United States
Environmental Protection
Agency
Air

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

EPA-454/R-01-007
June 2001

Quality Assurance Guidance Document

Quality Assurance Project Plan for the Air Toxics Monitoring Program

Foreword

EPA policy requires that all projects involving the generation, acquisition, and use of environmental data be planned and documented and have an Agency-approved quality assurance project plan or QAPP prior to the start of data collection. The primary purpose of the QAPP is to provide an overview of the project, describe the need for the measurements, and define QA/QC activities to be applied to the project, all within a single document. The QAPP should be detailed enough to provide a clear description of every aspect of the project and include information for every member of the project staff, including site operators, lab staff, and data reviewers. The QAPP facilitates communication among clients, data users, project staff, management, and external reviewers. Effective implementation of the QAPP assists project managers in keeping projects on schedule and within the resource budget. Agency QA policy is described in the Quality Manual and EPA QA/R-1, *EPA Quality System Requirements for Environmental Programs.*

The following document represents a draft model Quality Assurance Project Plan (QAPP) for the environmental data operations for Air Toxics Monitoring Program (ATMP). The Office of Air Quality Planning and Standards (OAQPS) staff developed this Model QAPP to serve as an example of the type of information and detail necessary for the documents that will submitted by state and local organizations involved in their ATMP. Please review this document and forward your comments and suggestions to the persons listed in the Acknowledgment Section.

This draft model QAPP was generated using the EPA QA regulations and guidance as described in *EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans* and the accompanying document, *EPA QA/G-5, Guidance for Quality Assurance Project Plans.* All pertinent elements of the QAPP regulations and guidance are addressed in this model. **The model also contains background information and a rationale for each element which are excerpts from *EPA QA/G-5* and are included in text brackets (as seen above), usually found at the beginning of a section or subsection.**

The Model QAPP must not and can not be referenced verbatim. Data in the tables should not be used by organizations to meet the data quality needs for their ATMP. These are provided as examples only. **Therefore, state and local organizations should develop their own QAPPs that meet their needs.**

The Standard Operation Procedures (SOPs) listed in the Table of Contents are a guidance document developed by OAQPS for the Air Toxics Pilot Project. It is the outcome of work by the Air Toxics Pilot Laboratory Sub-committee, headed by Joann Rice and Sharon Nizich. The guidance actually outlines the preferred guideline and direction for air toxics monitoring and should be used by the air toxics community as much as possible. The guidance document has appendices, which are the EPA's Toxic Organic (TO) Compendia, which had been written earlier. OAQPS has not developed SOPs for this project because it would be difficult to write SOPs for all of the different field and laboratory instruments that are available. The TO Compendia are useful as guidance only. **SOPs must be developed by the State and Local Agencies for their individual programs.**

Acknowledgments

This Model QAPP is the product of the EPA's Office of Air Quality Planning and Standards. The development and review of the material found in this document was accomplished through the activities of the air toxics QA and Data Analysis Workgroup. The following individuals are acknowledged for their contributions.

Principle Authors

Dennis Mikel, OAQPS-EMAD-MQAG, Research Triangle Park, North Carolina
Michael Papp, OAQPS-EMAD-MQAG, Research Triangle Park, ,North Carolina

Reviewers

EPA Regions

Region	
1	Peter Kahn
4	Van Shrieves
10	Keith Rose, Ginna Grepo-Grove

Office of Air Quality Planning and Standards

Sharon Nizich, JoAnn Rice

State and Local Agencies

MaryAnn Heindorf, State of Michigan
Alain Watson, Pinellas County Department of Environmental Management

Other Organizations

Donna Kenski, Lake Michigan Air Directors Consortium

Comments and questions can be directed to:

Dennis Mikel, OAQPS, RTP,NC mikel.dennisk@epa.gov

Acronyms and Abbreviations

AIRS	Aerometric Information Retrieval System
ATMP	Air Toxics Monitoring Program
ANSI	American National Standards Institute
APTI	Air Pollution Training Institute
ASTM	American Society for Testing and Materials
CAA	Clean Air Act
CFR	Code of Federal Regulations
COC	chain of custody
DAS	data acquisition system
DQA	data quality assessment
DQOs	data quality objectives
EDO	environmental data operation
EMAD	Emissions, Monitoring, and Analysis Division
EPA	Environmental Protection Agency
FIPS	Federal Information Processing Standards
GIS	geographical information systems
GLP	good laboratory practice
HVAC	Heating and Ventilating Air Conditioning Unit
IO	InOrganic
LAN	local area network
LIMS	Laboratory Information Management System
MPA	monitoring planning area
MQOs	measurement quality objectives
MSA	metropolitan statistical area
MSR	management system review
NAAQS	National Ambient Air Quality Standards
NAMS	national air monitoring station
NIST	National Institute of Standards and Technology
OAQPS	Office of Air Quality Planning and Standards
ORD	Office of Research and Development
PC	personal computer
PD	percent difference
PTFE	polytetrafluoroethylene
PUF	poly-urethane foam
QA/QC	quality assurance/quality control
QA	quality assurance
QAAR	quality assurance annual report
QAD	quality assurance division director
QAM	quality assurance manager
QAO	quality assurance officer
QAPP	quality assurance project plan
QMP	quality management plan
SIPS	State Implementation Plans
SLAMS	state and local monitoring stations
SOP	standard operating procedure

SPMS	special purpose monitoring stations
SVOC	Semi-Volatile Organic Compounds
SYSOP	system operator
TCAPCD	Toxa City Air Pollution Control District
TO	Toxic Organic
TSA	technical system audit
TSP	total suspended particulate
UATS	Urban Air Toxics Strategy
VOC	volatile organic compound
WAM	Work Assignment Manager

Tables

Figures

1.0 QA Project Plan Identification and Approval

The purpose of the approval sheet is to enable officials to document their approval of the QAPP. The title page (along with the organization chart) also identifies the key project officials for the work. The title and approval sheet should also indicate the date of the revision and a document number, if appropriate.

Title: *Toxa City Air Pollution Control District Project Plan for the air toxics ambient air monitoring program.*

The attached QAPP for the ATMP is hereby recommended for approval and commits the Department to follow the elements described within.

Toxa City Air Pollution Control District

1) Signature: _____Date:_____
Dr. Melvin Thomas - Air Pollution Control Officer

2) Signature: _____Date:_____
Russell Kuntz - QA Division Director

EPA Region 11

1) Signature: _____Date:_____
Dennis Mickelson-Technical Project Officer - Air Monitoring Branch

2) Signature: _____Date:_____
Benjamin T. Zachary - QA Officer - QA Branch

2.0 Table of Contents

The table of contents lists all the elements, references, and appendices contained in a QAPP, including a list of tables and a list of figures that are used in the text. The major headings for most QAPPs should closely follow the list of required elements. While the exact format of the QAPP does not have to follow the sequence given here, it is generally more convenient to do so, and it provides a standard format to the QAPP reviewer. Moreover, consistency in the format makes the document more familiar to users, who can expect to find a specific item in the same place in every QAPP. The table of contents of the QAPP may include a document control component. This information should appear in the upper right-hand corner of each page of the QAPP when document control format is desired.

Appendices

3.0 Distribution

All the persons and document files designated to receive copies of the QAPP, and any planned future revisions, need to be listed in the QAPP. This list, together with the document control information, will help the project manager ensure that all key personnel in the implementation of the QAPP have up-to-date copies of the plan. A typical distribution list appears in Table 3-1

A hardcopy of this QAPP has been distributed to the individuals in Table 3-1. The document is also available on the Internet at http://www.toxacity.apcd.gov.

Table 3.1 Distribution List

Name	Position	Division/Branch
Toxa City Air Pollution Control District		
Dr. Melvin Thomas	Air Pollution Control Officer	TCAPCD
Russell Kuntz	QA Division Director	QA Division
John Holstine	QA Officer	QA Division
Thomas Sutherland	QA Technician	QA Division
Daniel Willis	Air Division Director	Air Division
Holly J. Webster	Ambient Air Monitoring Branch Chief	Technical/ Ambient Air Monitoring
James Courtney	Field Technician	Technical/ Ambient Air Monitoring
Robert Kirk	Field Technician	Technical/ Ambient Air Monitoring
Joe L. Craig	Field Technician	Technical/ Ambient Air Monitoring
Kent Field	Data Manager	Technical/ Ambient Air Monitoring
Alexander Barnett	Program Support Division Director	Program Support
Janet Hoppert	Shipping/Receiving Branch Chief	Program Support/Shipping &Rec.
David Bush	Clerk	Program Support/Shipping &Rec.
Gary Arcemont	Laboratory Branch Chief	Technical/Laboratory
Lisa Killion	Lab Technician	Technical/Laboratory
Robert Renelle	Lab Technician	Technical/Laboratory
Mark Fredrickson	Lab Technician	Technical/Laboratory
EPA Region 11		
Dennis Mickelson	QA Officer	Air/ Air Quality Monitoring
Benjamin T. Zachary	EPA Project Officer	Air/Quality Assurance

4.0 Project/Task Organization

The purpose of the project organization is to provide EPA and other involved parties with a clear understanding of the role that each party plays in the investigation or study and to provide the lines of authority and reporting for the project.

4.1 Roles and Responsibilities

The specific roles, activities, and responsibilities of participants, as well as the internal lines of authority and communication within and between organizations, should be detailed. The position of the QA Manager or QA Officer should be described. Include the principal data users, the decision-maker, project manager, QA manager, and all persons responsible for implementation of the QAPP. Also included should be the person responsible for maintaining the QAPP and any individual approving deliverables other than the project manager. A concise chart showing the project organization, the lines of responsibility, and the lines of communication should be presented. For complex projects, it may be useful to include more than one chart—one for the overall project (with at least the primary contact) and others for each organization.

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 follow.

4.1.1 Office of Air Quality Planning and Standards

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 and develops national standards; works with State and local agencies to develop plans for meeting these standards; 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.

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 over 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;
- rendering technical assistance to the EPA Regional Offices and air pollution monitoring community.

4.1.2 EPA Region 11 Office

The EPA Regional Offices will 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 Regional Offices, 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.

Toxa City will direct all technical and QA questions to Region 11.

4.1.3 Toxa City Air Pollution Control District

40 CFR Part 58 defines a State Agency as "the air pollution control agency primarily responsible for the development and implementation of a plan under the Act (CAA)". Section 302 of the CAA provides a more detailed description of the air pollution control agency.

40 CFR Part 58 defines the Local Agency as "any local government agency, other than the state agency, which is charged with the responsibility for carrying out a portion of the plan (SIP)".

The major responsibility of State and local agencies is the implementation of a satisfactory monitoring program, which would naturally include the implementation of an appropriate quality assurance program. It is the responsibility of State and local agencies to implement quality assurance programs in all phases of the environmental data operation (EDO), including the field, their own laboratories, and in any consulting and contractor laboratories which they may use to obtain data. An EDO is defined as work performed to obtain, use, or report information pertaining to environmental processes or conditions.

Figure 4.1 represents the organizational structure of the areas of the Toxa City Air Pollution Control District (TCAPCD or the District) that are responsible for the activities of the air toxics ambient air quality monitoring program. The following information lists the specific responsibilities of each individual and are grouped by functions of the Directors Office, and the divisions related to Quality Assurance, Technical Support, and Program Support.

4.1.3.1 Directors Office

Air Pollution Control Director - Dr. Melvin Thomas

The Director has overall responsibility for managing the Toxa City Air Pollution Control District according to policy. The direct responsibility for assuring data quality rests with management. Ultimately, the Director is responsible for establishing QA policy and for resolving QA issues identified through the QA program. Major QA related responsibilities of the Director include:

- approving the budget and planning processes;
- assuring that the District develops and maintains a current and germane quality system;
- assuring that the District develops and maintains a current air toxics QAPP and ensures adherence to the document by staff, and where appropriate, other extramural cooperators;
- establishing policies to ensure that QA requirements are incorporated in all environmental data operations;
- maintaining an active line of communication with the QA and technical managers;
- conducting management systems reviews.

The Director delegates the responsibility of QA development and implementation in accordance with District policy to the Division Directors. Oversight of the District's QA program is delegated to the QA Division Director.

4.1.3.2 QA Division

QA Division Director (QAD) - Russell Kuntz

The QA Division Director is the delegated manager of the District's QA Program. He has direct access to the Director on all matters pertaining to quality assurance. The main responsibility of the QAD is QA oversight, and ensuring that all personnel understand the District's QA policy and all pertinent EPA QA policies and regulations specific to the Ambient Air Quality Monitoring Program. The QAD provides technical support and reviews and approves QA products. Responsibilities include:

- developing and interpreting District QA policy and revising it as necessary;
- developing a QA Annual Report for the Director;
- reviewing acquisition packages (contracts, grants, cooperative agreements, inter-agency agreements) to determine the necessary QA requirements;
- developing QA budgets;
- assisting staff scientists and project managers in developing QA documentation and in providing answers to technical questions;
- ensuring that all personnel involved in environmental data operations have access to any training or QA information needed to be knowledgeable in QA requirements, protocols, and technology of that activity;
- reviewing and approving the QAPP for the ATMP;
- ensuring that environmental data operations are covered by appropriate QA planning documentation (e.g., QA project plans and data quality objectives);
- ensuring that Management System Reviews (MSRs), assessments and audits are scheduled and completed, and at times, conducting or participating in these QA activities;
- tracking the QA/QC status of all programs;
- recommending required management-level corrective actions;
- serving as the program's QA liaison with EPA Regional QA Managers or QA Officers and the Regional Project Officer.

The QAD has the authority to carry out these responsibilities and to bring to the attention of the Director any issues associated with these responsibilities. The QAD delegates the responsibility of QA development and implementation in accordance with District policy to the QA Officer and technician.

Quality Assurance Officer - John Holstine

The QA Officer is a main point of contact within the QA Division. The QA Officer's responsibilities include:

- implementing and overseeing the District's QA policy within the division;
- acting as a conduit for QA information to division staff ;
- assisting the QAD in developing QA policies and procedures;
- coordinating the input to the QA Annual Report (QAAR);
- assisting in solving QA-related problems at the lowest possible organizational level.
- ensuring that an updated QAPP is in place for all environmental data operations associated with the ATMP;
- ensuring that technical systems audits, audits of data quality, and data quality; assessments occur within the appropriate schedule and conducting or participating in these audits.
- tracking and ensuring the timely implementation of corrective actions;
- ensuring that a management system review occurs every 3 years;

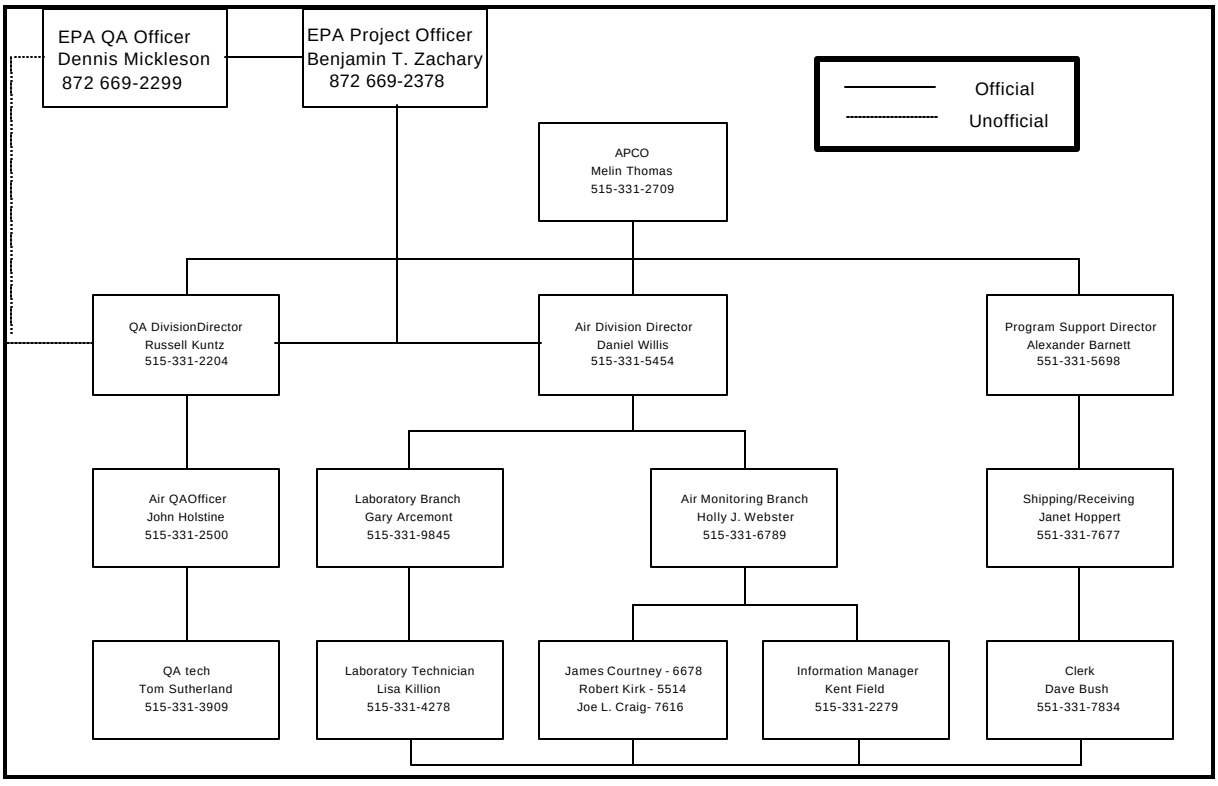

Figure 4.1 Organizational Structure of Toxa City Air Pollution Control District for air toxics monitoring.

- ensuring that technical personnel follow the QAPP
- review precision and bias in the data;

- data validation;
- ensuring that all environmental data activities effectively follow the QA/QC requirements.

The QA officer has the authority to carry out these responsibilities and to bring to the attention of his or her respective Division Director any issues related to these responsibilities. The QA officer delegates the responsibility of QA development and implementation in accordance with District policy.

Quality Assurance Technician - Thomas Sutherland

The QA technician is the staff QA contact appointed by the QA officer. Tom Sutherland is the person who performs all field and laboratory audits. Mr. Sutherland's responsibilities include:

- remaining current on District QA policy and general and specific EPA QA policies and regulations as it relates to the ATMP;
- scheduling and implementing technical systems audits;
- performing data quality assessments;
- reviewing precision and bias data;
- providing QA training to Air and Program Support Division technical staff;
- ensuring timely follow-up and corrective actions resulting from auditing and evaluation activities;
- facilitating management systems reviews implemented by the QA Officer.

4.1.3.3 Technical Division

The technical divisions are responsible for all routine environmental data operations (EDOs) for the ATMP.

Air Division Director - Daniel Willis

The Air Division Director is the delegated manager of the routine ATMP which includes the QA/QC activities that are implemented as part of normal data collection activities. Responsibilities of the Director include:

- communication with EPA Project Officers and EPA QA personnel on issues related to routine sampling and QA activities;
- understanding EPA monitoring and QA regulations and guidance, and ensuring subordinates understand and follow these regulations and guidance;
- understanding District QA policy and ensuring subordinates understand and follow the policy;
- understanding and ensuring adherence to the QAPP;
- reviewing acquisition packages (contracts, grants, cooperative agreements, inter-agency agreements) to determine the necessary QA requirements.
- developing budgets and providing program costs necessary for EPA allocation activities

- ensuring that all personnel involved in environmental data collection have access to any training or QA information needed to be knowledgeable in QA requirements, protocols, and technology;
- recommending required management-level corrective actions.

The Air Director delegates the responsibility for the development and implementation of individual monitoring programs, in accordance with District policy, to the Air Division Branch Managers.

Air Monitoring Branch Manager - Holly J. Webster
Laboratory Branch Manager - Gary Arcemont

These two branches are responsible for overseeing the routine field/lab monitoring and QA activities of the Ambient Air Quality Monitoring Program. The Branch Manager's responsibilities include:

- implementing and overseeing the District's QA policy within the branch;
- acting as a conduit for information to branch staff;
- training staff in the requirements of the QA project plan and in the evaluation of QC measurements;
- assisting staff scientists and project managers in developing network designs, field/lab standard operating procedures and appropriate field/lab QA documentation;
- ensuring that an updated QAPP is in place for all environmental data operations associated with the ATMP;
- ensuring that technical personnel follow the QAPP;
- assure that the laboratory and field staff adhere to the QA/QC requirements of the specified analytical methods and Standard Operating Procedures (SOPs);
- assure that the laboratory and field programs generate data of known and needed quality to meet the programs Data Quality Objectives (DQOs);
- review and approve of modifications on the SOPs for the field and laboratory programs. In addition, review and approval any new SOPs with the integration of new instruments.

Field Personnel - James Courtney, Robert Kirk, and Joe L. Craig

The field personnel are responsible for carrying out a required task(s) and ensuring the data quality results of the task(s) by adhering to guidance and protocol specified by the QAPP and SOPs for the field activities. Responsibilities include:

- participating in the development and implementation of the QAPP;
- participating in training and certification activities;
- writing and modifying SOPs;
- verifying that all required QA activities are performed and that measurement quality standards are met as required in the QAPP;
- performing and documenting preventative maintenance;
- documenting deviations from established procedures and methods;
- reporting all problems and corrective actions to the Branch Managers;

- assessing and reporting data quality;
- preparing and delivering reports to the Branch Manager;
- flagging suspect data;
- handling/transport of cartridges, filters, Poly Urethane Foam (PUF) plugs and other sampling needs in and out of the field;
- maintain chain-of-custody records in the field;
- calibration of samplers as specified by the QAPP and SOPs;
- loading/unloading of samples;
- packing, shipping or transporting the exposed samples in accordance with the SOPs and QAPP;
- maintain logbooks of the QA/QC activities and equipment preventive maintenance logs.

Laboratory Personnel - Lisa Killion, Robert Renelle, Mark Fredrickson

Laboratory personnel are responsible for carrying out a required task(s) and ensuring the data quality results of the task(s) by adhering to guidance and protocol specified by the air toxics QAPP and SOPs for the lab activities. Their responsibilities include:

- participating in the development and implementation of the QAPP;
- participating in training and certification activities;
- participating in the development of data quality requirements (overall and laboratory) with the appropriate QA staff;
- writing and modifying SOPs and good laboratory practices (GLPs);
- verifying that all required QA activities were performed and that measurement quality standards were met as required in the QAPP;
- following all manufacturer's specifications;
- performing and documenting preventative maintenance;
- documenting deviations from established procedures and methods;
- reporting all problems and corrective actions to the Branch Manager;
- assessing and reporting data quality;
- preparing and delivering reports to the Branch Manager;
- flagging suspect data;
- preparing and delivering data to the Information Manager.

In addition, the laboratory personnel will perform the following duties:

- sample receiving and inspection from vendor;
- pre-sampling processing, assembling (for PUF) and preparation;
- clean-up and testing of canisters or PUF cartridges;
- Di-nitro-phenyl-hydrazine (DNPH) cartridge preparation;
- preparing the chain-of-custody forms for field use;
- post-sampling receiving of samples and processing of samples (i.e., refrigeration of DNPH

cartridges and PUF cartridges);
< sample preparation, extraction, and clean-up;
< Analysis of the VOC, Semi-Volatile Organic Compounds (SVOC), metals and aldehydes according to accepted SOPs.

Information Manager- Kent Field

The Information Manager is responsible for coordinating the information management activities of the ATMP. The main responsibilities of the Information Manager include ensuring that data and information collected for the ATMP are properly captured, stored, and transmitted for use by program participants. Responsibilities include:

C developing local data management standard operating procedures;
C ensuring that information management activities are developed within reasonable time frames for review and approval;
C maintenance and upkeep of the Laboratory Information Management System (LIMS);
< storage of raw data for the analysis data, i.e., chromatograms from the various laboratory instrumentation;
< long term storage of data to Compact Disk (CD) or other digital storage media;
< upkeep of LIMS software and upgrading when needed;
C ensuring the adherence to the QAPP where applicable;
C ensuring access to data for timely reporting and interpretation processes;
C ensuring the development of data base guides (data base structures, user guidance documents);
C ensuring timely delivery of all required data to the AIRS system.

4.1.3.4 Program Support

The Program Support Division include the areas of human resources, facilities maintenance, and shipping and receiving.

Program Support Division Director - Alexander Barnett

Responsibilities of the Director include:

C communication with QA and Air Monitoring Division on specific needs;
C understanding EPA monitoring and QA regulations and guidance, and ensuring subordinates understand and follow these regulations and guidance;
C understanding District QA policy and ensuring subordinates understand and follow the policy;
C understanding and ensuring adherence to the QAPP as it relates to program support activities;
C ensuring that all support personnel have access to any training or QA information needed to be knowledgeable in QA requirements, protocols, and technology.

Shipping/Receiving Branch Manager - Janet Hoppert

This branch is responsible for shipping and receiving equipment, supplies and consumables for the routine field/lab monitoring and QA activities of the ATMP. The Branch Managers responsibilities include:

- implementing and overseeing the District's QA policy within the branch
- acting as a conduit for information to branch staff;
- training staff in the requirements of the QA project plan as it relates to shipping/receiving;
- assisting staff in developing standard operating procedures;
- coordinating the Branch's input to the Quality Assurance Annual Report
- ensuring that technical personnel follow the QAPP;
- reviewing and evaluating staff performance and conformance to the QAPP.

Clerk -David Bush

Mr. Bush supports for all shipping/receiving of all equipment and consumable supplies for the ATMP. Responsibilities include:

- assisting in the development of standard operating procedures for shipping/receiving;
- following SOPs for receiving, storage, chain-of-custody and transfer of filters, canisters and cartridges;
- informing appropriate field /lab staff of arrival of consumables, equipment, and samples;
- documenting, tracking, and archiving shipping/receiving records.

5.0 Problem Definition/Background

The background information provided in this element will place the problem in historical perspective, giving readers and users of the QAPP a sense of the project's purpose and position relative to other project and program phases and initiatives

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 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 meet the city's strategic goals, the TCAPCD has developed an ATMP designed to characterize, prioritize, and equitably address the impacts of HAPs on the public health and the environment. The TCAPCD seeks to address air toxics problems through a strategic combination of agencies' 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 area covered by the network, i.e., to verify the spatial and temporal characteristics of HAPs within the city.*

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)[1]. 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 TCAPCD staff reviewed the 33 HAPs list and consulted with EPA and State of North Carolina staff. After several consultations, a final list of compounds were selected. The list is based on:

< The EPA's Concept Paper[2;]
< A major portion of the 33 Unified Air Toxics Strategy (UATS) HAPs can be measured with 4 field and lab systems;
< The limitations of the State-of-the-Science instruments.

A number of compound on the UATS list are difficult to characterize or the methods have not been developed yet. These compounds will not be included in the pollutant list. If at some time in the future methods are developed for these compounds, the District may, at some point include these compounds. See Table 5-1.

Table 5.1 List of HAPs

EPA Method	Pollutants on the UATS List	Additional HAPS
Volatile Organic Compounds TO-15	benzene 1,3-butadiene carbon tetrachloride chloroform 1,2-dichloropropane 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	methyl chloride methyl bromide ethyl chloride 1,1-dichloroethene 1,1-dichloroethane 1,1,1-trichloroethane 1,1,2-trichloroethane toluene chlorobenzene ethylbenzene mxylene p-xylene styrene o-xylene 1,4-dichlorobenzene 1,2,4-trichlorobenzene hexachloro-1,3-butadiene
Metals IO-3.5	arsenic beryllium cadmium chromium lead manganese nickel	antimony cobalt selenium
Aldehydes and Ketones TO-11A	acetaldehyde formaldehyde	propionaldehyde methyl ethyl ketone
Polycyclic Aromatic Hydrocarbons TO-13A		acephthalene anthracene benzo [a] pyrene fluorene pyrene chrysene benzo [a]anthracene naphthalene

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. The SVOCs that are on this list were detected during the pilot study. Therefore, it has been determined if these compounds exist in the ambient environment, they should be quantified and identified.

5.3 Locations of Interest for HAPs

Information on air toxics is needed for both industrial/downtown and suburban areas. The major manufacturing and industrial areas are also near the mouth of the bay. There are several neighborhood that surround this areas. The TCAPCD has decided to target this area as one of the monitoring locations since neighborhood scale and exposure are objectives of this program. The other locations are suburban-oriented sites needed to characterize general exposure and temporal and spatial variability

5.3.1 Spatial and Temporal Considerations

The monitoring network will primarily emphasize long-term measures of air quality. The major part of the effort to develop air quality and emissions data, therefore, will focus on year-round information. To provide maximum flexibility in data use, however, the data collection will be based on intermittent (e.g., every sixth day) collection of 24-hour samples throughout the year. Individual 24-hour data will be stored in EPA's Aerometric Information Retrieval System (AIRS) and the District's database.

Reference

1. National Air Toxics Program: The Integrated Urban Strategy-Report to Congress, EPA Document No. 453/R-99-007, July 2000, URL Address: http://www.epa.gov/ttn/atw/urban/urbanpg.html

2. Air Toxics Monitoring Concept Paper, Draft, February 29, 2000, URL address: http://www.epa.gov/ttn/amtic/airtxfil.html

6.0 Project/Task Description

The purpose of the project/task description element is to provide the participants with a background understanding of the project and the types of activities to be conducted, including the measurements that will be taken and the associated QA/QC goals, procedures, and timetables for collecting the measurements.

6.1 Description of Work to be Performed

(1) **Measurements that are expected during the course of the project.** Describe the characteristic or property to be studied and the measurement processes and techniques that will be used to collect data.

(2) **Any special personnel and equipment requirements that may indicate the complexity of the project.** Describe any special personnel or equipment required for the specific type of work being planned or measurements being taken.

(3) **The assessment techniques needed for the project.** The degree of quality assessment activity for a project will depend on the project's complexity, duration, and objectives. A discussion of the timing of each planned assessment and a brief outline of the roles of the different parties to be involved should be included.

(4) **A schedule for the work performed.** The anticipated start and completion dates for the project should be given. In addition, this discussion should include an approximate schedule of important project milestones, such as the start of environmental measurement activities.

The measurement goal of the ATMP 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, gases and semi-volatile organics. This is accomplished by four separate collection media: canister sampling with passivated canisters, DNPH cartridges, poly-urethane foam/XAD resin and high volume sampling on an 8 x 10" quartz glass filter.

The following sections will describe the measurements required for the routine field and laboratory activities for the network.

6.2 Field Activities

Table 6.1, 6.2, 6.3 and 6.4 summarizes some of the more critical performance requirements.

Table 6.1 Design/Performance Specifications - Total Suspended Particulates - Toxic Metals

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

Table 6.2 Design/Performance Specifications - Air Canister Sampler - Volatile Organic Compounds

Equipment	Frequency	Acceptance Criteria	Reference
Canister Design Specs.	1 in 6 days	See Reference 2	See Reference 2
Size		6 liters spherical	"Vender Spec.
Medium		Passivated SUMMA electro-	"
		polished Stainless Steel Canister	"
Max Pressure		30 psig	"
Max. pressure drop		14 psig.	"
Collection efficiency		99%	"
Lower Detection Limit		compound specific, usually >0.1 ppbv	See TO-14A
Sampler Performance Specs.	1 in 6 days		
Sample Flow Rate		180 cc/min.	"Vender Spec.
Flow Regulation		1.0 cc/min.	See Reference 2
Flow Rate Precision		$\pm$10%	TO-14A
Flow Rate Accuracy		$\pm$10%	"
External Leakage		Vendor specs	NA
Internal Leakage		Vendor specs	NA
		24 hour $\pm$ 2 min accuracy	"Sec 6.1.8

Table 6.3 Design/Performance Specifications - Poly-Urethane Foam Sampler - Semi-Volatile Organic Compounds

Equipment	Frequency	Acceptance Criteria	Reference
Filter Design Specs.	1 in 6 days	See Reference 3	See Reference 3
Size		101.6 mm Spherical filter	"TO-13A Sec 11.1
		followed by 22 mm x 76 mm	"
		Plug	"
Medium		Quartz Glass Fiber Filter and	"
		Poly Urethane Foam followed	"
Pore size		by	"Sec 10.3
Filter thickness		XAD resin	"Sec 9.11
Max. pressure drop		0.3 µm	Vender Spec.
Collection efficiency		0.50 mm	NA
		600 mm Hg @ 0.2 m^3/min	
		Varies by compound	
Sampler Performance Specs.	1 in 6 days		
Sample Flow Rate		0.20 m^3/min.	"Vender Spec.
Flow Regulation		0.2 m^3/min.	"
Flow Rate Precision		$\pm$10%	"
Flow Rate Accuracy		$\pm$10%	"
External Leakage		Vendor specs	NA
Internal Leakage		Vendor specs	NA
Clock/Timer		24 hour $\pm$ 2 min accuracy	"Vender Spec.

Table 6.4 Design/Performance Specifications - Carbonyl Sampler - Aldehyde and Ketone Compounds

Equipment	Frequency	Acceptance Criteria	Reference
Filter Design Specs.	1 in 6 days	See Reference 4	See Reference 3
Size		100 mm Cylindrical Silica Gel	"TO-11A Sec 7.1
		cartridge	"
		coated with	"
Medium		2,4-Dinitro-phenyl hydrazine	
Sampler Performance Specs.	1 in 6 days		
Sample Flow Rate		0.20 m^3/min.	"Vender Spec.
Flow Regulation		0.2 m^3/min.	"
Flow Rate Precision		$\pm$10%	"
Flow Rate Accuracy		$\pm$10%	"
External Leakage		Vendor specs	NA
Internal Leakage		Vendor specs	NA
Clock/Timer		24 hour $\pm$ 2 min accuracy	"Vender Spec.

The District 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 6-4.

6.2.1 Field Measurements

Table 6.1, 6.2 6.3 and 6.4 represents the field measurements that must be collected. This table is presented in the Compendia of Organic and Inorganic Methods listed in References 1 - 4. These measurements are made by the air sampler and are stored in the instrument for downloading by the field operator during routine visits.

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, cartridge and canister integrity;
- < Stabilizing/weighing filters;
- < extraction of VOCs from canisters;
- < extraction of metals from quartz filter using hot acid/microwave extraction;
- < extraction of DNPH compounds;
- < extraction of SVOC from PUF plug, XAD-2 resin and quartz filter;
- < Analysis of samples extracted;
- < Data downloads from field samplers;
- < 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: audit, performance evaluation (PE), management systems review (MSR), 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 District's assessments.

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

Table 6.5 Assessment Schedule

Assessment Type	Assessment Agency	Frequency
Technical Systems Audit	EPA Regional Office District's QA Office	1 every 3 years Annually
Network Review	EPA Regional Office District's Air Division	1 every 3 years Annually
Performance Evaluation	State's QA office	submit "blind" samples to laboratory annually
Data Quality Assessment	State's QA Office District's QA Office	1 every 3 years Annually
Performance Audits (field)	District's QA Office	Annually
Management Systems Review	EPA Regional QA Office Districts QA Office	1 every 3 years Annually

6.5 Schedule of Activities

Table 6.6 contains a list of the critical activities required to plan, implement, and assess the air toxics program.

Table 6.6 Schedule of Critical Air Toxics Activities

Activity	Due Date	Comments
Network development	June 15, 2000	Preliminary list of sites and samplers required
Sampler order	August 12, 2000	Samplers ordered from National contract
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	October 15, 2000	Received in Shipping and Receiving District
Sampler siting/testing	November 2000	Establishment of sites and preliminary testing of samplers
Field/Laboratory Training	December 2000	Field and laboratory training activities and certification.
QAPP Submittal	October 1, 2000	QAPP submittal to EPA
QAPP Approval	October 31, 2000	Approval by EPA
Pilot testing	November-December 2000	Pilot activities to ensure efficiency of measurement system
Final Installation of 2000 sites	December 31, 1998	Sites must be established and ready to collect data
Routine Sampling Begins	January 1, 2001	Routine activities must start

6.6 Project Records

The District will establish and maintain procedures for the timely preparation, review, approval, issuance, use, control, revision and maintenance of documents and records. Table 6-7 represents the categories and types of records and documents which are applicable to document control for air toxics information. Information on key documents in each category are explained in more detail in Section 9.

Table 6.7 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 Electronic deliverables of summary analytical runs Associated QC and calibration runs
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

Reference:

1. Compendium Method for the Determination of Inorganic Compounds in Air, United States Environmental Protection Agency, June 1999, Section IO-3.
2. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-11A, January 1999
3. Compendium Method for the Determination of Toxic Organic Communes in Air, United States Environmental Protection Agency, Section TO-14A, January 1999
4. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-13A, January 1999

7.0 Quality Objectives and Criteria for Measurement Data

The purpose of this element is to document the DQOs of the project and to establish performance criteria for the mandatory systematic planning process and measurement system that will be employed in generating the data.

7.1 Data Quality Objectives (DQOs)

7.1.1 Introduction

This section provides a description of the data quality objectives for the ambient air toxics characterization in Toxa City that is currently under development. Consistent with the District'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 TCAPCD can improve the effectiveness, efficiency, and defensibility of decisions in a resource-effective manner.

It is the policy of the TCAPCD 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."[1] The DQO process is detailed in US-EPA's "Guidance for the Data Quality Objectives Process, EPA QA/G-4[1] .

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 TCAPCD will assure that the type, quantity, and quality of environmental data used in decision making will be appropriate for the intended application.

7.1.2 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:

< State the Problem
< Identify the Decision
< Identify the Inputs to the Decision
< Define the Study Boundaries
< Develop a Decision Rule
< Specify Tolerable Limits on Decision Errors
< Optimize the design

Each of these steps will be examined in the following section. Each of these steps has been performed to ensure a maximized project.

(1) State the Problem: Currently, Toxa City does not have sufficient amount of data of known and needed quality or quantity to understand the spatial and temporal characteristics of the monitoring area at a neighborhood scale. Toxa City has evidence that a number of the hazardous air pollutants regulated under the Clean Air Act are being emitted in the air shed of Toxa City. TCAPCD 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;
< provide data to support and evaluate dispersion and deposition models, and;
< establish trends and evaluate effectiveness of HAP reduction strategies.

TCAPCD feels that if it can characterize ambient concentrations and deposition in Toxa City with adequate data quality, the data will support the modeling and trends analysis goals. This is consistent with the NATA *Concept Paper*[1] 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 TCAPCD study objective is consistent with this initial goal.

The current problem is:

> ***Toxa City will develop a monitoring network to characterize HAPS, how much monitoring is needed and where to place the monitors. Toxa City 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, TCAPCD has been provided with $1,500,000, over a five year period, which is intended to cover all equipment and consumable purchases, data collection, and assessment costs. TCAPCD must determine the appropriate tradeoffs (i.e., quality, quantity, instrument sensitivity, precision, bias) to produce the desired results within the resource constraints. These tradeoffs will be documented in order to help the TCAPCD 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 TCAPCD feels it can provide a meaningful annual HAP concentration estimates of Toxa City that adequately represents the spatial and temporal characteristics of the city at a 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 Toxa City and that we continue our plans to implement an ambient air monitoring program; or our results indicate that the estimate provides an inordinate amount of uncertainty that would need to be corrected by increasing the number on monitors in Toxa City, increasing the sampling frequency, stratifying the monitoring boundaries or correcting sampling or analytical errors**.**

Table 7.1 Principal Study Questions and Alternative Actions

Principal Study Question	**Alternate Actions**
Is the ambient air HAPS concentration appropriately characterized with adequate spatial and temporal resolution and appropriate quantity and quality of data	Yes- Start implementation of the monitoring network
	No- Need more monitoring sites or need to increase the monitoring frequency, stratify boundary conditions, correct measurement errors.

(3) Identify the Input to the Decision: For this pilot study the important inputs are:

< the actual 24-hour concentration estimates of HAPS 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 helped 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 Toxa City;
< Guassian Plume and Exposure Models which indicate that certain areas of the city may have levels of pollutants that are higher than EPA's benchmark values;
< A review of the emission inventory 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 PAMS;

- 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, detectability, repeatability, and bias, and
- A number of PAMS and criteria pollutant monitoring sites available that could be used as sampling platforms.

Table 7.2 List of Top Ten HAPs in Toxa City

Pollutant	Tons Per Year (1999 est.)	Area or Point Source
1. Benzene	30,000	Area
2. Xylene	25,000	Area
3. Mercury	10,000	Point
4. Chromium	7,000	Point
5. Formaldehyde	6,590	Area and Point
6. Vinyl Chloride	4,100	Point
7. Methylene Chloride	2,220	Point
8. Trichlorethylene	950	Point
9. Naphthalene	400	Point
10 Cadmium	250	Point

(4) Define the Study Boundaries: The spatial and temporal boundaries will be based upon what can reasonably achieved within our current and predicted resources for an ambient air monitoring network

The spatial boundary, Toxa City, is described in detail in Section 10, but in general, is considered as the counties of Hillsburg and Pine Lake. Within this boundary pollutant gradients have been subjectively identified based upon proximity on known HAP emitters. These gradients will differ depending on the HAP.

The temporal condition is one year. The data is collected with the intent of providing an annual average. These averages are based on the collection of 24 hour samples collected once every 6-days.

(5) Develop a Decision Rule: Given the objective 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 which was described in an EPA technical report titled: *Data Quality Objective Guidance for the Ambient Air Toxics Characterization Pilot Study*.

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

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

where Y_{ijk} is the measured concentration, : characterizes the major endpoint of concern (e.g., an area's true annual average), "$_i$ characterizes spatial variability, $j characterizes temporal variability, ($_{ij}$ characterizes spatial-temporal interaction variability and g$_{ijk}$ characterizes sampling/analytical variability. The first three sources of variability can be considered as population variability while the last (g$_{ijk}$) 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 the sites will be operated by one field technician and samples of any particular pollutant will be sent to one 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.

(6) Specify Tolerable Limits on Decision Errors: Since this study's objective is to characterize spatial and temporal variability there is no intolerable limits 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. TCAPCD must feel comfortable that it will be able provide reasonable annual estimates of HAPs. Since "risk-based concentrations" have been established for some HAPs the planning team decided it was important to have an established and adequate level of confidence in concentrations that were reported at these levels. Since there are many HAPS, the planning team selected one that they knew contained an appreciable concentration in Toxa City (Table 7-2) , and which had a risk-based concentration that was above the method detection limit. Therefore trichloroethene was selected.

The planning team established a **baseline condition** which is:

The annual average concentration for trichloroethene is greater than the risk-base concentration of 0.61 ppbv

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

- *falsely accepting the baseline condition that the annual average concentration for trichloroethene is greater than the risk-based concentration when in truth it does not*

- *falsely rejecting the baseline condition by stating that the **annual average concentration for trichloroethene is less than the risk-based concentration** when in truth it is greater than the*

risk based concentration.

Table 7.3 also illustrates the false acceptance and false rejection decisions of this pilot study.

Table 7.3 False Acceptance and False Rejection Decisions

Decision Based on Sampling Data	**The True Condition**	
	Baseline is true	**Alternative is true**
The annual average concentration for trichloroethene is greater than the risk-based concentration of 0.61 ppbv **(This is the baseline condition)**	Correct Decision	*The true concentration is* ***not greater*** *than the risk-base concentration* **Decision error (false acceptance)**
The annual average concentration for trichloroethene is not greater than the risk-based concentration of 0.61 ppbv	*The true concentration* ***is greater*** *than the risk-based concentration* **Decision error (false rejection)**	Correct Decision

Decision errors occur due to the population and measurement uncertainty components that are discussed above.

The planning team could just have easily set up the baseline condition that the concentration was less than the risk-based concentration. In either case, the planning team wanted to guard against making a false decision that the HAP concentrations were low when in truth they were a potential health hazard. In addition, the goal of the exercise in this step was to develop a monitoring system with acceptable levels of population and measurement uncertainty (i.e., correct sampling design, sampling frequency) in order to make the decisions within tolerable levels of decision error.

The planning team then went about setting the tolerable levels of decision errors. Figure 7.1 shows the case where a decision maker considers the more severe decision error to occur above the Action Level and has labeled that as baseline. Figure 7.1, the decision performance goal diagram (DPGD) shows the case where a decision maker considers the more severe decision error to occur above the Action Level and has labeled that as baseline.

The plausible range of values based on professional judgment would be approximately the Detection Limit to 1.0 ppbv. The Action Level was 0.61 ppbv. A false rejection would be saying the parameter is less than the Action Level, when, in fact, it is really greater. A false acceptance would be saying the parameter level is above the Action Level, when, in reality, it is below the Action Level. The gray region is the area where we considered it is tolerable to make a decision error. For example, if TCAPCD decided the true parameter level was above the Action Level (0.61 ppbv) when in reality it was 0.55

ppbv. Although an error has occurred (false acceptance), it is not particularly severe because the difference of .06 ppbv on human health and financial resources is minimal. On the other hand, suppose TCAPCD decided the true parameter level was above the Action Level (0.61 ppbv) when in reality it was 0.45ppbv. Again, an error has occurred (false acceptance), but it is severe because a difference of 0.16 ppbv is considerable. In this particular case the planning team chose 0.45 ppbv as the edge of their gray region because it represented the case where errors in decision making have a great impact on

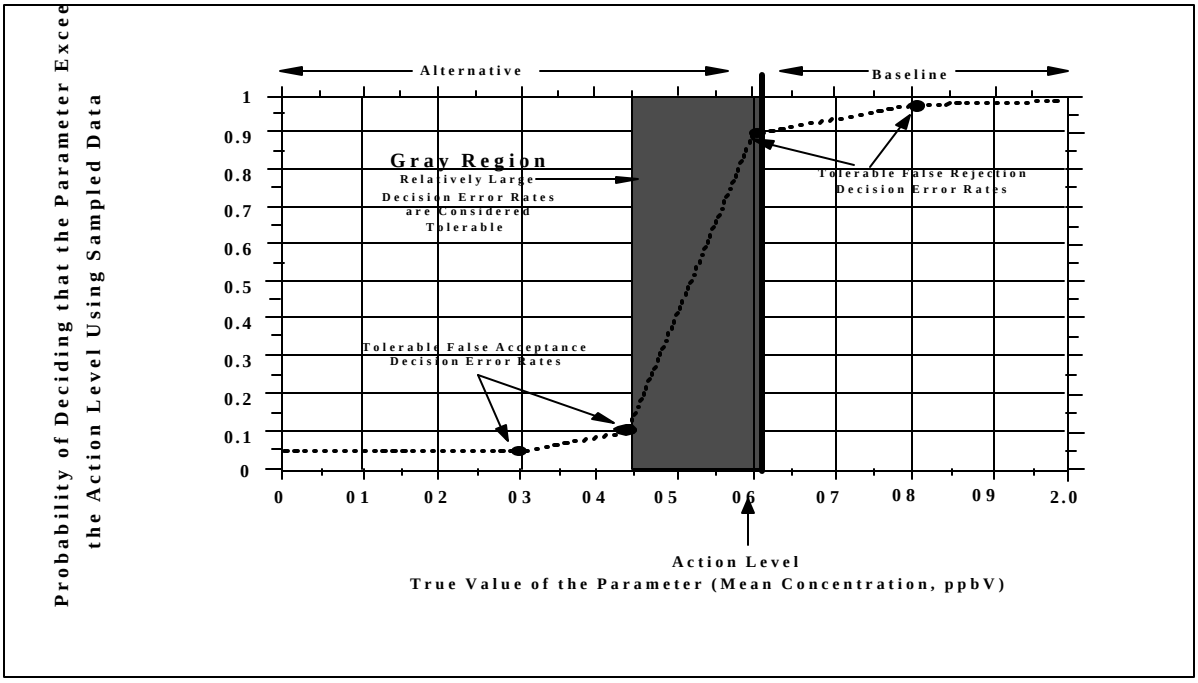

Figure 7.1 An example of a Decision Performance Goal Diagram Baseline Condition: <u>Parameter exceeds</u> the Action Level. (More severe decision error occurs above action level)

resources. The planning team then assigned risk probabilities to the chance of making decision errors for various true values of the parameter. The team agreed that, if the true value was 0.45 ppbv and they decided (from the data to be collected) that the true value exceeded 0.61 ug/m3, they were only willing to accept a 10% risk of this happening. The team then considered the implications of what adverse effect would occur if the true value was 0.3 ppbv, but they decided the parameter was greater than 0.61 ppbv. The analysis showed a additional expenditure of resources, so the planning team elected to take only a 5% risk of this happening. The Planning Team did a similar exercise with the tolerable false rejection error rates.

Summary

- The **baseline condition** (i.e., the null hypothesis [H_o]) was established as "the measured concentration for the HAP is above the risk-based concentration".
- The **gray region** was designated as that area adjacent to the Action Level where the planning team considered that the consequences of a false acceptance decision error were minimal. The planning team specified a width of 0.15ppbv for the gray region based on their preferences to guard against false

acceptance decision errors at a concentration of 0.45 ppbv (the lower bound of the gray region).

< Below the Action Level, the planning team set the maximum tolerable probability of making a false acceptance error at 10% when the true parameter was from 0.45 to 0.61 ppbv and 5% when it was below 0.45 ppbv. These limits were based on both experience and an economic analysis that showed that these decision error rates reasonably balanced the cost of additional sampling/monitoring

(7) Optimize the Design: In order to achieve the DPGD the Planning Team gathered some preliminary information from other monitoring programs and information they had available in monitoring HAPS to provide some information on the total uncertainty (population + measurement). The goal was 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 5 sites to establish the spatial and temporal variability across a gradient of pollution concentrations
< Sampling frequency of every six days in order to determine the adequacy of a annual estimate (~300 samples)

Based upon this design the DPGD can be met if total variability. Section 10 explains the sampling design in more detail.

