning Team will develop a monitoring network to characterize Urban Air Toxics, how much monitoring is needed and where to place the monitors. The Tampa Bay Region does not have an adequate understanding of the spatial and temporal characteristics of its monitoring area, sampled at the neighborhood scale, to ensure adequate characterization of the annual average concentrations.

In order to address this problem, the planning team has been provided with \$300,000 which is intended to cover all equipment and consumable purchases, data collection, and assessment

costs. The Planning Team must determine the appropriate tradeoffs (i.e., quality, quantity, and instrument sensitivity, precision, bias) to produce the desired results within the resource constraints. These tradeoffs will be documented in order to help the planning team determine the best monitoring design within budgets and data quality constraints.

(2) Identify the Decision: The decision that must be made once the data is evaluated is whether or not meaningful Urban Air Toxic concentration estimates for the Tampa Bay Region adequately represents the spatial and temporal characteristics of the urban area at an every 6-day sampling frequency. Possible actions, as described in Table 7.1, could be that the data from the study appears to adequately represent the region. Therefore, we continue plans to implement a national ambient air monitoring program or, our results indicate that the estimate provides an inordinate amount of uncertainty. This uncertainty may be corrected by increasing the number on monitors in an urban area, increasing the sampling frequency, stratifying the monitoring boundaries or correcting sampling or analytical errors.

Table 7.1 Principle Study Questions and Alternative Actions

Principal Study Question	Alternate Actions
Is the ambient air urban HAPS concentration appropriately characterized with adequate spatial and temporal resolution and appropriate quantity and quality of data?	Yes- Validate the network design for urban air toxics monitoring.
	No- Recommend further study of monitoring sites, sampling frequency, stratified boundary conditions, and measurement errors.

(3) Identify the Input to the Decision: The important inputs, for the TBRATS project, are:

- the actual 24-hour concentration estimates of Urban Air Toxics listed in Tables 7-4 to 7-7;
- measurements of overall precision and bias to quantify the source of measurement error; and
- location information of each sampling site (latitude and longitude).

Several supporting inputs are available that will help in our development of this study and will be used to support development of the final monitoring network. These are listed below:

- Initial monitoring results, which indicate that certain HAPs have been measured in the Tampa Bay Region;
- Guassian Plume and Exposure Models, which indicate that certain areas of the city may have levels of pollutants that are higher than EPA’s risk-based concentrations;

- A review of the emission inventory, which indicates that there are a number of pollutants being generated within the city that are of concern. We have location data on the emission sources;
- Meteorological data (i.e., wind rose information);
- Technical staff expertise in development of ambient air monitoring networks for criteria pollutants and HAPs;
- Sampling instruments that can meet our requirements for sampling time, contamination, precision, durability, and ease of use;
- Analytical instruments and methods that can meet our requirements for, contamination, sensitivity, repeatability, and bias; and
- A number of air toxics and criteria pollutant monitoring sites available that could be used as sampling platforms.

(4) Define the Study Boundaries: The spatial and temporal boundaries will be based upon what can reasonably be achieved within our current and predicted resources for an ambient air monitoring network. Since the purpose of this study is to collect new air toxics data in a uniform and consistent manner, the preliminary scale of the spatial and temporal boundaries remains broad. Subsequent iterations of the DQO processes will refine the spatial and temporal resolutions within the study domain.

The spatial boundary for the TBRATS is described in detail in Section 10, but in general, it is considered as the counties of Hillsborough and Pinellas. The study domain consists of six monitoring site, three in each county, that represent a neighborhood spatial scale. The data collected will be evaluated at the end of the study to better define spatial resolution for each urban HAP from the core list of monitored pollutants.

The temporal condition is 1 year for the overall study. The data are collected with the intent of providing an annual average for each urban HAP from the core list of monitored pollutants. These averages are based on the collection of 24-hour samples collected once every 6-days. The data will be further evaluated at the end of the first year to better define temporal resolutions within the study period.

(5) Develop a Decision Rule: Given the objective is to characterize sources of variability, the most straightforward representation that, both characterizes a major endpoint and separates out the magnitude of the distinct sources of variability (error) associated with that characterization, is the following equation. This equation is described in the EPA technical report titled: *Data Quality Objective Guidance for the Ambient Air Toxics Characterization Pilot Study*.

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_{ij} + \epsilon_{ijk} \quad (1)$$

(i.e., Measurement = Truth
 + Spatial Variability
 + Temporal Variability
 + Spatial-Temporal Interaction Variability
 + Sampling/Analytical Error)

where Y_{ijk} is the measured concentration, μ characterizes the major endpoint of concern (e.g., an area's true annual average), α_i characterizes spatial variability, β_j characterizes temporal variability, γ_{ij} characterizes spatial-temporal interaction variability and ϵ_{ijk} characterizes sampling/analytical variability. The first three sources of variability can be considered population variability while the last (ϵ_{ijk}) can be considered measurement uncertainty. In addition our major concern with measurement error are those errors that do not effect all sites equally (i.e., systematic bias in one sampler). Since all field personnel will follow standard operating procedures and samples from each pollutant group (metals, carbonyls, VOC's) will be sent to the corresponding laboratory, measurement errors effecting any particular site, sampler, or sample will be minimized. Therefore, the difference in concentration from each of the monitoring sites on any given day can be considered the spatial and temporal variability. However, each value will contain measurement uncertainty that must be minimized as well as quantified in order to separate it from the population variability.

The decision rule for this project is based on expected data from 18 core hazardous air pollutants established for the UATMP Pilot City Studies. Due to the limited information on ambient concentrations for these urban HAPs, the specific decisions on individual pollutants must be deferred until the completion of this short-term research study. Therefore, the parameter of interest is best defined as the quantity and quality of data compiled that satisfies the principle study question outlined in step 2 of the DQO process. In this situation, the action level is defined as having 75% of all data collected, at any one site, meeting the measurement quality objectives (MQO's) under Section 7.2 of this element.

If the data collected at any one monitoring location is sufficient to characterize the spatial and/or temporal variability, then the TBRATS network represents an appropriate design for urban air toxics monitoring.

(6) Specify Tolerable Limits on Decision Errors: Since this study's objective is to characterize spatial and temporal variability, there is no intolerable limit on population variability. What is initially important is that each sampling site provides a true estimate of what it represents (boundary condition); therefore, the goal is to establish an adequate estimate of the boundary. The TBRATS planning team feels comfortable that it will be able provide reasonable annual

estimates of monitored HAPs in this study. For several years the PCDEM, Air Toxics Monitoring program has compiled data for nine (9) of the UATM HAPs. The planning team decided it was important to have an established and adequate level of confidence in concentrations that were monitored. Since there are 18 core pollutants in the study and limited historical information on individual urban HAP compounds for the Tampa Bay area, it is not practical nor defensible to specify tolerable limits for each core pollutant. Therefore, the planning team elects to specify tolerable limits on decision errors in terms of the amount of data collected. Subsequent iterations of the DQO process for individual compounds are possible as more data is collected.

The **baseline condition** is stated as follows:

The percentage of data meeting the MQO's is less than 75% of the total data collected at a TBRATS site over the study period.

From this statement, we could establish the two types of potential decision error:

- *falsely accepting the baseline condition that the percent data meeting the MQO's is less than 75%, when in truth it is not;*
- *falsely rejecting the baseline condition by stating that the percent data meeting the MQO's is greater than or equal to 75%, when in truth it is less.*

Decision errors occur due to the population and measurement uncertainty components that are discussed above. Table 7.2 also illustrates the false acceptance and false rejection decisions of this pilot study.

The planning team wanted to guard against making a false decision that the percentage of data meeting the MQO's is greater than or equal to 0.75 because this action would result in satisfying the decision rule without an adequate amount of data. This false represents a rejection of the baseline condition and corresponds to a more severe decision error. The goal of the exercise in this step is to develop a monitoring system with acceptable levels of population and measurement uncertainty (i.e., correct sampling design, and sampling frequency) in order to make the decisions within tolerable levels of decision error.

Table 7.2 False Acceptance and False Rejection Decisions

Decision Based on Sampling Data	True Condition	
	Baseline is true	Alternative is true
<p><i>The percentage of data meeting the MQO's is < 75% of the total data collected at a TBRATS site over the study period.</i></p> <p>(This is the null hypothesis)</p>	Correct Decision	<p><i>The percent data is not less than 75% of the total data collected</i></p> <p>Decision error (false acceptance)</p>
<p><i>The percentage of data meeting the MQO's is \geq 75% of the total data collected at a TBRATS site over the study period.</i></p> <p>(This is the alternate hypothesis)</p>	<p><i>The percent data is less than 75% of the total data collected</i></p> <p>Decision error (false rejection)</p>	Correct Decision

(7) Optimize the Design: The goal is to reduce total uncertainty through an appropriate choice of sample design and data collection (sampling/analysis) techniques. If the total variability can be reduced to a value less than that specified in Step 6, the result will be either a reduction in decision error rates (given a fixed number of samples) or reduction in the number of samples (and, hence, resource expenditure) for a given set of decision error rates. Based upon the number of samples taken in the proposed design we estimated total variability around the mean at the 95% confidence limits to be <20%. Based upon our initial estimates of variability and the resources available to perform the study, the following design was established:

- Location of 6 sites to establish the spatial and temporal variability across a gradient of pollution concentrations,
- Sampling frequency of every 6 days in order to determine the adequacy of an annual estimate.

7.2 Measurement Quality Objectives

Once a DQO is established, the quality of the data must be evaluated and controlled to ensure that it is maintained within the established acceptance criteria. Measurement Quality Objectives (MQOs) are designed to evaluate and control various phases (sampling, preparation, analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the DQOs. MQOs can be defined in terms of the following data quality indicators:

Precision - a measure of mutual agreement among individual measurements of the same property usually under prescribed similar conditions. This is the random component of error. Precision is estimated by various statistical techniques using some derivation of the standard deviation.

Bias - the systematic or persistent distortion of a measurement process that causes error in one direction. Bias will be determined by estimating the positive and negative deviation from the true value as a percentage of the true value.

Representativeness - a measure of the degree which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Detectability- The determination of the low range critical value of a characteristic that a method specific procedure can reliably discern (40 CFR Part 136, Appendix B).

Completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Data completeness requirements are included in the reference methods (40 CFR Pt. 50).

Comparability - a measure of confidence with which one data set can be compared to another.

Accuracy has been a term frequently used to represent closeness to “truth” and includes a combination of precision and bias error components. If possible, the Department will attempt to distinguish measurement uncertainties into precision and bias components.

For each of these attributes, acceptance criteria can be developed for various phases of the environmental data operation. In theory, if these MQOs are met, measurement uncertainty should be controlled to the levels required by the DQO. Table 7-4 through 7-6 lists the MQOs for pollutants to be measured in the TBRATS project. More detailed descriptions of these MQOs and how they will be used to control and assess measurement uncertainty will be described in other elements, as well as SOPs of this QAPP.

Table 7.4 Measurement Quality Objectives - Air Toxics Metals

Compound	Reporting Units	Precision (CV)	Accuracy	Representativeness	Comparability/ Method Selection	Completeness	Minimum Detection Limits ¹
Arsenic	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.30

Compound	Reporting Units	Precision (CV)	Accuracy	Representativeness	Comparability/ Method Selection	Completeness	Minimum Detection Limits ¹
beryllium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.02
cadmium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.02
chromium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.01
lead	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.01
manganese	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.02
nickel	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.02
antimony	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.01
cobalt	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	0.01
selenium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP	>75%	1.10

¹ The MDL's listed here are the values from the EPA Compendium Method for Inorganic Compounds, Section IO-3. Actual MDLs for air toxic metals will be determined upon installation and calibration of the sequential ICP instrument.

Table 7.5 Measurement Quality Objectives - Air Toxics Carbonyls

Compound	Reporting Units	Precision (CV)	Accuracy	Representativeness	Comparability/ Method Selection	Completeness	Minimum Detection Limits ²
Acetaldehyde	ppbv	10%	+/- 15%	Neighborhood Scale	Liquid Chromatography	>75%	1.36
Formaldehyde	ppbv	10%	+/- 15%	Neighborhood Scale	Liquid Chromatography	>75%	1.45
Propionaldehyde	ppbv	10%	+/- 15%	Neighborhood Scale	Liquid Chromatography	>75%	1.28
methyl ethyl ketone	ppbv	10%	+/- 15%	Neighborhood Scale	Liquid Chromatography	>75%	1.50

² The MDL's listed here are the values from the EPA Compendium Method for Toxic Organic Compounds, Section TO-11.

Table 7.6 Measurement Quality Objectives - Air Toxics Volatile Organics

Compound	Reporting Units	Precision (Rel % Diff)	Accuracy	Representativeness	Comparability/ Method Selection	Completeness	Minimum Detection Limits ³
benzene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.06
1,3 - butadiene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.09
carbon tetrachloride	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
chloroform	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.08
1,2-dichloropropane	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.06

Compound	Reporting Units	Precision (Rel % Diff)	Accuracy	Representativeness	Comparability/ Method Selection	Completeness	Minimum Detection Limits ³
Methylene chloride	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.06
Tetrachloroethylene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.08
Trichloroethylene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.1
vinyl chloride	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
acrylonitrile	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.08
1,2-dibromoethane	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.07
cis-1,3,-dichloropropene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.07
trans-1,3,-dichloropropene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
1,2--dichloroethane	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
1,1,1,2-tetrachloroethane	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.07
methyl chloride	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.09
methyl bromide	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
ethyl chloride	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.07
1,1-dichloroethane	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.04
1,1-dichloroethene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.07
1,1,1-trichloroethane	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
1,1,2-trichloroethane	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.07
toluene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.05
chlorobenzene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.05
ethylbenzene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.08
xylene (isomers)	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
styrene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.06
1,4-dichlorobenzene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
1,2,4-trichlorobenzene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.2
hexachloro-1,3-butadiene	ppbv	25%	+/- 30%	Neighborhood Scale	GC/MS	>75%	0.09

³ MDLs for VOCs are "expected values" from instrument manufacturer literature. Actual MDLs will be determined as described in 40CFR part 136 appendix B upon installation of new lab equipment.

8.0 Special Training Requirements/Certification

8.1 Training

Personnel assigned to the air toxics ambient air monitoring activities will meet the educational, work experience, responsibility, personal attributes, and training requirements for their positions. Records on personnel qualifications and training will be maintained in personnel files and will be accessible for review during audit activities.

Adequate education and training are integral to any monitoring program that strives for reliable and comparable data. Training is aimed at increasing the effectiveness of employees and the Department. No special training beyond the ambient air monitoring groundwork is required for the TBRATS project. However, Eastern Research Group, Inc. provides training for operational procedures, set-up and handling of carbonyl samplers. In addition, the product vendors provide training for the GC/MS and ICP analyzers, including any peripheral software and/or equipment.

8.2 Certification

No special certifications are required.

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B. MEASUREMENT/DATA ACQUISITION

9.0 Documentation and Records

For the TBRATS, there are number of documents and records that need to be retained. A document, from a record management perspective, is a volume that contains information which describes, defines, specifies, reports, certifies, or provides data or results pertaining to environmental programs. As defined in the *Federal Records Act of 1950 and the Paperwork Reduction Act of 1995* (now 44 U.S.C. 3101-3107), records are: "...books, papers, maps, photographs, machine readable materials, or other documentary materials, regardless of physical form or characteristics, made or received by an agency of the United States Government under Federal Law or in connection with the transaction of public business and preserved or appropriate for preservation by that agency or its legitimate successor as evidence of the organization, functions, policies, decisions, procedures, operations, or other activities of the Government or because of the informational value of data in them..."

The following information describes the document and records management procedures for the TBRATS. All the information required to support the concentration data reported to EPA and the State, which includes all data required to be collected as well as data deemed important by the planning team, will be included in the reporting package under the policies and records management procedures described here.

9.1 Information Included in the Reporting Package

9.1.1 Routine Data Activities

The PCDEM and EPC/HC each have a structured record management retrieval system that allows for the efficient archive and retrieval of records. The air toxics information will be included in the respective system. The routine data handling, reporting, and archiving will be in accordance with the provisions of the most recent version of the Florida Department of Environmental Protection, State-Wide Quality Assurance Air Program Plan (QAP-001, revised June 1998).

9.1.2 Annual Summary Report Submitted to EPA

The TBRATS planning team shall submit to EPA Region 4 Office, an annual summary report of all the air toxics data collected within the study period. The report will be submitted by April 1, 2002 for the data collected from January 1 to December 31 of the previous year. The report will contain the following information:

Site and Monitoring Information

- City name;
- county name and street address of site location;
- AIRS-AQS site code;
- AIRS-AQS monitoring method code.

In addition, the summary report will include basic descriptive statistics for the laboratory and field activities.

9.2 Data Reporting Package Format and Documentation Control

All raw data required for the calculation of air toxics concentrations, the submission to the AIRS database, and QA/QC data, are collected electronically or on data forms that are included in the field and analytical methods sections. All hardcopy information will be filled out in indelible ink. Corrections will be made by inserting one line through the incorrect entry, initialing this correction, and placing the correct entry alongside the incorrect entry, if this can be accomplished legibly, or by providing the information on a new line.

Independently, the PCDEM and the EPC/HC will be responsible for its own records. General policies and procedures, along with document control, will be specified in the latest version of the State-Wide Quality Assurance Air Program Plan.

9.3 Data Reporting Package Archiving and Retrieval

As stated in 40 CFR, Part 31.42, in general, all the information associated with the TBRATS project will be retained for three years from the date the grantee submits its final expenditure report unless otherwise noted in the funding agreement. However, if any litigation, claim, negotiation, audit or other action involving the records has been started before the expiration of the 3-year period, the records will be retained until completion of the action and resolution of all issues which arise from it, or until the end of the regular 3-year period, whichever is later. The PCDEM and EPC/HC will extend this regulation in order to store records for three full years past the year of collection. For example, any data collected in calendar year 2000 (1/1/00 - 12/31/00) will be retained until, at a minimum, January 1, 2004; unless the information is used for litigation purposes.

10.0 Sampling Design

The purpose of this Section is to describe all of the relevant components of the monitoring network to be operated for the TBRATS project, including the network design for evaluating the quality of the data. This entails describing the key parameters to be estimated, the rationale for the locations of the monitors and the collocated samplers, the frequency of sampling at the primary and collocated samplers, the types of samplers used at each site, frequency and performance evaluations. The network design components comply with the regulations stipulated in *Network Design and Site Exposure for Selected Noncriteria Air Pollutants*¹.

10.1 Scheduled Project Activities, Including Management Activities

As explained in Section 10.4, the TBRATS project will monitor concentrations at six locations in the urban area. It is anticipated that the installation of the primary and QA samplers will be completed by December 31, 2000. Table 10.1 represents the activities associated with the ordering and deployment of the primary and collocated samplers.

Table 10.1 Activity Schedule

Activity	Due Date	Comments
Receive samplers	July 1, 2000	After receipt, begin conditioning of filters
Install samplers at ELK site (#1)	December 2000	samplers installed: TSP, Carbonyl, VOC
Install samplers at DUN site (#2)	December 2000	samplers installed: TSP, Carbonyl, VOC
Install samplers at AZP site (#3)	December 2000	samplers installed: TSP, Carbonyl, VOC
Install collocated samplers at DUN site	December 2000	samplers installed: Carbonyl, VOC
Install samplers at LEW site (#4)	December 2000	samplers installed: TSP, Carbonyl, VOC
Install samplers at GAN site (#5)	December 2000	samplers installed: TSP, Carbonyl, VOC
Install collocated samplers at site GAN	December 2000	samplers installed: TSP
Install samplers at SMP site (#6)	December 2000	samplers installed: TSP, Carbonyl, VOC
Begin routine sampling at all sites	January 1, 2001	

Activity	Due Date	Comments
Report routine data to AIRS-AQS	Ongoing – due within 90 days after end of quarterly reporting period	
Performance Evaluations	Receive 1 st State/EPA blind lab samples	
Report QA data to AIRS-AQS	Ongoing – due within 90 days after end of quarterly reporting period	
Review QA reports generated by AIRS	Ongoing	Needed to determine which, if any, monitors fail bias and/or precision limits.
Primary network review	Annually	Evaluate reasonableness of siting.

10.2 Rationale for the Design

10.2.1 Primary Samplers

The purpose of the TBRATS is to ascertain the spatial/temporal variability of the urban area. To determine whether these characteristics are quantified with sufficient confidence, the project planning team must address sampler type, sampling frequency, and sampler siting. By employing samplers that are described in the appropriate compendia^{1,2,3,4}, the data collected will be comparable to standard EPA methods. By complying with the sampling frequency requirements of *Network Design and Site Exposure Criteria for Selected Noncriteria Air Pollutants*⁵, the planning team assumes that the sampling frequency is sufficient to attain the desired confidence in the annual 95th percentile and annual mean of concentrations in the vicinity of each monitor. By selecting sampler locations using the rules in *Network Design and Site Exposure Criteria for Selected Noncriteria Air Pollutants*, the planning team can be confident that the concentrations within its jurisdiction are adequately characterized. Sampler type, frequency, and siting are further described in section 10.4.

10.2.2 QA Samplers

The purpose of collocated samplers and the performance evaluation is to estimate the precision and bias of the various systems samplers. The goal of the study is to have concentrations measured by a sampler be within $\pm 10\%$ of the true concentration and that the precision have a coefficient of variation less than 10% for each monitoring system. To estimate the level of bias and precision being achieved in the field, one site will operate collocated samplers for VOCs and

metals. Carbonyl samplers will utilize duplicate sampler cartridges to determine bias and precision. Accuracy will be estimated using flow checks and analysis of known reference analytes prepared by independent laboratories submitted to the participating laboratories. If a sampler and laboratory equipment are operating within the required bias, precision and accuracy levels, then the decision maker can proceed knowing that the decisions will be supported by unambiguous data. Thus, the key characteristics being measured with the QA samplers are bias and precision.

To determine whether these characteristics are measured with sufficient confidence, the TBRATS project planning team must address sampler type, sampling frequency, and sampler siting for the QA network. As with the primary network, by using samplers as described in the TO and IO methods, maintaining the sampling frequency specified in *Network Design and Site Exposure Criteria for Selected Noncriteria Air Pollutants*, planning team assumes its QA network will measure bias and precision with sufficient confidence. These issues are described in more detail in section 10.4.

10.3 Design Assumptions

The sampling design is based on the assumption that following the rules and guidance provided in CFR and *Network Design and Site Exposure Criteria for Selected Noncriteria Air Pollutants* will result in data that can be used to measure compliance with the national standards. The remaining issues to consider for the TBRATS project are the sampler siting, and to a degree, sampling frequency. The siting assumes homogeneity of concentrations within the MSA. Boundaries will be regularly reviewed, as part of the network reviews (Section 20). The basis for creating and revising the boundaries is described in the following section.

10.4 Procedure for Locating and Selecting Environmental Samples

10.4.1 Sampling Design

The design of the air toxics network must achieve the monitoring objective. This is:

- Determine the ambient concentrations expected to occur in the area covered by the network, i.e., to verify the spatial and temporal characteristics of HAPs within the urban region.

The procedure for siting the samplers to achieve the objective is based on judgmental sampling, as is the case for most ambient air monitoring networks. Judgmental sampling uses data from existing monitoring networks, knowledge of source emissions and population distribution, and inference from analyses of meteorology to select optimal sampler locations.

10.4.2 Sampling Locations

Tampa Bay sits on the west-central coast of the Florida peninsula and is bounded by Pinellas County on the west and Hillsborough County to the east. These two counties make up the urban center of the greater Tampa Bay metropolitan area. They have a combined permanent population approaching 2 million and constitute the primary counties in the Tampa-St. Petersburg-Clearwater, Metropolitan Statistical Area (MSA). Consequently, the degree of urbanization, population densities, and location of known HAP emission sources define the study domain. The

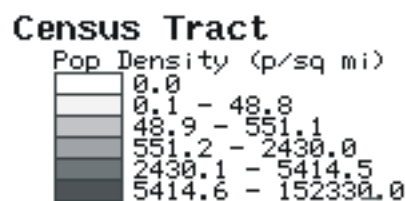
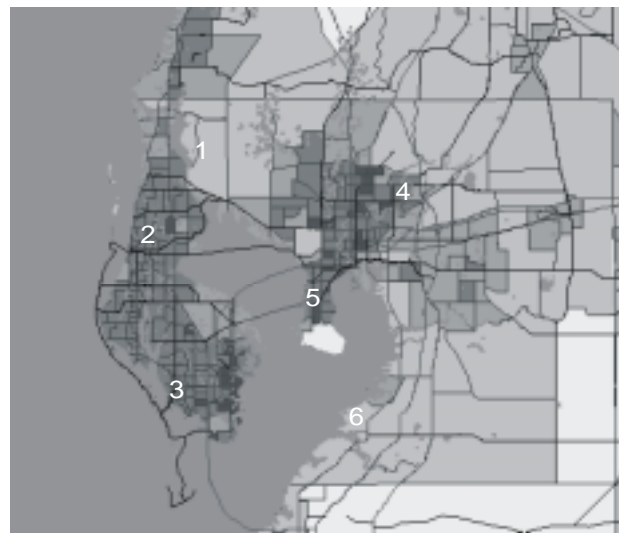


figure above, shows 1990 Census population densities within the study domain and the location of the six toxics monitoring sites.

10.4.3 Sampling Frequency

The TBRATS project is a pilot study and therefore sets a baseline sampling frequency of one 24-hour sample every six- (6) days for all monitors in the study domain. The only variation is that two 12-hr VOC samples are measured once every six days at the Azalea Park (#3) site. This will allow investigation of diurnal variability in the urban site. A detailed accounting of sampling frequencies is illustrated in the sampling schedule (Appendix X).

10.4.4 QA Samplers

According to the primary network design, the EPC/HC will deploy and operate collocated TSP samplers at the Gandy (#5) site. The PCDEM will deploy and operate collocated VOC canisters at the Dunedin (#2) site. Finally, a duplicate carbonyl sample will also be collected at the Dunedin (#2) site. As data from the network becomes available, the data will be reviewed at the conclusion of the study to determine if a different site is more appropriate for collocation. The collocation samples for TSP, Carbonyls and VOC's will be operated on a 12-day sampling schedule, regardless of the sampling frequency of the primary samplers and will coincide with the sampling run time of the primary sampler so that the primary and collocated samplers are operating on the same days. See Table 10.2 for details on the location of primary and QA samplers.

Table 10.2 List of Collocated Samplers

Site Name	Map No.	Samplers Operated	Collocated/Duplicate
East Lake (ELK)	1	VOC, TSP, Carbonyls	
Dunedin (DUN)	2	VOC, TSP, Carbonyls	VOC, Carbonyl
Azalea Park (AZP)	3	VOC, TSP, Carbonyls	
Lewis (LWS)	4	VOC, TSP, Carbonyls	
Gandy (GAN)	5	VOC, TSP, Carbonyls	TSP
Simmons Park (SMP)	6	VOC, TSP, Carbonyls	

10.5 Classification of Measurements as Critical/Non-critical

The ambient concentration and site location data will be submitted to AIRS. The information collected at collocated samplers is the same as that presented in Tables 6-1, 6-2, 6-3 and 6-4 for primary samplers. All of the measurements in these tables are considered critical because it forms the basis for estimating bias and precision, which are critical for evaluating the ability of the decision makers to make decisions at desired levels of confidence.

10.6 Validation of Any Nonstandard Measurements

At this time, there are no NAAQS for the air toxics compounds, with the exception of lead (Pb). The TBRATS project deploys and operates instruments according to descriptions in the applicable EPA guidance documents.

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11.0 Sampling Methods Requirements

11.1 Purpose/Background

The methods described herein provide for measurement of the relative concentration of hazardous air pollutants in ambient air for 24-hour and 12-hour sampling periods.

Since there are three separate instruments and subsequently three separate analytical techniques, each of the sampling methods is different. However, general QA handling is crucial for all sampling and thus, sample handling requirements are similar.

11.2 Sample Collection and Preparation

11.2.1 Sample Set-up

The sample set-up for the air toxics monitors in the TBRATS network takes place any day after the previous sample has been recovered. For instance, on a Sunday through Thursday sample day set-up when 1-in-6-day sampling is required, the pickup typically occurs the day after the run. However, on Friday and Saturday run dates, the pick up is typically on the following Monday. At collocated sites, the second monitor will be set up to run at a minimum sample frequency of 1 in 12 days; however, sample set-up will take place on the same day as the primary sampler. Detailed sample set-up procedures are available from the corresponding standard operating procedure (SOP) documents from the PCDEM and the EPC/HC.

11.2.2 Sample Recovery

Sample recovery of any individual sample from the air toxics instruments sampler in the TBRATS network should occur within 96 hours of the end of the sample period for that sampler. For 1-in-6-day sampling, this will normally be the next working day after a sample is taken. The next sample would also be set-up at this time.

11.3 Support Facilities for Sampling Methods

The main support facility for sampling is the sample trailer or shelter. At five of the six sample locations in the TBRATS network there is a climate controlled sample trailer. The trailer has limited storage space for items used in support of air toxic sampling. The Lewis site (#4), utilizes a climate controlled storage shelter. Table 11.1 lists the supplies that are stored at each sample location.

Table 11.1 Supplies at Storage Trailers

Item	Minimum Quantity	Notes
Powder Free Gloves	box	<i>Material must be inert and powder free</i>
Fuses	2	<i>Of the type specified in the sampler manual</i>
Sampler Operations Manual	1 per model	
Sampling SOPS	1	
Flow rate verification filter	2	For TSP sampler

Since there are other items that the field operator may need during a site visit that are not expected to be at each site, the operator is expected to bring these items with him/her.

11.4 Sampling/Measurement System Corrective Action

Corrective action measures in the TBRATS project will be taken to ensure the data quality objectives are attained. There is the potential for many types of sampling and measurement system corrective actions. Table 11.2 provides an overview of the expected problems and corrective actions needed for a well-run network.

Table 11.2 Field Corrective Actions

Item	Problem	Action	Notification
Filter Inspection (Pre-sample)	Pinhole(s) or torn	1.) If additional filters have been brought, use one of them. Void filter with pinhole or tear. 2.) Use new field blank filter as sample filter. 3.) Obtain a new filter from lab.	1.) Document on field data sheet. 2.) Document on field data sheet. 3.) Notify Field Manager.
Filter Inspection (Post-sample)	Torn or otherwise suspect particulate by-passing filter.	1.) Inspect area downstream of where filter rests in sampler and determine if particulate has been by-passing filter. 2.) Inspect gaskets. Replace as necessary.	1.) Document on field data sheet. 2.) Document in log book.
Flow rate erratic	Heavy loading or motor/motor brushes are worn..	Replace brushes or motor. Recalibrate Motor.	Document in log book.
Sample Flow Rate Verification	Out of Specification ($\pm 10\%$ of transfer standard)	1.) Perform leak test. 2.) Check flow rate determine if problem is with zero bias or slope. 3.) Re-calibrate flow rate.	Document on data sheet. Document on data sheet. Notify Field Manager. Document on data sheet. Notify Field Manager.

Item	Problem	Action	Notification
Leak Test	VOC canisters will not hold pressure.	1.) Replace fitting on nut on sampler line. 2.) Inspect connections and re-perform leak test.	1.) Document in log book. 2.) Document in log book, notify Field Manager, and flag data since last successful leak test.
Sample Flow Rate	Consistently low flows documented during sample run	1.) Check setting of sampler flowrate for Carbonyl sampler. 2.) Check flow with a flow rate verification filter and determine if actual flow is low. 3.) Inspect in-line filter and flow controller; replace as necessary.	1.) Document in log book. 2.) Document in log book. 3.) Document in log book.
Elapsed Sample Time	Out of Specification (>1 hr/24 hrs)	Check settings, Verify Power Outages	Notify Field Manager.
Elapsed Sample Time	Sample did not run	1.) Check settings 2.) Try programming sample run to start while operator is at site. Use a flow verification filter.	1.) Document on data sheet. Notify Field Manager. 2.) Document in log book. Notify Field Manager.
Power	Power Interruptions	Check Line Voltage.	Notify Field Manager.
Power	LCD panel on, but sample not working.	Check circuit breaker, some the VOC and Carbonyl samplers have battery back-up for data but will not work without AC power.	Document in log book.

11.5 Sampling Equipment, Preservation, and Holding Time Requirements

This sections details the requirements needed to prevent sample contamination, the volume of air to be sampled, how to protect the sample from contamination, temperature preservation requirements, and the permissible holding times to ensure against degradation of sample integrity.

11.5.1 Sample Contamination Prevention

The quality system has rigid requirements for preventing sample contamination. Powder-free gloves are worn while handling ozone scrubbers and DNPH cartridges for carbonyl samplers. The scrubbers and cartridges are to be held in storage containers (static resistant bags) as provided by the sampler manufacturer during transport to and from the laboratory. The VOC canisters remain capped when transported to and from the field. Finally, quartz fiber filters for TSP samples are held in the boxes provided by the EPA as per EPA SOP. Once the filters are

used, they are returned to the laboratory for analysis and ultimate storage in protective envelopes as per EPA SOP for TSP metals sampling.

11.5.2 Sample Volume

The volume of air to be sampled is specified in manufacturer's specifications. The total sample of air collected will be based upon a 24-hour (12-hours for AZP VOC canister) sample. For all TBRATS monitors, with the exception of the AZP VOC sampler, the sample period is expected to be 24 hours ± no more than one hour. In some cases, a shorter sample period may occur due to power outages. A sample run should not be less than 23 hours. If the sample period is less than 23 hours or greater than 25 hours, the sample will be flagged and the QA Officer notified.

For the VOC sampler at Azalea Park, the total sample of air collected will be based upon a 12-hour sample ± no more than 30-minutes. A sample run should not be less than 11.5 hours. If the sample period is less than 11.5 hours or greater than 12.5 hours, the sample will be flagged and the QA Officer notified.

11.5.3 Temperature Preservation Requirements

The temperature requirements of the samples vary between methods. During transport from the laboratory to the sample location there are no specific requirements for temperature control with the exception of DNPH cartridges. Filters will be located in their protective container and in the transport container. Excessive heat must be avoided (e.g., do not leave in direct sunlight or a closed-up car during summer). Once at the laboratory, DNPH cartridges need to be stored at 4° C or less, until they are loaded into the sampler. The filter temperature requirements are detailed in Table 11.3.

Table 11.3 Temperature Requirements

Item	Temperature Requirement	Reference
TSP filter temperature control during sampling and until recovery.	No requirements	
DNPH Cartridge Filter temperature control pre- and post-installation .	4° C or less	TO-11A Compendium Section 9.4.2.1
VOC canister Pre and post sampling	No Requirements	

11.5.4 Permissible Holding Times

The permissible holding times for the sample are clearly detailed in the attached appendices. These holding times are provided in Table 11-4.

Table 11.4 Holding Times

Item	Holding Time	From:	To:	Reference
TSP filter temperature	No limits			
VOC canister	≤30 days	Completion of sample period	Time of analysis	TO-15 Sec. 1.3
DNPH Cartridge Filter	≤30 days	Sample end date/time	Time of analysis	TO-11 Compendium Sec. 11.1.1

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12.0 Sampling Custody

Chain of custody forms will be used to track the stages of filter, cartridge, and canister handling throughout the data collection operation. Copies of these forms are in the corresponding SOP. This element will address sample custody procedures at the following stages:

- Pre-sampling
- Post-sampling
- Sample receipt
- Sample archive

12.1 Sample Custody Procedure

One of the most important values in the sample custody procedure is the unique sample ID number. The ID is an alpha-numeric value. A description of chain of custody procedures for VOC sampling is in the VOC SOP section IV.A.1. The unique sample ID number will be generated by the laboratory analyst at the time of preparation of the sample. For TSP samples, the EPA provided quartz filters are pre-numbered by the manufacturer.

12.1.1 Pre-Sampling Custody

Each organization involved with the TBRATS project maintains pre-sampling SOPs defining how the samples will be enumerated, conditioned, weighed, placed into the protective shipping container, sealed with tape, and stored or refrigerated. See Table 11.4 for details on sample holding. An inventory log containing the type of sample media, unique sample ID number (TSP and VOC), signatures of originator and recipient and appropriate dates. Each sampling period, the site operators will select the sample media that they will use for the field. The number of filters, canisters, and/or cartridges selected will depend on the time in the field prior to returning to the laboratory and the number of samplers to be serviced.

12.1.2 Post Sampling Custody

Field SOPs specify the techniques for properly collecting and handling the sample filters, cartridges, and canisters. The post-sampling custody procedures for the TBRATS project, are described in the PCDEM and EPC/HC field SOPs.

12.1.3 Sample Receipt

The field sampling SOPs specify the techniques for properly collecting and handling the sample TSP filters and VOC canisters. Carbonyl samples are received by the ERG contract lab as per their quality assurance project plan, “Support For NMOC/SNMOC, UATMP, and PAMS Networks”, 2000.

12.1.4 Sample Archive

Once the analysis laboratory receives the filter, they will use their raw data entry sheets to log the samples back in from receiving and prepare them for post-sampling weighing activities. These activities are included in the analytical SOPs. The laboratory technicians will take the filters out of the protective containers or folders and examine them for integrity, which will be marked on the data entry sheets.

Upon completion of post-sampling weighing activities, each filter will be packaged according to the SOPs and stored in a box uniquely identified by Site ID and box number. Samples will be archived in the filter storage facility for 1 year past the date of collection.

VOC canister samples will not be retained after satisfactory lab analysis has been completed.

Carbonyl samples will be archived according to the ERG quality assurance project plan, "Support For NMOC/SNMOC, UATMP, and PAMS Networks", 2000.

13.0 Analytical Methods Requirements

13.1 Purpose/Background

The methods stated here provide for gravimetric, spectrophotometric and chromatographic analyses of samples collected in the TBRATS network. The basic methods used by the agency are based on the Toxic Organic and Inorganic Compendia^{1,2,3,4}. These are listed in the Reference area of this section.

13.2 Preparation of Samples

The TBRATS network consists of six (6) sites. The primary samplers will operate on a 1-in-6-day schedule. Note that the VOC sampler at the Azalea Park site (#3) runs two 12-hour samples in the 1-in-6-day schedule. Three QA samplers, one for each sample media in the TBRATS project, are collocated and will operate on a minimum of 1-in-12-days. The approximate number of routine samples that will be prepared, used, transported, and conditioned is 19 to 22 per week. In addition, field blanks and lab blanks must also be prepared. See the attached SOPs for activities associated with preparing pre-sample batches.

Upon delivery of approved sample media for use in the TBRATS network, the receipt is documented and the pre-sampling media stored in the conditioning room/laboratory. Storing samples in the laboratory makes it easier to maximize the amount of time available for conditioning. Upon receipt, samples will be labeled with the date of receipt, opened one at a time and used completely before opening another case. In the case of canisters, each canister will be cleaned according to the cleaning procedures in the VOC SOP. DNPH cartridges will be stored in a refrigerator until taken into the field. All TSP filters in a lot will be used before a case containing another lot is opened. When more than one case is available to open the “First In - First Out” rule will apply. This means that the first case of filters received is the first case that will be used.

13.3 Analysis Method

13.3.1 Analytical Equipment and Method

The instruments used for analysis are listed in Table 13.1.

Table 13.1 Instruments Used for the TBRATS

Parameter	Instrument	Method	Range
Metals		Inductively Coupled Plasma	0.01 to 50 ug/m ³
Carbonyls		High Pressure Liquid Chromatography	0.01 to 25 ppbv

Parameter	Instrument	Method	Range
VOCs	Agilent/Entech	Gas Chromatography/Mass Spectroscopy	0.2 to 100 ppbv

13.3.2 Environmental Control

The EPC/HC laboratory conditions TSP filters in a dessicator box maintained at $45 \pm 5\%$ relative humidity. The temperature range is 15° - 30° C. Humidity is manually recorded at the beginning and end of the equilibration process and during the weighing step. The temperature range over the equilibration process is measured with a max/min thermometer. Filters are weighed in a room in which the humidity has been dropped to below 50% with the aid of dehumidifiers. Relative humidities and temperatures are recorded in the lab book along with each daily weighing. The areas are cleaned periodically to eliminate contamination of samples. Small contaminants can be in the atmosphere of the laboratory and contaminate samples. Great care is exercised to keep the lab atmosphere clean. DNPH cartridges must be stored at 4° C or less before they are extracted and analyzed. VOC canisters will be stored at room temperature.

13.4 Internal QC and Corrective Action for Measurement System

A QC notebook or database (with disk backups) will be maintained which will contain QC data, including the calibrations, maintenance information, routine internal QC checks of mass reference standards and laboratory and field or lab filter blanks, and external QA audits. It is recommended that QC charts be maintained on each instrument and included in their maintenance notebooks. These charts may allow the discovery of excess drift that could signal an instrument malfunction.

At the beginning of each analysis day, after the analyst has completed zeroing and calibrating the instruments and measuring the working standard, analyze the laboratory filter blanks established for the current samples to be analyzed. For TSP filters, after approximately every tenth sample, the analyst will reweigh a filter, the one working standard and rezero the microbalance. Record the zero, working standard, and blank measurements in the laboratory data form and the laboratory QC notebook or database.

Corrective action measures in the system will be taken to ensure good quality data. There is the potential for many types of sampling and measurement system corrective actions. Each of the SOPs outline exact actions that will be taken if the analytical systems are out of control.

13.5 Filter Sample Contamination Prevention, Preservation, and Holding

13.5.1 Sample Contamination Prevention

The analytical support component of the network has rigid requirements for preventing sample contamination. TSP filters are equilibrated/conditioned and stored in the same room where they are weighed. Upon determination of its pre-sampling weight, the filter is placed in its filter holding jacket for storage.

Based on sampler design, all VOC post sampling canisters will be under slight vacuum upon receipt by the lab. Each canister will then be pressurized to slightly above ambient. Purging all lines and gauges, etc., with humid zero air and monitoring pressure changes that would indicate leaks are steps to prevent or detect contamination.

For DNPH cartridges, the best prevention is to not take the cartridges out of the sealed shipping packet until they are loaded into the sampler in the field. ERG purchases the cartridges directly from a chemical supply house with the DNPH coating already applied. Upon receipt and log-in, the cartridges are immediately stored in a refrigerator within the sealed package. The field personnel remove the cartridges (still in the sealed static resistant package) from the refrigerator and log-out the samples. The samples are then refrigerated at the field monitoring site. When the technician loads the samples into the carbonyl sampler, the DNPH cartridges are removed from the static resistant bag and installed. Powder free gloves are required when handling DNPH cartridges.

13.5.2 Temperature Preservation Requirements

The temperature requirements of the laboratory and field situations are detailed in IO and TO methods. In the weigh room laboratory, the TSP filters must be conditioned for a minimum of 24 hours prior to pre-weighing; although, a longer period of conditioning may be required. The weigh room laboratory temperature must be maintained between 15° and 30° C, with no more than a +/- 5° C change over the 24-hour period prior to weighing the filters. During transport from the weigh room to the sample location, there are no specific requirements for temperature control; however, the filters will be located in their protective container and excessive heat avoided.

The specifics of temperature preservation requirements for VOC and DNPH cartridges are clearly detailed in TO and IO methods^{1,2,3,4}. These requirements pertain to both sample media before collection and both the sample media and sample after a sample has been collected. Additionally, during the sample collection there are requirements for temperature control.

13.5.3 Permissible Holding Times

The permissible holding times for the sample are clearly detailed in the TO and IO Compendia^{1,2,3,4} and are listed in Table 11.5.

References

The following documents were utilized in the development of this section:

1. EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Section 11, May 1988.
2. EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Section 13, June 1988.
3. EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Section 15, January 1999.
4. EPA Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air Section 3, March 1994.

14.0 Quality Control Requirements

To assure the quality of data from air monitoring measurements, two distinct and important interrelated functions must be performed. One function is the control of the measurement process through broad quality assurance activities, such as establishing policies and procedures, developing data quality objectives, assigning roles and responsibilities, conducting oversight and reviews, and implementing corrective actions. The other function is the control of the measurement process through the implementation of specific quality control procedures, such as audits, calibrations, checks, replicates, routine self-assessments, etc. In general, the greater the control of a given monitoring system, the better will be the resulting quality of the monitoring data.

Quality Control (QC) is the overall system of technical activities that measures the attributes and performance of a process. In the case of the ATMP, QC activities are used to ensure that measurement uncertainty, as discussed in Section 7, is maintained within acceptance criteria for the attainment of the DQO.

14.1 QC Procedures

Day-to-day quality control is implemented through the use of various check samples or instruments that are used for comparison. The measurement quality objective table in Section 7 contains a complete listing of these QC samples as well as other requirements for the program. The procedures for implementing the compounds collected are included in the field and analytical methods section (Sections 11 and 13, respectively). The following information provides some additional descriptions of these QC activities, how they will be used in the evaluation process, and what corrective actions will be taken when they do not meet acceptance criteria.

14.1.1 Calibrations

Calibration is the comparison of a measurement standard or instrument with another standard or instrument to report, or eliminate by adjustment, any variation (deviation) in the accuracy of the item being compared. The purpose of calibration is to minimize bias.

Calibration activities for air toxics samplers follow a two-step process:

1. Certifying the calibration standard and/or transfer standard against an authoritative standard, and
2. Comparing the calibration standard and or transfer standard against the routine sampling/analytical instruments.

Calibration requirements for the critical field and laboratory equipment are found in the respective SOPs.

14.1.2 Blanks

Blank samples are used to determine contamination arising from principally four sources: the environment from which the sample was collected/analyzed, the reagents used in the analysis, the apparatus used, and the operator/analyst performing the analysis. Three types of blanks will be implemented in the air toxics program:

Lot blanks - shipments of 8 x 11-inch filters will be periodically sent from the EPA to the EPC/HC laboratory. Since these filters are EPA provided, existing EPA SOPs will be followed.

Field blanks - provides an estimate of total measurement system contamination. By comparing information from laboratory blanks against the field blanks, one can assess contamination from field activities. Details of the use of the field blanks can be found in field SOPs. Field blanks will be utilized for the carbonyls and metals. Field blanks cannot be utilized with the VOC canisters since they arrive in the field under vacuum.

Lab blanks - provides an estimate of contamination occurring at the weighing/analysis facility. Details of the use of the lab blanks can be found in can be found in SOPs. Lab blanks will be utilized for the carbonyls, metals, and VOCs. Lab blanks for VOCs are generated by the canister cleaning and dilution system.

Blank Evaluation

The number of field and lab blanks per session batch is defined in the corresponding SOP for each sample media. The following statistics will be generated for data evaluation purposes:

$$d = |Y-X|$$

Difference for a single check (d) - The difference, d , for each check is calculated using Equation 1, where X represents the concentration produced from the original weight and Y represents the concentration reported for the duplicate weight (TSP/metals only).

Percent Difference for a Single Check (d_i) - The percentage difference, d_i , for each check is calculated using Equation 2 where X_i represents the original concentration and Y_i represents the concentration reported for the duplicate concentration.

$$d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} \times 100$$

Mean difference for batch (d_z) - The mean difference d_z for both field and lab blanks within an analysis batch, is calculated using equation 3 where d_1 through d_n represent individual differences (calculated from equation 1) and n represents the number of blanks in the batch.

$$d_z = \frac{d_1 + d_2 + d_3 \dots d_n}{n}$$

Corrective action - The acceptance criteria for field blanks are discussed in the individual SOPs (doesn't apply to VOC). Field and lab blanks differences are determined by equation 1. However, the mean difference based upon the number of blanks in each batch will be used for comparison against the acceptance criteria. If the mean difference of either the field or laboratory blanks is greater than the accepted values in Table 14.1, then these will be noted in the QA report. For TSP filter, the laboratory balance will be checked for proper operation. If the blank means of either the field or lab blanks are still out of the acceptance criteria, all samples within the analysis session will be flagged with the appropriate flag) and efforts will be made to determine the source of contamination. In theory, field blanks should contain more contamination than laboratory blanks. Therefore, if the field blanks are outside of the criteria while the lab blanks are acceptable, analysis can continue on the next batch of samples while field contamination sources are investigated. If the mean difference of the laboratory blanks is greater than the acceptance criteria, the laboratory will stop until the issue is satisfactorily resolved. The laboratory technician will alert the Laboratory Branch Manager and QA Officer of the problem. The problem and solution will be reported and appropriately filed under response and corrective action reports that will be summarized in the QA report. Lab and field blanks will be control charted (see Section 14.3). The percent difference calculation (equation 2) is used for control charting purposes and can be used to determine status.

14.1.3 Precision Checks

Precision is the measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. In order to meet the data quality objectives for precision, the Division must ensure the entire measurement process is within statistical control. Precision measurements will be obtained using collocated monitoring (VOC, metals) or duplicate sample cartridges (carbonyls).

Collocated Monitoring

In order to evaluate total measurement precision, collocated monitoring or duplicate sample collection will be implemented. Therefore, every method designation **will have**:

- a) The VOC sampler will be collocated at the Dunedin site;
- b) The carbonyl sampler will collect duplicate samples at the Dunedin site; and
- c) The TSP sampler will be collocated at Gandy site.

Evaluation of Collocated Data - All collocated data will be reported to AIRS. The following algorithms will be used to evaluate collocated data. Collocated measurement pairs are selected for use in the precision calculations only when both measurements are within the acceptance criteria. Please see Table 14.1.

Percent Difference for a collocated (Check (d_i)) - The percentage difference, d_i , for each check is calculated by using Equation 19, where X_i represents the concentration produced from the primary sampler and Y_i represents the concentration reported for the duplicate sampler.

$$d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} \times 100$$

Precision of a Single Sampler - Quarterly Basis - For particulate sampler i , the individual 95% confidence limit, produced during the calendar year are pooled using the following equations:

Each individual compound must have the precision data generated.

Upper 95% Probability Limit

$$Limit = d_i + 1.96 * S_i$$

Lower 95% Probability Limit

$$Limit = d_i - 1.96 * S_i$$

Corrective Action: Quarter - Usually, corrective action will be initiated and imprecision rectified before a quarters worth of data fail to meet 15% Probability Limits (PL). However, in the case where the quarters PL is greater than 20%, the routine data for that monitor for that quarter will be flagged. The QA Office, the Lab, and the Air Monitoring Branch Managers will work together to identify the problem and a solution. The EPA Regional Office will be alerted of the issue and may be asked to help find a common solution. The problem and solution will be reported and appropriately filed under response and corrective action. This information will also be included in the annual QA report.

Table 14.1 Precision Acceptance Criteria

Parameter	Decision
Both samples did not run 24 hours +/- 1 hr	Do not accept
One or both filters are damaged or exhibit a pinhole or tear	Do not accept
One or both samplers has erratic flow pattern	Do not accept
The difference in the pressure of the VOC canisters is > 4 psig	Do not accept
One or both samples are not kept within the holding and storage temperature requirements for any length of time	Do not accept

14.1.4 Accuracy Checks

Accuracy is defined as the degree of agreement between an observed value and an accepted reference value and includes a combination of random error (precision) and systematic error (bias). Three accuracy checks are implemented in the air toxics monitoring program:

- Flow rate audits,
- Balance checks, and
- Laboratory audits.

The EPC/HC laboratory will use certified Class S weights (1.0-5.0 g.) for its primary standards. Acceptable criteria for the balance is specified in the SOP.

Flow Rate Audits

The flow rate audit is made by measuring the field instrument's normal operating flow rate using a certified flow rate transfer standard. The flow rate standard used for auditing will not be the same flow rate standard used to calibrate the analyzer. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate or volume standard. Report the audit (actual) flow rate and the corresponding flow rate indicated or assumed by the sampler. The procedures used to calculate measurement uncertainty are described below.

Accuracy of a Single Sampler - Single Check (Quarterly) Basis (d_i) - The percentage difference (d_i) for a single flow rate audit i is calculated using Equation 13, where X_i represents the audit standard flow rate (known) and Y_i represents the indicated flow rate.

$$d_i = \frac{Y_i - X_i}{X_i} \times 100$$

Balance Checks - Balance checks are frequent checks of the balance working standards (100 and 200 mg standards) against the balance to ensure that the balance is within acceptance criteria throughout the pre- and post-sampling weighing sessions. The ECP/HC will use ASTM class 1 weights for its primary and secondary (working) standards. Both working standards will be used measured at the beginning and end of the sample batch. Balance check samples will be controlled charted.

Balance Check Evaluation - The following algorithm will be used to evaluate the balance checks.

Difference for a single check (d_y) - The difference, d_y , for each check is calculated using Equation 3, where X represents the certified mass weight and Y represents the reported weight.

$$d_y = Y - X$$

Corrective Action - The difference among the reported weight and the certified weight must be ≤ 5 mg. Since this is the first check before any pre-or post-sampling weighing, if the acceptance criteria is not met, corrective action will be initiated. Corrective action may be as simple as allowing the balance to perform internal calibrations or to sufficiently warm-up, which may require checking the balance weights a number of times. If the acceptance criteria is still not met, the laboratory technician will be 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, the *Libra Balance Company* service technician will be called to perform corrective action.

If the balance check fails acceptance criteria during a run, the 10 filters weighed prior to the failure will be rerun. If the balance check continues to fail, trouble shooting, as discussed above, will be initiated. The values of the 10 samples weighed prior to the failure will be recorded and flagged, but will remain with the samples, yet to be weighed, in the batch and re-weighed when the balance meets the acceptance criteria. The data acquisition system will flag any balance check outside the acceptance criteria. The samples that were flagged will have all flags cleared once the balance comes into compliance with the QC procedure.

Accuracy of a Laboratory Audit - Single Check (Annual) Basis (d_i) - The laboratory audit is an independent check that is generated by an outside laboratory. Each calendar year, the EPA designated laboratory will be sending the TCAPCD laboratory a sample of metals on a quartz filter, aldehydes in a DNPH cartridge, and a canister with VOCs. The TCAPCD lab will analyze

the samples and send the results to the EPA certified laboratory. The audit sample for each system will be mailed directly to the laboratory. The lab technician will handle the audit sample in the same manner as all other samples. Once the analysis is performed, the results will be reviewed by the lab supervisor. These results will then be sent to the EPA certified laboratory. The equation used to define percentage difference (d_i) for a each individual compound audit i is calculated as:

$$d_i = \frac{Y_i - X_i}{X_i} \times 100$$

where X_i represents the audit standard concentration from a certified laboratory (known) and Y_i represents the indicated value obtained from the TCAPCD laboratory.

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15.0 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

15.1 Purpose/Background

The purpose of this element in the TBRATS QAPP is to discuss the procedures used to verify that all instruments and equipment are maintained in sound operating condition and are capable of operating at acceptable performance levels. The procedures for TSP and VOC samplers are defined in this document. The testing, inspection, and maintenance procedures for the carbonyl samplers are found in section 10 of the ERG Quality Assurance Project Plan, "Support For NMOC/SNMOC, UATMP, and PAMS Networks", 2000.

15.2 Testing

All samplers used in the TBRATS will be similar to the instruments described in the TO and IO Compendia. Therefore, they are assumed to be of sufficient quality for the data collection operation. Prior to field installation, project team will assemble and run the samplers at the laboratory facilities. The field operators will perform flow rate verification checks. If flow rate is out of specification, the field personnel will attempt to correct them. If the problem is beyond their expertise, the supervisor will contact the vendor for guidance. If the vendor does not provide sufficient support, then the instrument will be returned to the vendor. Once installed at the site, the field operators will run the tests at least one more time. If the sampling instrument meets the acceptance criteria, it will be assumed to be operating properly.

15.3 Inspection

Inspection of various equipment and components are provided here. Inspections are subdivided into two sections: one pertaining to laboratory issues and one associated with field activities.

15.3.1 Inspection in Laboratory

There are several items that need routine inspection in the laboratory. Table 15-1 details the items to inspect and how to appropriately document the inspection. All of the different areas of the laboratory conduction TSP mass weight, Liquid Chromatography and the ICP will be maintained according to Table 15.1.

Table 15.1 Inspections in the Laboratory

Item	Inspection Frequency	Inspection Parameter	Action if Item Fails Inspection	Documentation Requirement
Room Temperature	Daily	15 - 30° C	1.) adjust AC System	1.) Document in log book

Item	Inspection Frequency	Inspection Parameter	Action if Item Fails Inspection	Documentation Requirement
Room % RH	Daily	<50%	1.) Turn on dehumidifiers 2.) Do not weigh	1.) Document in log book 2.) Document in log book
Cleanliness	Monthly	Use glove and visually inspect	Clean room	1.) Document in log Book

15.3.2 Inspection of Field Items

There are several items to inspect in the field before and after a sample has been taken. The attached appendices discuss in detail the items that need to be inspected. Please refer to the attached SOPs.

15.4 Maintenance

There are many items that need maintenance attention in the network. This section describes the laboratory and field items.

15.4.1 Laboratory Maintenance Items

The successful execution of a preventive maintenance program for the laboratory will go a long way towards the success of the entire program. In the TBRATS network, laboratory preventive maintenance is handled through the use of several contractors.

Table 15.2 Preventive Maintenance in Weigh Room Laboratories

Item	Maintenance Frequency	Responsible Party
Analytical balance maintenance	annual	<i>Mettler</i>
Certification of Class S weights	3 years	<i>Florida Dept. of Agriculture</i>

Table 15.3 Preventive Maintenance in VOC Laboratories

Item	Maintenance Frequency	Responsible Party
Multi-point maintenance calibration	6 Months or as necessary	<i>GC/MS Chemist</i>
Comparison of NIST Standards to laboratory working and primary standards (subset of target cmpds)	After each multipoint calib	<i>GC/MS Chemist</i>
Replace GC Column	As necessary	<i>GC/MS Chemist</i>

Item	Maintenance Frequency	Responsible Party
Replace electron multiplier	3 years or as needed	<i>GC/MS Chemist</i>
Computer Back-up	Weekly	<i>GC/MS Chemist</i>
Computer Virus Check	Weekly	<i>GC/MS Chemist</i>
Computer system preventive maintenance (clean out old files, compress hard drive, inspect)	Yearly	<i>PC support personnel</i>

Table 15.4 Preventive Maintenance in Liquid Chromatography Laboratory

Item	Maintenance Frequency	Responsible Party
Multi-point maintenance calibration	6 Months	<i>ERG</i>
Comparison of NIST Standards to laboratory working and primary standards	6 Months	<i>ERG</i>
Replace Chromatography Column	6 months	<i>ERG</i>
Replace delivery system motor	2 years	<i>ERG</i>
Replace Teflon delivery tubing	Yearly	<i>ERG</i>
Computer Back-up	Weekly	<i>ERG</i>
Computer Virus Check	Weekly	<i>ERG</i>
Computer system preventive maintenance (clean out old files, compress hard drive, inspect)	Yearly	<i>PC support personnel</i>

The following table for preventative maintenance in the EPC/HC laboratory is provided as a guide. The preventative maintenance program will be set-up according to method and manufacturer's instructions upon installation of the new instrument.

Table 15.5 Preventive Maintenance in Inductively Coupled Plasma Laboratories

Item	Maintenance Frequency	Responsible Party
Multi-point maintenance calibration	6 Months	
Comparison of NIST Standards to laboratory working and primary standards	Monthly	
Clean Oven	Monthly	

Item	Maintenance Frequency	Responsible Party
Plasma Generator	Monthly	
Heat Generator	Yearly	
Computer Back-up	Weekly	<i>Balance Analyst</i>
Computer Virus Check	Weekly	<i>Balance Analyst</i>
Computer system preventive maintenance (clean out old files, compress hard drive, inspect)	Yearly	<i>PC support personnel</i>

15.4.2 Field Maintenance Items

There are many items associated with appropriate preventive maintenance of a successful field program. Please see Table 15.6 details the appropriate maintenance checks of the samplers and their frequency.

Table 15.6 Preventive Maintenance on Field Instruments

Instrument	Item	Maintenance Frequency	Responsible Party
TSP sampler	Motor Brush replacement	4 Months	<i>Field Specialist</i>
	Clean inside of sampler	6 Months	<i>Field Specialist</i>
	Inspect Motor	Annually	<i>Field Specialist</i>
VOC Sampler	Clean flow controller and filter	Annually	<i>Field Specialist</i>
Carbonyl Sampler	Replace 1/8" connectors	Annually	<i>ERG Field Technician</i>
	Cartridge connectors	Annually	<i>ERG Field Technician</i>
	Replace Motor Brushes	Annually	<i>ERG Field Technician</i>
	Fan motor replacement	2 years	<i>ERG Field Technician</i>
	Clean inside of sampler	6 Months	<i>ERG Field Technician</i>

16.0 Instrument Calibration and Frequency

This element on the QAPP describes the instrument calibration procedures that are used for instrumental and analytical methods in the TBRATS project. The procedures for TSP and VOC samples are outlined in this document. The procedures for carbonyl samples are outlined in section 11 of the ERG Quality Assurance Project Plan, "Support For NMOC/SNMOC, UATMP, and PAMS Networks", 2000.

16.1 Instrumentation Requiring Calibration

16.1.1 Analysis of Instruments - Laboratory

The laboratory support for the EPC/HC lab calls upon Mettler to perform routine maintenance and calibration on all its balances annually. The balance is checked whenever filters are weighed using 3 NIST traceable weights and 2 Class S weights. All of these actions are documented in the laboratory notebooks.

16.1.2 Flow Rate - Laboratory

Once every year the flow rate standards are sent to NIST or the State lab for re-certification. The laboratory and field personnel chose an automatic dry-piston flow meter for calibrations and flow rate verifications of the carbonyl and VOC samplers. In addition, the manual bubble flowmeter will be used in the lab as a primary standard and as a backup to the dry-piston flowmeter, where the absence of wind and relatively low humidity will have less negative effect on flowmeter performance. An orifice flow rate transfer standard is used to verify TSP sampler flow rates

Upon initial receipt of any new, repaired, or replaced air toxics sampler, a flow rate verification will be done to determine if initial performance is acceptable.

16.1.3 Sampler Temperature, Pressure, Time Sensors - Laboratory

The lab arranges support for the field calibration of temperature and pressure sensors by acquiring the necessary equipment and consumables, preparing and lab testing the temperature comparison apparatus. A stationary mercury barometer in the laboratory is used as a primary standard.

16.1.4 Field

The following calibrations are performed:

- calibration of volumetric flow rate meter of each samplers against the working standard;

- calibration of the min/max thermometers, normally located in the coolers in which DNPH cartridges are transported to and from the sampler in the field, against the laboratory-checked working standard thermometer.

16.2 Calibration Method that Will Be Used for Each Instrument

16.2.1 Laboratory - Gravimetric (Mass) Calibration

The calibration and QC (verification) checks of the analytical balance are addressed in the EPC/HC laboratory SOPs.

16.2.2 Laboratory/ Field - Flow Calibration.

The air monitoring and laboratory section managers conduct spot checks of lab and field notebooks to ensure that the lab and field personnel are following the SOPs, including the QA/QC checks, acceptance criteria and frequencies.

16.3 Calibration Standard Materials and Apparatus

Table 16.2 presents a summary of the specific standard materials and apparatus used in calibrating measurement systems.

Flow Rate

The flow rate standard apparatus used for flow-rate calibration (field- NIST-traceable, piston-type volumetric flow rate meter; laboratory -NIST-traceable manual soap bubble flow meter, orifice flow rate transfer standard, and time monitor) has its own certification and is traceable to other standards for volume or flow rate which are themselves NIST-traceable. A calibration relationship for the flow-rate standard, such as an equation, curve, or family of curves, is established by the manufacturer (and verified if needed) that is accurate to within 2% over the expected range of ambient temperatures and pressures at which the flow-rate standard is used. The flow rate standard will be re-calibrated and re-certified at least annually. The frequency for re-certifying the various standards used are specified in the “State-Wide Quality Assurance Air Program Plan”.

The High Volume sampler flow rate device is a *General Metal Works* orifice flow rate transfer standard, which is certified to a NIST traceable roots meter. The High Volume orifice is sent to the State’s certification laboratory on an annual basis to verify its flow rate.

Temperature

The operations manuals associated with the ATMP samplers identify types of temperature standards recommended for calibration and provide a detailed calibration procedure for TSP samplers.

The EPA Quality Assurance Handbook, Volume IV (EPA 1995), Section 4.3.5.1, gives information on calibration equipment and methods for assessing response characteristics of temperature sensors.

The temperature standard used for temperature calibration will have its own certification and be traceable to a NIST primary standard. A calibration relationship to the temperature standard (an equation or a curve) will be established that is accurate to within 2% over the expected range of ambient temperatures at which the temperature standard is to be used. The temperature standard must be used in compliance with the FDEP "State-Wide Quality Assurance Air Program Plan". The actual frequency of recertification depends on the type of temperature standard. The participating agencies will use an NIST-traceable mercury in glass thermometer, for laboratory calibration and certification of the temperature measuring devices.

The temperature sensor standards chosen by the lab and field staff and managers are both based on standard materials contained in standardized apparatus; each has been standardized (compared in a strictly controlled procedure) against temperature standards the manufacturers obtained from NIST.

Pressure

The primary standard used for barometric pressure measurements is a Princo mercury barometer.

16.4 Document Calibration Frequency

See the FDEP "State-Wide Quality Assurance Air Program Plan" for a summary of Primary and Working Standards QC checks that includes frequency and acceptance criteria and references for certification frequency. All of these events, as well as sampler and calibration equipment maintenance will be documented in field data records and notebooks. Laboratory and field activities associated with equipment used by the respective technical staff will be kept in record notebooks as well.

References

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NIST. 1988. Liquid-in-glass thermometer calibration service. National Institute of Standards and Technology. Special publication 250-23. September.

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17.0 Inspection/Acceptance for Supplies and Consumables

17.1 Purpose

The purpose of this element is to establish and document a system for inspecting and accepting all supplies and consumables that may directly or indirectly affect the quality of the Program. The TBRATS Network relies on various supplies and consumables that are critical to its operation. By having documented inspection and acceptance criteria, consistency of the supplies can be assured. This section details the supplies/consumables, their acceptance criteria, and the required documentation for tracking this process.

17.2 Critical Supplies and Consumables

Table 17.1 details the various components for the laboratory and field operations.

Table 17.1 Critical Field Supplies and Consumables

Area	Item	Description	Vendor
TSP Sampler	8 x 11" Quartz filters	Quartz filter	<i>Provided by EPA</i>
TSP Sampler	High Volume Motor	Blower motor	<i>Lamb</i>
TSP Sampler	Motor Brushes	Carbon Brush Elements	<i>GMW</i>
VOC Sampler	Stainless Steel tubing	Clean SS tubing	<i>Swagelok</i>
VOC Sampler	Mass Flow Controller	3.5- 7.0 cc/min.	<i>Veriflo</i>
Carbonyl Sampler	DNPH cartridges	DNPH coated plastic Cartridges	<i>Provided by ERG</i>
Carbonyl Sampler	Fuses	In sampler	<i>various</i>

Table 17.2 Critical Laboratory Supplies and Consumables

Area	Item	Description	Vendor
Weigh Room	Staticide	Anti-static solution	
Weigh Room	Forceps	non-serrated/Teflon Coated	
Weigh Room	Air Filters	High Efficiency	<i>Local</i>
All	Powder Free Antistatic Gloves	Vinyl, Class M4.5	

Area	Item	Description	Vendor
All	Low-lint wipes	4.5" x 8.5" Cleaning Wipes	
Liquid Chromatography	Teflon tubing	1/8" PTFE tubing	
Liquid Chromatography	Chromatographs column	36" column	
GC/MS	Chromatographs column	60 meter	<i>J & W</i>
GC/MS	Helium	Carrier Gas	<i>Cylinder Tech</i>
GC/MS	Liquid nitrogen	cryogen	<i>Air Liquide</i>
ICP	Argon Coolant	Coolant Flow	
ICP	Deionized H2O	Post Flush	
ICP	Photo multiplier Tube	Analytical element	

17.3 Acceptance Criteria

Acceptance criteria must be consistent with overall project technical and quality criteria. It is the air monitoring branch chief and the field personnel responsibility to update the criteria for acceptance of consumables. As requirements change, so do the acceptance criteria. Knowledge of field and laboratory equipment and experience are the best guides to acceptance criteria. Other acceptance criteria such as observation of damage due to shipping can only be performed once the equipment has arrived on site.

17.4 Tracking and Quality Verification of Supplies and Consumables

Tracking and quality verification of supplies and consumables have two main components. The first is the need of the end user of the supply or consumable to have an item of the required quality. The second need is for the purchasing department to accurately track goods received so that payment or credit of invoices can be approved. In order to address these two issues, the following procedures outline the proper tracking and documentation procedures to follow:

1. Receiving personnel will perform a rudimentary inspection of the packages as they are received from the courier or shipping company. Note any obvious problems with a receiving shipment such as crushed box or wet cardboard.

2. The package will be opened, inspected and contents compared against the packing slip.
3. If there is a problem with the equipment/supply, note it on the packing list, notify the branch chief of the receiving area and immediately call the vendor.
4. If the equipment/supplies appear to be complete and in good condition, sign and date the packing list and send to accounts payable so that payment can be made in a timely manner.
5. Notify appropriate personnel that equipment/supplies are available. For items such as the filters, it is critical to notify the laboratory manager of the weigh room so sufficient time for processing of the filters can be allowed.
6. Stock equipment/supplies in appropriate pre-determined area.
7. For supplies, consumables, and equipment used throughout the program: staff will notify the supervisor when these items are removed from inventory and then initiate reorder procedures.

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18.0 Data Acquisition Requirements

This section addresses data not obtained by direct measurement from the TBRATS project. This includes both outside data and historical monitoring data. Non-monitoring data and historical monitoring data are used in a variety of ways. Use of information that fails to meet the necessary Data Quality Objectives (DQOs) for the ATMP lead to erroneous trend reports and regulatory decision errors. The policies and procedures described in this section apply both to data acquired through the TBRATS project and to information previously acquired and/or acquired from outside sources.

18.1 Acquisition of Non-Direct Measurement Data

The TBRATS project relies on data that are generated through field and laboratory operations; however, other significant data are obtained from sources outside the participating agencies or from historical records. This section lists this data and addresses quality issues related to the ATMP.

Chemical and Physical Properties Data

Physical and chemical properties data and conversion constants are often required in the processing of raw data into reporting units. This type of information that has not already been specified in the monitoring regulations will be obtained from nationally and internationally recognized sources.

- National Institute of Standards and Technology (NIST);
- ISO, IUPAC, ANSI, and other widely-recognized national and international standards organizations;
- U.S. EPA;
- The current edition of certain standard handbooks may be used without prior approval of the TBRATS planning team. Two that are relevant to the fine particulate monitoring program are CRC Press' *Handbook of Chemistry and Physics*, and *Merck Manual*.

Sampler Operation and Manufacturers' Literature

Another important source of information needed for sampler operation is manufacturers' literature. Operations manuals and users' manuals frequently provide numerical information and equations pertaining to specific equipment. TCAPCD personnel are cautioned that such information is sometimes in error, and appropriate cross-checks will be made to verify the reasonableness of information contained in manuals. Whenever possible, the field operators will compare physical and chemical constants in the operators manuals to those given in the sources listed above. If discrepancies are found, determine the correct value by contacting the manufacturer. The following types of errors are commonly found in such manuals:

- insufficient precision;
- outdated values for physical constants;
- typographical errors;
- incorrectly specified units;
- inconsistent values within a manual, and
- use of different reference conditions than those called for in EPA regulations.

Geographic Location

Another source of data that will commonly be used in conjunction with the TBRATS project are geographic information systems (GIS). The planning team will locate these sites using GIS-based information and USGS quad maps as the primary means for locating and siting stations in the existing network.

External Monitoring Data Bases

All data used in the preparation of published reports and analyses will be obtained from the TBRATS data storage systems or the EPA AIRS database. The data utilized will have been validated and approved by the producing agency in accordance with the latest approved criteria for such activities.

Lead and Speciated Particulate Data

Airborne lead has been routinely monitoring in the Tampa Bay area since 1982 (Pinellas County). Early data is likely to be problematic because of significantly higher detection limits.

U.S. Weather Service Data

Meteorological information is gathered from the U.S. Weather Service stations in Ruskin, Florida and at Tampa International Airport. Parameters include: temperature, relative humidity, barometric pressure, rainfall, wind speed, wind direction, cloud type/layers, percentage cloud cover and visibility range. Historically, these data have not been used to calculate pollutant concentration values for any of the region's air toxics monitoring sites. However, NWS data are often included in summary reports.

19.0 Data Management

19.1 Background and Overview

This section describes the data management operations pertaining to measurements for the air toxics stations operated under the TBRATS. This includes an overview of the mathematical operations and analyses performed on raw (“as-collected”) data. These operations include, but are not limited to, data recording, validation, transformation, transmittal, reduction, analysis, management, storage, and retrieval. The data processing steps are integrated, to the extent possible, into the existing data processing system used for the TBRATS network. Filter tracking and chain-of-custody information are maintained in part in the laboratory LIMS and field records as specified in the appropriate field SOPs.

19.2 Data Recording

Procedures for filling out the laboratory sheets and subsequent data entry are provided in the appropriate laboratory SOPs.

19.3 Data Validation

Data validation is a combination of checking that data processing operations have been carried out correctly and of monitoring the quality of the field operations. Data validation can identify problems in either of these areas. Once problems are identified, the data can be corrected or invalidated, and corrective actions can be taken for field or laboratory operations.

The objective of the TBRATS project will be to optimize the performance of its monitoring equipment. Initially, the results of collocated operations will be control charted (see Element 14). From these charts, control limits will be established to flag potential problems.

19.4 Data Transformation

Calculations for transforming raw data from measured units to final concentrations are relatively straightforward. They will be completed using sound scientific procedures and judgement.

19.5 Data Transmittal

Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. Some examples of data transmittal are copying raw data from a notebook onto a data entry form for keying into a computer file and electronic transfer of data over a telephone or computer network. Table 19.1 summarizes data transfer operations.

The TBRATS planning team will report all ambient air quality data and information specified by the AIRS Users Guide (Volume II, Air Quality Data Coding, and Volume III, Air Quality Data Storage), coded in the AIRS-AQS format. Such air quality data and information will be fully screened and validated and will be submitted to the FDEP for entry into the AIRS-AQS via electronic transmission, in the format of the AIRS-AQS, and in accordance with the quarterly schedule. The specific quarterly reporting periods and due dates are shown in the Table 19.1.

Table 19.1 Data Reporting Schedule

Reporting Period	Due Date
January 1-March 31	June 30
April 1-June 30	September 30
July 1-September 30	December 31
October 1-December 31	March 31

19.6 Data Reduction

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. Since air toxics has no regulatory requirements, such as those with the NAAQS, monitoring regulations are not required to be reported regularly to U.S. EPA. Examples of data summaries include:

- average concentration for a station or set of stations for a specific time period;
- accuracy, bias, and precision statistics;
- data completeness reports based on numbers of valid samples collected during a specified period.

The Audit Trail is another important concept associated with data transformations and reductions. An audit trail is a data structure that provides documentation for changes made to a data set during processing. The audit trail may be a manual and/or automated system. Typical reasons for data changes that would be recorded include the following:

- corrections of data input due to human error;
- application of revised calibration factors;
- addition of new or supplementary data;
- flagging of data as invalid or suspect;
- logging of the date and times when automated data validation programs are run.

The automated audit trail is implemented as a separate table a relational data base. Audit trail records will include the following fields:

- operator's identity (ID code);
- date and time of the change;
- table and field names for the changed data item;
- reason for the change;
- full identifying information for the item changed (date, time, site location, parameter, etc.);
- value of the item before and after the change.

When routine data screening programs are run, the following additional data are recorded in the audit trail:

- version number of the screening program;
- values of screening limits (e.g., upper and lower acceptance limits for each parameter);
- numerical value of each data item flagged and the flag applied.

When utilizing data screening programs, the audit trail is produced automatically and can only document changes; there is no "undo" capability for reversing changes after they have been made. Available reports based on the automated audit trail may include:

- log of routine data validation, screening, and reporting program runs;
- report of data changes by station for a specified time period;
- report of data changes for a specified purpose;
- report of data changes made by a specified person.

Because of storage requirements, the System Administrator must periodically move old audit trail records to backup media. Audit trail information will not be moved to backup media until after the data are reported to AIRS. All backups will be retained so that any audit trail information can be retrieved for at least 3 years.

19.7 Data Summary

The UATMP Steering Committee is currently implementing the data summary and analysis program under contract with the Lake Michigan Air Directors Consortium (LADCO). It is anticipated that as the pilot city studies proceed, additional data analysis procedures will be developed. The following specific summary statistics will be tracked and reported for each UATM Pilot City Study network:

- Single sampler bias or accuracy (based on audit flow checks and laboratory audits);
- Single sampler precision (based on collocated data);
- Network-wide bias and precision;
- Data completeness.

19.8 Data Tracking

The LIMS utilized by agencies participating in the TBRATS project, contain the necessary input functions and reports to track and account for the whereabouts of filters and the status of data processing operations for specific data. Information about filter location is updated at distributed data entry terminals at the points of significant operations. The following input locations are used to track sample location and status:

Laboratory (initial receipt)

- Sample receipt (by lot);
- Pre-sampling processing or weighing (individual filter or cartridge number first enters the system);
- Canister number (VOC only);
- Filter packaged for the laboratory (filter numbers in each package are recorded);
- Shipping (package numbers are entered for both sending and receiving);

Laboratory(receipt from field)

- Package receipt (package is opened and filter numbers are logged in);
- Filter post-sampling weighing;
- Filter archival.

In most cases, the tracking data base and the monitoring data base are updated simultaneously. For example, when the filter is pre-weighed, the weight is entered into the monitoring data base and the filter number and status are entered into the tracking data base. For the VOC system, the sample handling is different. The VOC canisters are reused many times before they are retired from field use. Each canister has its own unique code that designates the can number. When the canister is sent into the field, a canister number becomes a portion of the tracking code. This allows the sample that was in the canister to be tracked.

19.9 Data Storage and Retrieval

Data archival policies for the data are shown in Table 19.2.

Table 19.2 Data Archive Policies

Data Type	Medium	Retention Time	Final Disposition
Weighing records; chain of custody forms	Hardcopy	3 years	Discarded
Laboratory Notebooks	Hardcopy	3 years	N/A
Field Notebooks	Hardcopy	3 years	Discarded
Data Base (excluding Audit Trail records)	Electronic (on-line)	indefinite (may be moved to backup media after 5 years)	Backup tapes retained indefinitely
Trail record	Hardcopy and electronic reports	3 years	N/A
TSP Quartz filters	Filters	1 year	Discarded
VOC canisters	metal can	reused after cleaning	Recycled
DNPH cartridge	plastic cartridge	6 months	Discarded

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C. ASSESSMENT / OVERSIGHT

20.0 Assessments and Response Actions

An assessment is defined as an evaluation process used to measure the performance or effectiveness of the quality system or the establishment of the monitoring network and sites and various measurement phases of the data operation.

The results of quality assurance assessments indicate whether the control efforts are adequate or need to be improved. Documentation of all quality assurance and quality control efforts implemented during the data collection, analysis, and reporting phases is important to data users, who can then consider the impact of these control efforts on the data quality (see Section 21). Both qualitative and quantitative assessments of the effectiveness of these control efforts will identify those areas most likely to impact the data quality and to what extent.

In order to ensure the adequate performance of the quality system, the TBRATS planning team in conjunction with the State, EPA Regional office and OAQPS, will perform the following assessments:

- Technical Systems Audits
- Network Reviews
- Audits of Data Quality
- Data Quality Assessments

The definitions of these terms can be found in Appendix A.

20.1 Assessment Activities and Project Planning

20.1.1 Technical Systems Audit

A Technical Systems Audit (TSA) is a thorough and systematic on-site qualitative audit, where facilities, equipment, personnel, training, procedures, and record keeping are examined for conformance to the QAPP. TSAs of the network will be accomplished in June 2001 by the EPA Regional Office in coordination with the local air agencies involved with this study. To increase uniformity of the TSA, an audit checklist will be developed and used. This checklist is based on the *EPA R-5* guidance.

Key personnel to be interviewed during the audit are those individuals with responsibilities for: planning, field operations, laboratory operations, QA/QC, data management, and reporting.

The audit team will prepare a brief written summary of findings, organized into the following areas: planning, field operations, laboratory operations, quality assurance/quality control, data

management, and reporting. Problems with specific areas will be discussed and an attempt made to rank them in order of their potential impact on data quality.

The audit finding form has been designed such that one is filled out for each major deficiency that requires formal corrective action. The finding should include items like: systems impacted, estimated time period of deficiency, site(s) affected, and reason of action. The finding form will inform the Division about serious problems that may compromise the quality of the data and, therefore, require specific corrective actions. They are initiated by the Audit Team, and discussed at the debriefing. During the debriefing, if the audited group is in agreement with the finding, the form is signed by the groups branch manager or his designee during the exit interview. If a disagreement occurs, the Audit Team will record the opinions of the group audited and set a time at some later date to address the finding at issue.

Post-Audit Activities - The major post-audit activity is the preparation of the systems audit report. The report will include:

- audit title and number and any other identifying information;
- audit team leaders, audit team participants and audited participants;
- background information about the project, purpose of the audit, dates of the audit; particular measurement phase or parameters that were audited, and a brief description of the audit process;
- summary and conclusions of the audit and corrective action requires;
- attachments or appendices that include all audit evaluations and audit finding forms.

To prepare the report, the audit team will meet and compare observations with collected documents and results of interviews and discussions with key personnel. Expected QA Project Plan implementation is compared with observed accomplishments and deficiencies and the audit findings are reviewed in detail. Within thirty (30) calendar days of the completion of the audit, the audit report will be prepared and submitted. The systems audit report will be submitted to the appropriate branch managers and appropriately filed.

If the branch has written comments or questions concerning the audit report, the Audit Team will review and incorporate them as appropriate, and subsequently prepare and resubmit a report in final form within thirty (30) days of receipt of the written comments. The report will include an agreed-upon schedule for corrective action implementation.

Follow-up and Corrective Action Requirements - The QA Office and the audited organization may work together to solve required corrective actions. As part of corrective action and follow-up, an audit finding response letter will be generated by the audited organization. The audit finding response letter will address what actions are being implemented to correct the finding of the TSA. The audit response letter will be completed by the audited organization within 30 days of acceptance of the audit report.

20.1.2 Network Reviews

The network review is used to determine how well a particular air monitoring network is achieving its required air monitoring objective, and how it should be modified to continue to meet its objective. The network review will be accomplished in June 2001 by the EPA Regional Office in coordination with the local air agencies involved with this study.

Prior to the implementation of the network review, significant data and information pertaining to the review will be compiled and evaluated. Such information might include the following:

- network files (including updated site information and site photographs);
- AIRS reports (AMP220, 225, 380, 390, 450);
- air toxics emissions trends reports for major metropolitan area;
- emission information, such as emission density maps for the region in which the monitor is located and emission maps showing the major sources of emissions;
- National Weather Service summaries for monitoring network area.

In addition, pollutant-specific priorities may be considered in areas that models may show persons to be at risk. Upon receiving the information it will be checked to ensure it is the most current. Discrepancies will be noted on the checklist and resolved during the review. Files and/or photographs that need to be updated will also be identified. Adequacy of the network will be determined by using the following information:

- maps of historical monitoring data;
- maps of emission densities;
- dispersion modeling;
- special studies/saturation sampling;
- best professional judgement;
- SIP requirements;
- GIS updates.

The number of samplers operating can be determined from the AMP220 report in AIRS. The number of monitors required, based on concentration levels and population, can be determined from the AMP450 report and the latest census population data.

Location of Monitors - Adequacy of the location of monitors can only be determined on the basis of stated objectives. Maps, graphical overlays, and GIS-based information will be helpful in visualizing or assessing the adequacy of monitor locations. Plots of potential emissions and/or historical monitoring data versus monitor locations will also be used.

During the network review, the stated objective for each monitoring location or site (see section 10) will be “reconfirmed” and the spatial scale “re-verified” and then compared to each location to determine whether these objectives can still be attained at the present location.

Probe Siting Requirements - The on-site visit will consist of the physical measurements and observations to determine the best locations. Prior to the site visit, the reviewer will obtain and review the following:

- most recent hard copy of site description (including any photographs);
- data on the seasons with the greatest potential for high concentrations for specified pollutants;
- predominant wind direction by season.

A checklist similar to the checklist used by the EPA Regional offices during their scheduled network reviews will be used. This checklist can be found in the *SLAMS/NAMS/PAMS Network Review Guidance* which is intended to assist the reviewers. In addition to the items on the checklist, the reviewer will also perform the following tasks:

- ensure that the inlet is clean;
- record findings in field notebook and/or checklist;
- take photographs/videotape in the 8 directions;
- document site conditions, with additional photographs/videotape.

Other Discussion Topics - In addition to the items included in the checklists, other subjects for discussion as part of the network review and overall adequacy of the monitoring program will include:

- installation of new monitors;
- relocation of existing monitors;
- siting criteria problems and suggested solutions;
- problems with data submittals and data completeness;
- maintenance and replacement of existing monitors and related equipment;
- quality assurance problems;
- air quality studies and special monitoring programs;
- other issues;
 - proposed regulations;
 - funding.

A report of the network review will be written within two months of the review and appropriately filed.

20.1.3 Audit of Data Quality (ADQ)

An ADQ reveals how the data are handled, what judgments were made, and whether uncorrected mistakes were made. ADQs can often identify the means to correct systematic data reduction errors. An ADQ will be performed at the end of the pilot study period by the EPA Regional Office in coordination with the local air agencies involved with TBRATS. Sufficient time and effort will be devoted to this activity so that the auditor or team has a clear understanding and complete documentation of data flow. Pertinent ADQ questions will appear on the TSA check sheets to ensure that the data collected at each stage maintains its integrity. The ADQ will serve as an effective framework for organizing the extensive amount of information gathered during the audit of laboratory, field monitoring, and support functions within the agency. The ADQ will have the same reporting/corrective action requirements as the TSA.

20.1.4 Data Quality Assessments

A data quality assessment (DQA) is the statistical analysis of environmental data to determine whether the quality of data is adequate to support the decision which are based on the DQOs. Data are appropriate if the level of uncertainty in a decision based on the data is acceptable. The DQA process is described in detail in *Guidance for the Data Quality Assessment Process*, EPA QA/G-9 and is summarized below.

1. *Review the data quality objectives (DQOs) and sampling design of the program:* review the DQO. Define statistical hypothesis, tolerance limits, and/or confidence intervals.
2. *Conduct preliminary data review.* Review Precision & Accuracy (P&A) and other available QA reports, calculate summary statistics, plots and graphs. Look for patterns, relationships, or anomalies.
3. *Select the statistical test:* select the best test for analysis based on the preliminary review, and identify underlying assumptions about the data for that test.
4. *Verify test assumptions:* decide whether the underlying assumptions made by the selected test hold true for the data and the consequences.
5. *Perform the statistical test:* perform test and document inferences. Evaluate the performance for future use.

Data quality assessment will be included in the QA AR. Details of these reports are discussed in Section 21.

Measurement uncertainty will be estimated for both automated and manual methods. Terminology associated with measurement uncertainty are found within 40 CFR Part 58

Appendix A and includes: (a) Precision - a measurement of mutual agreement among individual measurements of the same property usually under prescribed similar conditions, expressed generally in terms of the standard deviation; (b) Accuracy- the degree of agreement between an observed value and an accepted reference value, accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; (c) Bias- the systematic or persistent distortion of a measurement process which causes errors in one direction. The individual results of these tests for each method or analyzer shall be reported to EPA. Estimates of the data quality will be calculated on the basis of single monitors and aggregated to all monitors.

20.2 Documentation of Assessments

Table 20.1 Documentation of Assessments

Assessment Activity	Personnel Responsible	Schedule	Report Completion	Reporting/Resolution
Network Reviews	EPA Regional Office	June 2001	30 days after activity	UATMP Steering Committee
Technical Systems Audits	EPA Regional Office	June 2001	30 days after activity	UATMP Steering Committee
Audits of Data Quality	TBRATS Team	Jan 2002	30 days after activity	UATMP Steering Committee
Data Quality Assessment	TBRATS Team	Jan 2002	120 days after end of calendar year	UATMP Steering Committee

21.0 Reports to Management

This section describes the quality-related reports and communications to management necessary to support air toxics network operations and the associated data acquisition, validation, assessment, and reporting. Important benefits of regular QA reports to management include the opportunity to alert the management of data quality problems, to propose viable solutions to problems, and to procure necessary additional resources. Management should not rely entirely upon the TSA for their assessment of the data. Quality assessment, including the evaluation of the technical systems, the measurement of performance, and the assessment of data, is conducted to help insure that measurement results meet program objectives and to ensure that necessary corrective actions are taken early, when they will be most effective.

Effective communication among all personnel is an integral part of a quality system. Regular, planned quality reporting provides a means for tracking the following:

- adherence to scheduled delivery of data and reports,
- documentation of deviations from approved QA and test plans, and the impact of these deviations on data quality;
- analysis of the potential uncertainties in decisions based on the data.

21.1 Frequency, Content, and Distribution of Reports

Guidance for management report format and content are provided in guidance developed by EPA's Quality Assurance Division (QAD) and the Office of Air Quality Planning and Standards. These reports are described in the following subsections.

21.1.1 QA Annual Report

Periodic assessments of air toxics data are essential to good planning of a national air toxics monitoring network. The TBRATS QA Annual Report will include Quality information for each air toxic monitored in the network. Each section includes the following topics:

- program overview and update;
- quality objectives for measurement data;
- data quality assessment.

For reporting air toxics measurement uncertainties, the QA Annual Report contains the following summary information:

- Flow Rate Audits;
- Collocated Samplers Audits using estimation of Precision and Bias;

- Laboratory audits which include “round-robin” cylinders that are shared among many laboratories;
- NPAP audits.

21.1.2 Network Reviews

Section 20 discusses the contents of the network review.

21.1.3 Technical System Audit Reports

The TBRATS planning team assists in Technical System Audits of the monitoring system (section 20). These reports will be filed and made available to EPA personnel during their technical systems audits.

21.1.4 Response/Corrective Action Reports

The Response/Corrective Action Report procedure will be followed whenever a problem is found such as a safety defect, an operational problem, or a failure to comply with procedures. A Response/Corrective Action Report is one of the most important ongoing reports to management because it documents primary QA activities and provides valuable records of QA activities.

22.0 Data Review

22.1 Data Review Design

The primary purpose of this section is to describe the data validation procedures that are used by the TBRATS planning team to process ambient air toxics data. Data validation refers to those activities performed after the fact, that is, after the data have been collected. The difference between data validation and quality control techniques is that the quality control techniques attempt to minimize the amount of bad data being collected, while data validation seeks to prevent any bad data from getting through the data collection and storage systems.

It is preferable that data review be performed as soon as possible after the data collection, so that the questionable data can be checked by recalling information on unusual events and on meteorological conditions which can aid in the validation. Also, timely corrective actions should be taken when indicated to minimize further generation of questionable data. The data review group will attempt to review the data within 1 month after the end of the month of sampling. This will also help with getting the data loaded onto AIRS in a timely manner, as described in Section 19.5.

Personnel performing data review should:

1. Be familiar with typical diurnal concentration variations (e.g., the time daily maximum concentrations occur and the interrelationship of pollutants.) For example, benzene, toluene and xylene concentrations usually increase and decrease together, due to these being attributed to mobile sources, whereas, metals are usually attributable to manufacturing process, and may have a longer temporal cycle.
2. Be familiar with the type of instrument malfunctions which cause characteristic trace irregularities.
3. Recognize that cyclical or repetitive variations (at the same time each day or at periodic intervals during the day) may be caused by excessive line voltage or temperature variations. Nearby source activity can also cause erroneous or non-representative measurements.
4. Recognize that flow traces showing little or no activity often indicate flow problems, or sample line leaks.

There is a wide variety of information with which to validate air toxics data. Among them are the following, along with their uses:

1. Multi-point Calibration Forms - the multipoint forms should be used to establish proper initial calibration and can be used to show changes in the calibration;
2. Span Control Charts - these charts will be the most valuable tool in spotting data that is out of control limits;
3. Site and Instrument Logs - because all station activities are noted in one or both of these logs, one can obtain a good picture of station operations by reading these logs;
4. Data From Other Air Quality Stations - data from other air quality stations nearby can be compared between two stations to help the identification of invalid data.
5. Blanks, Replicates and Spikes - these QC indicators can be used to ascertain whether sample handling or analysis is causing bias in the data set.

22.2 Data Review Testing

22.2.1 Data Identification Checks

Data with improper identification codes are useless. Three equally important identification fields that must be correct are time, location, parameter and sampler ID.

22.2.2 Unusual Event Review

Extrinsic events (e.g., construction activity, dust storms, unusual traffic volume, and traffic jams) can explain unusual data. This information could also be used to explain why no data are reported for a specified time interval, or it could be the basis for deleting data from a file for specific analytical purposes.

22.2.3 Relationship Checks

Toxics data sets contain many physically or chemically related parameters. These relations can be routinely checked to ensure that the measured values on an individual parameter do not exceed the corresponding measured values of an aggregate parameter, which includes the individual parameter. For example, benzene, toluene and xylene are mobile source driven. The relative concentrations are within +/- 10 ppbv, if these values are recorded at the same time and location. Data sets in which individual parameter values exceed the corresponding aggregate values are flagged for further investigation. Minor exceptions to allow for measurement system noise may be permitted in cases where the individual value is a large percentage of the aggregate value.

22.2.4 Review of Spikes, Blanks and Replicates -

An additional check of the data set is to verify that the spikes, blanks and replicate samples have been reviewed. Generally, recovery of spikes in samples should be greater than 80%. Blanks should not be more than three times the MDL for any compound. The difference in concentration of replicates should be within +/- 10%. If any of these are outside of this boundary, then the reviewer should notify the air monitoring branch supervisor for direction. The air branch supervisor will discuss these results with the lab branch supervisor and the QA officer. The three will decide whether any of these results can or will invalidate a single run or batch.

22.2.5 Tests for Historical and Temporal Consistency

These tests check the consistency of the data set with respect to similar data recorded in the past. In particular these procedures will detect changes where each item is increased by a constant or by a multiplicative factor. Gross limit checks are useful in detecting data values that are either highly unlikely or considered impossible. The use of upper and lower 95% confidence limits is very useful in identifying outliers.

22.2.6 Pattern and Successive Difference Tests

These tests check data for pollutant behavior that has never or very rarely occurred in the past. Values representing pollutant behavior outside of these predetermined limits are then flagged for further investigation. Pattern tests place upper limits on:

- The individual concentration value (maximum-hour test),
- The difference in adjacent concentration values (adjacent hour test),
- The difference or percentage difference between a value and both of its adjacent values (spike test), and
- The average of three or more consecutive values (consecutive value test).

22.2.7 Parameter Relationship Tests

Parameter relationship tests can be divided into deterministic tests involving the theoretical relationships between parameters (e.g., ratios between benzene and toluene) or empirical tests which determine whether or not a parameter is behaving normally in relation to the observed behavior of one or more other parameters. Determining the “normal” behavior of related parameters requires the detailed review of historical data.

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D. VALIDATION AND USABILITY

23.0 Data Validation, Verification and Analysis

Many of the processes for verifying and validating the measurement phases of the data collection operation have been discussed in Section 22. If these processes, as written in the QAPP, are followed, and the sites are representative of the boundary conditions for which they were selected, one would expect to achieve the DQOs. However, exceptional field events may occur, and field and laboratory activities may negatively affect the integrity of samples. In addition, it is expected that some of the QC checks will fail to meet the acceptance criteria. This section will outline how the District will take the data to a higher level of analysis. This will be accomplished by performing software tests, plotting, and other methods of analysis.

23.1 Verification of Samples

After a sample batch is completed, a thorough review of the data will be conducted for completeness and data entry accuracy. All raw data that are hand entered on data sheets will be double keyed as discussed in Section 19, into the LIMS. For the chromatographic data, the data will be transferred from a Level 1 to a Level 2 status. The entries are compared to reduce the possibility of entry and transcription errors. Once the data is entered into the LIMS, the system will review the data for routine data outliers and data outside of acceptance criteria. These data will be flagged appropriately. All flagged data will be “re-verified” that the values are entered correctly. The data qualifiers or flags can be found in the SOPs.

23.2 Validation

Validation of measurement data will require two stages: one at the Level I and the Level II. Records of all invalid samples will be filed for 5 years. Information will include a brief summary of why the sample was invalidated along with the associated flags. This record will be available on the LIMS since all samples that were analyzed will be recorded. At least one flag will be associated with an invalid sample, that being the “INV” flag signifying invalid, or the “NAR” flag when no analysis result is reported, or “BDL” which means below the detection limit. Additional flags will usually be associated with the NAR, INV, or BDL flags that help describe the reason for these flags, as well as free form notes from the field personnel or laboratory analysts.

Validation of Measurement Values

Certain criteria based upon field operator and laboratory technician judgment have been developed that will be used to invalidate a sample or measurement. The flags listed in table 22-1 will be used to determine if individuals samples, or samples from a particular instrument will be invalidated. In all cases the sample will be returned to the laboratory for further examination.

When the laboratory technician reviews the field sheet and chain-of-custody forms he/she will look for flag values. Filters that have flags related to obvious contamination (CON), filter damage (DAM), field accidents (FAC) will be immediately examined. Upon concurrence of the laboratory technician and laboratory branch manager, these samples will be invalidated. The flag “NAR” for no analysis result will be placed in the flag area associated with this sample, along with the other associated flags.

Other flags listed may be used alone or in combination to invalidate samples. Since the possible flag combinations are overwhelming and cannot be anticipated, the air division will review these flags and determine if single values or values from a site for a particular time period will be invalidated. The division will keep a record of the combination of flags that resulted in invalidating a sample or set of samples. As mentioned above, all data invalidation will be documented. Table 23.1 contains criteria that can be used to invalidate single samples based on single flags.

Table 23.1 Single Flag Invalidation Criteria for Single Samples

Requirement	Flag	Comment
Contamination	CON	Concurrence with lab technician and branch manager
Filter Damage	DAM	Concurrence with lab technician and branch manager
Event	EVT	Exceptional, known field event expected to have effected sample. Concurrence with lab technician and branch manager
Laboratory Accident	LAC	Concurrence with lab technician and branch manager
Below Detection Limit	BDL	Value is below the Minimum Detection Limit of the analytical system
Field Accident	FAC	Concurrence with lab technician and branch manager

23.3 Data Analysis

Data analysis refers to the process of attempting to make sense of the data that are collected. By examining the list in Table 5-1, there are a large number of parameters to analyze. However, many of these have similar characteristics: Volatile Organics and particulate metals. One would assume that there physical and chemical properties could group them together.

This section will state how the TBRATS planning team will begin to analyze the data to ascertain what the data illustrates and how it should be applied.

23.3.1 Analytical tests

The planning team will employ several software programs towards analyzing the data. These are listed below with a short explanation of each.

Spreadsheet - The District will perform a rudimentary analysis on the data sets using EXCEL spreadsheets. Spreadsheets allow the user to input data and statistically analyze, plot and graph linear data. This type of analysis will allow the user to see if there are any variations in the data sets. In addition, various statistical tests such as tests for linearity, slope, intercept or correlation coefficient can be generated between two strings of data. Box and Whisker, Scatter and other plots can be employed. Time series plots can help identify the following trends:

- Large jumps or dips in concentrations;
- Periodicity of peaks within a month or quarter;
- Expected or unexpected relationships among species.

Wind Rose Plots - Recently the TCAPCD has purchased a wind rose program that will accept pollutant data. The wind direction, wind speed and pollutant data will be input into the program and wind rose which show the relative direction and speed of pollutants (transport) will be graphically displayed.

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24.0 Reconciliation with Data Quality Objectives

The DQOs for the air toxics monitoring network were developed in Section 7. This is stated below.

Determine the highest concentrations expected to occur in the area covered by the network, i.e., to verify the spatial and temporal characteristics of HAPs within the city.

This section of the QAPP will outline the assessment procedures that TBRATS planning team will follow to determine whether the monitors and laboratory analyses are producing data that comply with the stated goals. This section will then clearly state what action will be taken as a result of the assessment process. Such an assessment is termed a Data Quality Assessment (DQA) and is thoroughly described in *EPA QA/G-9: Guidance for Data Quality Assessment*¹.

For the stated DQO, the assessment process must follow statistical routines. The following five steps will discuss how this will be achieved.

24.1 Five Steps of DQA Process

As described in *EPA QA/G-9*, the DQA process is comprised of five steps. The steps are detailed below.

24.1.1 Review DQOs and Sampling Design

Section 7 of this QAPP contains the details for the development of the DQOs, including defining the objectives of the air toxics monitoring network, and developing limits on the decision errors. Section 10 of this QAPP contains the details for the sampling design, including the rationale for the design, the design assumptions, and the sampling locations and frequency. If any deviations from the sampling design have occurred, these will be indicated and their potential effect carefully considered throughout the entire DQA.

24.1.2 Conduct Preliminary Data Review

A preliminary data review will be performed to uncover potential limitations to using the data, to reveal outliers, and generally to explore the basic structure of the data. The first step is to review the quality assurance reports. The second step is to calculate basic summary statistics, generate graphical presentations of the data, and review these summary statistics and graphs.

Review Quality Assurance Reports – TBRATS planning team will review all relevant quality assurance reports, internal and external, that describe the data collection and reporting process. Particular attention will be directed to looking for anomalies in recorded data, missing values,

and any deviations from standard operating procedures. This is a qualitative review. However, any concerns will be further investigated in the next two steps.

24.1.3 Select the Statistical Test

TBRATS planning team will generate summary statistics for each of its primary and QA samplers. The summary statistics will be calculated at the annual level and will include only valid samples. These following statistical tests will be performed:

- Test to examine distribution of the data
- Simple annual and 3-year averages of all pollutants for examination of trends
- Examination of bias and precision of the data
- Seasonal averages to determine any seasonal variability

Particular attention will be given to the impact on the statistics caused by the observations noted in the quality assurance review. In fact, the planning team may evaluate the influence of a potential outlier by evaluating the change in the summary statistics resulting from exclusion of the outlier.

TBRATS planning team will generate some graphics to present the results from the summary statistics and to show the spatial continuity over the Tampa Bay region. Maps will be created for the annual means, maxima, and interquartile ranges. The maps will help uncover potential outliers and will help in the network design review. Additionally, basic histograms will be generated for each of the primary and QA samplers and for the percent difference at the collocated sites. The histograms will be useful in identifying anomalies and evaluating the normality assumption in the measurement errors. GIS spatial analysis may be performed, if additional resources are provided, to see if meteorology and topography have any influence on the concentrations.

24.1.4 Verify Assumptions of Statistical Test.

There are no NAAQS to compare with air toxics. Therefore, verification of the data must be done against estimated values, such as models. However, before this can occur, the distribution, tests for trends, tests for outliers must be examined.

Normal distribution for measurement error - Assuming that measurement errors are normally distributed is common in environmental monitoring. The planning team has not investigated the sensitivity of the statistical test to violation of this assumption; although, small departures from normality generally do not create serious problems. The planning team will evaluate the reasonableness of the normality assumption by reviewing a normal probability plot and employing the Coefficient of Variance Test. If the plot or statistics indicate possible violations

of normality, the planning team may need to determine the sensitivity of the DQOs to departures in normality.

Trends Analysis - It is recommended that a simple linear regression test be performed to observe the temporal variations in the data sets. Air toxics data can be roughly divided into two categories: Point and area sources. In terms of area sources, of which many of these may be mobile sources, one would assume that mobile related toxics would vary with the diurnal variations of traffic in urban and suburban environment. The linear regression test would provide information on whether certain compounds are tied to mobile sources. For instance, benzene is identified as major mobile HAP. If a linear regression is performed against a compound whose source is unknown, then a small correlation coefficient would provide information on its possible source. In addition to the linear regression test, it is recommended that annual and 3-year average trend plots be generated. These plots can give a long-term temporal information.

Measurement precision and bias - For each sampling system, the planning team will review the 95% confidence limits. If any exceed 10%, the planning team may need to determine the sensitivity of the DQOs to larger levels of measurement imprecision.

24.1.5 Draw Conclusions from the Data

If the sampling design and the statistical test bear out, it can be assumed that the network design and the uncertainty of the data are acceptable. This conclusion can then be written in the Annual Report to management. Management may then decide whether to perform risk assessments, allow the State and EPA to analyze the data or work closely with the nearby university to determine whether this data can be used to assess conclusion from health effects studies.

24.2 Action Plan Based on Conclusions from DQA

A thorough DQA process will be completed during 2002. For this section, the planning team will assume that the assumptions used for developing the DQOs have been met. If this is not the case, we must first revisit the impact on the bias and precision limits determined by the DQO process.

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Appendix A

Glossary

The following glossary is taken from the document *EPA Guidance For Quality Assurance Project Plans EPA QA/G-5*

GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS

Acceptance criteria — Specified limits placed on characteristics of an item, process, or service defined in requirements documents. (ASQC Definitions)

Accuracy — A measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; the EPA recommends using the terms “*precision*” and “*bias*,” rather than “accuracy,” to convey the information usually associated with accuracy. Refer to *Appendix D, Data Quality Indicators* for a more detailed definition.

Activity — An all-inclusive term describing a specific set of operations of related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication), that, in total, result in a product or service.

Assessment — The evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance.

Audit (quality) — A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

Audit of Data Quality (ADQ) — A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Authenticate — The act of establishing an item as genuine, valid, or authoritative.

Bias — The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample’s true value). Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Blank — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results. A sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

Calibration — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Calibration drift — The deviation in instrument response from a reference value over a period of time before recalibration.

Certification — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

Chain of custody — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Characteristic — Any property or attribute of a datum, item, process, or service that is distinct, describable, and/or measurable.

Check standard — A standard prepared independently of the calibration standards and analyzed exactly like the samples. Check standard results are used to estimate analytical precision and to indicate the presence of bias due to the calibration of the analytical system.

Collocated samples — Two or more portions collected at the same point in time and space so as to be considered identical. These samples are also known as field replicates and should be identified as such.

Comparability — A measure of the confidence with which one data set or method can be compared to another.

Completeness — A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Computer program — A sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution. A computer program may be stored on magnetic media and referred to as “software,” or it may be stored permanently on computer chips, referred to as “firmware.” Computer programs covered in a QAPP are those used for design analysis, data acquisition, data reduction, data storage (databases), operation or control, and database or document control registers when used as the controlled source of quality information.

Confidence Interval — The numerical interval constructed around a point estimate of a population parameter, combined with a probability statement (the confidence coefficient) linking it to the population's true parameter value. If the same confidence interval construction technique and assumptions are used to calculate future intervals, they will include the unknown population parameter with the same specified probability.

Confidentiality procedure — A procedure used to protect confidential business information (including proprietary data and personnel records) from unauthorized access.

Configuration — The functional, physical, and procedural characteristics of an item, experiment, or document.

Conformance — An affirmative indication or judgment that a product or service has met the requirements of the relevant specification, contract, or regulation; also, the state of meeting the requirements.

Consensus standard — A standard established by a group representing a cross section of a particular industry or trade, or a part thereof.

Contractor — Any organization or individual contracting to furnish services or items or to perform work.

Corrective action — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Correlation coefficient — A number between -1 and 1 that indicates the degree of linearity between two variables or sets of numbers. The closer to -1 or +1, the stronger the linear relationship between the two (i.e., the better the correlation). Values close to zero suggest no correlation between the two variables. The most common correlation coefficient is the product-moment, a measure of the degree of linear relationship between two variables.

Data of known quality — Data that have the qualitative and quantitative components associated with their derivation documented appropriately for their intended use, and when such documentation is verifiable and defensible.

Data Quality Assessment (DQA) — The scientific and statistical evaluation of data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use. The five steps of the DQA Process include: 1) reviewing the DQOs and sampling design, 2) conducting a preliminary data review, 3) selecting the statistical test, 4) verifying the assumptions of the statistical test, and 5) drawing conclusions from the data.

Data Quality Indicators (DQIs) — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy (bias is preferred), comparability, completeness, representativeness.

Data Quality Objectives (DQOs) — The qualitative and quantitative statements derived from the DQO Process that clarify study's technical and quality objectives, define the appropriate type of data, and specify 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.

Data Quality Objectives (DQO) Process — A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. The key elements of the DQO process include:

1. state the problem,
2. identify the decision,
3. identify the inputs to the decision,
4. define the boundaries of the study,
5. develop a decision rule,
6. specify tolerable limits on decision errors, and
7. optimize the design for obtaining data.

DQOs are the qualitative and quantitative outputs from the DQO Process.

Data reduction — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

Data usability — The process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Deficiency — An unauthorized deviation from acceptable procedures or practices, or a defect in an item.

Demonstrated capability — The capability to meet a procurement's technical and quality specifications through evidence presented by the supplier to substantiate its claims and in a manner defined by the customer.

Design — The specifications, drawings, design criteria, and performance requirements. Also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

Design change — Any revision or alteration of the technical requirements defined by approved and issued design output documents and approved and issued changes thereto.

Design review — A documented evaluation by a team, including personnel such as the responsible designers, the client for whom the work or product is being designed, and a quality assurance (QA) representative but excluding the original designers, to determine if a proposed design will meet the established design criteria and perform as expected when implemented.

Detection Limit (DL) — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte- and matrix-specific and may be laboratory-dependent.

Distribution — 1) The appointment of an environmental contaminant at a point over time, over an area, or within a volume; 2) a probability function (density function, mass function, or distribution function) used to describe a set of observations (statistical sample) or a population from which the observations are generated.

Document — Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results.

Document control — The policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's requirements.

Duplicate samples — Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis. See also *collocated sample*.

Environmental conditions — The description of a physical medium (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Environmental data — Any parameters or pieces of information collected or produced from measurements, analyses, or models of environmental processes, conditions, and effects of pollutants on human health and the ecology, including results from laboratory analyses or from experimental systems representing such processes and conditions.

Environmental data operations — Any work performed to obtain, use, or report information pertaining to environmental processes and conditions.

Environmental monitoring — The process of measuring or collecting environmental data.

Environmental processes — Any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

Environmental programs — An all-inclusive term pertaining to any work or activities involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

Environmental technology — An all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from, or to prevent them from entering, the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this term applies to hardware-based systems; however, it can also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

Estimate — A characteristic from the sample from which inferences on parameters can be made.

Evidentiary records — Any records identified as part of litigation and subject to restricted access, custody, use, and disposal.

Expedited change — An abbreviated method of revising a document at the work location where the document is used when the normal change process would cause unnecessary or intolerable delay in the work.

Field blank — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.

Field (matrix) spike — A sample prepared at the sampling point (i.e., in the field) by adding a known mass of the target analyte to a specified amount of the sample. Field matrix spikes are used, for example, to determine the effect of the sample preservation, shipment, storage, and preparation on analyte recovery efficiency (the analytical bias).

Field split samples — Two or more representative portions taken from the same sample and submitted for analysis to different laboratories to estimate interlaboratory precision.

Financial assistance — The process by which funds are provided by one organization (usually governmental) to another organization for the purpose of performing work or furnishing services or items.

Financial assistance mechanisms include grants, cooperative agreements, and governmental interagency agreements.

Finding — An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative, and is normally accompanied by specific examples of the observed condition.

Goodness-of-fit test — The application of the chi square distribution in comparing the frequency distribution of a statistic observed in a sample with the expected frequency distribution based on some theoretical model.

Grade — The category or rank given to entities having the same functional use but different requirements for quality.

Graded approach — The process of basing the level of application of managerial controls applied to an item or work according to the intended use of the results and the degree of confidence needed in the quality of the results. (See also *Data Quality Objectives (DQO) Process*.)

Guidance — A suggested practice that is not mandatory, intended as an aid or example in complying with a standard or requirement.

Guideline — A suggested practice that is not mandatory in programs intended to comply with a standard.

Hazardous waste — Any waste material that satisfies the definition of hazardous waste given in 40 CFR 261, “Identification and Listing of Hazardous Waste.”

Holding time — The period of time a sample may be stored prior to its required analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or “flagging” of any data not meeting all of the specified acceptance criteria.

Identification error — The misidentification of an analyte. In this error type, the contaminant of concern is unidentified and the measured concentration is incorrectly assigned to another contaminant.

Independent assessment — An assessment performed by a qualified individual, group, or organization that is not a part of the organization directly performing and accountable for the work being assessed.

Inspection — The examination or measurement of an item or activity to verify conformance to specific requirements.

Internal standard — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

Item — An all-inclusive term used in place of the following: appurtenance, facility, sample, assembly, component, equipment, material, module, part, product, structure, subassembly, subsystem, system, unit, documented concepts, or data.

Laboratory split samples — Two or more representative portions taken from the same sample and analyzed by different laboratories to estimate the interlaboratory precision or variability and the data comparability.

Limit of quantitation — The minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.

Management — Those individuals directly responsible and accountable for planning, implementing, and assessing work.

Management system — A structured, nontechnical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

Matrix spike — A sample prepared by adding a known mass of a target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

May — When used in a sentence, a term denoting permission but not a necessity.

Mean (arithmetic) — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Mean squared error — A statistical term for variance added to the square of the bias.

Measurement and Testing Equipment (M&TE) — Tools, gauges, instruments, sampling devices, or systems used to calibrate, measure, test, or inspect in order to control or acquire data to verify conformance to specified requirements.

Memory effects error — The effect that a relatively high concentration sample has on the measurement of a lower concentration sample of the same analyte when the higher concentration sample precedes the lower concentration sample in the same analytical instrument.

Method — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method blank — A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

Mid-range check — A standard used to establish whether the middle of a measurement method's calibrated range is still within specifications.

Mixed waste — A hazardous waste material as defined by 40 CFR 261 Resource Conservation and Recovery Act (RCRA) and mixed with radioactive waste subject to the requirements of the Atomic Energy Act.

Must — When used in a sentence, a term denoting a requirement that has to be met.

Nonconformance — A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

Objective evidence — Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

Observation — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Organization — A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Organization structure — The responsibilities, authorities, and relationships, arranged in a pattern, through which an organization performs its functions.

Outlier — An extreme observation that is shown to have a low probability of belonging to a specified data population.

Parameter — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for "variable," "characteristic," or "property."

Peer review — A documented critical review of work generally beyond the state of the art or characterized by the existence of potential uncertainty. Conducted by qualified individuals (or an organization) who are independent of those who performed the work but collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. Peer reviews are conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements. An in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

Performance Evaluation (PE) — A type of 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.

Pollution prevention — An organized, comprehensive effort to systematically reduce or eliminate pollutants or contaminants prior to their generation or their release or discharge into the environment.

Population — The totality of items or units of material under consideration or study.

Precision — A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions expressed generally in terms of the standard deviation. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Procedure — A specified way to perform an activity.

Process — A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

Project — An organized set of activities within a program.

Qualified data — Any data that have been modified or adjusted as part of statistical or mathematical evaluation, data validation, or data verification operations.

Qualified services — An indication that suppliers providing services have been evaluated and determined to meet the technical and quality requirements of the client as provided by approved procurement documents and demonstrated by the supplier to the client's satisfaction.

Quality — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

Quality Assurance (QA) — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Assurance Program Description/Plan — See *quality management plan*.

Quality Assurance Project Plan (QAPP) — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. The QAPP components are divided into four classes: 1) Project Management, 2) Measurement/Data Acquisition, 3) Assessment/Oversight, and 4) Data Validation and Usability. Guidance and requirements on preparation of QAPPs can be found in EPA QA/R-5 and QA/G-5.

Quality Control (QC) — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. The system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring the results are of acceptable quality.

Quality control (QC) sample — An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality improvement — A management program for improving the quality of operations. Such management programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

Quality management — That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

Quality Management Plan (QMP) — A formal document that describes the quality system in terms of the organization's structure, the functional responsibilities of management and staff, the lines of authority, and the required interfaces for those planning, implementing, and assessing all activities conducted.

Quality system — A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality

system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC).

Radioactive waste — Waste material containing, or contaminated by, radio nuclides, subject to the requirements of the Atomic Energy Act.

Readiness review — A systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

Record (quality) — A document that furnishes objective evidence of the quality of items or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data recording media.

Recovery — The act of determining whether or not the methodology measures all of the analyte contained in a sample. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Remediation — The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health.

Repeatability — The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

Reporting limit — The lowest concentration or amount of the target analyte required to be reported from a data collection project. Reporting limits are generally greater than detection limits and are usually not associated with a probability level.

Representativeness — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition. See also *Appendix D, Data Quality Indicators*.

Reproducibility — The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

Requirement — A formal statement of a need and the expected manner in which it is to be met.

Research (applied) — A process, the objective of which is to gain the knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Research (basic) — A process, the objective of which is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Research development/demonstration — The systematic use of the knowledge and understanding gained from research and directed toward the production of useful materials, devices, systems, or methods, including prototypes and processes.

Round-robin study — A method validation study involving a predetermined number of laboratories or analysts, all analyzing the same sample(s) by the same method. In a round-robin study, all results are

compared and used to develop summary statistics such as interlaboratory precision and method bias or recovery efficiency.

Ruggedness study — The carefully ordered testing of an analytical method while making slight variations in test conditions (as might be expected in routine use) to determine how such variations affect test results. If a variation affects the results significantly, the method restrictions are tightened to minimize this variability.

Scientific method — The principles and processes regarded as necessary for scientific investigation, including rules for concept or hypothesis formulation, conduct of experiments, and validation of hypotheses by analysis of observations.

Self-assessment — The assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

Sensitivity — the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Refer to *Appendix D, Data Quality Indicators*, for a more detailed definition.

Service — The result generated by activities at the interface between the supplier and the customer, and the supplier internal activities to meet customer needs. Such activities in environmental programs include design, inspection, laboratory and/or field analysis, repair, and installation.

Shall — A term denoting a requirement that is mandatory whenever the criterion for conformance with the specification permits no deviation. This term does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Should — A term denoting a guideline or recommendation whenever noncompliance with the specification is permissible.

Significant condition — Any state, status, incident, or situation of an environmental process or condition, or environmental technology in which the work being performed will be adversely affected sufficiently to require corrective action to satisfy quality objectives or specifications and safety requirements.

Software life cycle — The period of time that starts when a software product is conceived and ends when the software product is no longer available for routine use. The software life cycle typically includes a requirement phase, a design phase, an implementation phase, a test phase, an installation and check-out phase, an operation and maintenance phase, and sometimes a retirement phase.

Source reduction — Any practice that reduces the quantity of hazardous substances, contaminants, or pollutants.

Span check — A standard used to establish that a measurement method is not deviating from its calibrated range.

Specification — A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

Spike — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

Split samples — Two or more representative portions taken from one sample in the field or in the laboratory and analyzed by different analysts or laboratories. Split samples are quality control (QC) samples that are used to assess analytical variability and comparability.

Standard deviation — A measure of the dispersion or imprecision of a sample or population distribution expressed as the positive square root of the variance and has the same unit of measurement as the mean.

Standard Operating Procedure (SOP) — A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

Supplier — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surrogate spike or analyte — A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.

Surveillance (quality) — Continual or frequent monitoring and verification of the status of an entity and the analysis of records to ensure that specified requirements are being fulfilled.

Technical review — A documented critical review of work that has been performed within the state of the art. The review is accomplished by one or more qualified reviewers who are independent of those who performed the work but are collectively equivalent in technical expertise to those who performed the original work. The review is an in-depth analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that established requirements have been satisfied.

Technical Systems Audit (TSA) — A thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system.

Traceability — The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

Trip blank — A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

Validation — Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled. In design and development, validation concerns the process of examining a product or result to determine conformance to user needs. See also *Appendix G, Data Management*.

Variance (statistical) — A measure or dispersion of a sample or population distribution. Population variance is the sum of squares of deviation from the mean divided by the population size (number of elements). Sample variance is the sum of squares of deviations from the mean divided by the degrees of freedom (number of observations minus one).

Verification — Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. In design and development, verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity