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 which 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 District 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 7-7 lists the MQOs for pollutants to be measured in the pilot study $PM_{2.5}$ program. 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-MS	>75%	0.30
beryllium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.02
cadmium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.02
chromium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.01
lead	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.01
manganese	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.02
nickel	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.02
antimony	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.01
cobalt	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	0.01
selenium	ng/m3	10%	+/- 15%	Neighborhood Scale	ICP-MS	>75%	1.10

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

Table 7.6 Measurement Quality Objectives - Air Toxics Volatile Organics

Compound	Reporting Units	Precision (CV)	Accuracy	Representativeness	Comparability/ Method Selection	Completeness	Minimum Detection Limits[3]
benzene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.34
1,3 - butadiene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	1.00
carbon tetrachloride	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.42
chloroform	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.25
1,2–dichloropropane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.21
methylene chloride	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	1.38
tetrachloroethene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.75
tetrachloroethane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.28
trichloroethene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.45
vinyl chloride	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.48
acrylonitrile	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	1.00
1,2-dibromoethane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.05
cis-1,3,-dichloropropene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.36
trans-1,3,-dichloropropene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.06
1,2--dichloroethane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.24
1,1,2,2-tetrachloroethane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.28
methyl chloride	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.40
methyl bromide	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.53
ethyl chloride	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.19
1,1-dichloroethane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.27
1,1-dichloroethene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.50
1,1,1-trichloroethane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.62
1,1,2-trichloroethane	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.50
toluene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.99
chlorobenzene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.34
ethylbenzene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.27
xylene (isomers)	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.76/0.57
styrene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	1.64
1,4-dichlorobenzene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	0.70
1,2,4-trichlorobenzene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	NA
hexachloro-1,3-butadiene	ppbv	10%	+/- 15%	Neighborhood Scale	Gas Chromatography	>75%	NA

Table 7.7 Measurement Quality Objectives - Air Toxics Semi-Volatile Organics

Compound	Reporting Units	Precision	Accuracy	Representativeness	Comparability/ Method Selection	Completeness	Minimum Detection Limits[4]
acenaphthene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	18.0
anthracene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	21.0
benzo [a] pyrene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	31.1
fluorene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	18.5
pyrene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	23.4
chrysene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	26.7
benzo [a] anthracene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	26.3
naphthalene	pg/uL	+/- 10%	+/- 20%	Neighborhood Scale	Gas Chrom/Mass Spec.	>75%	14.0

References

1. Compendium Method for the Determination of Inorganic Compounds in Air, United States Environmental Protection Agency, June 1999, Section IO-3.
2. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-11A, January 1999
3. Compendium Method for the Determination of Toxic Organic Communes in Air, United States Environmental Protection Agency, Section TO-14A, January 1999
4. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-13A, January 1999

8.0 Special Training Requirements/Certification

The purpose of this element is to ensure that any specialized or unusual training requirements necessary to complete the projects are known and furnished and the procedures are described in sufficient detail to ensure that specific training skills can be verified, documented, and updated as necessary.

8.1 Training

Requirements for specialized training for nonroutine field sampling techniques, field analyses, laboratory analyses, or data validation should be specified. Depending on the nature of the environmental data operation, the QAPP may need to address compliance with specifically mandated training requirements.

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 District. Table 8.1 represents the general training requirements for all employees, depending upon there job classification.

Table 8.1 TCAPCD Training Requirements.

Job Classification	Training Title	Time/Frequency Requirement
Directors	Executive Development Program	As available
Branch Chief and above	Framework for Supervision	1st 6 months
	Keys to Managerial Excellence	After comp. of above
	EEO for Managers and Supervisors	As available
	Sexual Harassment	"
	Contract Administration for Supervisors	"
	40 hours of developmental activities	"
Project Officers and Above	Contract Administration	Prior to responsibility
	Contract Administration Recertification	Every three years
	EEO for Managers and Supervisors	As available
	Grants Training	Prior to responsibility
	Project Officer Training (contract/grants)	"
	Ethics in Procurement	"
	Work statements for Negotiated Procurement	"

Job Classification	Training Title	Time/Frequency Requirement
Field Personnel	24-Hour Field Safety	1st time
	8- hour Field Safety Refresher	Yearly
	8-hour First Aid/CPR	Yearly
	Blood borne pathogens	1st time
Laboratory Personnel	24- Hour Laboratory Safety	1st time
	4- Hour Refresher	Yearly
	Safety Video/Discussion	Yearly
	Chemical Spill Emergency Response	1st time
	Blood borne pathogens	1st time

8.1.1 Ambient Air Monitoring Training

Appropriate training is be available to employees supporting the Ambient Air Quality Monitoring Program, commensurate with their duties. Such training may consist of classroom lectures, workshops, tele-conferences, and on-the-job training.

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

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

Table 8.2 presents a sequence of core ambient air monitoring and QA courses for ambient air monitoring staff, and QA managers. The suggested course sequences assume little or no experience in QA/QC or air monitoring. Persons having experience in the subject matter described in the courses would select courses according to their appropriate experience level. Courses not included in the core sequence would be selected according to individual responsibilities, preferences, and available resources.

Table 8.2. Core Ambient Air Training Courses

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

* Courses recommended for QA Managers

8.2 Certification

Usually, the organizations participating in the project that are responsible for conducting training and health and safety programs are also responsible for ensuring certification. Various commercial training courses are available that meet some government regulations. Training and certification should be planned well in advance for necessary personnel prior to the implementation of the project. All certificates or documentation representing completion of specialized training should be maintained in personnel files.

For the air toxics program, the QA Division will issue training certifications for the successful completion of field, laboratory, sample custody and data management training. Certification will be based upon the qualitative and quantitative assessment of individuals adherence to the SOPs.

9.0 Documentation and Records

The purpose of this element is to define which records are critical to the project and what information needs to be included in reports, as well as the data reporting format and the document control procedures to be used. Specification of the proper reporting format, compatible with data validation, will facilitate clear, direct communication of the investigation and its conclusions and be a resource document for the design of future studies.

For the ATMP, there are number of documents and records that need to be retained. A document, from a records 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 TCAPCD follows the guidelines to ensure the public that the District's procedures are being performed within the guidelines of the Paper Reduction Act.

The following information describes the Air Pollution Control's document and records procedures for ATMP. In this QAPP regulation and guidance, the District uses the term reporting package. It is defined as 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 District under its policies and records management procedures. Table 9-1 identifies these documents and records.

9.1 Information Included in the Reporting Package

The selection of which records to include in a data reporting package must be determined based on how the data will be used. Different "levels of effort" require different supporting QA/QC documentation. For example, organizations conducting basic research have different reporting requirements from organizations collecting data in support of litigation or in compliance with permits. When possible, field and laboratory records should be integrated to provide a continuous track of reporting.

9.1.1 Routine Data Activities

The TCAPCD has a structured records management retrieval system that allows for the efficient archive and retrieval of records. The air toxics information will be included in this system. It is organized in a

similar manner to the EPA's records management system (EPA-220-B-97-003) and follows the same coding scheme in order to facilitate easy retrieval of information during EPA technical systems audits and network reviews. Table 9.1 includes the documents and records that will be filed according to the statute of limitations discussed in Section 9.3. In order to archive the information as a cohesive unit, the air toxics information will be filed under the individual codes depending on the chemical makeup of the compound. Please see Table 9.1.

Table 9.1 Air Toxics Reporting Package Information

Categories	Record/Document Types	File Codes
Management and Organization	State Implementation Plan	AIRP/217
	Reporting agency information	AIRP/237
	Organizational structure	ADMI/106
	Personnel qualifications and training	PERS/123
	Training Certification	AIRP/482
	Quality management plan	AIRP/216
	Document control plan	ADMI/307
	EPA Directives	DIRE/007
	Grant allocations	BUDG/043
	Support Contract	CONT/003
		CONT/202
Site Information	Network description	AIRP/237
	Site characterization file	AIRP/237
	Site maps	AIRP/237
	Site Pictures	AUDV/708
Environmental Data Operations	QA Project Plans	PROG/185
	Standard operating procedures (SOPs)	SAMP/223
	Field and laboratory notebooks	SAMP/502
	Sample handling/custody records	TRAN/643
	Inspection/Maintenance records	AIRP/486
Raw Data	Any original data (routine and QC data) including data entry forms	SAMP/223
	Electronic deliverables of summary analytical and associated QC and calibration runs per instrument	SAMP/224
Data Reporting	Air quality index report	AIRP/484
	Data summary reports	AIRP/484
	Journal articles/papers/presentations	PUBL/250
Data Management	Data algorithms	INFO/304
	Data management plans/flowcharts	INFO/304
	Air toxics Data	INFO/160 - INFO/173
	Data Management Systems	INFO/304 - INFO/170

Categories	Record/Document Types	File Codes
Quality Assurance	Good Laboratory Practice	COMP/322
	Network reviews	OVER/255
	Control charts	SAMP/223
	Data quality assessments	SAMP/223
	QA reports	OVER/203
	System audits	OVER/255
	Response/Corrective action reports	PROG/082
	Site Audits	OVER/658

9.1.2 Annual Summary Reports Submitted to EPA

The TCAPCD shall submit to EPA Region 11 Office, an annual summary report of all the air toxics data collected within that calender year. The report will be submitted by April 1 of each year 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.

Summary Data

- < Annual arithmetic mean, and
- < Sampling schedule used as once every 6-day schedule.

Dr. Melvin Thomas, as the senior air pollution control officer for the District, will certify that the annual summary is accurate to the best of his knowledge. This certification will be based on the various assessments and reports performed by the organization, in particular, the Quality Assurance Annual Report (QAAR). Section 21 documents the quality of the air toxics data and the effectiveness of the quality system.

9.2 Data Reporting Package Format and Documentation Control

The format of data reporting packages, whether for field or lab data, must be consistent with the requirements and procedures used for data validation and data assessment. All individual records that represent actions taken to achieve the objective of the data operation and the performance of specific QA functions are potential components of the final data reporting package. This element of the QAPP should discuss how these various components will be assembled to represent a concise and accurate record of all activities impacting data quality. The discussion should detail the recording medium for the project, guidelines for hand-recorded data (e.g., using indelible ink), procedures for correcting data (e.g., single line drawn through errors and initialed by the responsible person), and documentation control. Procedures for making revisions to technical documents should be clearly specified and the lines of authority indicated.

Table 9-1 represents the documents and records, at a minimum, that must be filed into the reporting package. The details of these various documents and records will be discussed in the appropriate sections of this document.

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, the date of 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.

9.2.1 Notebooks

The District will issue notebooks to each field and laboratory technician. This notebook will be uniquely numbered and associated with the individual and the ATMP. Although data entry forms are associated with all routine environmental data operations, the notebooks can be used to record additional information about these operations. All notebooks will be bound as well as paginated so that individual pages cannot be removed unnoticeably.

Field notebooks - Notebooks will be issued for each sampling site. These will be 3-ring binders that will contain the appropriate data forms for routine operations as well as inspection and maintenance forms and SOPs.

Lab Notebooks - Notebooks will also be issued for the laboratory. These notebooks will be uniquely numbered and associated with the ATMP. One notebook will be available for general comments/notes; others will be associated with, the temperature and humidity recording instruments, the refrigerator, calibration equipment/standards, and the analytical balances and instruments used for this program.

Sample shipping/receipt- One notebook will be issued to the shipping and receiving facility. This notebook will be uniquely numbered and associated with the ATMP. It will include standard forms and areas for free form notes.

9.2.2 Electronic data collection

In order to reduce the potential for data entry errors, automated systems will be utilized where appropriate and will record the same information that is found on data entry forms. In order to provide a back-up, a hardcopy of automated data collection information will be stored for the appropriate time frame in project files. The Information Manager will back-up analytical data acquired by each laboratory instrument including tuning, calibrations and QC sample runs associated with samples.

9.3 Data Reporting Package Archiving and Retrieval

The length of storage for the data reporting package may be governed by regulatory requirements, organizational policy, or contractual project requirements. This element of the QAPP should note the governing authority for storage of, access to, and final disposal of all records

In general, all the information listed in Table 9-1 will be retained for 5 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 5-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 5-year period, whichever is later. The District 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, 2006, unless the information is used for litigation purposes.

10.0 Sampling Design

The purpose of this element is to describe all the relevant components of the experimental design; define the key parameters to be estimated; indicate the number and type of samples expected; and describe where, when, and how samples are to be taken. The level of detail should be sufficient that a person knowledgeable in this area could understand how and why the samples will be collected. This element provides the main opportunity for QAPP reviewers to ensure that the "right" samples will be taken. Strategies such as stratification, compositing, and clustering should be discussed, and diagrams or maps showing sampling points should be included. Most of this information should be available as outputs from the final steps of the planning (DQO) process.

The purpose of this Section is to describe all of the relevant components of the monitoring network to be operated by TCAPCD, 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

This element should give anticipated start and completion dates for the project as well as anticipated dates of major milestones, such as the following:

- schedule of sampling events;
- schedule for analytical services by offsite laboratories;
- schedule for phases of sequential sampling (or testing), if applicable;
- schedule of test or trial runs; and
- schedule for peer review activities.

The use of bar charts showing time frames of various QAPP activities to identify both potential bottlenecks and the need for concurrent activities is recommended.

TCAPCD will be monitoring concentrations at five locations. The order of installation of the primary samplers has been determined based on anticipated concentrations at each of the locations. The sites with the highest anticipated concentrations will be installed first, and the collocated samplers will be installed at a later date. Table 10.1 represents the activities associated with the ordering and deployment of the primary and collocated samplers.

Table 10.1. Schedule of Air toxics Sampling-Related Activities

Activity	Due Date	Comments
Receive samplers	July 1, 2000	After receipt, begin conditioning of filters
Install samplers at site TC1	September 2000	First samplers installed. PUF and VOC
Install samplers at site TC2	September 2000	Second samplers installed: PUF, VOC, TSP
Install samplers at site TC3	October 2000	Third samplers installed. VOC, PUF, ALD
Install collocated samplers at site TC2	October 2000	First collocated samplers installed. TSP
Install samplers at site TC4		First samplers installed. PUF, TSP and VOC
Install collocated samplers at site TC3	November 2000	Second collocated samplers installed. PUF, VOC, ALD
Install samplers at TC5	December 2000	VOC sampler only
Begin routine sampling at collocated sites TC1 and TC2	January 1, 2001	Begin sampler shakedown. Make repairs/changes as needed
Begin routine sampling at collocated sites TC3 and TC4 and TC5	February 2001	
Begin sample analysis in laboratory	February 2001	Begin laboratory equipment shakedown. Make adjustments as necessary.
Report routine data to AIRS-AQS	Ongoing - due within 90 days after end of quarterly reporting period	
Performance Evaluations	Receive 1st 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

The objectives for an environmental study should be formulated in the planning stage of any investigation. The requirements and the rationale of the design for the collection of data are derived from the quantitative outputs of the DQO Process. The type of design used to collect data depends heavily on the key characteristic being investigated. For example, if the purpose of the study is to estimate overall average contamination at a site or location, the characteristic (or parameter) of interest would be the mean level of contamination. This information is identified in Step 5 of the DQO Process. The relationship of this parameter to any decision that has to be made from the data collected is obtained from Steps 2 and 3 of the DQO Process.

10.2.1 Primary Samplers

The purpose of the ATMP operated by Toxa City is to ascertain the spatial/temporal variability of the urban area. To determine whether these characteristics are quantified with sufficient confidence, Toxa City 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],Toxa City 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*, Toxa City 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 District is to have concentrations measured by a sampler be within ±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, at least one site will operate collocated samplers. Chapter 24outlines the equations that will be used to determine precision. There will be 2 analytes from each instrument that will be used to determine the bias and precision.

Field accuracy will be estimated using flow, temperature sensor and barometric checks. Laboratory accuracy will be determined by the analysis of known reference analytes prepared by independent laboratories submitted to the TCAPCD laboratory. 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, Toxa City 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*,

Toxa City 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 planning process usually recommends a specific data collection method (Step 7 of the DQO Process), but the effectiveness of this methodology rests firmly on assumptions made to establish the data collection design. Typical assumptions include the homogeneity of the medium to be sampled (for example, sludge, fine silt, or wastewater effluent), the independence in the collection of individual samples (for example, four separate samples rather than four aliquots derived from a single sample), and the stability of the conditions during sample collection (for example, the effects of a rainstorm during collection of wastewater from an industrial plant). The assumptions should have been considered during the DQO Process and should be summarized together with a contingency plan to account for exceptions to the proposed sampling plan. An important part of the contingency plan is documenting the procedures to be adopted in reporting deviations or anomalies observed after the data collection has been completed. Examples include an extreme lack of homogeneity within a physical sample or the presence of analytes that were not mentioned in the original sampling plan. Chapter 1 of EPA QA/G-9 provides an overview of sampling plans and the assumptions needed for their implementation, and EPA QA/G-5S provides more detailed guidance on the construction of sampling plans to meet the requirements generated by the DQO Process.

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 only issue at Toxa City's discretion is 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

The most appropriate plan for a particular sampling application will depend on: the practicality and feasibility (e.g., determining specific sampling locations) of the plan, the key characteristic (the parameter established in Step 5 of the DQO Process) to be estimated, and the implementation resource requirements (e.g., the costs of sample collection, transportation, and analysis).

This element of the QAPP should also describe the frequency of sampling and specific sample locations (e.g., emissions inventory, population exposure, determination of highest concentration) and sampling materials. Sometimes decisions on the number and location of samples will be made in the field; therefore, the QAPP should describe how these decisions will be driven whether by actual observations or by field screening data. When locational data are to be collected, stored, and transmitted, the methodology used must be specified and described (or referenced) and include the following:

- procedures for finding prescribed sample locations,
- contingencies for cases where prescribed locations are inaccessible,
- location bias and its assessment, and
- procedures for reporting deviations from the sampling plan.

When appropriate, a map of the sample locations should be provided and locational map coordinates supplied. EPA QA/G-5S provides nonmandatory guidance on the practicality of constructing sampling plans and references to alternative sampling procedures.

10.4.1 Sampling Design

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

< 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.

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. In addition, a Geographic Information System (GIS) software package was also utilized to help locate the samplers. Figures 10-1 and 10-2 illustrate the use of GIS for locating the samplers. Figures 10.1 shows that the highest population in the area is in the northwest and just southeast of the bay. Between these residential areas are the port facilities, power plants and the majority of the industrial sources. This knowledge were used to locate the sampling areas. The exact locations are discussed in Section 10.4.2

10.4.2 Sampling Locations

Toxa City is situated in 2 counties: Hillsburg and Pine Lake. The boundaries were determined based on (1) the 1990 census data by census tract, (2) the boundaries of the existing MSAs, and (3) the surrounding geography. Figure 10-1 shows the population and major air toxics sources for the counties which TCACPD is responsible. According to the 1990 census, the Hillsburg County has a population of

834,054 while Pine Lake county has a population of 851, 659. The population is evenly distributed through the MSA except in the downtown area (see Figure 10-1). As can be seen from figure 10-1, the two counties surround a coastal bay.

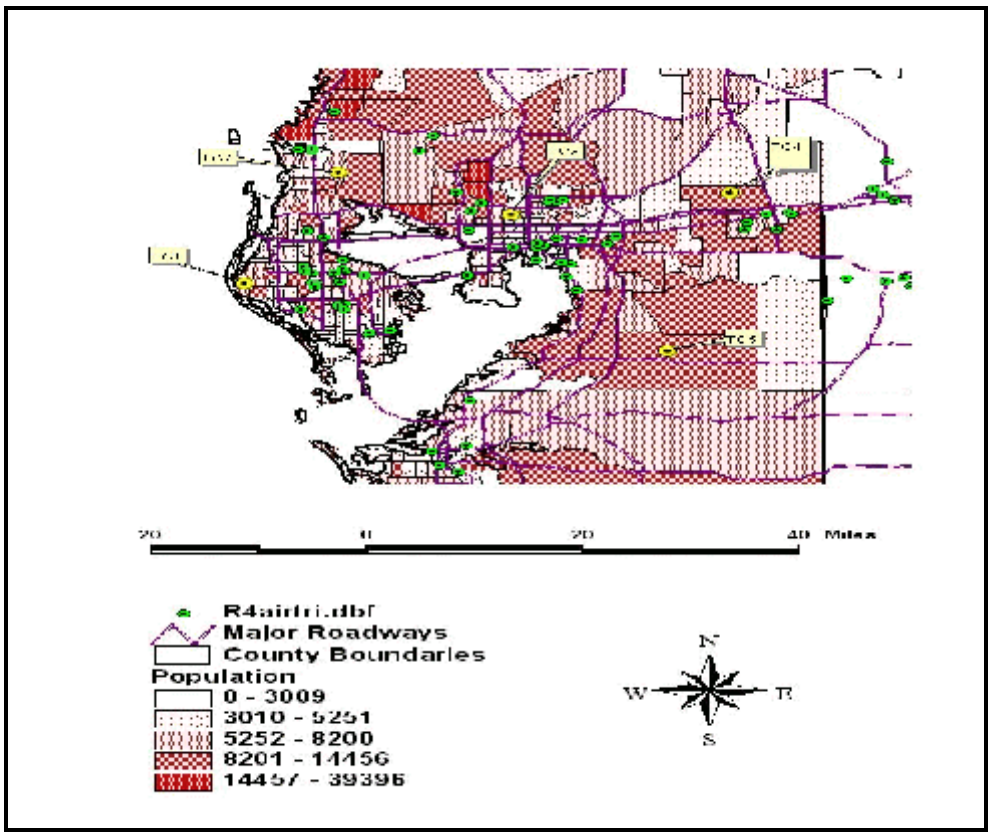

Figure 10.1 Population distribution of Toxa City

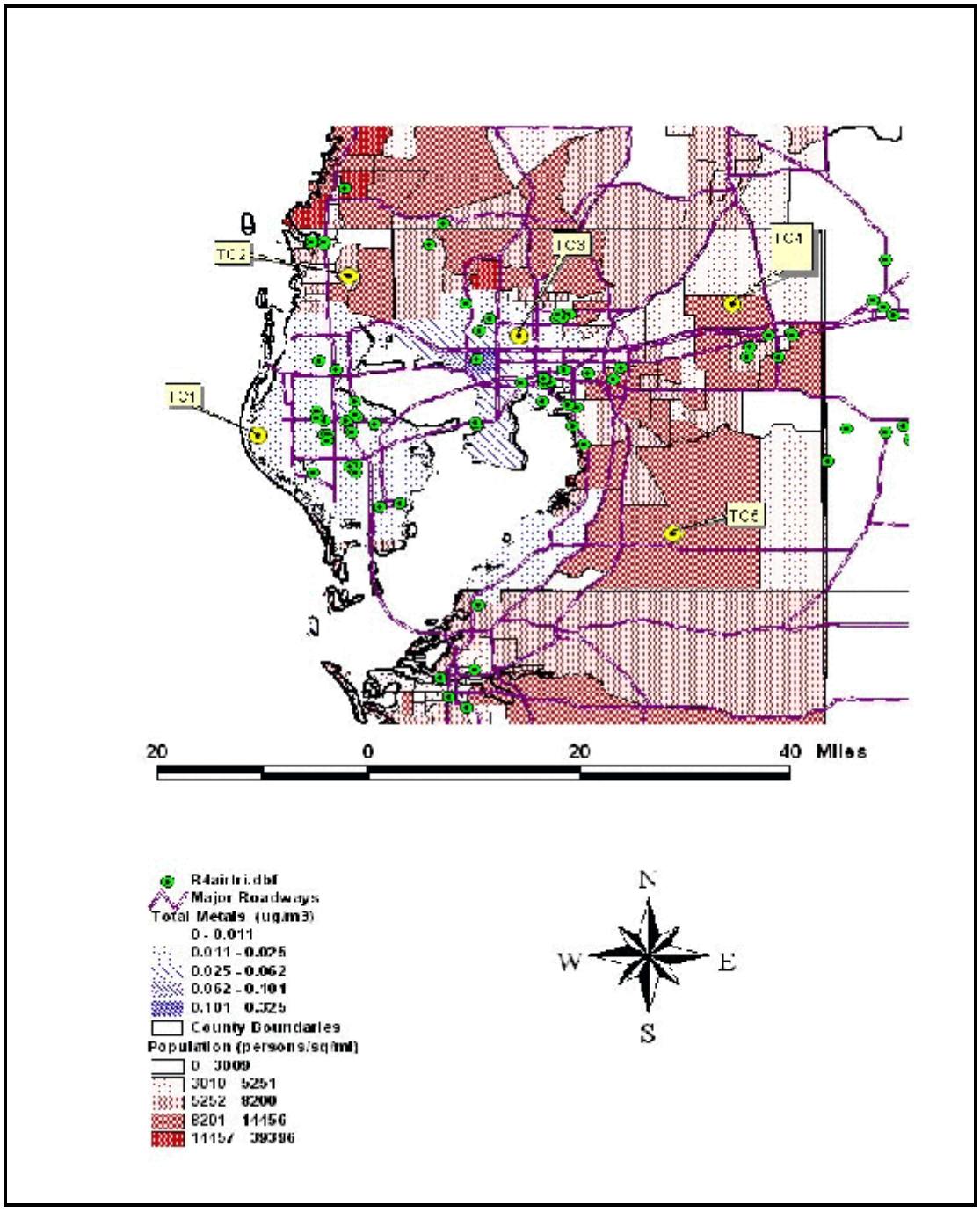

Figure 10.2 Metals data and Population

Figure 10-2 illustrates the metals exposure, population, the proposed air monitoring stations and the major air toxics sources**.** As can be seen from this view, the areas that have the highest exposure are the districts in the northeastern end of the bay. This is where the major boat manufacturing activities exist. For metals, site TC2 will collect the highest concentrations. TC1, TC4 and TC5 will collect downwind levels and verify population exposure. As mentioned previously, the procedure for siting the samplers is based on the expertise of the monitoring staff with the help of the TCAPCD modelers. TCAPCD staff believe that five sites will be needed to adequately characterize the HAPs in the two counties. Two of the monitor stations will be located in Pine Lake and three in Hillsburg County. Figure 10-2 shows a map of the proposed locations of the sites in relation to population and major air toxics release locations.

One site, TC1 will be the upwind/background and will be located to quantify the background concentrations. The siting of TC1 fulfills one of the DQOs for background concentrations. Site TC3 is located on the bay near the industrial center. Again, this site satisfies the DQO for highest concentration. This is a middle scale monitoring station sited to capture maximum concentrations. Site TC2 will be collocated with neighborhood scale monitoring. Sites TC4 and TC5 are downwind/suburban monitoring locations and are also neighborhood scale. The latitude/longitude coordinates for the five monitoring sites are listed in Table 10-2.

10.4.3 Sampling Frequency

The TCAPCD has set the frequency for the samplers to once every six days. Please see Table 11-1 for details.

10.4.4 Collocated Sampling

According to the primary network design, Toxa City will deploy and operate one site (TC2) using collocated TSP samplers. A second site, TC3 will have collocated PUF, Aldehyde and VOC samplers. According to 40 CFR Part 58, Appendix A, Section 3.5.2, for each method designation, at least 25% (minimum of one) of the samplers must be collocated. Although the 40 CFR 58 requirements do not directly relate to air toxics monitoring, the District will uses these as guidelines for precision and bias. As a result, Toxa City will collocate the samplers of each type. Based on the data collected by the Toxa City pilot study, it is assumed the site that will most likely monitor concentrations above the risk assessment benchmarks is TC3. However, as data from the network becomes available, the data will be reviewed on an annual basis to determine if a different site is more appropriate for collocation. The collocation samplers 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 and Coordnates

Site Name	Samplers Operated	Collocated	Coordinates (Lat./Long.)
TC1	PUF, VOC		27.89/-82.80
TC2	PUF,VOC, TSP	TSP	28.12/-82.61
TC3	PUF, Aldehydes, VOC	Aldehydes, PUF, VOC	27.96/-82.39
TC4	PUF, VOC, TSP		28.03/-82.16
TC5	VOC		27.71/-82.36

10.5 Classification of Measurements as Critical/Noncritical

All measurements should be classified as critical (i.e., required to achieve project objectives or limits on decision errors, Step 6 of the DQO Process) or noncritical (for informational purposes only or needed to provide background information). Critical measurements will undergo closer scrutiny during the data gathering and review processes and will have first claim on limited budget resources. It is also possible to include the expected number of samples to be tested by each procedure and the acceptance criteria for QC checks (as described in element B5, "Quality Control Requirements").

The ambient concentration and site location data will be provided 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 Non-Standard Measurements

For nonstandard sampling methods, sample matrices, or other unusual situations, appropriate method validation study information may be needed to confirm the performance of the method for the particular matrix. The purpose of this validation information is to assess the potential impact on the representativeness of the data generated. For example, if qualitative data are needed from a modified method, rigorous validation may not be necessary. Such validation studies may include round-robin studies performed by EPA or by other organizations. If previous validation studies are not available, some level of single-user validation study or ruggedness study should be performed during the project and included as part of the project's final report. This element of the QAPP should clearly reference any available validation study information.

At this time there are no NAAQS for the air toxics compounds, with the except for lead. Toxa City is deploying and operating instruments according to descriptions in the applicable EPA guidance documents.

References

1. Network Design and Site Exposure Criteria For Selected Noncriteria Air Pollutants, EPA Document Number, EPA 450/4-84-022, September 1984.

11.0 Sampling Methods Requirements

Environmental samples should reflect the target population and parameters of interest. As with all other considerations involving environmental measurements, sampling methods should be chosen with respect to the intended application of the data. Just as methods of analysis vary in accordance with project needs. Different sampling methods have operational characteristics, such as cost, difficulty, and necessary equipment. In addition, the sampling method can materially affect the representativeness, comparability, bias, and precision of the final analytical result.

In the area of environmental sampling, there exists a great variety of sample types. It is beyond the scope of this document to provide detailed advice for each sampling situation and sample type. Nevertheless, it is possible to define certain common elements that are pertinent to many sampling situations (see EPA QA/G-5S).

If a separate sampling and analysis plan is required for the project, it should be included as an appendix to the QAPP. The QAPP should simply refer to the appropriate portions of the sampling and analysis plan for the pertinent information and not reiterate information.

11.1 Purpose/Background

The methods described herein provides for measurement of the relative concentration of a number hazardous air pollutants in ambient air for a 24-hour sampling period .

Since there are 4 separate instruments and subsequently four separate analytical techniques, each of the sampling methods are different. General QA handling requirements are crucial for all sampling, so in that aspect, sample handling is similar.

11.2 Sample Collection and Preparation

(1) *Select and describe appropriate sampling methods from the appropriate compendia of methods.* For each parameter within each sampling situation, identify appropriate sampling methods from applicable EPA regulations, compendia of methods, or other sources of methods that have been approved by EPA. When EPA-sanctioned procedures are available, they will usually be selected. When EPA-sanctioned procedures are not available, standard procedures from other organizations and disciplines may be used. In addition, the QAPP should specify the type of sample to be collected (e.g., grab, composite, depth-integrated, flow-weighted) together with the method of sample preservation.

(2) *Discuss sampling methods' requirements.* Each medium or contaminant matrix has its own characteristics that define the method performance and the type of material to be sampled. Investigators should address the following:

- choice of sampling method/collection;
- inclusion of all particles within the volume sampled, and
- correct subsampling to reduce the representative field sample into a representative laboratory aliquot.

(3) *Describe the decontamination procedures and materials.* Decontamination is primarily applicable in situations of sample acquisition from solid, semi-solid, or liquid media, but it should be addressed, if applicable, for continuous monitors as well. Conversely, if ppb-level detection is required, rigorous decontamination or the use of disposable equipment is required.

Sample preparation is an essential portion of the AMTP. The following functions are required for sample preparation:

- TSP - filter receipt and inspection, filter numbering, conditioning and storage;
- VOC - cleaning, testing , verification and storage of canisters;
- SVOC - filter receipt and inspection, cleaning of filters, inspection, clean-up and certification of PUF cartridges;
- Aldehydes - receipt and storage of DNPH cartridges in the laboratory refrigerator.

Sample set-up of the air toxics samplers in the Toxa City network takes place any day after the previous sample has been recovered. For instance, on a Sunday - Thursday sample day set-up when 1 in 6 day sampling is required, the pickup occurs the day after the run. However, on Friday and Saturday run dates, the pick up is on the following Monday. It is important to recognize that the only holding time that affects sample set-up is the 30 day window from the time a samples are pre-weighed/processed to the time it is installed in the monitor. At collocated, sites the second monitor will be set up to run at a 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 Toxa City sample methods standard operating procedure.

11.2.2 Sample Recovery

Sample recovery of any individual sample from the air toxics instruments sampler in the Toxa City

network must occur within 72 hours of the end of the sample period for that sampler. For 1 in 6 day sampling this will normally be the day after a sample is taken. The next sample would also be set-up at this time. See Table 11.1.

Table 11.1 Sample Set-up, Run and Recovery dates

Sample Frequency	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 in6 Week 1	Sample Day 1	*Recovery & Set-up*					Sample Day 3
1 in6 Week 2		*Recovery & Set-up*				Sample Day 5	
1 in 6 Week 3		*Recovery & Set-up*			Sample Day 7	*Recovery & Set-up*	
1 in 6 Week 4				Sample Day 9	*Recovery & Set-up*		
1 in 6 Week 5			Sample Day 11	*Recovery & Set-up*			
1 in 6 Week 6		Sample Day 13	*Recovery & Set-up*				

11.3 Support Facilities for Sampling Methods

Support facilities vary widely in their analysis capabilities, from percentage-level accuracy to ppb-level accuracy. The investigator must ascertain that the capabilities of the support facilities are commensurate with the requirements of the sampling plan established in Step 7 of the DQO Process.

The main support facility for sampling is the sample trailer or shelter. At each sample location in the Toxa City network there is a climate controlled sample trailer. The trailer has limited storage space for items used in support of air toxic sampling. Table 11.2 lists the supplies that are stored at each sample location trailer

Table 11.2 Supplies at Storage Trailers

Item	Minimum Quantity	Notes
Powder Free Gloves	box	*Material must be inert and powder free*
Fuses	2	*Of the type specified in the sampler manual*
Temperature standard	1	*In the range expected for this site and NIST traceable*
Flow rate standard	1	*Calibrated from at least 15.0 LPM to 18.4 LPM and NIST Traceable*
Sampler Operations Manual	1 per model	
Sampling SOPS	1	
Flow rate verification filter	2	For TSP sampler
Tools	1	*One Tool kit with various wrenches, screwdrivers, etc..*
Filter Cassettes	1	*For use with flow rate check filter or non-permeable membrane*
Motor Brushes	1 set of 2	*For TSP and PUF samplers*
Various 1/8”’ and 1/4" fittings	1 Box	
pumps	1 Box	*For Carbonyl and VOC samplers*
Data Download Cable	1	*For use with laptop computer*
Teflon end caps	1 Box	For capping the DNPH cartridges
aluminum foil	1 Box	*For Carbonyl and PUF samplers*
ice chests	2	*Spare ice chests for transporting samples*

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

This section should address issues of responsibility for the quality of the data, the methods for making changes and corrections, the criteria for deciding on a new sample location, and how these changes will be documented. This section should describe what will be done if there are serious flaws with the implementation of the sampling methodology and how these flaws will be corrected. For example, if part of the complete set of samples is found to be inadmissable, how replacement samples will be obtained and how these new samples will be integrated into the total set of data should be described.

Corrective action measures in the ATMP 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 11.3 is an attempt to detail the expected problems and corrective actions needed for a well-run network.

Table 11.3 Field Corrective Action

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 46.2 mm filter.	1.) Inspect area downstream of where filter rests in sampler and determine if particulate has been by-passing filter. 2.) Inspect in-line filter before sample pump and determine if excessive loading has occurred. 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. Re-calibrate flowrate.	Document in log book
Sample Flow Rate Verification	Out of Specification (+ 10% of transfer standard)	1.) Completely remove mass flow controller and perform flow rate check. 2.) Perform leak test. 3.) Check flow rate at 3 points to determine if flow rate problem is with zero bias or slope. 4.) Re-calibrate flow rate	1.) Document on data sheet. 2.) Document on data sheet. 3.) Document on data sheet. Notify Field Manager 4.) 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 to the mass flow controller 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 programming of sampler flowrate of VOC/Carbonyl Sampler. 2.) Check flow with a flow rate verification filter and determine if actual flow is low. 3.) Inspect in-line filter and PUF cartridge downstream of filter location, replace as necessary.	1.) Document in log book. 2.) Document in log book. 3.) Document in log book.
Ambient Temperature Verification, and Filter Temperature Verification.	Out of Specification (+ 1°C of standard)	1.) Make certain thermocouples are immersed in same liquid at same point without touching sides or bottom of container. 2.) Use ice bath or warm water bath to check a different temperature. If acceptable, re-perform ambient temperature verification. 3.) Connect new thermocouple. 4.) Check ambient temperature with another NIST traceable thermometer.	1.) Document on data sheet. 2.) Document on data sheet. 3.) Document on data sheet. Notify Field Manager. 4.) Document on data sheet. Notify Field Manager.
Ambient Pressure Verification	Out of Specification (±10 mm Hg)	1.) Make certain pressure sensors are each exposed to the ambient air and are not in direct sunlight. 2.) Call local Airport or other source of ambient pressure data and compare that pressure to pressure data from monitors sensor. Pressure correction may be required 3.) Connect new pressure sensor	1.) Document on data sheet. 2.) Document on data sheet. 3.) Document on data sheet. Notify Field Manager
Elapsed Sample Time	Out of Specification (10 min/day)	Check Programming, Verify Power Outages	Notify Field Manager
Elapsed Sample Time	Sample did not run	1.) Check Programming 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

Item	Problem	Action	Notification
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
Data Downloading	Data will not transfer to laptop computer or there is no printout from the Carbonyl/VOC samplers	Document key information on sample data sheet. Make certain problem is resolved before data is written over in sampler microprocessor.	Notify Field Manager.

In addition to these corrective actions, the samplers will also be calibrated: when installed, after any major repairs, or when an audit flow rate shows that the samplers is outside of the +/- 10% relative to the audit flow value.

11.5 Sampling Equipment, Preservation, and Holding Time Requirements

This section includes the requirements needed to prevent sample contamination (disposable samplers or samplers capable of appropriate decontamination), the physical volume of the material to be collected (the size of composite samples, core material, or the volume of water needed for analysis), the protection of physical specimens to prevent contamination from outside sources, the temperature preservation requirements, and the permissible holding times to ensure against degradation of sample integrity.

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 filter cassettes, PUF and DNPH cartridges . Filter and cartridges are to be held in storage containers (static resistant zip lock bags) as provided by the sampler manufacturer during transport to and from the laboratory. Once samples have been analyzed they, are stored in static resistant zip lock bags.

11.5.2 Sample Volume

The volume of air to be sampled is specified in manufacturer's and the Method specifications. The different methods specify that certain minimum volumes must be collected Samples are expected to be 24 hours, therefore the site operators must set the flow rates to collect sufficient sample to obtain the minimum sample volume. In some cases a shorter sample period may occur due to power outages. A valid sample run should not to 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 Branch Manager 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). DNPH cartridges need to stored at 4° C until they are loaded into the sampler. The filter temperature requirements are detailed in Table 11.4.

Table 11.4 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-sampling .	4° C or less	TO-11A Compendium Section 9.4.3
VOC canister Pre and post sampling	No Requirements	
PUF cartridge and filter	4° C or less	TO-13A Section 6.2.7

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 11-5.

Table 11-5 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 Compendium Section 9.4.2.1
PUF cartridge and filter	<24 Hours (ideally) or 20 days if refrigerated	Time of recovery	Time placed in conditioning room	TO-13 Compendium Section 11.3.19
DNPH Cartridge Filter	≤30 days	Sample end date/time	Date of Post Weigh	TO-11 Compendium Section 11.1.1

12.0 Sampling Custody

This element of the QAPP should clearly describe all procedures that are necessary for ensuring that:

1. samples are collected, transferred, stored, and analyzed by authorized personnel;
2. sample integrity is maintained during all phases of sample handling and analyses; and
3. an accurate written record is maintained of sample handling and treatment from the time of its collection through laboratory procedures to disposal.

Proper sample custody minimizes accidents by assigning responsibility for all stages of sample handling and ensures that problems will be detected and documented if they occur. A sample is in custody if it is in actual physical possession or it is in a secured area that is restricted to authorized personnel. The level of custody necessary is dependent upon the project's DQOs. While enforcement actions necessitate stringent custody procedures, custody in other types of situations (i.e., academic research) may be primarily concerned only with the tracking of sample collection, handling, and analysis.

Sample custody procedures are necessary to prove that the sample data correspond to the sample collected, if data are intended to be legally defensible in court as evidence. In a number of situations, a complete, detailed, unbroken chain of custody will allow the documentation and data to substitute for the physical evidence of the samples (which are often hazardous waste) in a civil courtroom.

An outline of the scope of sample custody--starting from the planning of sample collection, field sampling, sample analysis to sample disposal--should also be included. This discussion should further stress the completion of sample custody procedures, which include the transfer of sample custody from field personnel to lab, sample custody within the analytical lab during sample preparation and analysis, and data storage.

Figures 12.1 - 12.4 represent chain of custody forms that will be used to track the stages of filter handling throughout the data collection operation. Although entries on this form will be made by hand, the information will be entered into the a sampling tracking system, where an electronic record will be kept. This section will address sample custody procedures at the following stages:

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

DNPH Cartridge Chain of Custody Record

Pre-Sampling Cartridge

Site Operator Initial	Cart. ID	Receipt Date	Monitor ID	Install Date	Temp. Storage	Comments
BLM	*D990101*	*99/01/01*	*060021125811041*	*99/01/03*	*4 C*	
BLM	*DC990101*	*99/01/01*	*060021125811041*	*99/01/03*	*4 C*	

Post-Sampling Recovery

Site Operator Final	Cart. ID	Monitor ID	Removal Date	Removal Time	Comments
BLM	*D990101*	*060021125811041*	*99/01/03*	*0900*	
BLM	*DC990101*	*060021125811041*	*99/01/03*	*0900*	

Free Form Notes -

Receipt Box 1 Max Temp _____ Min Temp _____ Box 2 Max Temp _____ Min Temp _____

Receiver ID	Filter ID	Date Received	Receipt time	Shipping Integrity Flags	Archived	Sent to Lab
SBM	*D990101*	99/01/04	*1030*	*GSI*		X
SBM	*DC990101*	99/01/04	*1030*	*GSI*		X

Free Form Notes -

Transfer

Relinquished by: *SBM* **Date/Time:** *99/01/04 / 1130* **Received by:** *FIN* **Date/Time:** *99/01/04 / 1130*

Figure 12.1 Example DNPH Cartridge chain of custody record

VOC Canister Chain of Custody Record

Pre-Sampling Canister Selection

Site Operator Initial	Can. ID	Receipt Date	Monitor ID	Install Date	Comments
BLM	*V990101*	*99/01/01*	*060021125811041*	*1/1/00*	

Post-Sampling Canister Recovery

Site Operator Final	Can. ID	Monitor ID	Removal Date	Removal Time	Comments
BLM	*V990101*	*060021125811041*	*99/01/02*	*0900*	

Free Form Notes -

_____

_____

Canister Receipt

Receiver ID	Can ID	Date Received	Receipt time	Shipping Integrity Flags	Sent to Lab
SBM	*V990101*	99/01/04	*1030*	*GSI*	X

Free Form Notes -

Figure 12.2 Example filter VOC Canister chain of custody record

PUF Cartridge Chain of Custody Record

Pre-Sampling Cartridge

Site Operator Initial	Cart. ID	Receipt Date	Monitor ID	Install Date	Comments
BLM	*P990101*	*99/01/01*	*060021125811041*	*99/01/03*	
BLM	*PFB990101*	*99/01/01*	*060021125811041*	*99/01/03*	

Post-Sampling Recovery

Site Operator Final	Cart. ID	Monitor ID	Removal Date	Removal Time	Comments
BLM	*P990101*	*060021125811041*	*99/01/03*	*0900*	
BLM	*PFB990101*	*060021125811041*	*99/01/03*	*0900*	

Free Form Notes -

_____

_____

Box 1 Max Temp _____ Min Temp _____ Box 2 Max Temp _____ Min Temp _____

Receiver ID	Filter ID	Date Received	Receipt time	Shipping Integrity Flags	Temp of Sample	Sent to Lab
SBM	*P990101*	99/01/04	*1030*	*GSI*		X
SBM	*PFB990101*	99/01/04	*1030*	*GSI*		X

Free Form Notes -

_____

_____

Transfer

Relinquished by: *SBM* **Date/Time:** *99/01/04 / 1130* **Received by:** *FIN* **Date/Time:** *99/01/04 / 1130*

Figure 12.3 Example PUF Cartridge chain of custody record

TSP Filter Chain of Custody Record

Pre-Sampling Filter Selection

Site Operator Initial	Filter ID	Cont. ID	Receipt Date	Monitor ID	Sampler ID	Installation Date	Comments
BLM	*M990101*	*MC001*	*99/01/01*	*060021125811041*	*AD001*	*99/01/01*	

Post-Sampling Filter Recovery

Site Operator Final	Filter ID	Cont. ID	Monitor ID	Sampler ID	Removal Date	Removal Time	Field Qualifiers
BLM	*M990101*	*MC001*	*060021125811041*	*AD001*	*99/01/03*	*0900*	

Free Form Notes -

_____

_____

Receiver ID	Filter ID	Cont. ID	Date Received	Receipt time	Shipping Integrity Flags	Archived	Sent to Lab
SBM	*M990101*	*MC001*	99/01/04	*1030*	*GSI*		X

Free Form Notes -

_____

12.4 Example of the TSP/Metal Chain of Custody Form

Archiving Tracking Form

Sample ID	Sample Type	Analysis Date	Archive Date	Box ID/Box #	Archived By:	Comments
MC990101	TSP	99/01/05	99/01/06	06002112581104 1/1	FIN	
PFB990101	PUF	99/01/05	99/01/06	06002112581104 1/1	FIN	

Figure 12.5 general archive form

12.1 Sample Custody Procedure

One of the most important values in the sample custody procedure is the unique sample ID number, illustrated in Figure 12.1 - 12.4. The ID is an alpha-numeric value. The alpha values identify the type of sample(V,P,D or M),a field blank (FB),a lab blank (LB) or collocated (C) . The next two values (YY) represent the last two digits of the calendar year and the next 4 digits represent a unique date (MM/DD). Therefore, for 1998 the first routine filter will be numbered M980101 for a metals filter and the collocated sample will be MC980101. The field blank for the same day would be label MFB980101. The filter ID will be generated by the laboratory analyst at the time of preparation of the sample.

12.1.1 Pre-Sampling Custody

The District's pre-sampling SOPs define how the samples will be enumerated, conditioned, weighed, placed into the protective shipping container, sealed with tape, and stored or refrigerated. See Table 11.3 for details on sample holding. The Inventory Sheets containing the ID, Sample Type, Container ID, and the Pre-sampling date will be attached to the field shelf for use by the site operator. Each sampling period, the site operators will select samples that they will used for the field. The number selected will depend on the time in the field prior to returning to the laboratory and the

number of samplers to be serviced. The site operator will perform the following Pre-sampling activities:

1. Contact Mr. Arcemont or Ms. Killion for access to laboratory.
2. Put on appropriate laboratory attire.
3. Enter the filter storage area.
4. Review the *Inventory Sheet* and select the next set of samples on the sheet. Ensure the seals are intact. Since the site operator can not check the ID he will have to use the container ID value.
5. Take the *Chain of Custody Records* for each site visited. Fill out the first 4 columns of the "Pre-Sampling Selection" portion of the *Chain of Custody Record* (Fig s12.1 - 12.4) for each sample.
6. Initial the column "Site Operator" on the *Inventory Sheets* to signify selection of the filters.
7. Pack samples in sample coolers for travel to the field.

Upon arrival at a site:

8. Select the appropriate samples.
9. Once the samples are installed at the site, complete the remainder of the columns of the "Pre-Sampling Selection" portion of the *Chain of Custody Records* (Fig 12.1- 12.4.).

12.1.2 Post Sampling Custody

The field sampling SOPs specify the techniques for properly collecting and handling the sample filters. Upon visiting the site:

1. Select the appropriate *Chain of Custody Records*. Ensure that the filter ID are correct.
2. Remove the sample. Please refer to Appendices A-D for explicit details on unloading samples. Briefly examine and and place it into the protective container per SOPs and seal with tape.
3. Place the protective container(s) into the shipping/transport container with the appropriate temperature control devices.
4. Record "Post Sampling Filter Recovery Information" on the *Filter Chain of Custody Record*.

12.1.3 Sample Reciept

The samples, whether transported by the site operator or next day air, will be received by either Janet Hoppert or David Bush at the Shipping/Receiving Office. The Shipping/Receiving Office will:

1. Receive shipping/transport container(s).
2. Upon receipt, open the container(s) to find *Filter Chain of Custody Record*(s) or collect the originals from the site operator (if delivered by operator).
3. Fill out the "Filter Receipt" area of the *Filter Chain of Custody Record*s(s). Check sample container seals.
4. If the samples are delivered on a weekday, follow sequence 5; if the sample (s) are delivered on a weekend, follow sequence 6.

5. Check the "Sent to Laboratory" column of the *Filter Chain of Custody Record*s(s) and transport the filters to the appropriate laboratory room . Upon delivery to the laboratory, complete the "Filter Transfer" area of the *Filter Chain of Custody Record*s(s).
6. Store the samples in the refrigerator and check the "archived" column of the *Filter Chain of Custody Record*s(s). On the Monday of the following week, deliver the archived filters to the laboratory and complete the "Filter Transfer" area of the *Filter Chain of Custody Record*s(s).

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. During all post-sampling activities, filter custody will be the responsibility of Mr. Arcemont. The samples will be stored within the laboratory freezer. The laboratory has restricted access to Ms. Killion and Mr. Arcemont.

Upon completion of post-sampling weighing activities, the *Filter Archiving Form* (Figure 12.2) will be used by the laboratory technicians to archive the filter. 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 one year past the date of collection..

13.0 Analytical Methods Requirements

The choice of analytical methods will be influenced by the performance criteria, Data Quality Objectives, and possible regulatory criteria. Qualification requirements may range from functional group contaminant identification only to complete individual contaminant specification. If appropriate, a citation of analytical procedures may be sufficient if the analytical method is a complete SOP, such as one of the Contract Lab Program Statements of Work. In other situations, complete step-wise analytical and/or sample preparation procedures will need to be attached to the QAPP if the procedure is unique or an adaption of a "standard" method.

Specific monitoring methods and requirements to demonstrate compliance traditionally were specified in the applicable regulations and/or permits. However, this approach is being replaced by the Performance-Based Measurement System (PBMS). PBMS is a process in which data quality needs, mandates, or limitations of a program or project are specified and serve as a criterion for selecting appropriate methods. The regulated body selects the most cost-effective methods that meet the criteria specified in the PBMS. Under the PBMS framework, the performance of the method employed is emphasized rather than the specific technique or procedure used in the analysis. Equally stressed in this system is the requirement that the performance of the method be documented and certified by the laboratory that appropriate QA/QC procedures have been conducted to verify the performance. PBMS applies to physical, chemical, and biological techniques of analysis performed in the field as well as in the laboratory. PBMS does not apply to the method-defined parameters.

The QAPP should also address the issue of the quality of analytical data as indicated by the data's ability to meet the QC acceptance criteria. This section should describe what should be done if the calibration check samples exceed the control limits due to mechanical failure of the instrumentation, a drift in the calibration curve occurs, or if a reagent blank indicates contamination. This section should also indicate the authorities responsible for the quality of the data, the protocols for making changes and implementing corrective actions, and the methods for reporting the data and its limitations.

Laboratory contamination from the processing of hazardous materials such as toxic or radioactive samples for analysis and their ultimate disposal should be a considered during the planning stages for selection of analysis methods. Safe handling requirements for project samples in the laboratory with appropriate decontamination and waste disposal procedures should also be described.

13.1 Purpose/Background

The methods stated here provide for gravimetric, spectrophotometric and chromatographic analyses of samples collected in the Toxa City 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

Preparation procedures should be described and standard methods cited and used where possible. Step-by-step operating procedures for the preparation of the project samples should be listed in an appendix. The sampling containers, methods of preservation, holding times, holding conditions, number and types of all QA/QC samples to be collected, percent recovery, and names of the laboratories that will perform the analyses need to be specifically referenced.

The Toxa City network consist of 5 sites. The primary samplers will operate on a 1 in 6 day schedule. The collocated samplers are on a 1 in 12 day schedule. Therefore, the approximate number of routine samples that have to be prepared, used, transported, and conditioned is 24 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 Toxa City 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 Appendix D. 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

The citation of an analytical method may not always be sufficient to fully characterize a method because the analysis of a sample may require deviation from a standard method and selection from the range of options in the method. The SOP for each analytical method should be cited or attached to the QAPP, and all deviations or alternative selections should be detailed in the QAPP.

Often the selected analytical methods may be presented conveniently in one or several tables describing the matrix, the analytes to be measured, the analysis methods, the type, the precision/accuracy data, the performance acceptance criteria, the calibration criteria, and etc.

13.3.1 Analytical Equipment and Method

The instruments used for analysis are listed in Table 13.1.

Table 13.1 Instruments Used in the Toxa City Laboratory

Parameter	Instrument	Method	Range
Metals	Antech 3000	Inductively Coupled Plasma	0.01 to 50 ug/m3
Aldehydes	AanTech 3001	High Pressure Liquid Chromatography	0.01 to 25 ppbv
VOCs	Antech 3001	Gas Chromatography	0.001 to 100ppbv
SVOC	AnTech 3001	Gas Chromatography/Mass Spectrometry	0.01 to 50 ppbv

13.3.2 Environmental Control

The Toxa City TSP weigh room facility is an environmentally controlled room with temperature and humidity control. Temperature is controlled at a minimum from 20 - 30^{O} C. Humidity is controlled from 30 - 40% relative humidity. Temperature and relative humidity are measured and recorded continuously during equilibration. The balance is located on a vibration free table and is protected from or located out of the path of any sources of drafts. Filters are conditioned before both the pre- and post-sampling weighings. Filters must be conditioned for at least 24 hours to allow their weights to stabilize before being weighed. The areas used for preparation of the canister, and PUF samples are clean laboratory benches in the main part of the lab. The areas are cleaned periodically to eliminate contamination of samples. This is particularly important for the PUF samples. Small contaminants can be in the atmosphere of the laboratory and contaminate the PUF samples. Great care is exercised to keep the lab atmosphere clean of SVOCs. Lab blanks for PUFs are performed once every 10 samples. DNPH cartridges must be stored at 4^{0} C before they are extracted and analyzed.

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 a requirement 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.

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 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. To minimize contamination, the sample media clean-up and sample preparation rooms are separate from the instrumentation rooms. In addition, Heating and Ventilation system is check annually by certified technicians. Hoods are also checked annually. TSP filters are equilibrated/conditioned and stored in the same room where they are weighed. Powder free gloves are worn while handling filters and filters are only contacted with the use of smooth non-serrated forceps. Upon determination of its pre-sampling weight, the filter is placed in its filter holding jacket for storage.

For VOC analytical method, the best prevention of contamination is not opening the canister in the

laboratory. All post sampling canisters that enter the laboratory should be under pressure between 12-14 psig. With positive pressure, there is less likely that the sample will be contaminated. However, care must be taken when the canisters are under vacuum and stored in the laboratory. If there is a slight leak in the canister cap or valve, then laboratory air can enter into the canister and contaminate the run.

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. TCAPCD purchases the cartridges 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 technicians remove the cartridges (still in the sealed Mylar 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 aldehyde sampler, the DNPH cartridges are removed from their Mylar package and installed.

Semi-Volatile Organics Compound contamination prevention is the most difficult of all of the air toxics. When SVOC samples are re-fluxed, small quantities of SVOC can become volatilized in the laboratory. Therefore, it is very important to have a properly operating HVAC system working in the lab. A HEPA filter is changed monthly in the HVAC to avoid contamination of laboratory air. In addition, good laboratory practice is followed to avoid contamination of samples upon Receipt.

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 20 and 30^{O} C, with no more than a +/- 5^{O} C change over the 24 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, SVOC 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. These are listed in Table 11.4.

13.5.4 Permissible Holding Times

The permissible holding times for the sample are clearly detailed in the TO and IO Compendia[1,2,3,4]. See Table 11.5.

References

1. Compendium Method for the Determination of Inorganic Compounds in Air, United States Environmental Protection Agency, June 1999, Section IO-3.

2. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-11A, January 1999

3. Compendium Method for the Determination of Toxic Organic Communes in Air, United States Environmental Protection Agency, Section TO-14A, January 1999

4. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-13A, January 1999

14.0 Quality Control Requirements

QC is "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." QC is both corrective and proactive in establishing techniques to prevent the generation of unacceptable data, and so the policy for corrective action should be outlined. This element will rely on information developed in section 7, "Quality Objectives and Criteria for Measurement Data," which establishes measurement performance criteria.

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,

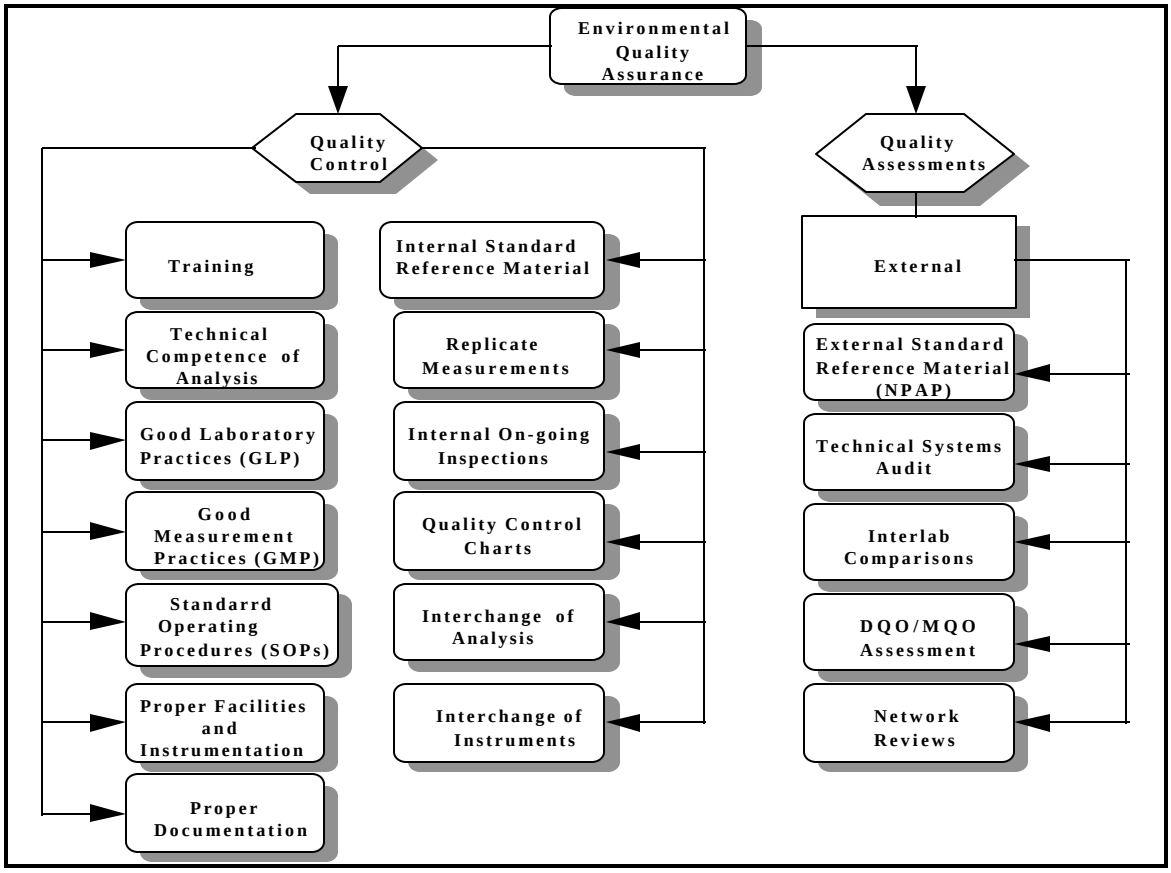

Figure 14.1 Quality control and quality assessment activities

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. Figure 14.1 represents a number of QC activities that help to evaluate and control data quality for the program. Many of the activities in this figure are implemented by the Air Division and are discussed in the appropriate sections of this QAPP.

14.1 QC Procedures

This element will need to furnish information on any QC checks not defined in other QAPP elements and should reference other elements that contain this information where possible.

Many of these QC checks result in measurement data that are used to compute statistical indicators of data quality. For example, a series of dilute solutions may be measured repeatedly to produce an estimate of the instrument detection limit. The formulas for calculating such Data Quality Indicators (DQIs) should be provided or referenced in the text. This element should also prescribe any limits that define acceptable data quality for these indicators (see also Appendix D, "Data Quality Indicators"). A QC checklist should be used to discuss the relation of QC to the overall project objectives with respect to:

- the frequency of the check and the point in the measurement process in which the check sample is introduced,
- the traceability of the standards,
- the matrix of the check sample,
- the level or concentration of the analyte of interest,
- the actions to be taken in the event that a QC check identifies a failed or changed measurement system,
- the formulas for estimating DQIs, and
- the procedures for documenting QC results, including control charts.

Finally, this element should describe how the QC check data will be used to determine that measurement performance is acceptable. This step can be accomplished by establishing QC "warning" and "control" limits for the statistical data generated by the QC checks (see standard QC textbooks or refer to EPA QA/G-5T for operational details).

Day-to-day quality control is implemented through the use of various check samples or instruments that are used for comparison. The measurement quality objectives 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 vendor to TCAPCD. Each shipment must be tested to determine the length of time it takes the filters to stabilize. Upon arrival of each shipment, 3 lot blanks will be randomly selected for the shipment and be subjected to the conditioning/pre-sampling weighing procedures. The blanks will be measured every 24 hours for a minimum of one week to determine the length of time it take to maintain a stable weight reading.

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 aldehydes, metals and SVOCs. 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 aldehydes, metals, VOC and SVOCs. Lab blanks for VOCs are generated by the canister cleaning system.

Blank Evaluation

The laboratory will include 3 field and 3 lab blanks into session batch. A batch is defined in section 14.2. The following statistics will be generated for data evaluation purposes:

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).

$$d = |Y - X|$$

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.

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

Corrective action- The acceptance criteria for field blanks are discussed in the individual SOPs. 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.

Collocated Monitoring

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

a. Each type of monitor collocated;
b. The VOC, PUF and Aldehyde samplers will be collocated at site ;
c. The TSP sampler will be collocated at TC 2.

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:

where the number of checks made during the calendar quarter. Each individual compound must have the precision data generated.

Upper 95% Percent Limit

$$Limit = d_i + 1.96 * S_i / \sqrt{2}$$

Lower 95% Percent Limit

$$Limit = d_i - 1.96 * S_{i/} / \sqrt{2}$$

Corrective Action: Quarter - Usually, corrective action will be initiated and imprecision rectified

before a quarters worth of data fail to meet 15% Confidence Limits (CL). However in the case were the quarters CL 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 +/- 10 min.	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 > 2 psig	Do not accept
One or both PUF plugs or filters are damaged	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.

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. Toxa City 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 weighings, 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 be remain with the unweighed samples in the batch to be reweighed 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 be un-flagged 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 or State designated laboratory will be sending the TCAPCD laboratory a sample of metals on a quartz filter, aldehydes in a DNPH cartridge, a canister with VOCs and a PUF sample with SVOC. 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:

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.

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

.

15.0 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The purpose of this element of the 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. This section describes how inspections and acceptance testing of environmental sampling and measurement systems and their components will be performed and documented.

15.1 Purpose/Background

The purpose of this element in the Toxa City 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.

15.2 Testing

The procedures described should (1) reflect consideration of the possible effect of equipment failure on overall data quality, including timely delivery of project results; (2) address any relevant site-specific effects (e.g., environmental conditions); and (3) include procedures for assessing the equipment status. This element should address the scheduling of routine calibration and maintenance activities, the steps that will be taken to minimize instrument downtime, and the prescribed corrective action procedures for addressing unacceptable inspection or assessment results. This element should also include periodic maintenance procedures and describe the availability of spare parts and how an inventory of these parts is monitored and maintained. The reader should be supplied with sufficient information to review the adequacy of the instrument/equipment management program. Appending SOPs containing this information to the QAPP and referencing the SOPs in the text are acceptable.

Inspection and testing procedures may employ reference materials, such as the National Institute of Standards and Technology's (NIST's) Standard Reference Materials (SRMs), as well as QC standards or an equipment certification program. The accuracy of calibration standards is important because all data will be measured in reference to the standard used. The types of standards or special programs should be noted in this element, including the inspection and acceptance testing criteria for all components. The acceptance limits for verifying the accuracy of all working standards against primary grade standards should also be provided.

All samplers used in the Toxa City ATMP 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, Toxa City will assemble and run the samplers at the laboratory facilities. The field operators will perform external and internal leak checks and temperature, pressure and flow rate verification checks. If any of these checks are out of specification, the field technicians will attempt to correct them.. If the problem is beyond their expertise, the division director 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 (TSP mass weight, Gas Chromatography/Mass Spec., Liquid Chromatography and the ICP rooms) 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
Weighing Room Temperature	Daily	20 - 30° C	1.) Check HVAC System 2.) Call service provider that holds maintenance agreement	1.) Document in log book 2.) Notify Lab Manager
Weighing Room Humidity	Daily	30 - 40° RH	1.) Check HVAC System 2.) Call service provider that holds maintenance agreement	1.) Document in log book 2.) Notify Lab Manager
Weighing Room Cleanliness	Monthly	Use glove and visually inspect	Clean room	Document in Log Book
GC/MC Room Temperature	Daily	20 - 30° C	1.) Check HVAC System 2.) Call service provider that holds maintenance agreement	Document in Logbook
GC/MS Cleanliness	Monthly	Use glove and visually inspect	Clean room and remove clutter put canisters back into rack	Document in Log Book
ICP Temperature	Daily	20 - 30° C	1.) Check HVAC System 2.) Call service provider that holds maintenance agreement	Document in Logbook
ICP Cleanliness	Monthly	Use glove and visually inspect	Clean room and remove clutter store and clean vial. Discard old filters	Document in Log Book

HPLC Room Temperature	Daily	20 - 30° C	1.) Check HVAC System 2.) Call service provider that holds maintenance agreement	Document in Logbook
HPLC Cleanliness	Monthly	Use glove and visually inspect	Clean room and store PUF cartridges	Document in Log Book
Extract ion Room	Weekly	Use glove and visually inspect	Thoroughly clean room and remove all materials. Clean all removal instrument and autoclave	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 Toxa City network, laboratory preventive maintenance is handled through the use of several contractors. The *Smith and Jones HVAC Company* has a contract to take care of all preventive maintenance associated with the heating, ventilation, and air conditioning system (HVAC). In addition to these contacts, the TCAPCD also hires *LabTech* Inc. to perform the maintenance on the ICP, GC/MS and the two Liquid Chromatographs. The *Smith and Jones HVAC Company* can be paged for all emergencies pertaining to the laboratory HVAC system. Preventive maintenance for the micro-balance is performed by the *Libra BalanceCompany* service technician. Preventive maintenance for the all analytical instruments is scheduled to occur at initial set-up and every 6-months thereafter. In the event that there is a problem with the analytical instruments that cannot be resolved within the Toxa City organization, the *Libra Balance Company and LabTech Inc.* service technician can be paged. The District's service agreement with *Libra Balance Company and LabTech Inc.* calls for service within 24 hours. The service technician will also have a working micro-balance in his/her possession that will be loaned to Toxa City in the case that the District's micro-balance can not be repaired on-site. In the event one of the other analytical instruments fail, the service technicians for the vendors will visit the TCAPCD laboratory and ascertain the problem. The parts will be shipped and replaced as soon as possible.

Service agreements with both the *Smith and Jones HVAC Company*, *Libra Balance Company and LabTech Inc.* are expected to be renewed each year. In the event either companies service agreement

is not renewed, a new service provider will be selected and contract put in place. The following tables details the maintenance items, how frequently they will be replaced, and who will be responsible for performing the maintenance.

Table 15.2 Preventive Maintenance in Weigh Room Laboratories

Item	Maintenance Frequency	Responsible Party
Multi-point Micro-balance maintenance calibration	6 Months	*Libra Balance Company*
Comparison of NIST Standards to laboratory working and primary standards	6 Months	*Libra Balance Company*
Verify Humidity and Temperature sensors	Monthly	*Balance Analyst*
HEPA filter replacement	Monthly	*Balance Analyst*
HVAC system preventive maintenance	Yearly	*Smith and Jones HVAC*
Computer Back-up	Weekly	*Lab Analyst*
Computer Virus Check	Weekly	*Lab Analyst*
Computer system preventive maintenance (clean out old files, compress hardrive, inspect)	Yearly	*PC support personnel*

Table 15.3 Preventive Maintenance in VOC Laboratories

Item	Maintenance Frequency	Responsible Party
Multi-point maintenance calibration	6 Months or after initial setup, after maintenance or repair, after column is replaced	***Lab Analyst.***
Comparison of NIST Standards to laboratory working and primary standards	Weekly	***Lab Analyst***
Filament Replacement	As necessary	*Lab Analyst*
Carrier gas scrubber replaced	When trap color indicates	*Lab Analyst*
MS Quadruples or ion source cleaned	Every 3 months	*Lab Analyst*
RF Generator Replaced	As needed	*Lab Analyst*
Test lines for pressure integrity	Annually	*Lab Analyst*
Replace Traps	as needed	***Lab Analyst***
Computer Back-up	Weekly	*Lab Analyst*

Computer Virus Check	Weekly	*Lab Analyst*
Computer system preventive maintenance (clean out old files, compress hardrive, inspect)	Yearly	*PC support personnel*

Table 15.4 Preventive Maintenance in Liquid Chromatography Laboratory

Item	Maintenance Frequency	Responsible Party
Multi-point maintenance calibration	6 Months	*LabTech Inc.*
Comparison of NIST Standards to laboratory working and primary standards	6 Months	*Lab Analyst*
Replace Chromatography Column	As needed	*Lab Analyst*
Replace delivery system motor	2 years	*LabTech Inc.*
Change Column guard	As needed	*Lab Analyst*
Replace Teflon delivery tubing	Yearly	*Lab Analyst*
Test Acetonitrile used for sample extraction	Monthly	*Lab Analyst*
Computer Back-up	Weekly	*Lab Analyst*
Computer Virus Check	Weekly	*Lab Analyst*
Computer system preventive maintenance (clean out old files, compress hardrive, inspect)	Yearly	*PC support personnel*

Table 15.5 Preventive Maintenance in Inductively Coupled Plasma Laboratories

Item	Maintenance Frequency	Responsible Party
Instrument Tuning	Initial Setup	*LabTech Inc.*
Torch and Spray chambers cleaned	3 months	*Lab Analyst.*
Multi-point maintenance calibration	6 Months	*LabTech Inc.*
Comparison of NIST Standards to laboratory working and primary standards	Monthly	*Lab Analyst*
Clean Oven	Monthly	*Lab Analyst*
Plasma Generator	Monthly	*Lab Analyst*
Heat Generator	Yearly	*LabTech Inc*
Computer Back-up	Weekly	*Balance Analyst*
Computer Virus Check	Weekly	*Balance Analyst*
Computer system preventive maintenance (clean out old files, compress hardrive, inspect)	Yearly	*PC support personnel*

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	3 Months	*Field Technician*
	Clean inside of sampler	6 Months	*Field Technician*
	Replace Motor	Annually	*Field Technician*
	Replace Motor	Annually	*Field Technician*
	Replace Motor gaskets	When motor is replaced	*Field Technician*
	Filter screen inspected for impacted deposits or bits of filter	Annually	*Field Technician*
	Check connecting tube and power lines for holes, crimps or cracks	6 months	*Field Technician*
PUF Sampler	Motor Brush replacement	3 Months	*Field Technician*
	Clean inside of sampler	6 Months	*Field Technician*
	Replace Motor	Annually	*Field Technician*
VOC Sampler	Replace sample lines	Annually	*Senior Field Technician*
	Clean flow controller	Annually	*Senior Field Technician*
Aldehyde Sampler	Replace 1/8" connectors	Annually	*Field Technician*
	Cartridge connectors	Annually	*Field Technician*
	Replace Motor Brushes	Annually	*Field Technician*
	Fan motor replacement	2 years	*Field Technician*
	Clean inside of sampler	6 Months	*Field Technician*

16.0 Instrument Calibration and Frequency

This element of the QAPP concerns the calibration procedures that will be used for instrumental analytical methods and other measurement methods that are used in environmental measurements. It is necessary to distinguish between defining calibration as the checking of physical measurements against accepted standards and as determining the relationship (function) of the response versus the concentration. The American Chemical Society (ACS) limits the definition of the term *calibration* to the checking of physical measurements against accepted standards, and uses the term *standardization* to describe the determination of the response function.

16.1 Instrumentation Requiring Calibration

The QAPP should identify any equipment or instrumentation that requires calibration to maintain acceptable performance. While the primary focus of this element is on instruments of the measurement system (sampling and measurement equipment), all methods require standardization to determine the relationship between response and concentration

16.1.1 Analysis of Instruments - Laboratory

The laboratory support for Toxa City includes calibration. As indicated in Section 13, the instruments are calibrated using NIST traceable standards (if available) once a year under a service agreement. For the *Libra 101*, the service technician performs routine maintenance and makes any balance response adjustments that the calibration shows to be necessary. During the visit by the service technician, both the in-house primary and secondary (working) standards are checked against the service technicians standards to ensure acceptability. All of these actions are documented in the service technician's report, a copy of which is provided to the laboratory manager, which after review, is appropriately filed .

The laboratory also maintains a set of standards for each of the laboratory systems. Please see Table 16.1. Below are brief statements on how these Calibrations are performed.

- For the Libra 101, the technician uses 3 Class A weights to verify that the balance is weighing within the tolerance limits. Once this is performed, the balance is tarred. Filters are weighed in batches of 10 samples. After a sample batch has been weighed, the technician re-weighs on filter (duplicate weight) and re-tares the balance. At the end of the day (or end of the weighing session) the technician reweigh the 3 Class A weights. Any difference in weight is noted.
- For the Gas Chromatographs, the NIST Traceable cylinder is attached to a mass flow control calibration unit. The concentration of the benzene and methylene chloride are blended down to a value which will be in the higher 80% of the range of compounds found in ambient concentrations. This usually is ~ 20 ppbv. The Gas Chromatographs is allowed to reach

operating conditions. The gas from the mass flow controller is injected into the system and the carrier helium is allowed to flow. Once the calibration gas is allowed to enter, two peaks should appear. The mass flow controller is then adjusted to allow the gas concentration to be ~ 40%. This process is then repeated with a concentration of 20% of range of compounds. Zero air is then generated and a baseline is determined. The system is now ready to accept ambient concentrations. After the day's batches are run, a single point (80%) is injected into the GC.

< After the Inductively Coupled Plasma unit is allowed to come to operating conditions, a standard solution of metals is injected into the ICP. The responses are noted. Distilled ion-free water is then injected into the ICP. This allows the system to reach a baseline.

< For the Liquid Chromatographs, (Aldehydes) the procedure is the same, with the exception of the compounds injected. 2,4 Dinitro phenylhydrazine is dissolved in ultra-pure Acetonitrile. These become the standard solutions. After the LCs have come to operating conditions, ultra-pure Acetonitrile is injected. This allows the system to reach a baseline. Then a concentration at 80% of the normal ambient concentrations of DNPH in Acetonitrile are injected into the LC. Response peaks are observed and recorded. This procedure is repeated at the end of the analysis batch run.

Table 16.1 Lab Instruments Standards

Manufacturer	Instrument	Type of Standard	Frequency	NIST Traceability
Libra 101 (filter weights	Balance	Class A Weights	1 every 10 samples	Class A Weights
Antech 3000 (metals)	Inductively Coupled Plasma	High Purity Reagents - High Purity grade Standards	Before and after each batch run	99.99% pure ultra high grade Standard solutions
ZanTech 3001 (Aldehydes)	Liquid Chromatographs	High Purity 2,4 Dinitro phenylhydrazine crystals dissolved in Acetonitrile	Before and after each batch run	Reagent grade available from Chemical vendor
AnTech 3001 (SVOCs)	Gas Chromatography	High Purity Benzo [a] Pyrene Standard Solutions	Before and after each batch run	Reagent grade available from Chemical vendor
AnTech 3001 (VOCs)	Gas Chromatography	Compressed Gas Cylinder	Before and after each batch run	Benzene, Methylene Chloride are NIST Traceable through vendor

16.1.2 Flow Rate - Laboratory

Laboratory technicians perform the comparison of the flow rate transfer standard to a NIST-traceable primary flow rate standard and once every year sends the primary standard to NIST for Recertification. The laboratory and field personnel chose an automatic dry-piston flow meter for field calibrations and flow rate verifications of the flow rates of the network samplers. This type of device has the advantage of providing volumetric flow rate values directly, without requiring conversion from mass flow measurements, temperature, pressure, or water vapor corrections. 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.

Upon initial receipt of any new, repaired, or replaced air toxics sampler, a field technician will perform a multipoint flow rate calibration verification on the sampler flow rate to determine if initial performance is acceptable. Once sampler flow rate is accepted, the lab performs the calibration and verifications at the frequency specified in Section 14, as well as directly performing or arranging to have another party perform the tests needed to recertify the organizations standards.

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 manometer in the laboratory is used as a primary standard to calibrate the two electronic aneroid barometers that go out in the field as transfer standards.

16.1.4 Field

The following calibrations are performed in the field:

- calibration of volumetric flow rate meter of each samplers against the working standard;
- calibration of sampler temperature and pressure sensors against the working temperature standard (VOC and Aldehyde Samplers only);
- calibration of the min/max thermometers, normally located in the coolers in which DNPH cartridges , PUFs and XAD 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

The QAPP must describe the calibration method for each instrument in enough detail for another researcher to duplicate the calibration method. It may reference external documents such as EPA-designated calibration procedures or SOPs providing that these documents can be easily obtained. Nonstandard calibration methods or modified standard calibration methods should be fully documented and justified.

Most EPA-approved analytical methods require multipoint (three or more) calibrations that include zeros, or blanks, and higher levels so that unknowns fall within the calibration range and are bracketed by calibration points. The number of calibration points, the calibration range, and any replication (repeated measures at each level) should be given in the QAPP.

The QAPP should describe how calibration data will be analyzed. The use of statistical QC techniques to process data across multiple calibrations to detect gradual degradations in the measurement system should be described. The QAPP should describe any corrective action that will be taken if calibration (or calibration check) data fail to meet the acceptance criteria, including recalibration. References to appended SOPs containing the calibration procedures are an acceptable alternative to describing the calibration procedures within the text of the QAPP.

16.2.1 Laboratory - Gravimetric (Mass) Calibration

The calibration and QC (verification) checks of the microbalance are addressed in Sections 16.1.1 and 13.3 of this QAPP. For the following 3 reasons, the multipoint calibration for this method will be zero, 100 and 200mg: 1) the required sample collection filters weigh between 100 and 200 mg; 2) the anticipated range of sample loadings for the 24 hour sample period is rarely going to be more than a few 100 mgs; and 3) the lowest, commercially available check weights that are certified according to nationally accepted standards are only in the single milligram range. Since the critical weight is not the absolute unloaded or loaded filter weight, but the difference between the two, the lack of microgram standard check weights is not considered cause for concern about data quality, as long as proper weighing procedure precautions are taken for controlling contamination, or other sources of mass variation in the procedure.

16.2.2 Laboratory/ Field - Flow Calibration.

The Air Monitoring and Laboratory Branch 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.

Method Summary: After equilibrating the calibration device to the ambient conditions, connect the flow calibration device on the sampler down tube or filter holding device. If the sampler has not been calibrated before, or if the previous calibration was not acceptable, perform a leak check according to the manufacturer's operational instruction manual, which is incorporated into Toxa City ATMP SOPs.

Otherwise, place the sampler in calibration or "run" mode and perform a one-point calibration/verification or a one-point flow rate verification. The field staff will only perform a leak check after calibration or verification of are outside of the acceptance criteria.

Following the calibration or verification, turn off the sampler pump, remove the filter, cartridge, or PUF holder, remove the flow calibration device, (and flow adaptor device if applicable), and replace the sampler inlet or hood. If the flow rate is determined to be outside of the required target flow rate, attempt to determine possible causes by minor diagnostic and trouble shooting techniques (e.g., leak checks), including those listed in the manufacturer's operating instruction manual.

16.2.3 Sampler Pressure Calibration Procedure

General: According to ASTM Standard D 3631 (ASTM 1977), a barometer can be calibrated by comparing it with a secondary standard traceable to a NIST primary standard.

Precautionary Note: Protect all barometers from violent mechanical shock and sudden changes in pressure. A barometer subjected to either of these events must be recalibrated. Maintain the vertical and horizontal temperature gradients across the instruments at less than 0.1°C/m. Locate the instrument so as to avoid direct sunlight, drafts, and vibration.

A Fortin mercury type of barometer is used in the laboratory to calibrate and verify the aneroid barometer used in the field to verify the barometric sensors of samplers. Details are provided in the appropriate SOP.

16.3 Calibration Standard Materials and Apparatus

Some instruments are calibrated using calibration apparatus rather than calibration standards. For example, an ozone generator is part of a system used to calibrate continuous ozone monitors. Commercially available calibration apparatus should be listed together with the make (the manufacturer's name), the model number, and the specific variable control settings that will be used during the calibrations. A calibration apparatus that is not commercially available should be described in enough detail for another researcher to duplicate the apparatus and follow the calibration procedure.

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

Table 16.2 Standard Materials and/or Apparatus for Air Toxics Calibration

Parameter M-Material A=Apparatus	**Std. Material**	**Std. Apparatus**	**Mfr. Name**	**Model #**	**Frequency of Calibration**
Mass M	Class A wgts	NA	*ScalesTech. Inc.*	111	NA
Temperature					
M+A	Hg	Thermometer	*Hot Water Inc.*	5500	NA
M+A	NA	Thermistor	*True Temp.*	8910	Annually
Pressure					
M+A	Hg	Fortin	*You Better...*	22	NA
A	NA	Aneroid	*Aviators Choice*	7-11	Quarterly
Flow Rate					
A	NA	Piston Meter	*Flowtech Inc.*	F199	Annually
A		Bubble Meter		LG88	NA
A		High Volume Flow	*SaapTech. Inc* *Top Hat Inc..*	TP-1	Annually

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 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 recalibrated and recertified at least annually.

The actual frequency with which this recertification process must be completed depends on the type of flow rate standard- some are much more likely to be stable than others. The Division will maintain a control chart (a running plot of the difference or percent difference between the flow-rate standard and the NIST-traceable primary flow-rate or volume standard) for all comparisons. In addition to providing excellent documentation of the certification of the standard, a control chart also gives a good indication of the stability of the standard. If the two standard-deviation control limits are close together, the chart indicates that the standard is very stable and could be certified less frequently. The minimum recertification frequency is 1 year. On the other hand, if the limits are wide, the chart would indicate a less stable standard that will be recertified more often.

The High Volume sampler flow rate device is a *Top Hat Inc., TP-1*, 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 TCAPCD samplers identify types of temperature standards recommended for calibration and provide a detailed calibration procedure for each type that is specifically designed for the particular sampler.

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 reverified and recertified at least annually. The actual frequency of recertification depends on the type of temperature standard; some are much more stable than others. The Division will use ana NIST-traceable mercury in glass thermometer, for laboratory calibration and certification of the field thermistor.

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.

The TCAPCD laboratory standards are 2 NIST-traceable mercury-in-glass thermometers from the *Hot Water Inc*, each with its own certificate summarizing the company's NIST traceability protocol and documenting the technicians signature, comparison date, identification of the NIST standard used, and the mean and standard deviation of the comparison results. There are 2 thermometers with overlapping ranges that span the complete range of typically measured summer to winter lab and field temperature values.

The TCAPCD field temperature standards are two *True Temp.8910* @ thermistor probes and one digital readout module with RS232C jack and cable connector available for linkage to a data logger or portable computer. The two probes have different optimum ranges, one including the full range of temperatures ever recorded in the summer and the other including the full range of temperatures ever recorded in the winter by the National Weather Service at the Toxa City sites. Each probe came with a certificate of NIST-traceability with the same kind of information as the thermometer certificates contained.

Pressure

The Fortin mercurial type of barometer works on fundamental principles of length and mass and is therefore more accurate but more difficult to read and correct than other types. By comparison, the precision aneroid barometer is an evacuated capsule with a flexible bellows coupled through mechanical, electrical, or optical linkage to an indicator. It is potentially less accurate than the Fortin type but can be transported with less risk to the reliability of its measurements and presents no damage

from mercury spills. The Fortin type of barometer is best employed as a higher quality laboratory standard which is used to adjust and certify an aneroid barometer in the laboratory. The Toxa City pressure standard is a *You Better Believe It*@ Model 22 Fortin-type mercury barometer. The field working standard is an *Aviator's Choice*@ 7-11 aneroid barometer with digital readout.

16.5 Document Calibration Frequency

See Table 16-1 for a summary of Primary and Working Standards QC checks that includes frequency and acceptance criteria and references for calibration and verification tests . All of these events, as well as sampler and calibration equipment maintenance will be documented in field data records and notebooks and annotated with the flags. Laboratory and field activities associated with equipment used by the respective technical staff will be kept in record notebooks as well. The records will normally be controlled by the Branch Managers, and located in the labs or field sites when in use or at the manager's offices when being reviewed or used for data validation.

References

1. ASTM. 1977. Standard test methods for measuring surface atmospheric pressure. American Society for Testing and Materials. Philadelphia, PA. Standard D 3631-84.

2. ASTM. 1995. Standard test methods for measuring surface atmospheric pressure. American Society for Testing and Materials. Publication number ASTM D3631-95.

3. EPA. 1995. Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV: Meteorological Measurements. U.S. Environmental Protection Agency. Document No. EPA/600/R-94/038d. Revised March.

4. NIST. 1976. Liquid-in-glass thermometry. National Institute of Standards and Technology. NBS Monograph 150. January.

5. NIST. 1986. Thermometer calibration: a model for state calibration laboratories. National Institute of Standards and Technology. NBS Monograph 174. January.

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

7. NIST. 1989. The calibration of thermocouples and thermocouple materials. National Institute of Standards and Technology. Special publication 250-35. April 1989

17.0 Inspection/Acceptance for Supplies and Consumables

Describe how and by whom supplies and consumables shall be inspected and accepted for use in the project. State acceptance criteria for such 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 Toxa City Air Toxics Monitoring 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

Clearly identify and document all supplies and consumables that may directly or indirectly affect the quality of the project or task. See Figures 10 and 11 for example documentation of inspection/acceptance testing requirements. Typical examples include sample bottles, calibration gases, reagents, hoses, materials for decontamination activities, deionized water, and potable water.

For each item identified, document the inspection or acceptance testing requirements or specifications (e.g., concentration, purity, cell viability, activity, or source of procurement) in addition to any requirements for certificates of purity or analysis.

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	Model Number
TSP Sampler	8 x 11" Quartz filters	Quartz filter	FilterTech Inc.	NA
TSP Sampler	High Volume Motor	20 amp. Blower motor	*XYZ Company*	*X300*
TSP Sampler	Motor Brushes	Carbon Brush Elements	*XYZ Company*	*X301*
VOC Sampler	Stainless Steel tubing	Clean SS tubing	*Steeltech*	*X3301*
VOC Sampler	Mass Flow Controller	0- 50 cc/min.	*Flowtech Inc.*	*FL100*
Aldehyde Sampler	DNPH cartridges	DNPH coated plastic Cartridges	*CartTech Inc.*	*D100*

Area	Item	Description	Vendor	Model Number
Aldehyde Sampler	Fuses	In sampler	*FuseTech Inc.*	*F100*
Aldehyde Sampler	Mass Flow Controller	0-100 cc/min	*Flowtech Inc.*	*Fl101*
Aldehyde Sampler	Motor	0-200 cc/min	*Flowtech Inc.*	
PUF Sampler	Low Volume Motor	16.7 l/m	Flowtech Inc.	FL3021
PUF Sampler	76 mm filter	Quartz	*XYZ Company*	*X401*
PUF Sampler	PUF Cartridge with XAD resin	Sampling media	*XYZ Company*	*X402*
PUF Sampler	Chart Paper	Flow check	*XYZ Company*	*D100*
PUF Sampler	Motor Brushes	Carbon Brush Elements	*XYZ Company*	X101

Table 17.2 Critical Laboratory Supplies and Consumables

Area	Item	Description	Vendor	Model Number
Weigh Room	Staticide	Anti-static solution	WeighTech	W1024
Weigh Room	Forceps	non-serrated/Teflon Coated	*WeighTech*	*W1010*
Weigh Room	Air Filters	High Efficiency	*Purchase Local*	
All	Powder Free Antistatic Gloves	Vinyl, Class M4.5	*Fisher Scientific*[@]	*11-393-85A*
All	Low-lint wipes	4.5" x 8.5" Cleaning Wipes	*Kimwipes*[@]	*34155*
Liquid Chromatography	Teflon tubing	1/8" PTFE tubing	*TubeTech Inc*	*T108*
Liquid Chromatography	Chromatographs column	36" column	*ZanTech Inc.*	*C1001*
GC/MS	Chromatographs column	48" column	*ZanTech Inc.*	*C1004*
GC/MS	FID Detector	High Detection	*ZanTech Inc.*	*D1001*
GC/MS	Helium	Carrier Gas	*CylinderTech*	*H10023*
GC/MS	Hydrogen Gas	Flame Gas	*CylinderTech*	*H10022*
GC/MS	Zero Air	Calibration Gas	*CylinderTech*	*H10024*

GC/MS	Liquid Nitrogen	200 gallons tank	*All Gases Inc.*	*H10021*
GC/MS	Silica Gel	Canister	*Zantech Inc*	*S10022*
GC/MS	cryogenic traps	stainless steel	*CylinderTech*	*H10023*
ICP	Argon Coolant	Coolant Flow	*CylinderTech*	*A10022*
ICP	Deionized H20	Post Flush	*Various Vendors*	
ICP	Photo multiplier Tube	Analytical element	*ZanTech Inc.*	*PT10045*
All Instruments	Reagent Grade Solvents	See SOPs	*Various Vendors*	
All Instruments	Reagent Grade Solvents	See SOPs	*Various Vendors*	
All Instruments	Various sizes of ferrules, tubing and connectors	See SOPs	*Various Vendors*	

17.3 Acceptance Criteria

Acceptance criteria must be consistent with overall project technical and quality criteria . If special requirements are needed for particular supplies or consumables, a clear agreement should be established with the supplier, including the methods used for evaluation and the provisions for settling disparities.

Acceptance criteria must be consistent with overall project technical and quality criteria. It is the air monitoring branch chief and the field technicians 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

Procedures should be established to ensure that inspections or acceptance testing of supplies and consumables are adequately documented by permanent, dated, and signed records or logs that uniquely identify the critical supplies or consumables, the date received, the date tested, the date to be retested (if applicable), and the expiration date. These records should be kept by the responsible individual(s) (see Figure 13 for an example log)

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 District 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, document when these items are changed out. A sign-in/sign-out sheet is placed outside of the stockroom. All personnel must sign-out for any consumables removed or added to the stock room.. A lab technician then enters this data into the equipment tracking database. The database will allow all levels (Division Director, Branch Chief, lab and field technicians) able to tell if items and consumables are in stock.

18.0 Data Acquisition Requirements

This element of the QAPP should clearly identify the intended sources of previously collected data and other information that will be used in this project. Information that is non-representative and possibly biased and is used uncritically may lead to decision errors. The care and skepticism applied to the generation of new data are also appropriate to the use of previously compiled data (for example, data sources such as handbooks and computerized databases).

This section addresses data not obtained by direct measurement from the Air Toxics Monitoring Program. This includes both outside data and historical monitoring data. Non-monitoring data and historical monitoring data are used by the Program 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 TCAPCD ATMP and to information previously acquired and/or acquired from outside sources.

18.1 Acquisition of Non-Direct Measurement Data

This element's criteria should be developed to support the objectives of element A7. Acceptance criteria for each collection of data being considered for use in this project should be explicitly stated, especially with respect to:

Representativeness. Were the data collected from a population that is sufficiently similar to the population of interest and the population boundaries? How will potentially confounding effects (for example, season, time of day, and cell type) be addressed so that these effects do not unduly alter the summary information?

Bias. Are there characteristics of the data set that would shift the conclusions. For example, has bias in analysis results been documented? Is there sufficient information to estimate and correct bias?

Precision. How is the spread in the results estimated? Does the estimate of variability indicate that it is sufficiently small to meet the objectives of this project as stated in element A7? See also Appendix D.

Qualifiers. Are the data evaluated in a manner that permits logical decisions on whether or not the data are applicable to the current project? Is the system of qualifying or flagging data adequately documented to allow the combination of data sets?

Summarization. Is the data summarization process clear and sufficiently consistent with the goals of this project? (See element D2 for further discussion.) Ideally, observations and transformation equations are available so that their assumptions can be evaluated against the objectives of the current project.

This element should also include a discussion on limitations on the use of the data and the nature of the uncertainty of the data.

The ATMP relies on data that are generated through field and laboratory operations; however, other significant data are obtained from sources outside the TCAPCD 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. Other data sources may be used with approval of the Air Division QA Officer.

- 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 Toxa City QA Officer. 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 type of data that will commonly be used in conjunction with the Monitoring Program is geographic information. For the current sites, the District will locate these sites using global positioning systems (GPS) that meet EPA Locational Data Policy of 25 meters accuracy. USGS maps were used as the primary means for locating and siting stations in the existing network. Geographic locations of Toxa City monitoring sites that are no longer in operation will not be re-determined.

External Monitoring Data Bases

It is the policy of the TCAPCD that no data obtained from the Internet, computer bulletin boards, or data bases from outside organizations shall be used in creating reportable data or published reports without approval of the Air Division Director. This policy is intended to ensure the use of high quality data in Toxa City publications.

Data from the EPA -AIRS data base may be used in published reports with appropriate caution. Care must be taken in reviewing/using any data that contain flags or data qualifiers. If data is flagged, such data shall not be utilized unless it is clear that the data still meets critical QA/QC requirements. It is impossible to assure that a data base such as AIRS is completely free from errors including outliers and biases, so caution and skepticism is called for in comparing Toxa City data from other reporting agencies as reported in AIRS. Users should review available QA/QC information to assure that the external data are comparable with Toxa City measurements and that the original data generator had an acceptable QA program in place.

Lead and Speciated Particulate Data

The TCAPCD has been routinely monitoring airborne lead since the 1981. Early data is likely to be problematic because of significantly higher detection limits. Caution is needed in directly comparing this data with the data because of the difference in size fractions.

Existing chemical speciation data for elements other than lead are very limited. Some speciation data from $PM_{2.5}$ Speciation Samples were obtained by the Toxa City Institute of Technology in cooperation with the District of Health during a1999 research study sponsored by the U.S.EPA. These results may be used to provide a historical baseline for the speciation results to be obtained by the PM_{25} Ambient Air Quality Monitoring Program; however, it is unclear whether the quality of these data is sufficient to allow direct comparison with new toxics data.

U.S. Weather Service Data

Meteorological information is gathered from the U.S. Weather Service station at the Toxa City 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 Toxa City monitoring sites, which each have the required meteorological sensors. However, NWS data are often included in summary reports. No changes to the way in which these data are collected are anticipated due to the addition of the air toxics data to the Toxa City Air Pollution Control District.

19.0 Data Management

19.1 Background and Overview

This element should present an overview of all mathematical operations and analyses performed on raw ("as-collected") data to change their form of expression, location, quantity, or dimensionality. These operations include data recording, validation, transformation, transmittal, reduction, analysis, management, storage, and retrieval. A diagram that illustrates the source(s) of the data, the processing steps, the intermediate and final data files, and the reports produced may be helpful, particularly when there are multiple data sources and data files. When appropriate, the data values should be subjected to the same chain-of-custody requirements as outlined in element B3. Appendix G has further details.

This section describes the data management operations pertaining to measurements for the air toxics stations operated by TCAPCD. This includes an overview of the mathematical operations and analyses performed on raw ("as-collected") data. These operations include data recording, validation, transformation, transmittal, reduction, analysis, management, storage, and retrieval.

Data processing for air toxics data are summarized in Figure 19-1. Data processing steps are integrated, to the extent possible, into the existing data processing system used for The TCAPCD airt toxics network. The data base resides on a machine running the Windows NT Server operating system, which is also the main file server for the Air Quality Division. This machine is shown in the upper left of Figure 19-1.

The sample tracking and chain of custody information are entered into the Laboratory Information Management System (LIMS) at four main stages as shown in Figure 19-1. Managers are able to obtain reports on status of samples, location of specific samples, etc.,using LIMS. All users must be authorized by the Manager, Air Quality Division, and receive a password necessary to log on to the LIMS. Different privileges are given each authorized user depending on that person's need. The following privilege levels are defined:

- < Data Entry Privilege - The individual may see and modify only data within LIMS, he or she has personally entered. After a data set has been "committed" to the system by the data entry operator, all further changes will generate entries in the system audit trail;
- < Reporting Privilege - This without additional privileges;
- < Data Administration Privilege - Data Administrators for the LIMS are allowed to change data as a result of QA screening and related reasons. All operations resulting in changes to data values are logged to the audit trail. The Data Administrator is responsible for performing the following tasks on a regular basis;
- C Merging/correcting the duplicate data entry files;
- C Running verification/validation routines, correcting data as necessary and generating summary data reports for management;

c Uploading verified/validated data to EPA -AIRS.

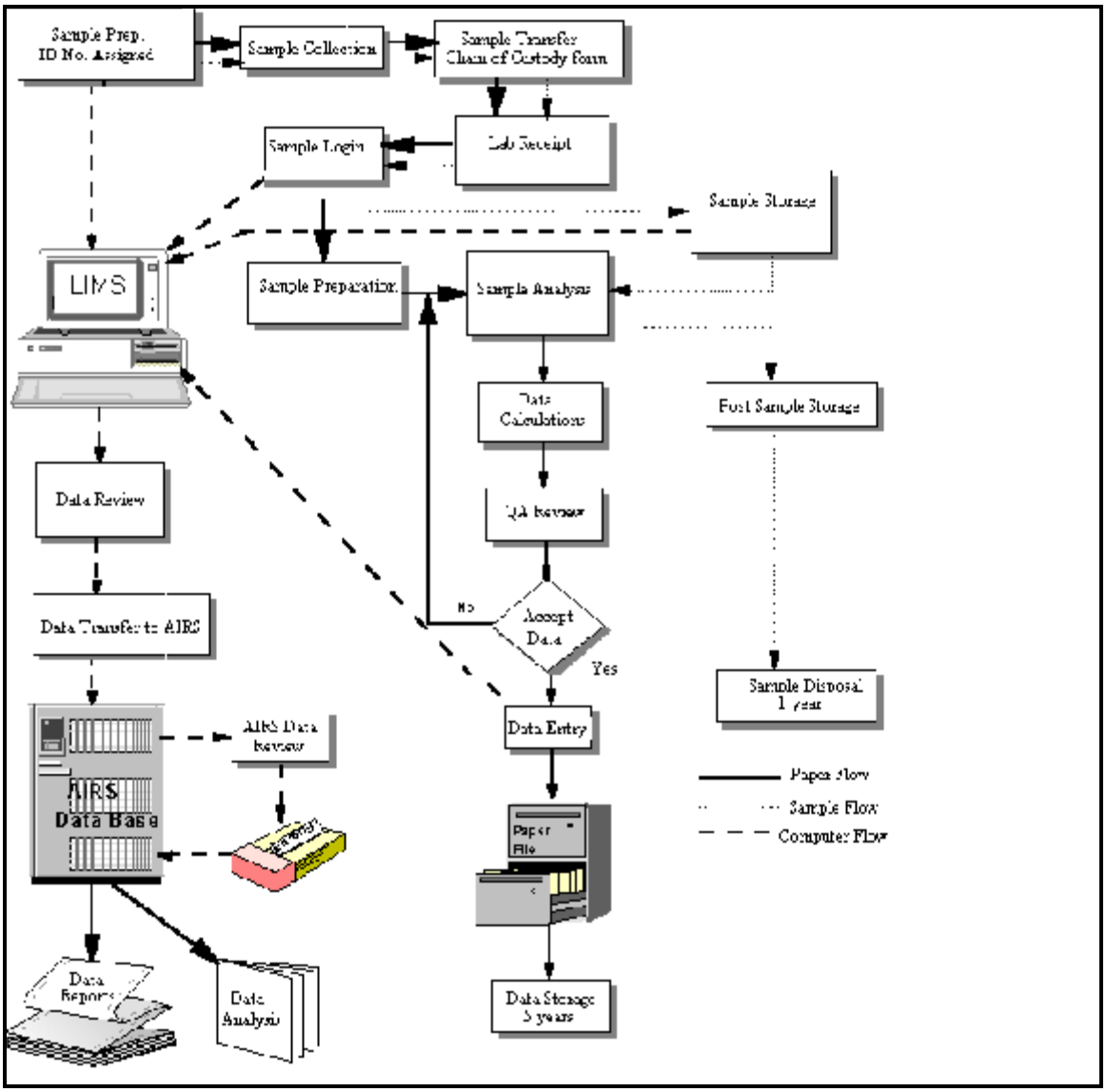

Figure 19.1 Data Management and Sample Flow Diagram

19.2 Data Recording

Any internal checks (including verification and validation checks) that will be used to ensure data quality during data encoding in the data entry process should be identified together with the mechanism for detailing and correcting recording errors. Examples of data entry forms and checklists should be included.

Data entry, validation, and verification functions are all integrated in the LIMS. Bench sheets shown in Figure 19.1 are entered by laboratory personnel. Procedures for filling out the laboratory sheets and subsequent data entry are provided in SOPs listed in Table 19.1 and included in the SOPs.

19.3 Data Validation

The details of the process of data validation and pre-specified criteria should be documented in this element of the QAPP. This element should address how the method, instrument, or system performs the function it is intended to consistently, reliably, and accurately in generating the data. Part D of this document addresses the overall project data validation, which is performed after the project has been completed.

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. Numerical data stored in the LIMS are never internally overwritten by condition flags. Flags denoting error conditions or QA status are saved as separate fields in the data base, so that it is possible to recover the original data.

The following validation functions are incorporated into the LIMS ensure quality of data entry and data processing operations:

- **Duplicate Key Entry** - the following data are subjected to duplicate entry by different operators: filter weight reports, field data sheets, chain of custody sheets. The results of duplicate key entry are compared and errors are corrected at biweekly intervals. The method for entering the data are given in SOPs. Procedures for reconciling the duplicate entries are given in SOPs.
- **Range Checks** - almost all monitored parameters have simple range checks programmed in. For example, valid times must be between 00:00 and 23:59, summer temperatures must be between 10 and 50 degrees Celsius, etc. The data entry operator is notified immediately when an entry is out of range. The operator has the option of correcting the entry or overriding the range limit. The specific values used for range checks may vary depending on season and other factors. Since these range limits for data input are not regulatory requirements, the Air Division QA Officer may adjust them from time to time to better meet quality goals.
- **Completeness Checks** - When the data are processed certain completeness criteria must be met. For example, each sample must have a start time, an end time, an average flow rate, dates weighed

or analyzed and operator and technician names. The data entry operator will be notified if an incomplete record has been entered before the record can be closed.

- **Internal Consistency and Other Reasonableness Checks -** Several other internal consistency checks are built into the LIMS. For example, the end time of a sample must be greater than the start time. Computed filter volume (integrated flow) must be approximately equal to the exposure time multiplied by the nominal flow. Additional consistency and other checks will be implemented as the result of problems encountered during data screening..
- **Data Retention** - Raw data sheets are retained on file in the Air Quality Division office for a minimum of five years, and are readily available for audits and data verification activities. After five years, hardcopy records and computer backup media are cataloged and boxed for storage at the Toxa City Services Warehouse. Physical samples such as filters shall be discarded with appropriate attention to proper disposal of potentially hazardous materials.
- **Statistical Data Checks** - Errors found during statistical screening will be traced back to original data entry files and to the raw data sheets, if necessary. These checks shall be run on a monthly schedule and prior to any data submission to AIRS. Data validation is the process by which raw data are screened and assessed before it can be included in the main data base (i.e., the LIMS).
- **Sample Batch Data Validation**- which is discussed in Section 23, associates flags, that are generated by QC values outside of acceptance criteria, with a sample batch. Batches containing too many flags would be rerun and or invalidated.

Table 19.1 summarizes the validation checks applicable to the data.

Table 19.1 Validation Check Summaries

Type of Data Check	Electronic Transmission and Storage	Manual Checks	Automated Checks
Data Parity and Transmission Protocol Checks	U		
Duplicate Key Entry		U	
Date and Time Consistency		U	U
Completeness of Required Fields		U	U
Range Checking			U
Statistical Outlier Checking			U
Manual Inspection of Charts and Reports		U	
Field and Lab Blank Checks		U	

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

19.4 Data Transformation

Data transformation is the conversion of individual data point values into related values or possibly symbols using conversion formulas (e.g., units conversion or logarithmic conversion) or a system for replacement. The transformations can be reversible (e.g., as in the conversion of data points using a formulas) or irreversible (e.g., when a symbol replaces actual values and the value is lost). The procedures for all data transformations should be described and recorded in this element. The procedure for converting calibration readings into an equation that will be applied to measurement readings should be documented in the QAPP. Transformation and aberration of data for statistical analysis should be outlined in element D3, "Reconciliation with Data Quality Objectives."

Calculations for transforming raw data from measured units to final concentrations are relatively straightforward.

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. The QAPP should describe each data transfer step and the procedures that will be used to characterize data transmittal error rates and to minimize information loss in the 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 19-3 summarizes data transfer operations.

Table 19.2 Data Transfer Operations

Description of Data Transfer	Originator	Recipient	QA Measures Applied
Keying Data into The LIMS	Laboratory Technician (hand-written data form)	Data Processing Personnel	Double Key Entry
Electronic data transfer	(between computers or over network)	--	Parity Checking; transmission protocols
Filter Receiving and Chain-of-Custody	Shipping and Receiving Clerk	The LIMS computer (shipping clerk enters data at a local terminal)	Sample numbers are verified automatically; reports indicate missing filters and/or incorrect data entries
Calibration and Audit Data	Auditor or field supervisor	Air Quality Field Supervisor	Entries are checked by Air Quality Supervisor and QA Officer
AIRS data summaries	Air Quality Supervisor	AIRS (U.S. EPA)	Entries are checked by Air Quality Supervisor and QA Officer

The TCAPCD 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 directly to 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 19.3.

Table 19.3 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 includes all processes that change the number of data items. This process is distinct from data transformation in that it entails an irreversible reduction in the size of the data set and an associated loss of detail. For manual calculations, the QAPP should include an example in which typical raw data are reduced. For automated data processing, the QAPP should clearly indicate how the raw data are to be reduced with a well-defined audit trail, and reference to the specific software documentation should be provided.

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. 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 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.

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 audit trail 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 three years.

19.7 Data Summary

Data analysis sometimes involves comparing suitably reduced data with a conceptual model (e.g., a dispersion model or an infectivity model). It frequently includes computation of summary statistics, standard errors, confidence intervals, tests of hypotheses relative to model parameters, and goodness-of-fit tests. This element should briefly outline the proposed methodology for data analysis and a more detailed discussion should be included in the final report.

The TCAPCD is currently implementing the data summary and analysis program It is anticipated that as the Monitoring Program develops, additional data analysis procedures will be developed. The following specific summary statistics will be tracked and reported for the 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.

Equations used for these reports are given in the Table 19.4.

Table 19.4 Report Equations

Criterion	Equation
Accuracy of Single Sampler Flow - Single Check (d_i) X_i is reference flow; Y_i is measured flow	$d_i = \frac{Y_i - X_i}{X_i} \times 100$
Bias of a Single Sampler - Annual Basis (D_j)- average of individual percent differences between sampler and reference value; n_j is the number of measurements over the period	$D_j = \frac{1}{n_j} \times \sum_{i=1}^{n_j} d_i$
Percent Difference for a Single Check (d_i) - X_i and Y_i are concentrations from the primary and duplicate samplers, respectively.	$d_i = \frac{Y_i - X_i}{(Y_i + X_i)/2} \times 100$
Upper 95% Confidence Limit	$Limit = d_i + 1.96 * S_i / \sqrt{2}$
Lower 95% Confidence Limit	$Limit = d_i - 1.96 * S_i / \sqrt{2}$
Completeness	$Completeness = \frac{N_{valid}}{N_{theoretical}} * 100$

19.8 Data Tracking

Data management includes tracking the status of data as they are collected, transmitted, and processed. The QAPP should describe the established procedures for tracking the flow of data through the data processing system.

The LIMS contains the necessary input functions and reports necessary 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)
  - C Sample receipt (by lot);
  - C Pre-sampling processing or weighing (individual filter or cartridge number first enters the system);
  - < Canister number (VOC only);
  - C 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)
  - C Package receipt (package is opened and filter numbers are logged in);
  - C Filter post-sampling weighing;
  - C 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.

The Air Division Branch Chief or designee is responsible for tracking sample status at least twice per week and following up on anomalies such as excessive holding time in the laboratory before analysis.

19.9 Data Storage and Retrieval

The QAPP should discuss data storage and retrieval including security and time of retention, and it should document the complete control system. The QAPP should also discuss the performance requirements of the data processing system, including provisions for the batch processing schedule and the data storage facilities.

Data archival policies for the data are shown in Table 19.5.

Table 19.5 Data Archive Policies

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

The data reside on an Local Access Network on the TCAPCD server. This computer has the following specifications:

- < Storage: 18 GB (SCSI RAID 0 array);
- < Backup: DAT (3 GB per tape) - incremental backups daily; full backups biweekly;
- < Network: Windows NT, 100 Mbps Ethernet network (currently 23 Windows 95 and NT workstations on site; additional workstations via 28.8 kbps dial-in modem);

- Security: Password protection on all workstations and dial-in lines; Additional password protection applied by application software.

Security of data in the data base is ensured by the following controls:

- Password protection on the data base that defines three levels of access to the data;
- Regular password changes (quarterly for continuing personnel; passwords for personnel leaving the Air Division will be canceled immediately);
- Independent password protection on all dial-in lines;
- Logging of all incoming communication sessions, including the originating telephone number, the user's ID, and connect times;
- Storage of media including backup tapes in locked, restricted access areas.

20.0 Assessments and Response Actions

During the planning process, many options for sampling design (ref. EPA QA/G-5S, *Guidance on Sampling Design to Support QAPPs*), sample handling, sample cleanup and analysis, and data reduction are evaluated and chosen for the project. In order to ensure that the data collection is conducted as planned, a process of evaluation of the collected data is necessary. This element of the QAPP describes the internal and external checks necessary to ensure that:

- all elements of the QAPP are correctly implemented as prescribed,
- the quality of the data generated by implementation of the QAPP is adequate, and
- corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

Although any external assessments that are planned should be described in the QAPP, the most important part of this element is documenting all planned internal assessments. Generally, internal assessments are initiated or performed by the internal QA Officer so the activities described in this element of the QAPP should be related to the responsibilities of the QA Officer.

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 TCAPCD in conjunction with the State, EPA Regional office will perform the following assessments:

20.1 ASSESSMENT ACTIVITIES AND PROJECT PLANNING

20.1.1 Management Systems Review

A management systems review (MSR) is a qualitative assessment of a data collection operation or organization to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate. MSRs conducted every three years by the QA Division. The MSR will use appropriate regulations, and the QAPP to determine the adequate operation of the air program and its related quality system. The quality assurance activities of all criteria pollutants including air toxics will be part of the MSR. The QA Office Director's staff will report its findings to the appropriate Divisions within 30 days of completion of the MSR. The report will be appropriately filed. Follow-up and progress on corrective action(s) will be determined during regularly scheduled division directors meetings

20.1.2 Network Reviews

Conformance with network requirements of the monitoring network through annual review . 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 every 3 years. Since the states are also required to perform these reviews, the District will coordinate its activity with the State in order to perform the activity at the same time (if possible). The Air Monitoring Branch will be responsible for conducting the network review.

The following criteria will be considered during the review:

- < date of last review;
- < areas where attainment/nonattainment redesignations are taking place or are likely to take place;
- < results of special studies, saturation sampling, point source oriented ambient monitoring, etc.;
- < proposed network modifications since the last network review.

In addition, pollutant-specific priorities may be considered in areas that models may show persons to be at risk.

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 quality summaries for the past five years for the monitors in the network;
- < 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.

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. The following categories will emphasized during network reviews:

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 "reverified" 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 Technical Systems Audits

A 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 every three years and will stagger the required TSA conducted by the State QA Office. The QA Office will implement the TSA either as a team or as an individual auditor. The QA Office will perform three TSA activities that can be accomplished separately or combined :

< Field - handling, sampling, shipping.;
< Laboratory - Pre-sampling , shipping. receiving, post-sampling weighing, analysis, archiving, and associated QA/QC;
< Data management - Information collection, flagging, data editing, security, upload.

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.

To increase uniformity of the TSA, an audit checklist will be developed and used. This checklist is based on the *EPA R-5* guidance.

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.

20.1.4 Performance Audit

A Performance Audit is a field operations audit that ascertains whether the samplers are operating within the specified limits as stated in the SOPs and QAPP. The Performance Audit is performed every year in conjunction with the field TSA. The audit consists of challenging the samplers to operate using independent NIST-traceable orifices or other flow devices. Once the audit has been performed, the flow rate is calculated and compared against the flow rates as specified in the QAPP or SOPs. If the flowrates are not within these ranges, then the field operations technician is notified and corrective action ensues. Once the field technicians have remedied the situation, a post audit confirms the adjustment or maintenance. The audit results are then written in a detailed report and are included in the QAAR.

20.1.5 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.

20.1.6 Performance Evaluations

The PE is an assessment tool for the laboratory operations. The State's Laboratory Division creates "blind" samples and sends them periodically to the District's laboratory. Upon receipt, the laboratory logs in the samples and performs the normal handling routines as any other sample. The PE is analyzed in accordance with the SOPs and QAPP. The results are then sent to the Laboratory Branch Manager for final review. Then the results are reported to the State's Laboratory Director. The State's laboratory writes up a PE report and sends a copy of the results to the Laboratory Branch Manager and the EPA QA Office. Any results outside of the State's acceptance criteria are then noted in the PE report. The TCAPCD has 120 days to address any deficiencies noted in the PE Report.

20.2 Documentation of Assessments

The following material describes what should be documented in a QAPP after consideration of the above issues and types of assessments:

Number, Frequency, and Types of Assessments- Depending upon the nature of the project, there may be more than one assessment. A schedule of the number, frequencies, and types of assessments required should be given.

Assessment Personnel- The QAPP should specify the individuals, or at least the specific organizational units, who will perform the assessments. Internal audits are usually performed by personnel who work for the organization performing the project work but who are organizationally independent of the management of the project. External audits are performed by personnel of organizations not connected with the project but who are technically qualified and who understand the QA requirements of the project.

Sschedule of Assessment Activities-A schedule of audit activities, together with relevant criteria for assessment, should be given to the extent that it is known in advance of project activities.

Remoting and Resolution of Issues-Audits, peer reviews, and other assessments often reveal findings of practice or procedure that do not conform to the written QAPP. Because these issues must be addressed in a timely manner, the protocol for resolving them should be given here together with the proposed actions to ensure that the corrective actions were performed effectively. The person to whom the concerns should be addressed, the decision-making hierarchy, the schedule and format for oral and written reports, and the responsibility for corrective action should all be discussed in this element. It also should explicitly define the unsatisfactory conditions upon which the assessors are authorized to act and list the project personnel who should receive assessment reports.

Table 20.1 Assessment Summary

Assessment Activity	Frequency	Personnel Responsible	Schedule	Report Completion	Reporting/Resolution
Management Systems Reviews	1/3 years	Directors Office	1/1/00	30 days after activity	Directors Office to QA, Air, Program Support Divisions
Network Reviews App D App E	1/ years 1/3 years	Air Division Air Division	1/1/00 1/1/00	30 days after activity	Air Division to Air Monitoring Branch
Technical Systems Audits	1/3 years	QA Office	5/1/99	30 days after activity	QA Division to Air Monitoring Division
Audits of Data Quality	1/ year	QA Office	5/1/99	30 days after activity	QA Division to Air Monitoring Division
Performance Audits	1/year	QA/Air Monitoring Divisions	1/1/00	120 days after end of calendar year	QA Division
Performance Evaluation	1/year	State Laboratory Division	1/1/00	120 days after end of calendar year	Laboratory Branch Manager

21.0 Reports to Management

Effective communication between all personnel is an integral part of a quality system. Planned reports provide a structure for apprizing management of the project schedule, the deviations from approved QA and test plans, the impact of these deviations on data quality, and the potential uncertainties in decisions based on the data. Verbal communication on deviations from QA plans should be noted in summary form in element D1 of the QAPP.

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 MSR and TSA for their assessment of the data. The MSR and TSA only occur once every three years. 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 insure 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

The QAPP should indicate the frequency, content, and distribution of the reports so that management may anticipate events and move to ameliorate potentially adverse results. An important benefit of the status reports is the opportunity to alert the management of data quality problems, propose viable solutions, and procure additional resources. If program assessment (including the evaluation of the technical systems, the measurement of performance, and the assessment of data) is not conducted on a continual basis, the integrity of the data generated in the program may not meet the quality requirements. These audit reports, submitted in a timely manner, will provide an opportunity to implement corrective actions when most appropriate

Required reports to management for monitoring in general are discussed in various sections of 40 CFR Parts 53 and 58. 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 required to be reported to EPA (40 CFR 58 Appendix A, Section 1.4, revised July 18, 1997). The Toxa City Air Pollution Control Air Division's QA Annual Report is issued to meet this requirement. This document describes the quality objectives for measurement data and how those objectives have been met.

The 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 TCAPCD performs 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.

External systems audits are conducted at least every three years by the EPA Regional Office as required by 40 CFR Part 58, Appendix A, Section 2.5. Further instructions are available from either the EPA Regional QA Coordinator or the Systems Audit QA Coordinator, Office of Air Quality Planning and Standards, Emissions Monitoring and Analysis Division (MD-14), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

21.1.5 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

How closely a measurement represents the actual environment at a given time and location is a complex issue that is considered during development of element B1. See *Guidance on Sampling Designs to Support QAPPs (*EPA QA/G-5S). Acceptable tolerances for each critical sample coordinate and the action to be taken if the tolerances are exceeded should be specified in element B1.

Each agency must develop its own sets of data review tools and criteria. The use of computers can greatly enhance the amount of data that can be reviewed and processed. There are many tools available to the modern air quality professional.

22.1 Data Review Design

The primary purpose of this section is to describe the data validation procedures which are used by the TCAPCD 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:

- 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.
- Be familiar with the type of instrument malfunctions which cause characteristic trace irregularities.
- 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.
- 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:

- 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;
- Span Control Charts - these charts will be the most valuable tool in spotting data that is out of control limits;
- 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
- 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.
- Blanks, Replicates and Spikes - these QC indicators can be used to ascertain whether sample handling or analysis is causing bias in the data set.
- Monthly Summary Reports - The Monthly Summary Reports are outputs from the Analytical Laboratory LIMS units. These reports are "canned" reports provided by the computer vendor who writes the interface software. These reports provide the following information:
    - Completeness report;
    - Initial Calibration Report from the Analytical Instruments;
    - Laboratory Control Sample Recoveries;
    - Field or Laboratory Surrogate Recoveries;
    - Spike Recoveries;
    - Laboratory Duplicate Results;
    - Serial Dilution Results.

22.2 Data Review Testing

Recently, the TCAPCD has received a copy of the newly developed program VOCDat. This program was developed by EPA-OAQPS for PAMS data validation. However, the TCAPCD will apply this to the Organic Toxics data by using the following VOCDat tests:

22.2.1 Data Identification Checks

Data with improper identification codes are useless. Three equally important identification fields which 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 3 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.

22.3 Data Review Testing

These tests check values in a data set which appear atypical when compared to the whole data set. Common anomalies of this type include unusually high or low values (outliers) and large differences in adjacent values. These tests will not detect errors which alter all values of the data set by either an additive or multiplicative factor (e.g., an error in the use of the scale). The following test for internal consistency are used:

< Data Plots

< Ratio Test

< Students “t-test”

22.3.1. 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.

22.3.2 Pattern and Successive Difference Tests

These tests check data for pollutant behavior which 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)

22.3.3 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.

23.0 Data Validation, Verification and Analysis

The purpose of this element is to describe, in detail, the process for validating (determining if data satisfy QAPP-defined user requirements) and verifying (ensuring that conclusions can be correctly drawn) project data. The amount of data validated is directly related to the DQOs developed for the project. The percentage validated for the specific project together with its rationale should be outlined or referenced. Diagrams should be developed showing the various roles and responsibilities with respect to the flow of data as the project progresses. The QAPP should have a clear definition of what is implied by "verification" and "validation."

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 effect 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 Describe the Process for Validating and Verifying Data

Each sample should be verified to ensure that the procedures used to generate the data (as identified in element B4 of the QAPP) were implemented as specified. Acceptance criteria should be developed for important components of the procedures, along with suitable codes for characterizing each sample's deviation from the procedure. Data validation activities should determine how seriously a sample deviated beyond the acceptable limit so that the potential effects of the deviation can be evaluated during DQA.

23.1.1 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 is 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 "reverified" that the values are entered correctly. The data qualifiers or flags can be found in the SOPs.

23.1.2 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 operator or laboratory technician.

Validation of Measurement Values

Certain criteria based upon field operator and laboratory technician judgement 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 can not 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 Minium Detection Limit of the analytical system
Field Accident	FAC	Concurrence with lab technician and branch manager

23.2 Data Analysis

Once the data has been reviewed, verified and validated. It should be loaded into a computer archive. This section will describe how the data will be analyzed in order to put the values collected into context with the environment.

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, Semi-Volatile Organics and particulate metals. One would assume that there physical and chemical properties could group them together.

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

23.2.1 Analytical tests

The District 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 un-expected relationships among species

VOCDat- As stated in Section 22, the EPA has placed resources into creating software that can analyze data. One such program is VOCDat. This software program was originally written for input of PAMS data.. VOCDat is a Windows-based program that provides a graphical platform from which to display collected VOC data; to perform quality control tasks on the data; and for exploratory data analysis. This program will enable the TCAPCD to rapidly validate and release their air toxics VOC data to AIRS. VOCDat displays the concentrations of the VOC data using scatter, fingerprint, and time series plots. Customizable screening criteria may be applied to the data and the quality control codes may be changed for individual data points as well as for the entire sample on all plots. VOCDat can allow a user to find out what percentage a particular compound is of the total. This test allows the user the ability to see if the data exceeds the 3 sigma rule for outliers. For more details, please see Section 22.2.

Wind Rose Plots - Recently the TCAPCD has purchased a wind rose program that will except 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.

GIS - GIS program that allows the user the ability to overlay concentration data on geographic data. By creating "views", the user can overlay temporally changing data into a spatial analysis too. Plots of concentrations of data can be temporal/spatially displaced.

24.0 Reconciliation with Data Quality Objectives

24.1 Reconciling Results with DQOs

The DQA process has been developed for cases where formal DQOs have been established. *Guidance for Data Quality Assessment* (EPA QA/G-9) focuses on evaluating data for fitness in decision- making and also provides many graphical and statistical tools.

DQA is a key part of the assessment phase of the data life cycle, as shown in Figure 9. As the part of the assessment phase that follows data validation and verification, DQA determines how well the validated data can support their intended use. If an approach other than DQA has been selected, an outline of the proposed activities should be included

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 Toxa City 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.

24.2 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.

24.2.1 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. Since this program is in its formative stages, no assessments have been performed. However, the State of North Carolina performs annual network reviews. The TCAPCD will request that the State Agency review the network siting and maintenance.

24.2.2 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.- Toxa City 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.

24.2.3 Select the Statistical Test

Toxa City will generate summary statistics for each of its primary and QA samplers. The summary statistics will be calculated at the annual, and a three-year levels and will include only valid samples. These following statistical test 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 as described in Table 19.6
- 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, Toxa City may evaluate the influence of a potential outlier by evaluating the change in the summary statistics resulting from exclusion of the outlier.

Toxa City will generate some graphics to present the results from the summary statistics and to show the spatial continuity over Toxa City. Maps will be created for the annual and three-year means, maxima, and interquartile ranges for a total of 6 maps. 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 will also be performed to see if meteorology and topography have any influence on the concentrations.

24.2.4. 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. Toxa City 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. Toxa City 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, Toxa City 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. It will also allow the TCAPCD the justification to decrease the network if trends illustrate that the values are also decreasing.

Measurement precision and bias- For each sampling system, TCAPCD will review the 95% confidence limits as determined in Table 19.2. If any exceed 10%, Toxa City may need to determine the sensitivity of the DQOs to larger levels of measurement imprecision. Before describing the algorithm, first some ground work. When less than three years of collocated data are available, the three-year bias and precision estimates must be predicted. Toxa City's strategy for accomplishing this will be to use all available quarters of data as the basis for projecting where the bias and precision estimates will be at the end of the three-year monitoring period.

Toxa City will develop confidence intervals for the bias and precision estimates. This will be accomplished using a re-sampling technique. The protocol for creating the confidence intervals are using the following equation.

Bias Algorithm:

1. For each measurement pair, use Equation 19 from Section 14 to estimate the percent relative bias, d_i. To reiterate, this equation is:

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

where X_i represents the concentration recorded by the primary sampler, and Y_i represents the concentration recorded by the collocated sampler.

2. Summarize the percent relative bias to the quarterly level, $D_{j,q}$, according to

$$D_{j,q} = \frac{1}{n_{j,q}} \sum_{i=1}^{n_{j,q}} d_i$$

where $n_{j,q}$ is the number of collocated pairs in quarter q for site j.

3. Summarize the quarterly bias estimates to the three-year level using

$$\hat{D}_j = \frac{\sum_{q=1}^{n_q} w_q D_{j,q}}{\sum_{q=1}^{n_q} w_q}$$

where n_q is the number of quarters with actual collocated data and w_q is the weight for quarter.

4. Examine $D_{j,q}$ to determine whether one sampler is consistently measuring above or below the other. To formally test this, a non-parametric test will be used. The test is called the Wilcoxon Signed Rank Test and is described in *EPA QA/G-9*[2]. If the null hypothesis is rejected, then one of the samplers is consistently measuring above or below the other. This information may be helpful in directing the investigation into the cause of the bias.

Precision Algorithm

1 For each measurement pair, calculate the coefficient of variation according to Equation 20 from Section 14 and repeated below:

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

2. Summarize the 95% confidence Limits to the quarterly level, according to where the number of collocated pairs in quarter.

Upper 95% Confidence Limits: $Limit = d_i + 1.96 * S_i / \sqrt{2}$

Upper 95% Confidence Limits: $Limit = d_i - 1.96 * S_i / \sqrt{2}$

24.2.5 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.

24.1.5 Action Plan Based on Conclusions from DQA

A thorough DQA process will be completed during the summer of each year. For this section, Toxa City will assume that the assumptions used for developing the DQOs have been met. If this is not the case, Toxa City must first revisit the impact on the bias and precision limits determined by the DQO process. At some point in time, it may be necessary to reduce the network. This would happen under the following scenario.

- The data at a particular location shows values that are very low or at the detection limit. If this occurs it will be the District's option to re-locate the sampler or remove it from service.
- Vandalism or loss of right of way

References

1. Guidance for the Data Quality Assessment Process EPA QA/G-9 U.S. Environmental Protection Agency, QAD EPA/600/R-96/084, July 1996.

2. U.S. EPA (1997b) Revised Requirements for Designation of Reference and Equivalent Methods for Air toxics and Ambient Air Quality Surveillance for Particulate Matter-Final Rule. 40 CFR Parts 53 and 58. *Federal Register*, **62**(138):38763-38854. July 18,1997.

Appendices

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:

- state the problem,
- identify the decision,
- identify the inputs to the decision,
- define the boundaries of the study,
- develop a decision rule,
- specify tolerable limits on decision errors, and
- 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.

Management Systems Review (MSR) — The qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate for ensuring that the type and quality of data needed are obtained.

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.

Appendix B

Air Toxics Pilot Program Technical System Audits Laboratory Form

This following section has the Technical Systems Audit Form that was developed for the Air Toxics Pilot Program. The form was developed between September and November 1999.

Air Toxics Pilot Program - Technical Systems Audit

Laboratory Form

Part 1- Systems Audit Checklist for Quality System Documentation

Laboratory _____

Assessor Name and Affiliation _____

Observer(s) Name and Affiliation _____

Reporting Organization _____

Assessment Date _____

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
1. Is there an approved quality assurance project plan (QAPP) for the overall program and has it been reviewed by all appropriate personnel?				
2. Is a copy of the approved QAPP available for review by field operators and laboratory analysts? If not, briefly describe how and where QA and quality control (QC) requirements and procedures are documented and are made available to them.				
3. Is the design and implementation of the program as is specified in the QAPP?				
4. Are there deviations from the QAPP?				
5. How are any deviations from the QAPP noted?				
6. Are the established procedures for corrective or response actions when MQOs (e.g., out-of-control calibration data) met? If yes, briefly describe them. ?				
7. Are corrective action procedures consistent with the QAPP?				
8. Have any such corrective actions been taken during the program?				
9. Are the SOPs complete, up-to-date and followed?				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	N A	
10. Are written and approved standard operating procedures (SOPs) used in the program? If so, are these the SOPs that were written up in the EPA Field QAPP? Are they available for review by field operators and laboratory analysts. If not, briefly describe how and where the program's operating procedures are documented.				
Additional Questions or Comments:				

Part 2- Systems Audit Checklist for Management and Organization

Laboratory _____

Assessment Date_____

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	N A	
A. ORGANIZATION AND RESPONSIBILITIES Identify the following personnel and determine whether they have the listed responsibilities:				
1. Lab Analysis Manager: _____ - Coordinates lab operations, - Logistical support of lab operations, - Training monitoring lab technicians, and - Review of routine lab data and quality control data.				
2. Lab Technician(s): _____ _____ _____ - receive samples, - analyze samples, - perform QA/QC checks, - report data to Lab Manager				
4. Who is authorized to halt the program in the event of a health or safety hazard or inadequate quality?				
Additional Questions or Comments:				
B. TRAINING AND SAFETY				
1. Do the lab technicians have the training and experience for the operation of the equipment?				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	N A	
2. Are the staff aware of hazards with which they are in contact? (i.e., benzene or x-ray fluorescence)				
3. Does the program maintain current summaries of the training/certification and qualifications for program personnel?				
4. Is there special safety equipment that is required for health and safety?				
5. Are personnel outfitted with any required safety equipment?				
6. Are personnel adequately trained regarding appropriate safety procedures?				
Additional Questions or Comments:				

Part 3- Systems Audit Checklist for Monitoring Site

Laboratory

_____

Assessment Date

_____

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
A. Laboratory QA				
1.Are the equipment calibration and maintenance logs and data sheets filled out promptly, clearly and completely?				
2. Does the operator keep the filter/sample/sample handling/preparation area neat and clean?				
3. Is there a copy of the applicable QAPP available to the lab technicians?				
4. Are copies of the SOPs available?				
Additional Comments:				

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
B. Sample Handling				
1. Are all samples handled with the necessary care and finesse to avoid contamination and/or loss of material?				
2. Check log books at the lab to verify that field and lab blanks are being collected and analyzed.				
3. Are blanks routinely used by the monitoring organization? Check log books at the lab to verify field blanks are run periodically, as specified by the weighing laboratory. *Trip blanks one set every 30 days* *Field blanks one set every 10 days*				
4. Observe the following handling steps for routine samples, verifying that the lab tech follows the sample handling SOPs correctly: - receipt of samples at the sampling site and unpacking - completion of sample logbook entries and other required documentation - packing and sending to the field - completion of chain of custody and field data forms supplied by the reporting organization - samples shipped to other labs?				
5. Request the lab tech perform the field blank sample-handling procedures (if not possible, go through the SOP step-by-step and verify that the technician knows the correct procedures.): - receipt of samples at the lab and unpacking - completion of sample logbook entries and other required documentation - inspection of the sample prior to analysis - completion of chain of custody and field data forms supplied by the reporting organization				

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
Additional Questions or Comments:				
D. Calibration				
1. Is the flow rate standard used for lab equipment calibration/verification recalibrated or reverified against a NIST-traceable standard at least annually?				
2. Is the barometric pressure standard used for lab equipment calibration/verification recalibrated or re-verified against a NIST-traceable standard at least annually?				
3. Is the temperature standard used for routine calibration/verification recalibrated or re-verified against a NIST-traceable standard at least annually?				

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
4. Obtain the SOPs used for the following activities and observe the operator perform the periodic verifications: - leak check - temperature verification - barometric pressure verification - flow rate check				

Additional Questions or Comments:

E. Sample Handling				
1. Is the sample handling area clean?				
2. Is the sample handling area cleaned before each unloading session?				
3. Are the filters handled with non-powder latex gloves?				
4. Are the filter handling forceps different from mass reference standards forceps?				
5. Is the temperature of samples (i.e., DNPH cartridges) being recorded upon receipt?				
5. Are all extracts, cartridges stored according to the QAPP and SOPs?				

Additional Questions or Comments:

Part 4- MQOs for Laboratory Systems

Laboratory

_____

Assessment Date

_____

Table 1. Analysis Matrices, Reporting Units, Holding Times and Preservation Techniques

Parameter	Matrix	Units	Maximum Holding Time	Preservation	Compliance?
PM mass	quartz /glass	mg/m^3	<30 days at 4 ^oC	Store at 4 ^oC	
Trace metals	quartz/glass	ug/m^3	60 days	Store at 4 ^oC	
PAHs, PCBs, Pesticides	QF/PUF	ng/m^3	7 days (before extraction); 40 days (after extraction)	Store at 4 ^oC	
carbonyls	DNPH	ppb	30 days	Store at 4 ^oC	
VOC	stainless steel	ppb	30 days	None	

Table 2 Measurement Quality Objectives- X-Ray Fluorescence (XRF) Analysis of Metals in Ambient Air Coarse (TSP/PM_{10}) Particulate Matter

Requirement	Frequency	Acceptance Criteria	Compliance?
X-ray attenuation corrections	Each run	Not specified	
Interference corrections	Each run	Not specified	
Flow fraction collection	Each run	Not specified	
Field filter/sample blank	1 per paired sample	Less than UDL for target analytes	
Lab filter/sample blank	1 per run	Less than LDL for target analytes	
Run-time QC: peak areas, background areas, centroid, FWHM	1 per run	Target and tolerance parameters by element; must be within tolerance units	
SRM1833 and SRM 1832	1 per run	Uncertainty intervals for analytical results and certified values must overlap	
Chi-square measure of fit	1 per run	<1.0	

Table 3 Measurement Quality Objectives-Gravimetric Analysis of Ambient Air Coarse (TSP/PM_{10}) Particulate Matter

Requirement	Frequency	Acceptance Criteria	Compliance?
After pre-weighing	All filter/samples	<30 days before sampling	
Before post-weighing	All filter/samples	<30 days at 4°C from sampling end date	
Sampling period	All data	24 ± 0.25 hours	
Reporting units	All data	mg/m^3	
Lower detection limit	All data	2 mg/m^3	
Upper concentration limit	All data	200 mg/m^3	
Visual defect check	All filter/samples	No visible defects	
Equilibration	All filter/samples	24 hours minimum	
Temperature range	All filter/samples	30-40 °C	
Temperature control	All filter/samples	± 2 °C SD over 24 hours	
Humidity range	All filter/samples	30-40% RH	
Humidity control	All filter/samples	± 5% RH SD over 24 hours	
Pre/Post sampling RH	All filter/samples	± 5% RH	
Balance	All filter/samples	Located in filter/sample conditioning room	
Lot blanks	3 filter/samples per lot	< 15 mg change between weighing	
Field filter/sample blank	1 per paired sample	± 30 mg change between weighing	
Lab filter/sample blank	1 per weighing session	± 15 :g change between weighing	
Balance check	Beginning, every 10^{th} sample, end	# 3 mg	
Duplicate filter/sample weighing	Every filter/sample	± 15 mg change between weighing	

Table 4. Measurement Quality Objectives-GC/MS Analysis of PAHs

Requirement	Frequency	Acceptance Criteria	Compliance?
Purchase specifications	All filter/samples	Binderless quartz microfiber filter/samples, 47-mm diameter	
Purchase specifications	All PUFs	6.0-cm diameter cylindrical plug cut from 7.6-cm 0.022 g/cm^3 stock	
Visual defect check	All filter/samples and PUFs	No visible defects	
Lot blanks	1 filter/sample and PUF per lot	PAHs below MDL	
Field surrogates	All filter/samples and PUFs	60-120% recovery	
Lab surrogates	All filter/samples and PUFs	1 :g of two deuterated PAHs	
Internal standards	All extracts	0.5 :g of five deuterated PAHs	
GC/MS tuning	Every 12 hours of operation, or after corrective action	With decafluorotriphenylphosphine (DFTPP) to meet mass spectral ion abundance criteria	
GC/MS calibration	After corrective action	Five calibration standards containing target compounds, internal standards and surrogate compounds between MDL and detector saturation	
GC/MS continuing calibration	After GC/MS tuning	One calibration standard (as above) is within ±30% of the initial calibration	
Laboratory method blank	Every batch of samples	-50% to +100% area response and ±20.0 seconds retention time for internal standards; PAHs below MDL	
Laboratory control spike	Every batch of samples	-50% to +100% area response and ±20.0 seconds retention time for internal standards; 60-120% recovery of PAHs	

Table 5. Measurement Quality Objectives-GC/ECD Analysis of PCBs and Pesticides

Requirement	Frequency	Acceptance Criteria	Compliance?
Field blank	One per sampling event	<10 ng single compound/sample, <100 ng multiple compounds/sample	
Spiked trip blank	One per sampling event	65-125% recovery	
Solvent blank	Each batch of sample	<10 ng single compound/sample, <100 ng multiple compounds/sample	
GC/ECD calibration	After corrective action	Three calibration standards in the linear range (<20% RSD), 85-115% recovery	
GC/ECD calibration	Beginning of each day and after every 10 samples	One midpoint-calibration standard with <15% RSD	
Sampling efficiency	At project start, and at least once per quarter	Recovery of >75% at <15% RSD of target compounds on a spiked filter/sample under normal sampling conditions	

Table 6. Measurement Quality Objectives-Carbonyls Analysis

Requirement	Frequency	Acceptance Criteria	Compliance?
Sample holding times	All cartridges	<30 days at 4^{o} C	
Sampling period	All data	24 ± 0.25 hours	
Reporting units	All data	ppb	
Detection limit		1 ppb	
Lower detection limit	All data	5 ppb	
Upper concentration limit	All data	100 ppb	
Purchase specifications	all cartridges	2,4-dinitro phenyl hydrazine coated cartridges, 50-mm diameter	
Lot blanks	1 filter/sample per lot	all carbonyls less than 1 ppb	
Field blank	One per sampling event	> 2 ppb of any carbonyl	
Replicate sample analysis	At project start, and once per quarter	<20% RSD	
Instrument calibration	Once per sample batch	Known volume and concentration of acetaldehyde	
Spiked lab blank		<5% RSD	
Lab blank		> 1 ppb	

Table 7 Measurement Quality Objectives-Metals by ICP/MS

Requirement	Frequency	Acceptance Criteria	Compliance?
Before shipping		<3 days at 4° C	
Before digestion		<7 days at 4° C	
After digestion		<30 days at 4° C	
Sampling period	All data	24 ± 1 hour	
Reporting units	All data	: g/m^2-day	
Detection limit	All data	2 : g/L	
Glassware pre-conditioning	All glassware and plasticware	Washed in 1:1 nitric acid in a clean room, double-wrapped in sealed plastic bags	
Field blank	One per sampling event	Metals below MDL	
Replicate sample analysis	30 paired analyses	<20% RSD	
Instrument calibration	Daily	Five standard concentrations, R^2>95%	
Calibration check	Beginning of run and after every 10 samples	One mid-point standard, <5% RSD	
NIST SRM 1648	Daily	70-120% recovery	
Lab replicate	One per sampling event	<15% RSD	
Lab splits (with another lab)	>10 samples	<20% RSD	

Table 8 Measurement Quality Objectives-Volatile Organic Compounds

Requirement	Frequency	Acceptance Criteria	Compliance?
Sample holding times	All canisters	<30 days	
Sampling period	All data	24 ± 0.25 hours	
Reporting units	All data	ppb	
Detection limit	All data	0.1ppb	
Lower detection limit	All data	5 ppb	
Upper concentration limit	All data	100 ppb	
Purchase specifications	Canisters	electro-polished stainless steel canisters	
Replicate sample analysis	At project start, and once per quarter	<20% RSD	
Instrument calibration	Once per sample batch	5 species calibration point at beginning and end of batch run	
Spiked lab blank	Once per batch	<5% RSD	
Lab blank	Once per batch	total VOC below 5 ppb	

Appendix C

Air Toxics Pilot Program Technical System Audits

Field Form

This following section has the Technical Systems Audit Form that was developed for the Air Toxics Pilot Program. The form was developed between September and November 1999.

Air Toxics Pilot Program - Technical Systems Audit
Field Form

Part 1- Systems Audit Checklist for Quality System Documentation

Monitoring Site Location _____

Assessor Name and Affiliation _____

Observer(s) Name and Affiliation _____

Reporting Organization _____

Assessment Date _____

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
1. Is there an approved quality assurance project plan (QAPP) for the overall program and has it been reviewed by all appropriate personnel?				
2. Is a copy of the approved QAPP available for review by field operators? If not, briefly describe how and where QA and quality control (QC) requirements and procedures are documented and are made available to them.				
3. Is the design and implementation of the program as is specified in the QAPP?				
4. Are there deviations from the QAPP?				
5. How are any deviations from the QAPP noted?				
6. What are the critical measurements in the program as defined in the QAPP?				
7. Are there established procedures for corrective or response actions when MQOs (e.g., out-of-control calibration data) are not met? If yes, briefly describe them.				
8. Are corrective action procedures consistent with the QAPP?				
9. Have any such corrective actions been taken during the program?				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	N A	
10. Are written and approved standard operating procedures (SOPs) used in the program? If so, list them on the attached sheet and note whether they are available for review by field operators and laboratory analysts. If not, briefly describe how and where the program's operating procedures are documented.				
11. Are the SOPs complete, up-to-date, and followed?				
Additional Questions or Comments:				

Part 2- Systems Audit Checklist for Management and Organization

Monitoring Station _____

Assessment Date _____

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	N A	
A. ORGANIZATION AND RESPONSIBILITIES Identify the following personnel and determine whether they have the listed responsibilities:				
1. Field Operations Manager: _____ - Development of monitoring network, - Coordinates field operations, - Logistical support of field operations, - Training monitoring site operators, and - Review of routine sampler data and quality control data.				
2. Monitoring Site Operator(s): _____ _____ _____ - Operation of samplers, - Calibration of samplers, - Maintenance of samplers, - Maintenance of monitoring site				
4. Who is authorized to halt the program in the event of a health or safety hazard or inadequate quality?				
Additional Questions or Comments:				
B. TRAINING AND SAFETY				
1. Do the monitoring site operators have training or experience for the operation of the sampler?				
2. Has the operator been trained in the particular hazards of the instruments/materials with which they are operating?				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	N A	
3. Is there special safety equipment required to ensure the health and safety of personnel?				
4. Are personnel outfitted with any required safety equipment?				
5. Are personnel adequately trained regarding appropriate safety procedures?				
Additional Questions or Comments:				

Part 3- Systems Audit Checklist for Monitoring Site

Monitoring Site _____

Assessment Date _____

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
A. Sampler Siting				
1. Does the location for the samplers and collocated samplers conform with the siting requirements of 40CFR58, Appendices A and E?				
2. Are there any changes at the site that might compromise original siting criteria (e.g., fast-growing trees or shrubs, new construction)?				
Additional Questions or Comments:				
B. Monitoring Site				
1. Are site logbooks and required data sheets filled in promptly, clearly, and completely?				
2. Does the operator keep the sample-handling area neat and clean?				
3. Is (are) a copy of the applicable QAPP(s) available to the site operator?				
4. Are copies of applicable SOPs available to the site operator?				
5. Do the sampler(s) appear to be well maintained and free of dirt and debris, bird/animal/insect nests, excessive rust and corrosion, etc.?				
6. Are the walkways to the station and equipment kept free of tall grass, weeds, and debris?				
7. Is the station shelter (if any) clean and in good repair?				

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
Additional Questions or Comments:				
C. Sample Handling				
1. Are all samples handled with the necessary care and finesse to avoid contamination and/or loss of material?				
2. Are blanks routinely used by the monitoring organization? Check log books at the site to verify field blanks are run periodically, as specified by the weighing laboratory. *Trip blanks should be 1 in 30 days Approximately 10% of sample samples should be field blanks.*				

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
3. Observe the following handling steps for routine samples, verifying that the operator follows the sample handling SOPs correctly: - receipt of samples at the sampling site and unpacking - completion of sample logbook entries and other required documentation - inspection of the sample prior to sampling - installation of sample in the sampler - retrieval from the sampler after sampling - packing and sending to the laboratory - completion of chain of custody and field data forms supplied by the reporting organization - samples shipped				
4. Request the operator to perform the field blank sample-handling procedures (if not possible, go through the SOP step-by-step and verify that the operator knows the correct procedures.): - receipt of samples at the sampling site and unpacking - completion of sample logbook entries and other required documentation - inspection of the sample prior to sampling - installation of sample in the sampler - retrieval from the sampler (without sampling) - packing and sending to the laboratory - completion of chain of custody and field data forms supplied by the reporting organization				

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
Additional Questions or Comments:				
D. Calibration				
1. Is the flow rate standard used for routine sampler calibration/verification recalibrated or reverified against a NIST-traceable standard at least annually?				
2. Is the calibration relationship for the flow rate standard (e.g., an equation, curve, or family of curves relating actual flow rate [Q_a] to the flow rate indicator reading) accurate to within what is specified in the QAPP over the expected range of ambient temperatures and pressures at which the flow rate standard may be used?				
3. Is the barometric pressure standard used for routine sampler calibration/verification recalibrated or re-verified against a NIST-traceable standard at least annually?				

AUDIT QUESTIONS	RESPONSE			COMMENT
	Y	N	NA	
4. Is the temperature standard used for routine sampler calibration/verification recalibrated or re-verified against a NIST-traceable standard at least annually?				
5. Obtain the SOPs used for the following activities and observe the operator perform the periodic verifications: - leak check - temperature verification - barometric pressure verification - flow rate check				

E. Sample Handling				
1. Is the sample handling area clean?				
2. Is the sample handling area cleaned before each unloading session?				
3. Are the filters and DNPH cartridges handled with non-powder latex gloves?				
4 Are the DNPH cartridges stored in a refrigerator while at the monitoring location?				
5 Describe the procedure that is followed after an exposed sample is received from the field, including the sample storage temperature.				

Additional Questions or Comments:

Part 4- MQOs for Monitoring Samplers

Monitoring Site _____

Assessment Date _____

Table 1. Total Suspended Particulate Sampler for Metals Testing, Inspection and Maintenance Requirements

Check/Maintenance	Frequency	Requirement	Performed?
Clock check	Once per week	Current date, time ± 30 minute	
Flow rate multipoint calibration	quarterly	3 points between 39--60 cfm	
Leak check	Every Run		
Motor Brushes	when they fail or every six months, whichever comes first.	Per Operating Manual	
Clean inside of housing cover	Semiannual inspection	Per Service Manual	
Clean air screens	Semiannual	Clear of obstructions to flow	
Check timer electrical cords and tubing	Semiannual	Per Service Manual	

Table 2. Volatile Organics Compounds Sampler (VOC) Testing, Inspection and Maintenance Requirements

Checks/Maintenance	Frequency	Requirement	Performed?
Clock check	Once per week	Current date, time ± 1 minute	
Pressure Gauge	quarterly	Ambient pressure +/- 1 psig	
Flowrate check	quarterly	70 cc/min +/- 5 cc/min	
Leak check	each run for two canisters	Loss of < 0.1 psig / 5 minute	
Sampler inlet	quarterly	Visual Inspection	
Computer backup battery	Semiannual inspection; replace as necessary	Per Service Manual	

Table 3. DNPH Carbonyl Sampler Testing, Inspection and Maintenance Requirements

Checks/Maintenance	Frequency	Requirement	Performed?
Clock check	**Once per week**	**Current date, time ± 1 minute**	
Flowrate check	**quarterly**	**1.01 l/min +/- 10 cc/min**	
Leak check	**each run for two cartridges**	**Loss of < 0.1 psig / 5 minute**	
Sampler inlet	**quarterly**	**Visual Inspection**	
Computer backup battery	**Semiannual inspection; replace as necessary**	**Per Service Manual**	

Table 4. SemiVolatile Organic Compounds Testing, Inspection and Maintenance Requirements

Checks/Maintenance	Frequency	Requirement	Performed?
Clock check	Once per week	Current date, time ± 2 minute	
Flowrate check	quarterly	0.2 m3/min +/- 0.02 m3/min	
Leak check	Every Run		
Motor Brushes	when they fail or every six months, whichever comes first.	Per Operating Manual	
Clean inside of housing cover	Semiannual inspection	Per Service Manual	
Clean air screens	Semiannual	Clear of obstructions to flow	
Check timer electrical cords and tubing	Semiannual	Per Service Manual	

Appendix D

Field Operations and Analytical and Calibration Procedures

This model QAPP only contains a place holder for the SOPs. SOPs should be developed by the State and Local Agencies since these are specific for the agencies' methods.. The following document and URL are a supplementary document that can assist the agencies in creating their SOPs. The Internet address is: http://www.epa.gov/ttn/amtic/airtxfil.html, the document name is "Pilot City Air Toxics Measurement Summary, February 2001, EPA No. 454/R-01-003. This document discusses the findings and recommendations of the Air Toxics Pilot City Measurement Workgroup from November 2000- January 2001.

TECHNICAL REPORT DATA

(Please read Instructions on reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-354/R01-001		

4. TITLE AND SUBTITLE	5. REPORT DATE
Quality Assurance Guidance Document, Quality Assurance Project Plan for the Air Toxics Monitoring Program	07/01
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Dennis Mikel, Michael Papp	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
U.S. Environmental Protection Agency Office of Air Quality Planning and Standards Research Triangle Park, NC 27711	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
Director Office of Air Quality Planning and Standards Office of Air and Radiation U.S. Environmental Protection Agency Research Triangle Park, NC 27711	14. SPONSORING AGENCY CODE EPA/200/04

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The Quality Guidance Document is the Quality Assurance Project Plan that outlines the field operations for a Model Air Toxics Monitoring Program. The guidance document gives details on how to set-up, operate, and perform all quality control and assurance duties that are required to provide precise, accurate and representative data. This guidance document also has two appendices. The first appendix is the glossary of terms. The second appendix references an AMTIC document. This Guidance Document is written in model format. The QAPP uses a fictitious city and outlines how an agency should approach the task of writing a QAPP.

. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Quality Monitoring Quality Assurance	Air Pollution Control	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(Report)*	21. NO. OF PAGES
Release Unlimited	Unclassified	
	20. SECURITY CLASS *(Page)*	22. PRICE
	Unclassified	

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE