



# **Quality Assurance Guidance Document**

## **Model Quality Assurance Project Plan For the National Air Toxics Trends Stations**

**Quality Assurance Guidance Document - Model Quality Assurance Project Plan  
For the National Air Toxics Trends Stations**

By:  
Dennis K. Mikel  
Office of Air Quality Planning and Standards  
Air Quality Assessment Division  
Research Triangle Park, North Carolina

U.S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Air Quality Assessment Division  
Research Triangle Park, North Carolina, 27711

## Forward

The following document represents the model Quality Assurance Project Plan (QAPP) for the National Air Toxics Trends Stations (NATTS). 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 be submitted by State, Local or Tribal Air Toxics Monitoring Programs (ATMP) involved in the NATTS.

This 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

Data in this QAPP should not be used by organizations to meet the data quality needs for ATMP, with the exception of Chapter 7, which describes the Data Quality Objectives (DQO) for the national program. Since all NATTS will be part of this trends network, OAQPS requires that the DQOs be identical. If an agency wishes to add DQOs to Chapter 7 that go beyond the needs of the national trends objectives, then this should be addressed in Chapter 7 and 24. Chapter 24 discusses the Data Quality Assessments (DQAs) for a local objective, which is not based on the DQOs in Chapter 7. Please note that Chapter 24 states that the national DQA will be performed by OAQPS.

The Standard Operation Procedures (SOPs) listed in the Table of Contents are a guidance document developed for OAQPS for the NATTS. This Technical Assistance Document (TAD) was created by Eastern Research Group, Morrisville, NC and is available at the following Internet web site: <http://www.epa.gov/ttn/amtic/airtxfil.html>. It should not be used verbatim, but as a guideline for development of an agency's SOPs. **SOPs must be developed by the State, Local and Tribal Agencies.**

Please note that both Toxa City and the Toxa City Air Pollution Control District are fictitious.

## ***Acknowledgments***

This Model QAPP is the product of the EPA's Office of Air Quality Planning and Standards. The following individuals are acknowledged for their contributions.

### **Principle Authors**

Chapters 1-6 and 8-24, Dennis K. Mikel, OAQPS-AQAD, Research Triangle Park, North Carolina

Chapter 7, Battelle Incorporated

## *Acronyms and Abbreviations*

ATMP	Air Toxics Monitoring Program
ANSI	American National Standards Institute
APTI	Air Pollution Training Institute
AQS	Air Quality System
ASTM	American Society for Testing and Materials
CAA	Clean Air Act
CFR	Code of Federal Regulations
COC	chain of custody
CV	coefficient of variance
DAS	data acquisition system
DQA	data quality assessment
DQOs	data quality objectives
EDO	environmental data operation
EPA	Environmental Protection Agency
GIS	geographical information systems
GLP	good laboratory practice
HVAC	Heating and Ventilating Air Conditioning Unit
IO	InOrganic
IPA	instrument performance audit
LAN	local area network
LIMS	Laboratory Information Management System
MQOs	measurement quality objectives
MSA	metropolitan statistical area
MSR	management system review
NAAQS	National Ambient Air Quality Standards
NATTS	National Air Toxics Trends Stations
NIST	National Institute of Standards and Technology
OAQPS	Office of Air Quality Planning and Standards
PAMS	Photochemical Assessment Monitoring Stations
PC	personal computer
PD	percent difference
PM <sub>10</sub>	particulate matter – 10 microns
PTFE	polytetrafluoroethylene
PT	Proficiency Testing
QA/QC	quality assurance/quality control
QA	quality assurance
QAAR	quality assurance annual report
QAD	quality assurance division director
QAM	quality assurance manager
QAPP	quality assurance project plan
QMP	quality management plan
SIPS	State Implementation Plans
SLAMS	state and local monitoring stations
SOP	standard operating procedure
TAD	technical assistance document
TCAPCD	Toxa City Air Pollution Control District
TO	Toxic Organic
TSA	technical system audit
UATS	Urban Air Toxics Strategy
VOC	volatile organic compound

## ***Tables***

<u><b>Number</b></u>	<u><b>Description</b></u>	<u><b>Page No.</b></u>
3.1	Distribution List	xi1
5.1	List of HAPs	3
6.1	Design/Performance Specifications-Total Suspended Particulates - Toxics Metals	2
6.2	Design/Performance Specifications-Air Canister Sampler - Volatile Organic Compounds	2
6.3	Design/Performance Specifications - Carbonyl Sampler - Aldehyde and Ketone Compounds	2
6.4	Design/Performance Specifications-Aethalometer –Black and Organic Carbon	3
6.5	Assessment Schedule	3
6.6	Schedule of Critical Air Toxics Activities	5
7.1	DQO input parameter for benzene at urban locations	9
7.2	DQO output parameter for benzene at urban locations	9
7.3	DQO input parameter for benzene at rural locations	10
7.4	DQO output parameter for benzene at rural locations	11
7.5	DQO input parameter for 1,3, butadiene at urban locations	12
7.6	DQO output parameter for 1,3 butadiene at urban locations	12
7.7	DQO input parameter for 1,3 butadiene at rural locations	13
7.8	DQO output parameter for 1,3 butadiene at rural locations	13
7.9	DQO input parameter for arsenic at urban locations	14
7.10	DQO output parameter for arsenic at urban locations	14
7.11	DQO input parameter for arsenic at rural locations	15
7.12	DQO output parameter for arsenic at rural locations	15
7.13	DQO input parameter for chromium	16
7.14	DQO output parameter for chromium	17
7.15	DQO input parameter for acrolein	17
7.16	DQO output parameter for acrolein	17
7.17	DQO input parameter for formaldehyde at urban locations	18
7.18	DQO output parameter for formaldehyde at urban locations	18
7.19	DQO input parameter for formaldehyde at rural locations	19
7.20	DQO output parameter for formaldehyde at rural locations	19
8.1	TCAPCD Training Requirements	1
8.2	Core Ambient Air Training Courses	3
9.1	Air Toxics Reporting Package Information	2
10.1	Schedule of Air Toxics Sampling Related Activities	1
10.2	List of Collocated Samplers and Coordinates	2
11.1	Sample Set-up, Run and Recovery Dates	2
11.2	Supplies at Storage Shelters	4
11.3	Field Corrective Action	8
11.4	Temperature Requirements	9
11.5	Holding Times	2
13.1	Instruments used in the Toxa City Laboratory	5
14.1	Precision Acceptance Criteria	2
15.1	Inspections in the Laboratory	4
15.2	Preventive Maintenance in Weight Room	4
15.3	Preventive Maintenance in VOC Laboratory	5
15.4	Preventive Maintenance in Liquid Chromatography Laboratory	5
15.5	Preventive Maintenance in Inductively Coupled Plasma Laboratory	6
15.6	Preventive Maintenance on Field Instruments	2
16.1	Lab Instrument Standards	5
16.2	Standard Materials and/or Apparatus for Air Toxics Calibrations	1
17.1	Critical Field Supplies and Consumables	2
17.2	Critical Laboratory Supplies and Consumables	2
19.1	Validation Check Summaries	4
19.2	Data Transfer Operations	5
19.3	Data Reporting Schedule	6
19.4	Reporting Equations	8
19.5	Data Archive Policies	9
20.1	Assessment Summary	8
23.1	Single Flag Invalidation Criteria for Single Sampler	2

## ***Figures***

<i><b>Number</b></i>		<i><b>Page</b></i>
4.1	Organizational Structure of TCAPCD	5
7.1	Power Curve for Benzene urban location	9
7.2	Power Curve for Benzene rural location	11
7.3	Power Curve for 1,3, butadiene urban location	11
7.4	Power Curve for 1,3 butadiene rural location	13
7.5	Power Curve for arsenic urban location	14
7.6	Power Curve for arsenic rural location	16
7.7	Power Curve for chromium	17
7.8	Power Curve for acrolein	18
7.9	Power Curve for formaldehyde urban location	19
7.10	Power Curve for formaldehyde rural location	20
10.1	Network Locations	4
19.1	Data Management and Sample Flow Diagrams	2

## 1.0 QA Project Plan Identification and Approval

**Title:** *Toxa City Air Pollution Control District Quality Assurance 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

<b>Section</b>	<b>Page</b>	<b>Revision</b>	<b>Date</b>
<i>Foreword</i>	ii	1.1	12/04/07
<i>Acknowledgments</i>	iii	1.1	12/04/07
<i>Acronyms and Abbreviations</i>	iv	1.1	12/04/07
<i>Tables</i>	v	1.1	12/04/07
<i>Figures</i>	vi	1.1	12/04/07
<i>Region Approval</i>	vii	1.1	12/04/07
 <b>A. PROJECT MANAGEMENT</b>			
1. Title and Approval Page	vii	1.1	12/04/07
2. Table of Contents	viii	1.1	12/04/07
3. Distribution List	xi	1.1	12/04/07
4. Project/Task Organization		1.1	12/04/07
4.1 Roles and Responsibilities	1/10		
5. Problem Definition/Background		1.1	12/04/07
5.1 Problem Statement and Background	1/4		
5.2 List of Pollutants	2/4		
5.3 Location of Interest for HAPs	3/4		
6. Project/Task Description		1.1	12/04/07
6.1 Description of Work	1/6		
6.2 Field Activities	2/6		
6.3 Laboratory Activities	3/6		
6.4 Project Assessment Techniques	4/6		
6.5 Schedule of Activities	5/6		
7. Data Quality Objectives		1.1	12/04/07
7.1 The General DQO Process	1/19		
7.2 State the Problem	2/19		
7.3 Identify the Decision	3/19		
7.4 Identify the Inputs to the Decision	4/19		
7.5 Define the Study Boundaries	5/19		
7.6 Develop the Decision Rule	5/19		
7.7 Specify Tolerable Limits on the Decision Error	5/19		
7.8 Optimize the Design	6/19		
7.9 DQOs for the Six Study Compounds	6/19		
7.10 DQOs for Measuring the Percent Decreases	6/19		
	9/19		
8. Special Training Requirements/Certification		1.1	12/04/07
8.1 Training	1/4		
8.2 Certification	4/4		

<i><b>Section</b></i>	<i><b>Page</b></i>	<i><b>Revision</b></i>	<i><b>Date</b></i>
9. Documentation and Records		1.1	12/04/07
9.1 Information Included in the Reporting Package	1/5		
9.2 Data Reporting Package and Documentation Control	4/5		
9.3 Data Reporting Package Archiving and Retrieval	5/5		
<b>B. MEASUREMENT/ DATA ACQUISITION</b>			
10. Sampling Design		1.1	12/04/07
10.1 Scheduled Project Activities, Including Measurement Activities	1/6		12/04/07
10.2 Rationale for the Design	1/6		
10.3 Design Assumptions	2/6		
10.4 Procedure for Locating and Selecting Environmental Samples	4/6		
10.5 Classification of Measurements as Critical/Noncritical	5/6		
10.6 Validation of Any Non-Standard Measurements	5/6		
11. Sampling Methods Requirements		1.1	12/04/07
11.1 Purpose/Background	1/9		
11.2 Sample Collection and Preparation	1/9		
11.3 Support Facilities for Sampling Methods	2/9		
11.4 Sampling/Measurement System Corrective Action	3/9		
11.5 Sampling Equipment, Preservation, and Holding Time Requirements	7/9		
12. Sample Custody		1.1	12/04/07
12.1 Sample Custody Procedure	1/3		
13. Analytical Methods Requirements		1.1	12/04/07
13.1 Purpose/Background	1/4		
13.2 Preparation of Samples	1/4		
13.3 Analysis Methods	1/4		
13.4 Internal QC and Corrective Action for Measurement System	2/4		
13.5 Sample Contamination Prevention, Preservation and Holding	3/4		
14. Quality Control Requirements		1.1	12/04/07
14.1 QC Procedures	1/8		
15. Instrument/Equipment Testing, Inspection, and Maintenance Requirements		1.1	12/04/07
15.1 Purpose/Background	1/7		
15.2 Testing	1/7		
15.3 Inspection	1/7		
15.4 Maintenance	3/7		
16. Instrument Calibration and Frequency		1.1	12/04/07
16.1 Instrumentation Requiring Calibration	1/8		
16.2 Calibration Methods	3/8		
16.3 Calibration Standard Materials and Apparatus	5/8		
16.4 Calibration Frequency	8/8		

<b><i>Section</i></b>	<b><i>Page</i></b>	<b><i>Revision</i></b>	<b><i>Date</i></b>
17. Inspection/Acceptance for Supplies and Consumables		1.1	12/04/07
17.1 Purpose	1/3		
17.2 Critical Supplies and Consumables	1/3		
17.3 Acceptance Criteria	3/3		
17.4 Tracking and Quality Verification of Supplies and Consumables	3/3		
18. Data Acquisition Requirements (non-direct measurements)		1.1	12/04/07
18.1 Acquisition of Non-Direct Measurement Data	1/3		
19. Data Management		1.1	12/04/07
19.1 Background and Overview	1/10		
19.2 Data Recording	3/10		
19.3 Data Validation	3/10		
19.4 Data Transformation	5/10		
19.5 Data Transmittal	5/10		
19.6 Data Reduction	6/10		
19.7 Data Summary	7/10		
19.8 Data Tracking	8/10		
19.9 Data Storage and Retrieval	9/10		
	9/10		
<b>C. ASSESSMENT/OVERSIGHT</b>			
20. Assessments and Response Actions		1.1	
20.1 Assessment Activities and Project Planning	1/8		12/04/07
20.2 External Assessment Schedule	8/8		
21. Reports to Management		1.1	12/04/07
21.1 Frequency, Content, and Distribution of Reports	1/2		
22. Data Review		1.1	
22.1 Data Review Design	1/4		
22.2 Data Review Testing	2/4	1.1	12/04/07
22.3 Procedures	3/4		
<b>D. VALIDATION AND USABILITY</b>		1.1	12/04/07
23. Validation, Verification and Analysis Methods	1/4		
23.1 Process for Validating and Verifying Data	3/4		
23.2 Data Analysis			
24. Reconciliation with Data Quality Objectives		1.1	12/04/07
24.1 Reconciling Results with DQOs	1/5		
24.2 Five Steps of the DQA Process	1/5		

## ***Appendices***

A. Technical Assistance Document For the National Ambient Air Toxics Trends and Assessment Program	1	11/4/02
--	---	---------

### 3.0 Distribution

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**

<b>Name</b>	<b>Position</b>	<b>Division/Branch</b>
<b><i>Toxa City Air Pollution Control District</i></b>		
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
<b><i>EPA Region 11</i></b>		
Dennis Mickelson	QA Officer	Air/ Air Quality Monitoring
Benjamin T. Zachary	EPA Project Officer	Air/Quality Assurance

## **4.0 Project/Task Organization**

### **4.1 Roles and Responsibilities**

Federal, State, Tribal and local agencies all have important roles in developing and implementing satisfactory air monitoring programs. As part of the planning effort, EPA is responsible for developing National Ambient Air Quality Standards (NAAQS), and identifying a minimum set of QC samples from which to judge data quality. The State and local organizations are responsible for taking this information and developing and implementing a quality system that will meet the data quality requirements. Then, it is the responsibility of both EPA and the State and local organizations to assess the quality of the data and take corrective action when appropriate. The responsibilities of each organization 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. OAQPS evaluates the need to regulate potential air pollutants, especially air toxics and develops national standards; works with State, Local and Tribal (S/L/T) agencies to develop plans for meeting these standards. In addition, OAQPS provide the funding, through Section §103 and §105 funds.

Within the OAQPS Air Quality Assessment Division (AQAD), the Monitoring and Quality Assurance Group (MQAG) is responsible for the oversight of the NATTS. 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
- ▶ evaluating the performance, through Technical Systems Audits (TSAs) and Management System Reviews (MSRs), of organizations making air pollution measurements;
- ▶ 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;

- ▶ 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 NATTS, 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 TSAs and network reviews whose frequency is addressed in the Code of Federal Regulations;
- ▶ 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 is 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**

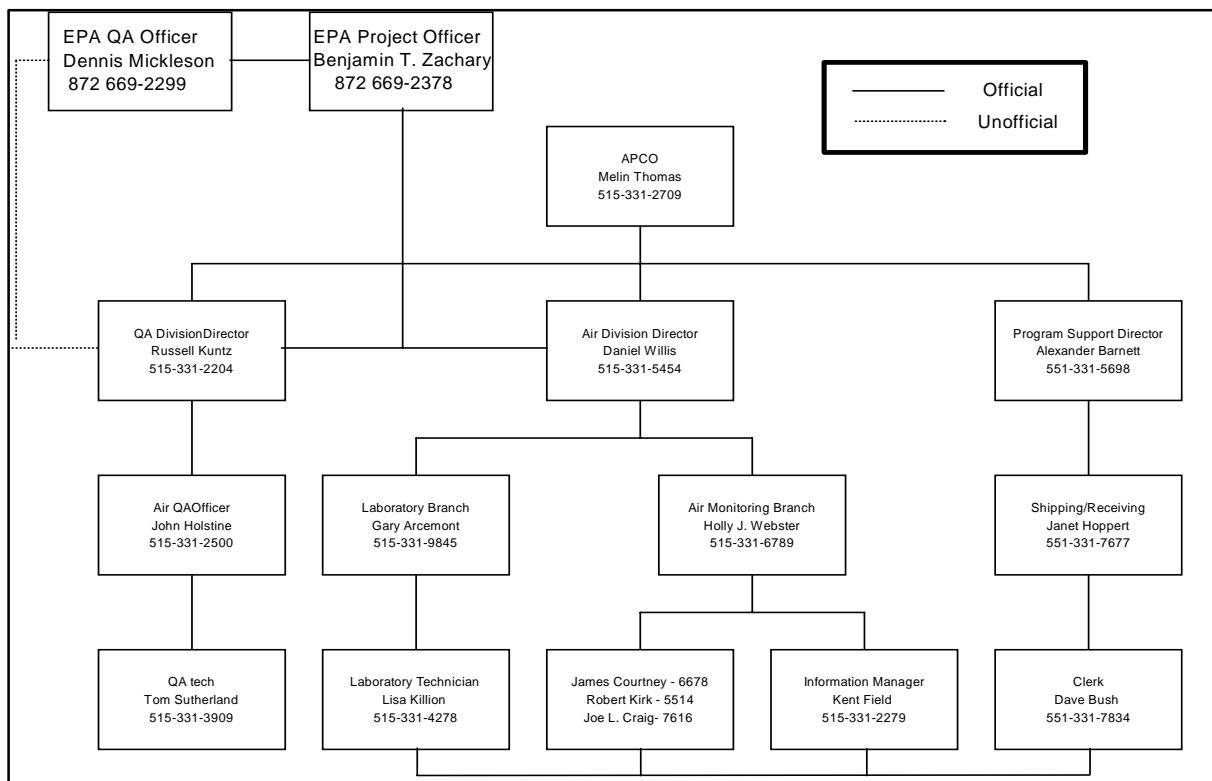
##### ***QA Division Director (QAD) - Russell Kuntz***

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





**Figure 4.1 Organization Chart for the TCAPCD**

### ***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;
- ensuring that technical personnel follow the QAPP
- review precision 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 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 and 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, 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 manufacturers' 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;

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

- ▶ sample receiving and inspection from vendor;
- ▶ 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);
- ▶ sample preparation, extraction, and clean-up;
- ▶ Analysis of the VOC, 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:

- developing local data management standard operating procedures;
- ensuring that information management activities are developed within reasonable time frames for review and approval;
- 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;
- ensuring the adherence to the QAPP where applicable;
- ensuring access to data for timely reporting and interpretation processes;
- ensuring the development of data base guides (data base structures, user guidance documents);
- 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:

- communication with QA and Air Monitoring Division on specific needs;
- 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 as it relates to program support activities;
- 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**

### **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.

#### **5.1.2 The National Air Toxics Trends Stations and the Role of the TCAPCD**

EPA finalized the Urban Air Toxics Strategy (UATS) in the Federal Register on July 19, 1999<sup>1</sup>. The UATS states that emissions data are needed to quantify the sources of air toxics impacts and aid in the development of control strategies, while ambient 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. The EPA proposed the National Air Toxics Assessment (NATA). There are four activities which are key to the success of the NATA.

- ▶ Source-specific standards and sector-based standards, including section 112 standards, i.e. Maximum Achievable Control Technology (MACT), Generally Achievable Control Technology (GACT), residual risk standards, and section 129 standards. - National, regional, and community-based initiatives to focus on multi-media and;
- ▶ Cumulative risks, such as the Integrated UATS, Great Waters, Mercury initiatives, Persistent Bio-accumulative Toxics (PBT) and Total Maximum Daily Load (TMDL) initiatives, and Clean Air Partnerships.
- ▶ NATA activities that will help EPA identify areas of concern, characterize risks and track progress. These activities include expanded air toxics monitoring, improving and periodically updating emissions inventories, national- and local scale air quality and exposure modeling, and continued research on effects and assessment tools, leading to

- improved characterizations of air toxics risk and reductions in risk resulting from ongoing and future implementation of air toxics emissions control standards and initiatives.
- ▶ Education and outreach.

The success of the NATA critically depends on our ability to quantify the impacts of air toxics emissions on public health and the environment. All of these activities are aimed at providing the best technical information regarding air toxics emissions, ambient concentrations, and health impacts to support the development of sound policies for NATA. Specifically, these activities include:

- ▶ The measurement of air toxics emission rates from individual pollution sources;
- ▶ the compilation of comprehensive air toxics emission inventories for local, State, and national domains;
- ▶ the analysis of patterns and trends in ambient air toxics measurements;
- ▶ the estimation of ambient air toxics concentrations from emission inventories using dispersion modeling;
- ▶ the estimation of human and environmental exposures to air toxics, and;
- ▶ the assessment of risks due to air toxics:
- ▶ **and the measurement of ambient concentrations of air toxics at trends monitoring sites throughout the nation.**

Analysis was performed by OAQPS to ascertain the size and features of a national trends network that would satisfy the goals as stated above. This analysis illustrated that a number urban and rural locations would provide the needed coverage for estimates of national trends. TCAPCD was contacted by the EPA to support one of these national trends sites. TCAPCD has agreed to provide the support to this network. TCAPCD will support one monitoring station as agreed through the Section §103 and §105 funds received from the Regional Office.

This QAPP focuses on the Quality Assurance (QA) and Quality Control (QC) that will be instituted by the TCAPCD to fulfill it's obligation to the NATTS. 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.

## 5.2 List of Pollutants

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

- ▶ The EPA's Concept Paper<sup>2</sup>;



- ▶ A major portion of the 33 Unified Air Toxics Strategy (UATS) HAPs can be measured with 3 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. However, EPA is only requiring the TCAPCD to report to the national Air Quality System (AQS) six compound that are listed in the Required Section of Table 5-1. Since the collection and analysis of samples will also provide data on other compounds, the TCAPCD will report values to AQS that can be quality assured and accepted by the procedures detailed in this QAPP.

**Table 5.1 List of HAPs**

Required	Core	Max
Benzene, chromium, acrolein, and formaldehyde	Benzene, 1,3-butadiene, carbon tetrachloride, chloroform, 1,2-dichloropropane, dichloromethane, tetrachloroethylene, trichloroethylene, vinyl chloride, arsenic, beryllium, cadmium, chromium, lead, manganese, formaldehyde and acrolein	Acrylonitrile, benzene, 1,3-butadiene, carbon tetrachloride, chloroform, 1,2 dibromomethane, 1,3-dichloropropene, 1,2-dichloropropane, ethylene dichloride, ethylene oxide, dichloromethane, tetrachloro ethane, tetrachloroethylene, trichloroethylene, vinyl chloride, arsenic, beryllium, cadmium, chromium, lead, mercury, manganese, nickel, acetaldehyde, formaldehyde and acrolein, 2,2,7,8 tetrachlorobenzo-p-dioxin, coke oven emissions, hexachlorobenzene, hydrazine, polycyclic organic matter, polychloronated biphenyls, quinoline

As can be seen from Table 5-1, there are a number of additional HAPs in the Core and Max lists. Many of these are HAPs that the current analytical systems can measure. The TCAPCD will report the compounds that are on the Core and Max list if these can be detected and analyzed while collecting the data on the required list.

### **5.3 Locations of Interest for HAPs**

The main objective for the TCAPCD NATTS is to provide data for the national trends, as determined in Chapter 7 of this QAPP. However, the TCAPCD will also be operating four other air toxics monitoring stations. Further 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 neighborhoods that surround this area. The TCAPCD has decided to target these several areas in addition to the NATTS. The other locations are suburban-oriented sites needed to characterize general exposure and temporal and spatial variability.

### **References**

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

### 6.1 Description of Work

The measurement goal of the NATTS is to estimate the concentration, in units of micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) and parts per billion/volume (ppbv) of air toxic compounds of particulates and gases. This is accomplished by three separate collection media: canister sampling with passivated canisters, DNPH cartridges and Particulate Matter – 10 micron ( $\text{PM}_{10}$ ) high volume sampling on an 8 x 10" quartz glass filter and diesel emissions through continuous spectrophotometry.

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 - Particulate Matter – 10 micron - Toxic Metals**

Equipment	Frequency	Acceptance Criteria	Reference
<b>Filter Design Specs.</b> Size Medium Filter thickness Collection efficiency Stability Temperature	1 in 6 days	See Reference 1 8.5" x 11" Quartz Glass Fiber Filter 0.50 mm 99.95% temperatures > 540°C	See Reference 1 "IO-2.1 Sec 8.1 " Sec 3.2 "Sec 6.2.4 "Sec 6.2.2 "Sec 6.2.2
<b>Sampler Performance Specs.</b> Sample Flow Rate Flow Regulation Flow Rate Precision Flow Rate Accuracy Clock/Timer	1 in 6 days	1.13 $\text{m}^3/\text{min}$ . 0.1 $\text{m}^3/\text{min}$ . $\pm 7$ $\pm 7$ 24 hour $\pm 2$ min accuracy	"Sec 6.1.4 " See Reference 4, Appendix J See Reference 5 Section 2.11.7 See Reference 6, Section 2.11.2

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

Equipment	Frequency	Acceptance Criteria	Reference
<b>Canister Design Specs.</b> Size Medium  Max Pressure Max. pressure drop Collection efficiency Lower Detection Limit	1 in 6 days	See Reference 2 6 liters spherical Passivated SUMMA electro- polished Stainless Steel Canister 30 psig 14 psig. 99% compound specific, usually >0.1 ppbv	See Reference 2 “Vender Spec. “ “ “ “ See TO-15
<b>Sampler Performance Specs.</b> Sample Flow Rate Flow Regulation Flow Rate Precision Flow Rate Accuracy External Leakage Internal Leakage	1 in 6 days	180 cc/min. 1.0 cc/min. ±10% ±10% Vendor specs Vendor specs 24 hour ± 2 min accuracy	“Vender Spec. See Reference 2 TO-15 “ NA NA “Sec 6.1.8

**Table 6.3 Design/Performance Specifications - Carbonyl Sampler - Aldehyde and Ketone Compounds**

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

**Table 6.4 Design/Performance Specifications – Aethalometer – Black and Organic Carbon**

Equipment	Frequency	Acceptance Criteria	Reference
<b>Sampler Performance Specs.</b>			
Sample Flow Rate	Continuous	2 to 6 l/min.	
Size		19" by 10.5 "	"Vender Spec.
medium		Quartz Tape	"
Data Recording	Continuous	0-5 VDC	"
Power		60 watts/ 110V AC	"
Temperature Range		0 – 40 deg. C	"
Wavelength		880 nm and 370 nm	"
Time Resolution		1hour or 1minute	"
Sensitivity		0.1 ug/m3	"

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.

### 6.2.1 Field Measurements

Table 6.1, 6.2, 6.3 and 6.4 represents the field measurements that must be collected. These tables presented in the Compendia of Organic and Inorganic Methods listed in References 1 - 3. At the urging of the EPA, the TCAPCD will also measure Elemental Carbon (EC) and Organic Carbon (OC) using the Aethalometer. This is a continuous instrument that draws samples through quartz tape. The OC/EC particle are trapped on the tape and analyzed via spectrophotometry at 880 and 370 nm. The data are stored on the internal 3.5 inch drive and can be retrieved during site visits. All other instruments collect discreet 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;
- ▶ 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- 3.

## **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: Proficiency Testing (PT), Instrument Performance Audits (IPAs), Technical System Audits (TSAs), peer review, inspection, or surveillance. 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**

Agency	Type of Assessment	Agency Assessed	Frequency
EPA Contractor	PTs	S/L/T agencies	Annually
EPA Contractor	TSAs, IPAs	S/L/T agencies	As needed by AQAD determination
Regional Offices	Network Reviews	S/L/T agencies	Once every 5 years
Regional Offices	TSAs and IPAs	S/L/T agencies	Once every three years

## 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 (EPA)	June 2002	Preliminary list of sites and samplers required
Sampler order	August 2002	Samplers ordered from National contract
Laboratory upgrade	August 2002	Listing of laboratory requirements
Laboratory procurement	September 2002	Ordering/purchase of all laboratory and miscellaneous field equipment
QAPP development	November 2002	Development of the QAPP
Samplers arrive	November 2002	Received in Shipping and Receiving District
Sampler siting/testing	November 2002	Establishment of sites and preliminary testing of samplers
QAPP Submittal	December 2002	QAPP submittal to EPA
Field/Laboratory Training	December 2002	Field and laboratory training activities and certification.
QAPP Approval	January 2003	Approval by EPA
Routine Sampling Begins	January 1, 2003	Routine activities must start

## References

1. Compendium Method for the Determination of Inorganic Compounds in Air, United States Environmental Protection Agency, June 1999, Section IO-2.1.
2. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-15, January 1999
3. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-11A, January 1999
4. Code of Federal Regulations, Chapter 40, Part 50, Appendix J, Section 4.1
5. Quality Assurance Handbook for Air Pollution Measurement Systems Volume II, Section 2.11.7, April 1989
6. Quality Assurance Handbook for Air Pollution Measurement Systems Volume II, Section 2.11.2, April 1989



## 7.0 Data Quality Objectives

Since the TCAPCD has decided to participate in the NATTS, staff realized that the objectives of the non-trend stations would be different from the NATTS. Since EPA-OAQPS has developed the DQOs for the trends sites, the TCAPCD has decided to state the objectives for the non-trends sites. Below is the non-trends objective statement.

**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.**

Please note that these are the identical monitoring objective to those of the pilot study, which were developed in the TCAPCD Pilot City QAPP. However, the NATTS objectives are different. Therefore, the DQOs developed for the NATTS are described below.

The DQO process described in EPA's QA/G-4 document provides a general framework for ensuring that the data collected by EPA meets the needs of the intended decision makers and data users. The process establishes the link between the specific end use(s) of the data with the data collection process and the data quality (and quantity) needed to meet a program's goals. This process was applied to one of the primary goals of the National Air Toxics Trends Network, namely to establish trends and evaluate the effectiveness of HAP reduction strategies. This section describes the results of the DQO process for the local monitoring data requirements for: benzene, 1,3-butadiene, arsenic, chromium, acrolein, and formaldehyde. In addition, the objectives for the rest of the network should also be stated clearly.

The technical approach used followed the conceptual model developed for the PM<sub>2.5</sub> FRM DQOs. This conceptual model was followed mainly due to its success in use with PM<sub>2.5</sub> and the flexibility of the conceptual model. It is a quite general model for simulating the characterization of ambient concentrations in terms of annual or multi-year averages from 1 in n day sampling. The model incorporates several sources of variability: seasonal variability, natural day-to-day variability, sampling incompleteness, and measurement error. The measurement error was restricted to a precision component without a bias component because the final mathematical form of the assessment of trends is robust to multiplicative bias. Pollutant specific parameters were used in the modeling. The parameters describing the natural variation of the pollutants were based on data analyses of the Pilot City data and the Air Toxics Archive. Finally, separate urban and rural DQOs were established for the pollutants that were sufficiently measured in rural locations of the Pilot Study.

A workgroup organized by EPA/OAQPS/AQAD provided representatives of data users, decision makers, state and local parties, and monitoring and laboratory personnel. Battelle provided technical statistical support throughout the process with examples and

data analyses. The workgroup guided the DQO development and made the decisions that were not driven by data analyses in the DQO development during a series of conference calls. These decisions included items such as establishing a specific mathematical form for measuring trends and establishing limits on the sampling rate. Battelle and EPA also held a meeting in Research Triangle Park, North Carolina, on June 17, 2002 to discuss the development details.

## **7.1 THE GENERAL DQO PROCESS**

This section presents an overview of the seven steps in EPA's QA/G-4 DQO process as applied to one of the primary goals of the National Air Toxics Monitoring Network, namely to establish trends and evaluate the effectiveness of HAP reduction strategies (see [www.epa.gov/quality/qa\\_docs.html](http://www.epa.gov/quality/qa_docs.html)). The purpose of this section is to provide general discussion on the specific issues that were used in developing the DQOs as they relate to the general DQO process.

The DQO process is a seven-step process based on the scientific method to ensure that the data collected by EPA meet the needs of its data users and decision makers in terms of the information to be collected, in particular the desired quality and quantity of data. It also provides a framework for checking and evaluating the program goals to make sure they are feasible and that the data are collected efficiently. The seven steps are usually labeled as:

- State the Problem
- Identify the Decision
- Identify the Inputs to the Decision
- Define the Study Boundaries
- Develop a Decision Rule
- Specify Tolerable Limits on the Decision Errors
- Optimize the Design.

This section has general discussion for each of these items. The pollutant specific outcomes of the DQO process are contained in Section 3.

## 7.2 State the Problem

*Characterize the ambient concentrations in the region represented by the monitor to establish any significant downward trend (measured by a percent change between successive 3-year means of the concentrations).*

The ability to characterize the trends was statistically modeled. The statistical model was designed by starting with a model similar to the one used for PM<sub>2.5</sub> FRM data. The ambient concentrations are modeled as deviations from a sine curve, where the sine curve represents seasonality. This sine curve represents long-term daily averages of the concentrations that one would observe at the site. The form used is as follows:

$$A \left[ 1 + \left( \frac{r-1}{r+1} \right) \sin \left( \frac{\text{day}}{365} 2 \pi \right) \right]$$

where

A = the long term annual average and  
 r = the ratio of the highest point on the sine curve to the lowest point. A value of r = 1 indicates no seasonality.)

The natural deviations from the sine curve are assumed to follow a lognormal distribution with a mean that is given by the particular point on the sine curve. (For example, the value of the sine curve for Day 100 is the mean for all Day 100s across many years.) The coefficient of variation (CV) of the lognormal distribution is assumed to be a constant. The general model considered also allows for the day-to-day deviations from the sine curve to be correlated, but the current DQOs are based on a correlation of zero. (The correlation effectively measures how quickly the concentrations can change from one deviation from the sine curve to another. A correlation of zero indicates that it can change fast enough that values measured on consecutive days would be completely independent. A value of 0.2 would say that a positive deviation from the curve is somewhat more likely to be followed by another positive deviation than a negative deviation. A value of 0.9 would indicate that positive deviations are almost always followed by another positive deviation.) Finally, the measured values are modeled with a normally distributed random measurement error with a constant coefficient of variation (CV). The specific values for the various parameters are pollutant specific.

The population parameters (the degree of seasonality, the autocorrelation, and the CV of the deviations from the sine curve) were estimated from the Pilot City data (and in the case of benzene compared with estimates from the Air Toxics Data Archive). A near worst-case choice was made for each of the parameters. The power curves and decision

errors are established via Monte-Carlo simulation of the model with the particular parameters for various combinations of truth and observed percent changes in three-year mean concentrations. The power curves are plotted as functions of the true percent change in the three-year annual means for compound specific combinations of the sampling frequency, completeness, and precision. Decision errors are stated for these worst-case scenarios.

Note: It was decided by the workgroup from budgetary considerations that the proposed DQOs should be constrained to no more than one in six day sampling.

### **7.3 Identify the Decision**

The decision statement should provide a link between the principal study question and possible actions. The potential actions associated with achieving or failing to achieve a particular percent decrease in the observed three-year mean concentration were not defined by the workgroup. However, it was decided that any decision would be based on whether or not a 15 percent decrease was observed. Hence the form of the decision was fixed, and may be specified as follows:

*Significant decreases (15 percent or more) between successive three-year mean concentration levels will result in ... Insignificant decreases, (increases, or decreases of less than 15 percent) will trigger alternate actions of.*

### **7.4 Identify the Inputs to the Decision**

Only six HAPs (benzene, 1,3-butadiene, arsenic, chromium, acrolein, and formaldehyde) were considered in the DQO development. It is assumed that the other pollutants will be represented by at least one of these six. The statements included here apply implicitly to the other HAPs.

It is assumed that the analytical techniques used in the Pilot study will be used throughout the program. Most importantly for the DQOs the Method Detection Limits (MDLs) will not increase. The pollutant specific MDLs assumed are listed in Section 3. Those values were identified as pollutant-site maximums that were achieved by at least two of the pilot sites in each pollutant's case.

Among the key decisions made as a part of the DQO process was that each pollutant will need to be measured on a schedule of at least once every six days with a quarterly completeness of 85 percent for six consecutive years. The completeness criterion was checked against the pilot data, and was generally achieved. All valid measurements count toward the completeness goal, including non-detects. The analysis of the trends at the site level will be based on a percent difference between the mean of the first three annual concentrations and the mean of the last three annual concentrations. Hence for each year the annual average concentration,  $X_i$ , needs to be found,  $i = 1, 2, \dots 6$ . Next

find the mean,  $X$ , for the first three years and the mean,  $Y$ , for years 4 through 6 as follows:

$$X = \frac{X_1 + X_2 + X_3}{3} \text{ and } Y = \frac{X_4 + X_5 + X_6}{3}.$$

Then the downward trend,  $T$ , is the percent decrease from the first three-year period to the second three-year period. Namely,

$$T = \frac{X - Y}{X} \cdot 100.$$

The Action Level is the cutoff point that separates different decision alternatives. Based on the assumed budgetary constraint of one in six day sampling and the natural variation exhibited by the six compounds considered, an action level of 15 percent was chosen. Hence at least a 15 percent decrease between the two distinct three-year mean concentrations will need to be observed in order to be considered a significant decrease. This assumes that the mean concentrations are above the health standards, and hence it makes sense to consider trends. (Note that characterizing the mean concentrations is a separate goal of the Air Toxics program that has not yet been considered and could result in different DQOs.)

## 7.5 Define the Study Boundaries

It is desired that the specific location of the monitors be constrained so that they represent neighborhood scale assessment for each of the two three-year periods under consideration. The details of how to ensure this goal have not yet been determined. Some guideline is provided by the Air Toxics Monitoring Concept Paper (see <http://www.epa.gov/ttn/antic/airtxfil.html>).

## 7.6 Develop a Decision Rule

The decision rule is an “if ... then” statement for how the various alternatives will be chosen. As noted above the specific alternative actions have not been formalized yet, just the form of the decision rule.

*If the percent change between successive three-year average concentration levels is greater than or equal to 15 percent, then  
... Otherwise ...*

## 7.7 Specify Tolerable Limits on the Decision Errors

Since the program will not generate complete, error-free data, there will be some probability of making a decision error. The main goal of the DQO process is to find a

workable balance between how complete and error free the data are with acceptable levels of decision errors. To find the balance, the possible errors need to be carefully defined. This usually needs to be done with the recognition that there will be a range, often called the gray zone, where it is impractical to control decision errors.

The QA/G-4 guidance recommends using 0.01 as the starting point for setting decision error rates. However, such a limit would generally require a sampling rate that is not feasible. The workgroup decided on the following limits:

*If there is no true decrease in the three-year average concentrations, then the probability of observing a mean concentration for years four through six that is at least 15 percent below the observed mean concentration from years one through three should be no more than 10 percent.*

*If there is a true decrease in the three-year average concentrations of at least 30 percent, then the probability of observing a mean concentration for years four through six that is less than 15 percent below the observed mean concentration from years one through three should be no more than 10 percent.*

*Equivalently, the second statement could read that:*

*If there is a true decrease in the three-year average concentrations of at least 30 percent, then the probability of observing a mean concentration for years four through six that is at least 15 percent below the observed mean concentration from years one through three should be at least 90 percent.*

The power curves shown in Section 3 show the probability of observing at least a 15 percent decrease as a function of the true decrease. In terms of the above goals this means that the power curve graphs should start below 10 percent for a true percent change of 0 and end above 90 percent for a true percent change of 30 percent. Since there is a particular interest in the error rates for no true change and for a true change of a 30 percent decrease, this associated x-axis (horizontal axis) range is shown for each curve. Also, it is sometimes useful to know when the two target error rates are achieved. The range of “truth” between these values is referred to as the gray zone, i.e., the range of true percent decreases that cannot be reliably detected by the sampling scheme. These are also given for each curve (and indicated with vertical dotted lines).

## **7.8 Optimize the Design**

In each pollutant’s case, a sampling schedule of once every six days is set forth with a quarterly completeness criteria of 85 percent. Pilot City study participants were surveyed

and almost all were collecting and obtaining valid data values at a rate that exceeded 85 percent for each of the six compounds considered (valid non-detects counted toward completeness). Hence, the target rate of 85 percent was selected, instead of the more common 75 percent completeness goal. This should make the power curves more representative of the network's expected monitoring conditions.

## 7.9 DQOS For the Six Study Compounds

This section states the design values, namely it gives the expected maximum error rates, gray zones, and power curves for each of the six compounds considered explicitly. The parameters describing the natural state of the ambient conditions used to construct the power curves, error rates and gray zone are compound specific based on data from the Pilot Study. In each case, the Pilot City data yielded a range of estimates. The specific values used were the extremes (or nearly so) that would make detecting a downward trend more difficult. Actual performance in almost all cases should be better than that indicated by the power curves, since specific sites would not be characterized by these extremes in each of these parameters. However, since the sensitivity to the different parameters is not the same, the DQOs need to protect against a combined set of extremes. Hence, the use of extremes for network design purposes is conservative.

Since the rural sites can be quite different from urban sites, separate DQOs are shown in those cases where there were sufficient data to support investigating a separate set of DQOs. In the case of formaldehyde, the urban and rural DQOs are essentially the same.

There are twelve input parameters shown in each section. They are:

1. T1. This is the target error rate for when there is no change. It is always 10 percent.
2. T2. This is the target error rate for when there is a 30 percent decrease. It is always 10 percent.
3. The action limit. This is the minimum observed percent change from the mean concentration of the first three years to the mean concentration from the last three years that would be used to indicate that the concentrations have decreased. Decreases less than this amount would not be considered significant decreases in the mean concentration.
4. The sampling rate. It is set to one in six day sampling in each case.
5. The quarterly completeness criterion. This was set to 85 percent based on the recommendation of ERG and a review of the Pilot Study data completeness.

6. Measurement error Coefficient of Variation (CV). This was assumed to be 15 percent for each compound. (A sensitivity analysis showed that the DQOs are robust to moderate changes in this value.)
7. Seasonality ratio. This is a measure of the degree of seasonality. Specifically, it is the ratio of the highest point on the seasonal curve to the lowest point. A value of 1 indicates no seasonality. Larger values make it more difficult to estimate an annual or three-year mean concentration, and hence larger values make it more difficult to measure the percent change.
8. Autocorrelation. This is a measurement of how quickly day-to-day deviation from the seasonal curve can occur. A value of 0 indicates that changes occur quickly enough that each day is independent of the preceding day. Values greater than 0 indicate that the changes are generally slower, so that days with concentrations above the seasonal curve are more likely to be followed by another day above the seasonal curve. Values greater than 0 increase the precision of the three-year means and the percent change between the three-year means. Hence, a value of 0 is the most conservative choice for the DQOs. Zero was used in all cases, because many daily measurements are required to obtain a reliable estimate of this parameter.
9. Population CV. This is a measurement of the natural variation about the seasonal curve. Larger values decrease the precision of the three-year mean concentration estimates and the percent change between them. The power curves are strongly dependent on this parameter, but the estimates can be strongly influenced by a few outlier values. Generally the 90<sup>th</sup> percentile of the estimates from the Pilot study was used as a balance between these competing forces. This value was then rounded up to be a multiple of 5 percent for the urban DQOs. For the rural DQOs an additional 5 percent was added, since there were fewer rural sites on which to base the estimates.
10. MDL. This is the MDL used in the simulations. The value was chosen to be a reasonably attainable maximum for a site and compound.
11. Initial mean concentration. This is the mean concentration of the first three years in the simulations. Values closer to the MDL decrease the precision of the percent change estimate. The value chosen was approximately equal to the 25<sup>th</sup> percentile of the site-compound means from the Pilot study.
12. Health Risk Standard. This value is shown for reference only. It was not used in the simulations.

In addition to the power curves, there are three sets of output values.



1. Error<sub>0</sub> is the percent of the simulations with no change in the true three-year means that in fact generated at least a 15 percent decrease in the observed three-year means.
2. Error<sub>30</sub> is the percent of the simulations with a 30 percent decrease in the true three-year means that generated less than a 15 percent decrease in the observed three-year means.
3. The gray zone is the interval of the true decreases that cannot be detected with confidence by the study design. In this range, the probability of observing at least a 15 percent decrease is greater than 10 percent, but less than 90 percent.

In summary, based on variability and uncertainty estimates from the ten-city Pilot Study, the following Sections 3.1 through 3.10 suggest that the specified air toxics trends DQOs will be met for monitoring sites that satisfy the goals of 1 in 6 day sampling, 85 percent completeness, and 15 percent measurement CV. These results were explicitly developed for benzene (urban and rural); 1,3-butadiene (urban and rural); arsenic (urban and rural); chromium (urban only); acrolein (urban only); and formaldehyde (urban and rural).

## 7.10 DQOs for Measuring the Percent Decrease

### 7.10.1 Benzene at Urban Locations

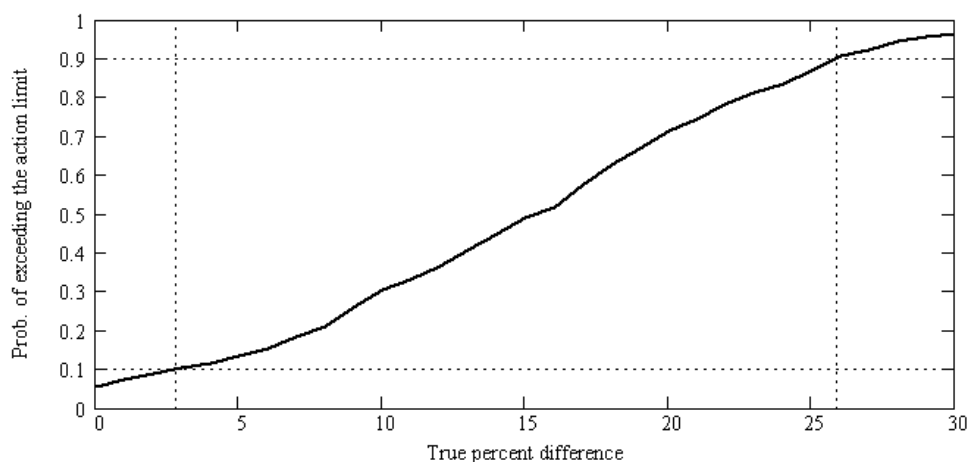
Table 3.1.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of benzene at urban locations. Table 3.1.2 shows the output values from the simulations. Figure 3.1.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.1.2 suggests that the specified air toxics trends DQOs will be met for benzene at urban monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.1 DQO input parameters for benzene at urban locations**

<b>T1</b>	<b>Action Limit</b>	<b>Sampling Rate</b>	<b>Seasonality</b>	<b>Population CV</b>	<b>Initial Concentration (<math>\mu\text{g}/\text{m}^3</math>)</b>
10%	15%	1 in 6 day	4.5	85%	1.0
<b>T2</b>	<b>Measurement CV</b>	<b>Completeness</b>	<b>Autocorrelation</b>	<b>MDL (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Risk Standard (<math>\mu\text{g}/\text{m}^3</math>)</b>
10%	15%	85%	0	0.044	0.128

**Table 7.2 DQO output parameters for benzene at urban locations**

<b>Error rate for no true change</b>	<b>Error rate for 30% decrease</b>	<b>Gray zone</b>
6%	97%	3% - 26%



**Figure 7.1** Power curve for detecting a 15 percent decrease between successive three-year means of benzene concentrations based on the data variation found in urban locations of the Pilot Study

### 7.10.2 DQOs for Measuring the Percent Decrease of Benzene at Rural Locations

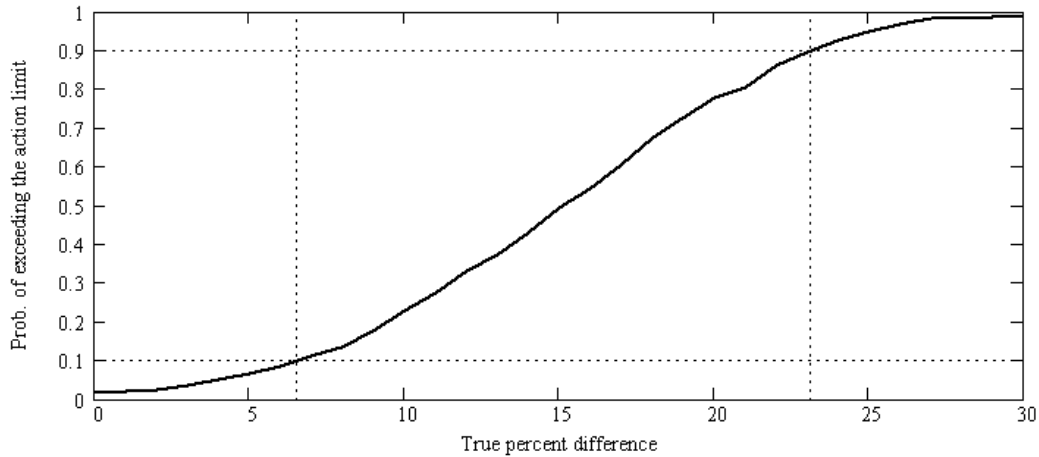
Table 3.2.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of benzene at rural locations. Table 3.2.2 shows the output values from the simulations. Figure 3.2.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.2.2 suggests that the specified air toxics trends DQOs will be met for benzene at rural monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.3** DQO input parameters for benzene at rural locations

T1	Action Limit	Sampling Rate	Seasonality	Population CV	Initial Concentration ( $\mu\text{g}/\text{m}^3$ )
10%	15%	1 in 6 day	4.0	60%	1.0
T2	Measurement CV	Completeness	Autocorrelation	MDL ( $\mu\text{g}/\text{m}^3$ )	Risk Standard ( $\mu\text{g}/\text{m}^3$ )
10%	15%	85%	0	0.044	0.128

**Table 7.4** DQO output parameters for benzene at rural locations

Error rate for no true change	Error rate for 30% decrease	Gray zone
2%	99%	7% - 23%



**Figure 7.2** Power curve for detecting a 15 percent decrease between successive three-year means of benzene concentrations based on the data variation found in rural locations of the Pilot Study

### 7.10.3 DQOs for Measuring the Percent Decrease of 1,3-Butadiene at Urban Locations

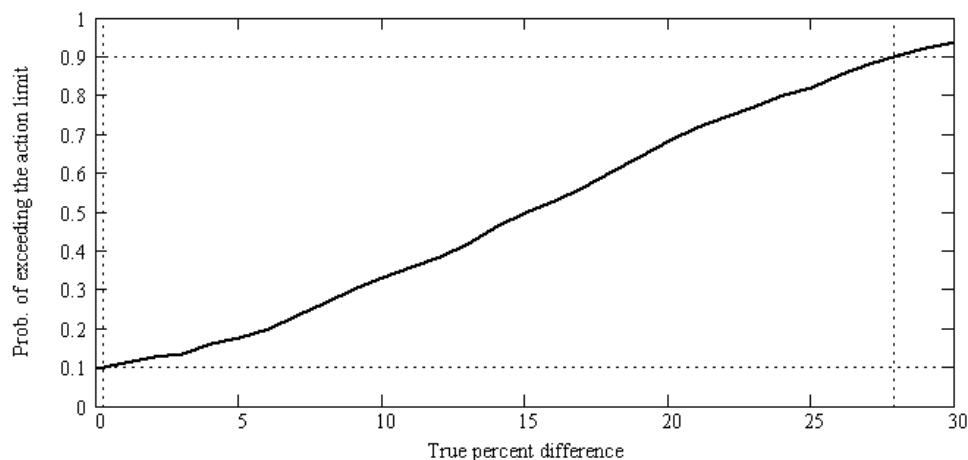
Table 3.3.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of 1,3-butadiene at urban locations. Table 3.3.2 shows the output values from the simulations. Figure 3.3.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.3.2 suggests that the specified air toxics trends DQOs will be met for 1,3-butadiene at urban monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.5 DQO input parameters for 1,3-butadiene at urban locations**

T1	Action Limit	Sampling Rate	Seasonality	Population CV	Initial Concentration ( $\mu\text{g}/\text{m}^3$ )
10%	15%	1 in 6 day	7.0	100%	0.1
T2	Measurement CV	Completeness	Autocorrelation	MDL ( $\mu\text{g}/\text{m}^3$ )	Risk Standard ( $\mu\text{g}/\text{m}^3$ )
10%	15%	85%	0	0.02	$10^{-5}$

**Table 7.6 DQO output parameters for 1,3-butadiene at urban locations**

Error rate for no true change	Error rate for 30% decrease	Gray zone
10%	94%	0% - 28%



**Figure 7.3 Power curve for detecting a 15 percent decrease between successive three-year means of 1,3-butadiene concentrations based on the data variation found in urban locations of the Pilot Study**

#### **7.10.4 DQOs for Measuring the Percent Decrease of 1,3-butadiene at Rural Locations**

Table 3.4.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of 1,3-butadiene at rural locations. Table 3.4.2 shows the output values from the simulations. Figure 3.4.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.4.2 suggests that the specified air toxics trends DQOs will be met for 1,3-butadiene at rural monitoring sites that satisfy the goals of one in six-day sampling, 85 percent

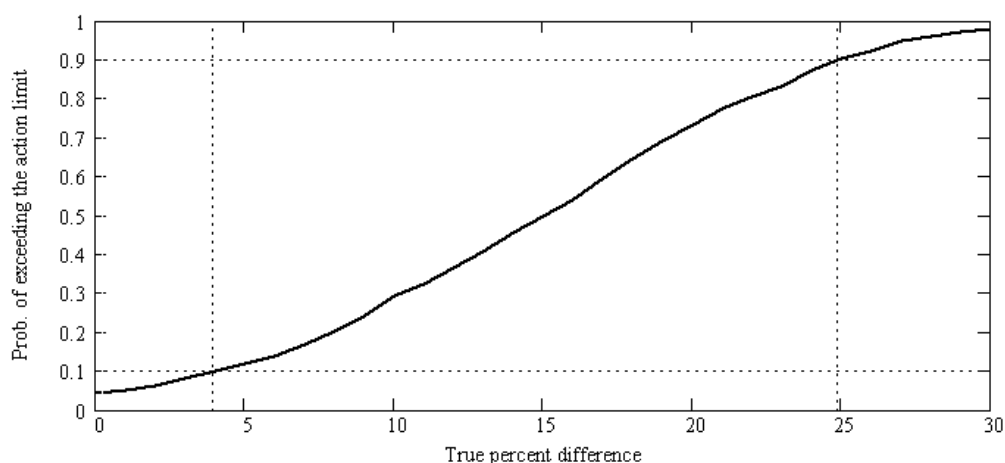
completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.7 DQO input parameters for 1,3-butadiene at rural locations**

T1	Action Limit	Sampling Rate	Seasonality	Population CV	Initial Concentration ( $\mu\text{g}/\text{m}^3$ )
10%	15%	1 in 6 day	6.0	75%	0.1
T2	Measurement CV	Completeness	Autocorrelation	MDL ( $\mu\text{g}/\text{m}^3$ )	Risk Standard ( $\mu\text{g}/\text{m}^3$ )
10%	15%	85%	0	0.02	$10^{-5}$

**Table 7.8 DQO output parameters for 1,3-butadiene at rural locations**

Error rate for no true change	Error rate for 30% decrease	Gray zone
4%	98%	4% - 25%



**Figure 7.4 Power curve for detecting a 15 percent decrease between successive three-year means of 1,3-butadiene concentrations based on the data variation found in rural locations of the Pilot Study**

### 7.10.5 DQOs for Measuring the Percent Decrease of Arsenic at Urban Locations

Table 3.5.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of arsenic at urban locations. Table 3.5.2 shows the output values from the simulations. Figure 3.5.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.5.2 suggests that the

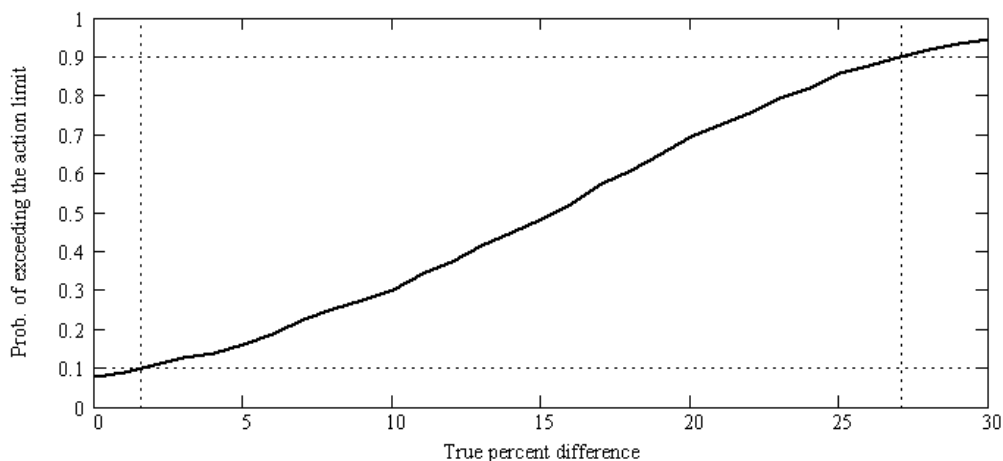
specified air toxics trends DQOs will be met for arsenic at urban monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.9 DQO input parameters for arsenic at urban locations**

T1	Action Limit	Sampling Rate	Seasonality	Population CV	Initial Concentration ( $\mu\text{g}/\text{m}^3$ )
10%	15%	1 in 6 day	5.0	85%	0.002
T2	Measurement CV	Completeness	Autocorrelation	MDL ( $\mu\text{g}/\text{m}^3$ )	Risk Standard ( $\mu\text{g}/\text{m}^3$ )
10%	15%	85%	0	0.000046	0.0043

**Table 7.10 DQO output parameters for arsenic at urban locations**

Error rate for no true change	Error rate for 30% decrease	Gray zone
8%	95%	2% - 27%



**Figure 7.5 Power curve for detecting a 15 percent decrease between successive three-year means of arsenic concentrations based on the data variation found in urban locations of the Pilot Study**

#### 7.10.6 DQOs for Measuring the Percent Decrease of Arsenic at Rural Locations

Table 3.6.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of arsenic at rural locations. Table 3.6.2 shows the output values from the simulations. Figure 3.6.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and

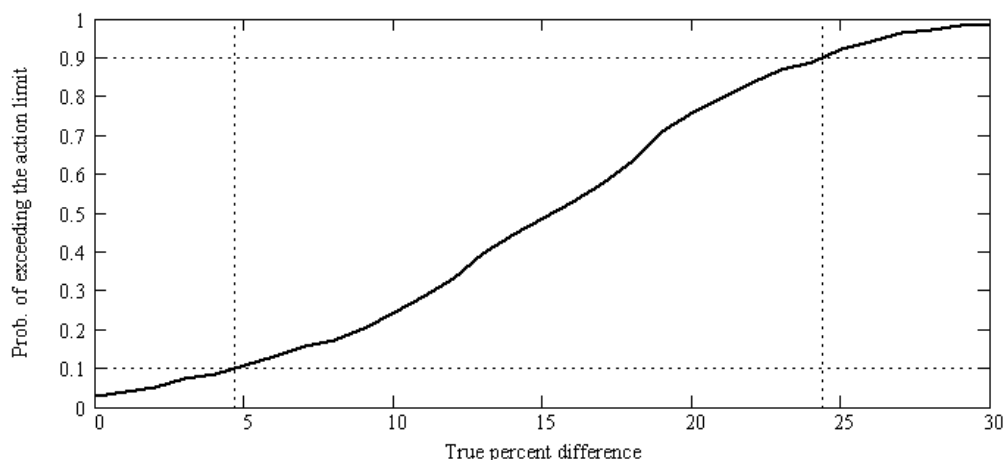
uncertainty estimates from the ten-city Pilot Study data, Table 3.6.2 suggests that the specified air toxics trends DQOs will be met for arsenic at rural monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.11 DQO input parameters for arsenic at rural locations**

<b>T1</b>	<b>Action Limit</b>	<b>Sampling Rate</b>	<b>Seasonality</b>	<b>Population CV</b>	<b>Initial Concentration (<math>\mu\text{g}/\text{m}^3</math>)</b>
10%	15%	1 in 6 day	4.0	65%	0.001
<b>T2</b>	<b>Measurement CV</b>	<b>Completeness</b>	<b>Autocorrelation</b>	<b>MDL (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Risk Standard (<math>\mu\text{g}/\text{m}^3</math>)</b>
10%	15%	85%	0	0.000046	0.0043

**Table 7.12 DQO output parameters for arsenic at rural locations**

<b>Error rate for no true change</b>	<b>Error rate for 30% decrease</b>	<b>Gray zone</b>
3%	99%	5% - 24%



**Figure 7.6 Power curve for detecting a 15 percent decrease between successive three-year means of arsenic concentrations based on the data variation found in rural locations of the Pilot Study**

### 7.10.7 DQOs for Measuring the Percent Decrease of Chromium

Table 3.7.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of chromium. Table 3.7.2 shows the output values from the simulations. Figure 3.7.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and

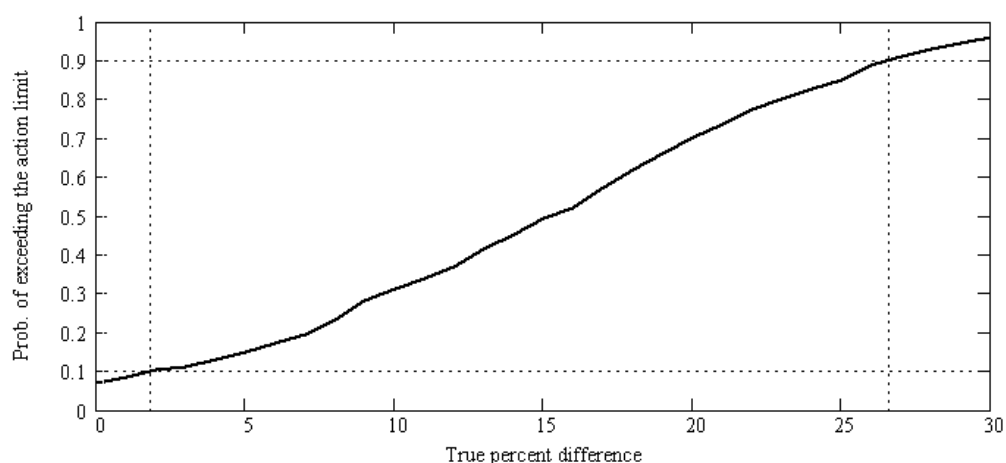
uncertainty estimates from the ten-city Pilot Study data, Table 3.7.2 suggests that the specified air toxics trends DQOs will be met for chromium at monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.13 DQO input parameters for chromium**

T1	Action Limit	Sampling Rate	Seasonality	Population CV	Initial Concentration ( $\mu\text{g}/\text{m}^3$ )
10%	15%	1 in 6 day	5.0	90%	0.0015
T2	Measurement CV	Completeness	Autocorrelation	MDL ( $\mu\text{g}/\text{m}^3$ )	Risk Standard ( $\mu\text{g}/\text{m}^3$ )
10%	15%	85%	0	0.00018	0.012

**Table 7.14 DQO output parameters for chromium**

Error rate for no true change	Error rate for 30% decrease	Gray zone
7%	96%	2% - 27%



**Figure 7.7 Power curve for detecting a 15 percent decrease between successive three-year means of chromium concentrations based on the data variation found in of the Pilot Study**

#### 7.10.8 DQOs for Measuring the Percent Decrease of Acrolein

Table 3.8.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of acrolein. Table 3.8.2 shows the output values from the simulations. Figure 3.8.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the



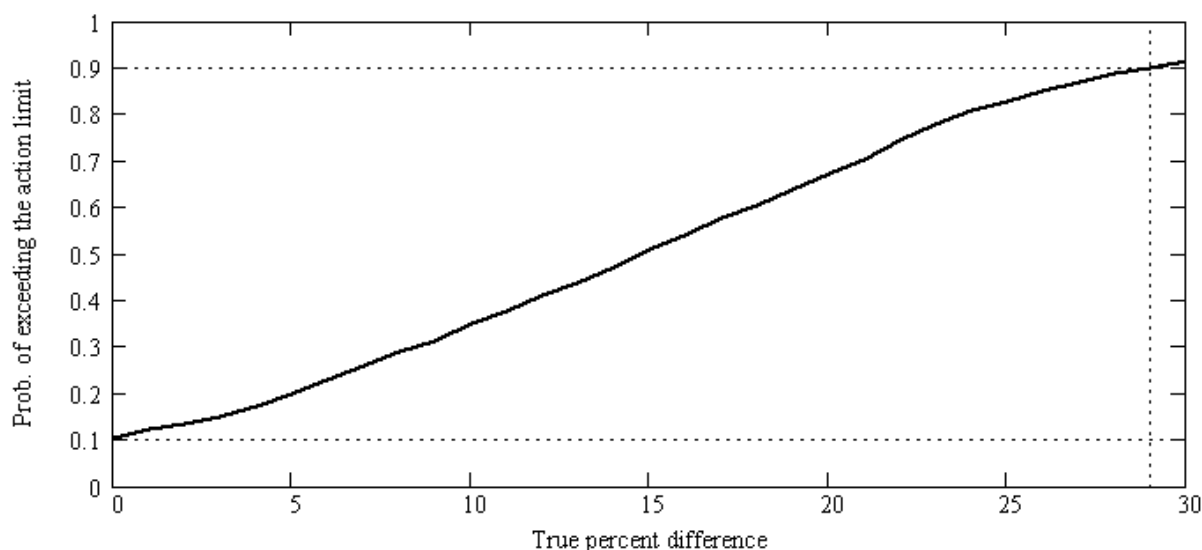
distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.8.2 suggests that the specified air toxics trends DQOs will be met for acrolein at monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See section 3.0 for definitions of the input parameters and output values.)

**Table 7.15 DQO input parameters for acrolein**

<b>T1</b>	<b>Action Limit</b>	<b>Sampling Rate</b>	<b>Seasonality</b>	<b>Population CV</b>	<b>Initial Concentration (<math>\mu\text{g}/\text{m}^3</math>)</b>
10%	15%	1 in 6 day	4.0	105%	0.4
<b>T2</b>	<b>Measurement CV</b>	<b>Completeness</b>	<b>Autocorrelation</b>	<b>MDL (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Risk Standard (<math>\mu\text{g}/\text{m}^3</math>)</b>
10%	15%	85%	0	0.14	-

**Table 7.16 DQO output parameters for acrolein**

<b>Error rate for no true change</b>	<b>Error rate for 30% decrease</b>	<b>Gray zone</b>
10%	91%	0% - 29%



**Figure 7.8 Power curve for detecting a 15 percent decrease between successive three-year means of acrolein concentrations based on the data variation found in the Pilot Study**

### **7.10.9 DQOs for Measuring the Percent Decrease of Formaldehyde at Urban Locations**

Table 3.9.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of formaldehyde at urban locations. Table 3.9.2 shows the output values from the simulations. Figure 3.9.1 shows the associated power curve, which is the probability of

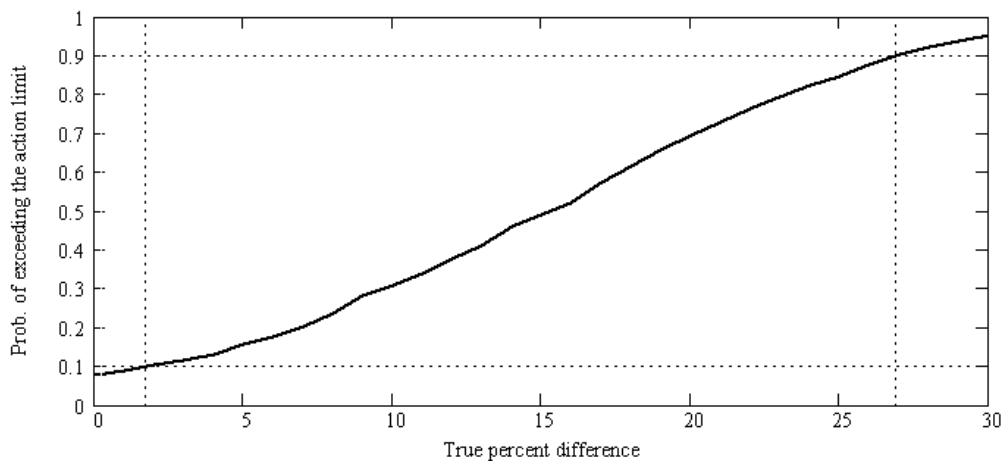
observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.9.2 suggests that the specified air toxics trends DQOs will be met for formaldehyde at urban monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See Section 3.0 for definitions of the input parameters and output values.)

**Table 7.17 DQO input parameters for formaldehyde at urban locations**

T1	Action Limit	Sampling Rate	Seasonality	Population CV	Initial Concentration ( $\mu\text{g}/\text{m}^3$ )
10%	15%	1 in 6 day	7.0	90%	2.5
T2	Measurement CV	Completeness	Autocorrelation	MDL ( $\mu\text{g}/\text{m}^3$ )	Risk Standard ( $\mu\text{g}/\text{m}^3$ )
10%	15%	85%	0	0.014	$1.3 \cdot 10^{-5}$

**Table 7.18 DQO output parameters for formaldehyde at urban locations**

Error rate for no true change	Error rate for 30% decrease	Gray zone
8%	95%	2% - 27%



**Figure 7.9 Power curve for detecting a 15 percent decrease between successive three-year means of formaldehyde concentrations based on the data variation found in urban locations of the Pilot Study**

#### 7.10.10 DQOs for Measuring the Percent Decrease of Formaldehyde at Rural Locations

Table 3.10.1 shows the input parameters used in the simulation model in developing the DQOs for measuring the percent decrease between three-year mean concentrations of

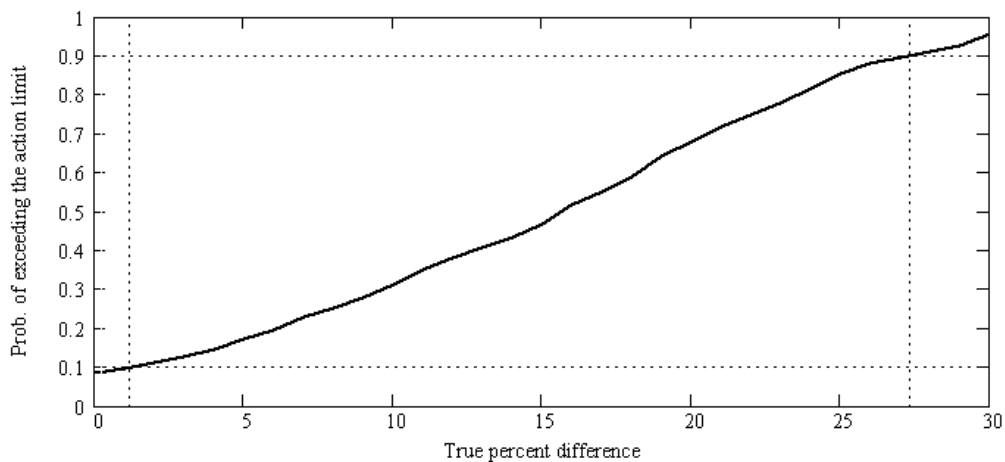
formaldehyde at rural locations. Table 3.10.2 shows the output values from the simulations. Figure 3.10.1 shows the associated power curve, which is the probability of observing a 15 percent difference between successive three-year means as a function of the true percent difference in the distinct three-year means. In summary, based on variability and uncertainty estimates from the ten-city Pilot Study data, Table 3.10.2 suggests that the specified air toxics trends DQOs will be met for formaldehyde at rural monitoring sites that satisfy the goals of one in six-day sampling, 85 percent completeness, and 15 percent measurement CV. (See Section 3.0 for definitions of the input parameters and output values.)

**Table 7.19 DQO input parameters for formaldehyde at rural locations**

T1	Action Limit	Sampling Rate	Seasonality	Population CV	Initial Concentration ( $\mu\text{g}/\text{m}^3$ )
10%	15%	1 in 6 day	7.0	90%	2.1
T2	Measurement CV	Completeness	Autocorrelation	MDL ( $\mu\text{g}/\text{m}^3$ )	Risk Standard ( $\mu\text{g}/\text{m}^3$ )
10%	15%	85%	0	0.014	$1.3 \cdot 10^{-5}$

**Table 7.20 DQO output parameters for formaldehyde at rural locations**

Error rate for no true change	Error rate for 30% decrease	Gray zone
8%	95%	1% - 27%



**Figure 7.10 Power curve for detecting a 15 percent decrease between successive three-year means of formaldehyde concentrations based on the data variation found in rural locations of the Pilot Study**

## 8.0 Special Training Requirements/Certification

### 8.1 Training

Personnel assigned to the NATTS 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 Keys to Managerial Excellence EEO for Managers and Supervisors Sexual Harassment Contract Administration for Supervisors 40 hours of developmental activities	1st 6 months After comp. of above As available " " "
Project Officers and Above	Contract Administration Contract Administration Recertification EEO for Managers and Supervisors Grants Training Project Officer Training (contract/grants) Ethics in Procurement Work statements for Negotiated Procurement	Prior to responsibility Every three years As available Prior to responsibility " " "
Field Personnel	24-Hour Field Safety 8- hour Field Safety Refresher 8-hour First Aid/CPR Blood borne pathogens	1st time Yearly Yearly 1st time
Laboratory Personnel	24- Hour Laboratory Safety 4- Hour Refresher Safety Video/Discussion Chemical Spill Emergency Response Blood borne pathogens	1st time Yearly Yearly 1st time 1st time

### 8.1.1 Ambient Air Monitoring Training

Appropriate training is available to employees supporting the 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*	Orientation to Quality Assurance Management	QAD
3*	Introduction to Ambient Air Monitoring (Under Revision), SI:434	APTI
4*	General Quality Assurance Considerations for Ambient Air Monitoring (Under Revision), SI:471	APTI
5*	Quality Assurance for Air Pollution Measurement Systems (Under Revision), 470	APTI
6*	Data Quality Objectives Workshop	QAD
7*	Quality Assurance Project Plan	QAD
8	Atmospheric Sampling (Under Revision), 435	APTI
9	Analytical Methods for Air Quality Standards, 464	APTI
10	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
	AQS Training	OAQPS

\* Courses recommended for QA Managers

## 8.2 Certification

For the NATTS, 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 individual's adherence to the SOPs.

## **9.0 Documentation and Records**

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 the NATTS. 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**

#### **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**

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



Categories	Record/Document Types	File Codes
Data Management	Data algorithms Data management plans/flowcharts Air toxics Data Data Management Systems	INFO/304 INFO/304 INFO/160 - INFO/173 INFO/304 - INFO/170
Quality Assurance	Good Laboratory Practice Network reviews Control charts Data quality assessments QA reports System audits Response/Corrective action reports Site Audits	COMP/322 OVER/255 SAMP/223 SAMP/223 OVER/203 OVER/255 PROG/082 OVER/658

### 9.1.2 Annual Summary Reports Submitted to EPA

The TCAPCD shall submit to EPA Region 11 Office, included in the standard annual summary report, all the air toxics data collected within that calendar 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;
- ▶ AQS site code;
- ▶ 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**

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 AQS database, and QA/QC data, are collected electronically, on data forms or in notebooks 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 NATTS. 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 are issued for each sampling site. The TCAPCD NATTS will also have a sampling site notebook. This 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**

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 2003 (1/1/03 - 12/31/03) will be retained until, at a minimum, January 1, 2009, unless the information is used for litigation purposes.

## Section 10.0 Sampling Design

### 10.1 Scheduled Project Activities, Including Measurement Activities

TCAPCD will be monitoring concentrations at five locations. Therefore, this section will discuss the operation and installation of all samplers including the NATTS. Since the NATTS is a nationally recognized monitoring location each system (with the exception of the Aethalometer), will be collocated. Table 10.1 represents the activities associated with the ordering and deployment of the primary and collocated samplers. Please note that since the TCAPCD had participated in the National Air Toxics Pilot Program, many of the samplers were already in place. However, the NATTS site will be expanded to accommodate the collocated samplers.

**Table 10.1. Schedule of Air toxics Sampling-Related Activities**

Activity	Due Date	Comments
Receive samples	September 1, 2002	After receipt, begin conditioning of filters
Remove QA PM <sub>10</sub> sampler from TC3.	September 2002	
Install collocated PM <sub>10</sub> sampler at site TC5	November 2002	Collocated samplers installed. VOC, ALD, PM <sub>10</sub>
Receive Aethalometer	November 2002	Test in laboratory. After two weeks, install at TC5
Begin testing laboratory equipment	November 2002	Bring analytical equipment on line
Perform pre-run sampling	November 2002	Test samplers and analytical laboratory systems
Calibrate all field samplers	December 2002	Perform official calibration for samplers
Begin routine sampling	January 1, 2003	Begin NATTS sampling

### 10.2 Rationale for the Design

#### 10.2.1 Primary Samplers

The purpose of the ATMP operated by Toxa City is to ascertain the long term trends as described in Chapter 7. 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<sup>1,2,3</sup>, 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*<sup>4</sup>, 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 of the various systems samplers. The goal of the District is to have concentrations measured by a sampler be within  $\pm 10\%$  of the true concentration and that the precision have a coefficient of variation less than 10% for each monitoring system. To estimate the level of precision being achieved in the field, the NATTS site will operate collocated samplers for PM<sub>10</sub>. The VOC and Aldehyde samplers have dual channel configuration, which allows collocated canisters and DNPH cartridges to be loaded and allowed to collect samples on the same instrument as the primary sample. The QA samples will be set, run and collected on a 1 in 12 day schedule. Please see Table 11.1 for details on setup and recovery of collocated samples. Chapter 24 outlines the equations that will be used to determine precision. There will be 2 analytes from each instrument that will be used to determine the 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 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 precision.

### **10.3 Design Assumptions**

The sampling design is based on the assumption that following the rules and guidance provided in CFR and *Network Design and Site Exposure Criteria for Selected Noncriteria Air Pollutants* will result in data that can be used to measure compliance with the national standards. The 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**

### **10.4.1 Sampling Design**

The design of the air toxics network must achieve the monitoring objective. For the NATTS, the objectives are stated in Statement 1 and for the rest of the ATMP, the objective is stated in Statement 2.

- 1. Detect a percent difference change between successive three-year average concentration levels that is greater than or equal to 15 percent**
- 2. 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. Figure 10-1 illustrates the use of GIS for locating the samplers. Figure 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 was 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 2000 census data by census tract, (2) the boundaries of the existing MSAs, and (3) the surrounding geography. Figure 10-1 shows the population for which TCACPD is responsible. According to the 2000 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.

One site, TC1 will be the upwind/background and will be located to quantify the background concentrations. The siting of TC1 is best suited for background concentrations. Site TC3 is located on the bay near the industrial center. Again, this site well suited for highest concentration. This is a middle scale monitoring station sited to capture maximum concentrations. Site TC4 is a downwind neighborhood scale site.

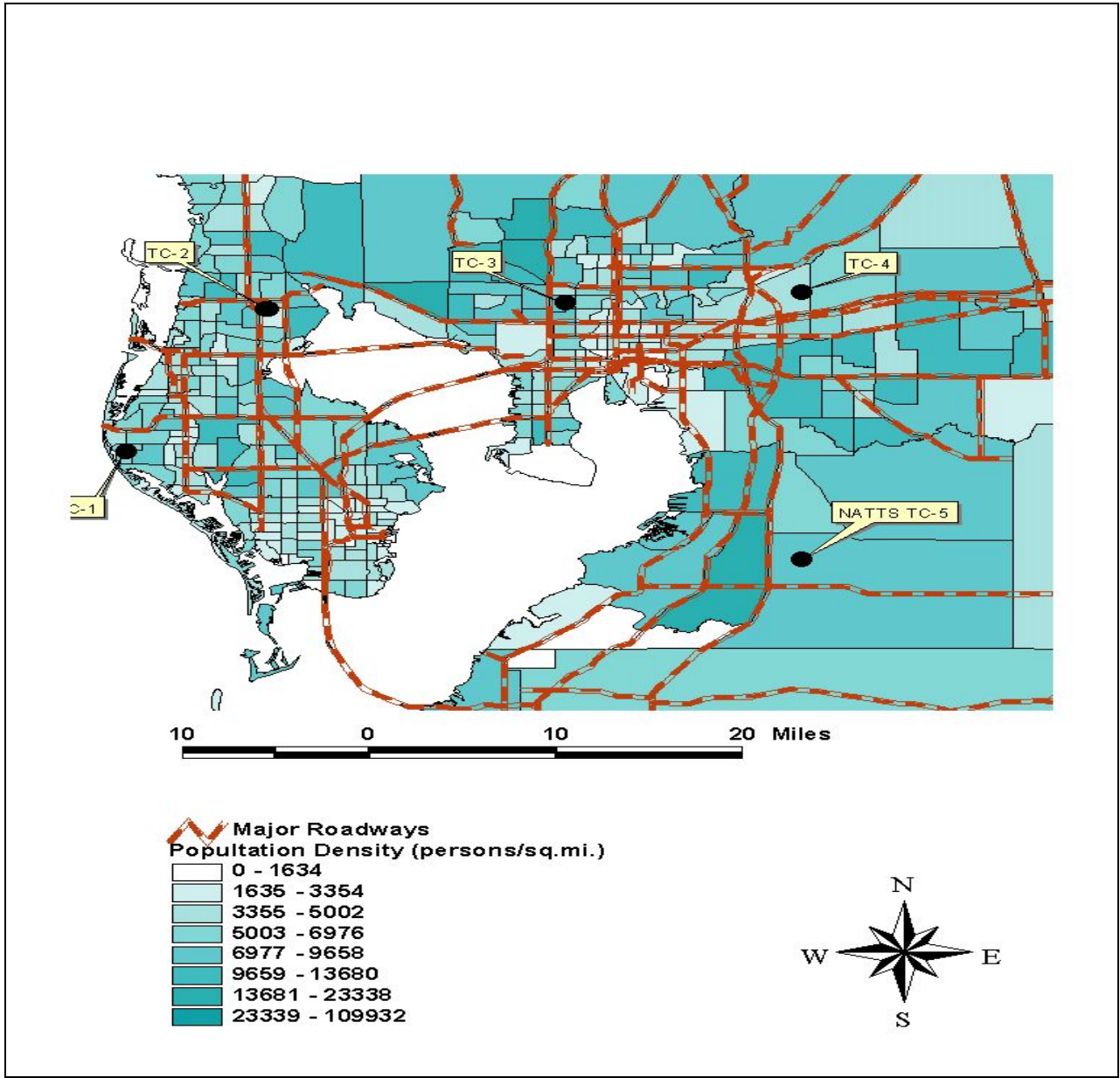


Figure 10-1 Network Locations

The latitude/longitude coordinates for the five monitoring sites are listed in Table 10-2. It was decided by the TCAPCD staff that since TC5 was a downwind/suburban monitoring location, it would be selected as the NATTS.

**Table 10.2 List of Collocated Samplers and Coordinates**

Site Name	Samplers Operated	Collocated	Coordinates (Lat./Long.)
TC1	VOC, PM <sub>10</sub> , Aldehydes		27.89/-82.80
TC2	VOC, PM <sub>10</sub>		28.12/-82.61
TC3	Aldehydes, VOC		27.96/-82.39
TC4	VOC, PM <sub>10</sub>		28.03/-82.16
NATTS/TC5	VOC, PM <sub>10</sub> , Aldehydes, Aethalometer	VOC, PM <sub>10</sub> , Aldehydes	27.71/-82.36

## 10.5 Classification of Measurements as Critical/Noncritical

The ambient concentration and site location data will be provided to AQS. 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 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

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. Compendium Method for the Determination of Inorganic Compounds in Air, United States Environmental Protection Agency, June 1999, Section IO-2.1.
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 Compounds in Air, United States Environmental Protection Agency, Section TO-15, January 1999
4. 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**

### **11.1 Purpose/Background**

The methods described herein provide for measurement of the relative concentration of HAPs in ambient air for a 24-hour sampling period. The method requirements for the Aethalometer are described in Section 5.

Since three of the instruments are discreet samplers that collect HAPs inside or on a substrate, there are three separate analytical techniques. General QA handling requirements are crucial for sampling however the handling regimes are similar.

### **11.2 Sample Collection and Preparation**

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

- ▶ PM<sub>10</sub> - filter receipt and inspection, filter numbering, conditioning and storage;
- ▶ VOC - cleaning, testing, verification and storage of canisters;
- ▶ 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. Since the NATTS has collocated samplers, 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 SOPs.

#### **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
<b>1 in 6 Week 1</b>	<u>Sample Day 1</u>	<i>Recovery &amp; Set-up</i>					<u>Sample Day 2 Collocated Samples Run</u>
<b>1 in 6 Week 2</b>		<i>Recovery &amp; Set-up</i>				<u>Sample Day 3</u>	
<b>1 in 6 Week 3</b>		<i>Recovery &amp; Set-up</i>			<u>Sample Day 4 Collocated Samples Run</u>	<i>Recovery &amp; Set-up</i>	
<b>1 in 6 Week 4</b>				<u>Sample Day 5</u>	<i>Recovery &amp; Set-up</i>		
<b>1 in 6 Week 5</b>			<u>Sample Day 6 Collocated Samples Run</u>	<i>Recovery &amp; Set-up</i>			
<b>1 in 6 Week 6</b>		<u>Sample Day 7</u>	<i>Recovery &amp; Set-up</i>				

### 11.3 Support Facilities for Sampling Methods

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	<i>Material must be inert and powder free</i>
Fuses	2	<i>Of the type specified in the sampler manual</i>
Temperature standard	1	<i>In the range expected for this site and NIST traceable</i>
Flow rate standard	1	<i>Calibrated from at least 15.0 LPM to 18.4 LPM and NIST Traceable</i>
Sampler Operations Manual	1 per model	
Sampling SOPS	1	
Flow rate verification filter	2	For PM <sub>10</sub> sampler
Tools	1	<i>One Tool kit with various wrenches, screwdrivers, etc..</i>
Filter Cassettes	1	<i>For use with flow rate check filter or non-permeable membrane</i>
Motor Brushes	1 set of 2	<i>For PM<sub>10</sub> samplers</i>
Various 1/8" and 1/4" fittings	1 Box	
Pumps	1 Box	<i>For Carbonyl and VOC samplers</i>
Data Download Cable	1	<i>For use with laptop computer</i>
Teflon end caps	1 Box	For capping the DNPH cartridges
aluminum foil	1 Box	<i>For Carbonyl samplers</i>
ice chests	2	<i>Spare ice chests for transporting samples</i>

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

#### 11.4 Sampling/Measurement System Corrective Action

Corrective action measures in the 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

Item	Problem	Action	Notification
Sample Flow Rate Verification	Out of Specification ( $\pm 10\%$ 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.
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.	1.) Document in log book.  2.) Document in log book.

Item	Problem	Action	Notification
Ambient Temperature Verification, and Filter Temperature Verification.	Out of Specification ( $\pm 1^{\circ}\text{C}$ 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 ( $\pm 10$ 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 monitor's 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

Item	Problem	Action	Notification
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
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 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, canisters 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 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 be stored at 4° C until they are loaded into the sampler. The temperature requirements are detailed in Table 11.4.

**Table 11.4 Temperature Requirements**

Item	Temperature Requirement	Reference
PM <sub>10</sub> 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	

#### 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
PM <sub>10</sub> filter temperature	No limits			
VOC canister	<30 days	Completion of sample period	Time of analysis	TO-15 Compendium Section 9.4.2.1 <sup>1</sup>
DNPH Cartridge Filter	≤30 days	Sample end date/time	Date of Post Weigh	TO-11 Compendium Section 11.1.1 <sup>2</sup>

#### References

1. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-15, January 1999
2. Compendium Method for the Determination of Toxic Organic Compounds in Air, United States Environmental Protection Agency, Section TO-11A, January 1999

## **12.0 Sampling Custody**

### **12.1 Sample Custody Procedure**

Sample custody and handling is one of the most important aspects of a quality system. The TCAPCD tracks the whereabouts of each sample at each stage throughout the data collection operation. Entries on Chain of Custody (CoC) forms will be made by hand and the information will be entered into the 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.

One of the most important values in the sample custody procedure is the unique sample ID number. The ID is an alpha-numeric value. The alpha values identify the type of sample (V for VOC, D for DNPH or M for metals), 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 conditioned, weighed, placed into the protective shipping container, sealed with tape, and stored or refrigerated. See Table 11-5 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 use 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:

- ▶ Contact Mr. Arcemont or Ms. Killion for access to laboratory.
- ▶ Put on appropriate laboratory attire.
- ▶ Enter the filter storage area.

- ▶ 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.
- ▶ Take the *Chain of Custody Records* for each site visited. Fill out the columns of the “Pre-Sampling Selection,” portion of the *Chain of Custody Record* for each sample.
- ▶ Initial the column “Site Operator” on the *Inventory Sheets* to signify selection of the filters.
- ▶ Pack samples in sample coolers for travel to the field.

Upon arrival at a site:

- ▶ Select the appropriate samples.
- ▶ 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 Record*.

### 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:

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

### 12.1.3 Sample Receipt

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:

- ▶ Receive shipping/transport containers;
- ▶ Upon receipt, open the containers to find *Filter Chain of Custody Records* or collect the originals from the site operator (if delivered by operator).
- ▶ Fill out the “Filter Receipt” area of the *Filter Chain of Custody Records*. Check sample container seals.
- ▶ If the samples are delivered on a weekday, follow sequence 5; if the samples are delivered on a weekend, follow sequence 6.

- ▶ Check the “Sent to Laboratory” column of the *Filter Chain of Custody Records* 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 Records*.
- ▶ Store the samples in the refrigerator and check the “archived” column of the *Filter Chain of Custody Records*. 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 Records*.

#### **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* 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**

### **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<sup>1,2,3</sup>. These are listed in the Reference area of this section.

### **13.2 Preparation of Samples**

The Toxa City NATTS is at one location within a 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 3-6 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 the SOP. DNPH cartridges will be stored in a refrigerator until taken into the field. All PM<sub>10</sub> filters in a lot will be used before a case containing another lot is opened. When more than one case is available, 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 Methods**

#### **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	ZanTech 3001	High Pressure Liquid Chromatography	0.01 to 25 ppbv
VOCs	AnTech 3001	Gas Chromatography	0.001 to 100ppbv

### 13.3.2 Environmental Control

The Toxa City filter weigh room facility is an environmentally controlled room with temperature and humidity control. Temperature is controlled at a minimum from 20 - 30° 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 weighing. 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 aldehyde cartridge samples are clean laboratory benches in the main part of the lab

### 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 checked annually by certified technicians. Hoods are also checked annually. PM<sub>10</sub> 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.

### **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 PM<sub>10</sub> 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° C, with no more than a +/- 5° 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, and DNPH cartridges are clearly detailed in Section 11 and the TO and IO methods<sup>1,2,3</sup>. 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<sup>1,2,3</sup>. 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-2.1.
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 Compounds in Air, United States Environmental Protection Agency, Section TO-15, January 1999

## **14.0 Quality Control Requirements**

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**

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 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 and metals. Field blanks cannot be utilized with the VOC canisters since they arrive in the field under vacuum.

**Lab blanks** -provides an estimate of contamination occurring at the weighing/analysis facility. Details of the use of the lab blanks can be found in can be found in SOPs. Lab blanks will be utilized for the aldehydes, metals and VOCs. 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 (PM<sub>10</sub>/metals only).

$$D = | Y - X |$$

**Percent Difference for a Single Check ( $d_i$ )**. The percentage difference,  $d_i$ , for each check is calculated using the following equation 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 below) and  $n$  represents the number of blanks in the batch.

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

**Corrective action-** The acceptance criteria for field blanks are discussed in the individual SOPs. 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 PM<sub>10</sub> 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 District must ensure the entire measurement process is within statistical control. Precision measurements will be obtained using collocated monitoring.

**Evaluation of Collocated Data-** All collocated data will be reported to AQS. 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 the following equation, 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 and  $S_i$  is the standard error calculated for each quarterly set. Each individual compound must have the precision data generated.

$$\begin{aligned} &\text{Upper 95\% Percent Limit} \\ &Limit = d_i + 1.96 * S_i / \sqrt{2} \end{aligned}$$

$$\begin{aligned} &\text{Lower 95\% Percent Limit} \\ &Limit = d_i - 1.96 * S_i / \sqrt{2} \end{aligned}$$

**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 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). 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 the following equation, 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 the following equation, where  $X$  represents the certified mass weight and  $Y$  represents the reported weight.

$$d_v = Y - X$$

**Corrective Action** - The difference among the reported weight and the certified weight must be  $\leq 5$  mg. Since this is the first check before any pre-or post-sampling weighing, if the acceptance criteria is not met, corrective action will be initiated. Corrective action may be as simple as allowing the balance to perform internal calibrations or to sufficiently warm-up, which may require checking the balance weights a number of times. If the acceptance criteria are still not met, the laboratory technician will be required to verify the working standards to the primary standards. Finally, if it is established that the balance does not meet acceptance criteria for both the working and primary standards, and other trouble shooting techniques fail, the *Libra Balance Company* service technician will be called to perform corrective action.

If the balance check fails acceptance criteria during a run, the 10 filters weighed prior to the failure will be rerun. If the balance check continues to fail, trouble-shooting, as discussed above, will be initiated. The values of the 10 samples weighed prior to the failure will be recorded and flagged, but will remain with the un-weighed 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, through it's contractor or State designated laboratory will be sending the TCAPCD laboratory a sample of metals on a quartz filter, aldehydes in a DNPH cartridge and a canister with VOCs. The TCAPCD lab will analyze the samples and send the results to the EPA certified laboratory. The audit sample for each system will be mailed directly to the laboratory. The lab technician will handle the audit sample in the same manner as all other samples. Once the analysis is performed, the results will be reviewed by the lab supervisor. These results will then be sent to the EPA certified laboratory. The equation used to define percentage difference ( $d_i$ ) for a each individual compound audit  $i$  is calculated as:

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**

### **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**

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 (PM<sub>10</sub> mass weight, Gas Chromatography/Mass Spec. 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 <sup>o</sup> 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 <sup>o</sup> 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 <sup>o</sup> 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 <sup>o</sup> 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 <sup>o</sup> 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 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 contracts, the TCAPCD also hires *LabTech Inc.* to perform the maintenance on the ICP, GC/MS and the Liquid Chromatograph. 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 Balance Company* 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	<i>Libra Balance Company</i>
Comparison of NIST Standards to laboratory working and primary standards	6 Months	<i>Libra Balance Company</i>
Verify Humidity and Temperature sensors	Monthly	<i>Balance Analyst</i>
HEPA filter replacement	Monthly	<i>Balance Analyst</i>
HVAC system preventive maintenance	Yearly	<i>Smith and Jones HVAC</i>
Computer Back-up	Weekly	<i>Lab Analyst</i>
Computer Virus Check	Weekly	<i>Lab Analyst</i>
Computer system preventive maintenance (clean out old files, compress hardrive, inspect)	Yearly	<i>PC support personnel</i>

**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	<b><i>Lab Analyst.</i></b>
Comparison of NIST Standards to laboratory working and primary standards	Weekly	<b><i>Lab Analyst</i></b>
Filament Replacement	As necessary	<i>Lab Analyst</i>
Carrier gas scrubber replaced	When trap color indicates	<i>Lab Analyst</i>
MS Quadruples or ion source cleaned	Every 3 months	<i>Lab Analyst</i>
RF Generator Replaced	As needed	<i>Lab Analyst</i>
Test lines for pressure integrity	Annually	<i>Lab Analyst</i>
Replace Traps	as needed	<b><i>Lab Analyst</i></b>
Computer Back-up	Weekly	<i>Lab Analyst</i>
Computer Virus Check	Weekly	<i>Lab Analyst</i>
Computer system preventive maintenance (clean out old files, compress hardrive, inspect)	Yearly	<i>PC support personnel</i>

**Table 15.4 Preventive Maintenance in Liquid Chromatography Laboratory**

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

**Table 15.5 Preventive Maintenance in Inductively Coupled Plasma Laboratories**

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

## 15.4.2 Field Maintenance Items

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

**Table 15.6 Preventive Maintenance on Field Instruments**

Instrument	Item	Maintenance Frequency	Responsible Party
PM <sub>10</sub> sampler	Motor Brush replacement	3 Months	<i>Field Technician</i>
	Clean inside of sampler	6 Months	<i>Field Technician</i>
	Replace Motor	Annually	<i>Field Technician</i>
	Replace Motor	Annually	<i>Field Technician</i>
	Replace Motor gaskets	When motor is replaced	<i>Field Technician</i>
	Filter screen inspected for impacted deposits or bits of filter	Annually	<i>Field Technician</i>
	Check connecting tube and power lines for holes, crimps or cracks	6 months	<i>Field Technician</i>
Aethalometer	Replace quartz tape	3 Months	<i>Field Technician</i>
	Clean Pm <sub>fine</sub> inlet	3 Months	<i>Field Technician</i>
	Replace pump	As needed	<i>Field Technician</i>
VOC Sampler	Replace sample lines	Annually	<i>Senior Field Technician</i>
	Clean flow controller	Annually	<i>Senior Field Technician</i>

Aldehyde Sampler	Replace 1/8" connectors	Annually	<i>Field Technician</i>
	Cartridge connectors	Annually	<i>Field Technician</i>
	Replace Motor Brushes	Annually	<i>Field Technician</i>
	Fan motor replacement	2 years	<i>Field Technician</i>
	Clean inside of sampler	6 Months	<i>Field Technician</i>

## 16.0 Instrument Calibration and Frequency

### 16.1 Instrumentation Requiring Calibration

#### 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 technician's standards to ensure acceptability. All of these actions are documented in the service technician's report, a copy of which is provided to the 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 reweighs 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 concentrations of benzene, propane 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, 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. Different 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 (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 multi-point 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 are transported to and from the sampler in the field, against the laboratory-checked working standard thermometer;
- ▶ Check the background using the fine mesh screen on the Aethalometer.

## **16.2 Calibration Method**

### **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, and 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

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 wgt	NA	<i>ScalesTech, Inc.</i>	111	NA
Temperature M+A M+A	Hg NA	Thermometer Thermistor	<i>Hot Water Inc. True Temp.</i>	5500 8910	NA Annually
Pressure M+A A	Hg NA	Fortin Aneroid	<i>You Better... Aviators Choice</i>	22 7-11	NA Quarterly
Flow Rate A A A	NA	Piston Meter Bubble Meter High Volume Flow	<i>Flowtech Inc. SaapTech, Inc Top Hat Inc..</i>	F199 LG88 TP-1	Annually NA 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, provides 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 re-verified 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 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 technician's 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.

There are two TCAPCD field temperature standards *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.

## **16.4 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. NIST. 1986. Thermometer calibration: a model for state calibration laboratories. National Institute of Standards and Technology. NBS Monograph 174. January.
5. NIST. 1988. Liquid-in-glass thermometer calibration service. National Institute of Standards and Technology. Special publication 250-23. September.
6. 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 of 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 and consistency of the supplies can be assured. This section details the supplies/consumables, their acceptance criteria, and the required documentation for tracking this process.

### 17.2 Critical Supplies and Consumables

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

**Table 17.1 Critical Field Supplies and Consumables**

Area	Item	Description	Vendor	Model Number
PM <sub>10</sub> Sampler	8 x 11" Quartz filters	Quartz filter	FilterTech Inc.	NA
PM <sub>10</sub> Sampler	High Volume Motor	20 amp. Blower motor	XYZ Company	X300
PM <sub>10</sub> 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
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.	
Aethalometer	Quartz tape	Quartz Tape	Magee Scientific	
Aethalometer	Pump	Pump	Magee Scientific	



**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 H2O	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. It is the air monitoring branch chief and the field technician's responsibility to update the criteria for acceptance of consumables. As requirements change, so do the acceptance criteria. Knowledge of field and laboratory equipment and experience are the best guides to acceptance criteria. Other acceptance criteria such as observation of damage due to shipping can only be performed once the equipment has arrived on site.

### **17.4 Tracking and Quality Verification of Supplies and Consumables**

Tracking and quality verification of supplies and consumables have two main components. The first is the need of the end user of the supply or consumable to have an item of the required quality. The second need is for the purchasing 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:

- 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.
- The package will be opened, inspected and contents compared against the packing slip.
- 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.
- 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.
- 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.
- Stock equipment/supplies in appropriate pre-determined area.
- 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.

## **18.0 Data Acquisition Requirements**

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 DQOs for the ATMP leads 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**

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;
- 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.

### **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.

### **Speciated Particulate Data**

The TCAPCD has been routinely monitoring PM<sub>2.5</sub> mass sampler at TC5 since the 1999. In mid-2000, the EPA notified the TCAPCD that it should operate a PM<sub>2.5</sub> speciation sampler at the TC5 site as well.

PM<sub>2.5</sub> Speciation data has collected at TC5 and is one of the reasons that TC5 was selected as the NATTS.

### **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 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 air 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 three main stages as shown in Figure 19-1. Managers are able to obtain reports on status of samples, location of specific samples, etc., using the 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;
- Merging/correcting the duplicate data entry files;
- Running verification/validation routines, correcting data as necessary and generating summary data reports for management;
- Uploading verified/validated data to EPA -AQS.

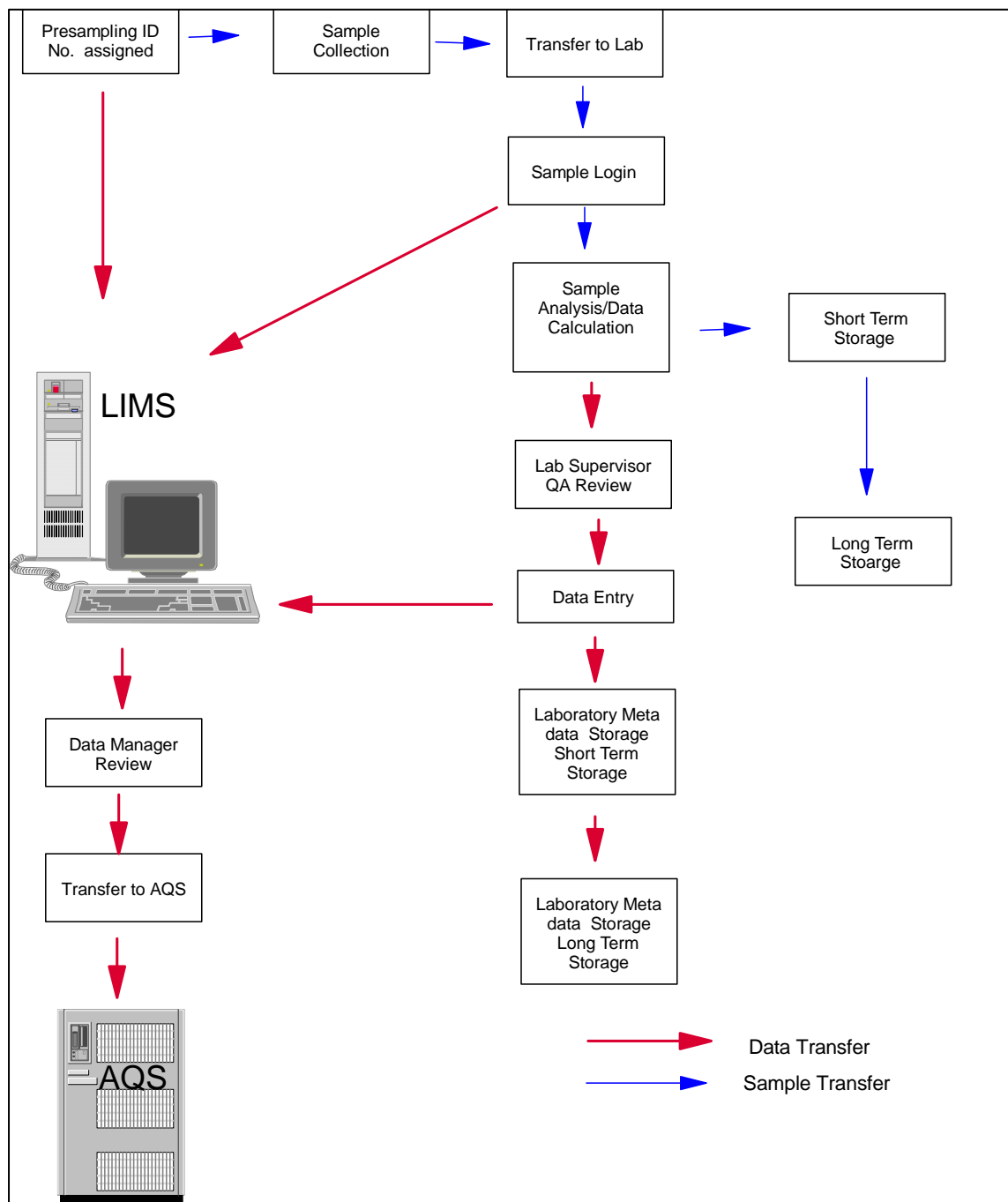


Figure 19.1 Data Management and Sample Flow Diagram

## 19.2 Data Recording

Data entry, validation, and verification functions are all integrated in the LIMS. Bench sheet data are entered into the LIMS 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 QA Review

QA review is the data validation portion that 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 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 is given in the 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, associate 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	✓		
Duplicate Key Entry		✓	
Date and Time Consistency		✓	✓
Completeness of Required Fields		✓	✓
Range Checking			✓
Statistical Outlier Checking			✓
Manual Inspection of Charts and Reports		✓	
Field and Lab Blank Checks		✓	

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

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. Table 19-3 summarizes data transfer operations.

**Table 19.2 Data Transfer Operations**

<b>Description of Data Transfer</b>	<b>Originator</b>	<b>Recipient</b>	<b>QA Measures Applied</b>
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	AQS (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 AQS Users Guide, coded in the AQS format. Such air quality data and information will be fully screened and validated and will be submitted directly to the AQS via electronic transmission, in the format of the 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**

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

## **19.6 Data Reduction**

Data reduction processes involve aggregating and summarizing results so that they can be understood and interpreted in different ways. Since air toxics have 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, 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**

The TCAPCD is currently implementing the data summary and analysis program. The following specific summary statistics will be tracked and reported for the network:

- Single sampler 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**

<b>Criterion</b>	<b>Equation</b>
Accuracy of Single Sampler Flow - Single Check ( $d_i$ ) $X_i$ is reference flow; $Y_i$ is measured flow	$d_i = \frac{Y_i - X_i}{X_i} \times 100$
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

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

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

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

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

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
PM <sub>10</sub> Quartz filters	Filters	Laboratory	1 year	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 Assessment and Response Actions**

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

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

An 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 is accomplished through annual reviews. The network review is used to determine how well a particular air monitoring network is achieving its required air monitoring objective, and how it should be modified to continue to meet its objective. The network review will be accomplished 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 re-designations 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);
- ▶ 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 be 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 “re-verified” and then compared to each location to determine whether these objectives can still be attained at the present location.

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

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

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

- ▶ ensure that the inlet is clean;
- ▶ record findings in field notebook and/or checklist;

- ▶ take photographs/videotape in the 8 directions;
- ▶ document site conditions, with additional photographs/videotape.

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

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

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 or EPA Regional 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 group's 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.

#### **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.

- ▶ *Review the data quality objectives (DQOs) and sampling design of the program:* review the DQO. Define statistical hypothesis, tolerance limits, and/or confidence intervals.
- ▶ *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.
- ▶ *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.
- ▶ *Verify test assumptions:* decide whether the underlying assumptions made by the selected test hold true for the data and the consequences.
- ▶ *Perform the statistical test:* perform test and document inferences. Evaluate the performance for future use.

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. Estimates of the data quality will be calculated on the basis of single monitors and aggregated to all monitors.

#### **20.1.6 Proficiency Testing**

The PT is an assessment tool for the laboratory operations. An EPA's Contract laboratory 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 PT 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 EPA's Contract Laboratory Director. The Contract laboratory writes up a PT report and sends a copy of the results to the Laboratory Branch Manager and the EPA QA Office. Any results outside of the EPA's acceptance criteria are then noted in the PT report. The TCAPCD has 120 days to address any deficiencies noted in the PT Report.

## 20.2 External Assessment Schedule

**Table 20.1 Assessment Summary**

Agency	Type of Assessment	Agency Assessed	Frequency
EPA Contractor	PTs	S/L/T agencies	Annually
EPA Contractor	TSAs, IPAs	S/L/T agencies	As needed by AQAD determination
Regional Offices	Network Reviews	S/L/T agencies	Once every 5 years
Regional Offices	TSAs and IPAs	S/L/T agencies	Once every three years

## **21.0 Reports to Management**

This section describes the quality-related reports and communications to management necessary to support air toxics network operations and the associated data acquisition, validation, assessment, and reporting.

Important benefits of regular QA reports to management include the opportunity to alert the management of data quality problems, to propose viable solutions to problems, and to procure necessary additional resources. Management should not rely entirely upon the MSRs for their assessment of the data. The MSR 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**

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 Regional Offices under the grant requirements. 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;
- ▶ Laboratory audits which include “round-robin” cylinders that are shared among many laboratories;
- ▶ NPAP audits.

### **21.1.2 Technical System Audit Reports**

External TSAs are conducted at least once every three years by the EPA Regional Office or EPA OAQPS Contractor as required by 40 CFR Part 58. Further instructions are available from the EPA Regional QA Coordinator or the Systems Audit QA Coordinator, Office of Air Quality Planning and Standards, AQAD, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.

### **21.1.3 Response/Corrective Action Reports**

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

## **22.0 Data Review**

### **22.1 Data Review Design**

The primary purpose of this section is to describe the data validation procedures 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 AQS 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 and 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 Procedures**

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 tests 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**

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 impact 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 Process for Validating and Verifying Data**

#### **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 “re-verified” 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 individual 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 affected sample . Concurrence with lab technician and branch manager
Laboratory Accident	LAC	Concurrence with lab technician and branch manager
Below Detection Limit	BDL	Value is below the Minimum Detection Limit of the analytical system
Field Accident	FAC	Concurrence with lab technician and branch manager

## 23.2 Data Analysis

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

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

- 1. Detect a percent difference change between successive three-year average concentration levels that are greater than or equal to 15 percent**

In addition, for the rest of the air toxics systems in the network:

- 2. 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*<sup>1</sup>.

For the stated DQO, the assessment process must follow statistical routines. The following five steps will discuss how this will be achieved. Please note that OAQPS has notified the District that it will perform DQAs of the data from a national perspective. Therefore, the District will allow OAQPS to perform these assessments on behalf of the District. The DQAs that will be performed by the District will pertain to the data collected at all five sites and the DQAs will pertain to answering the second statement.

### **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. The State Agency 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. The 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 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 inter-quartile (i.e., seasonal) 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 precisions-* 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. Toxa City's strategy for accomplishing this will be to use all available quarters of data as the basis for projecting where the precision estimates will be at the end of the three-year monitoring period.

Toxa City will develop confidence intervals for the precision estimates. This will be accomplished using a re-sampling technique. The protocols for creating the confidence intervals are described in the following equation. OAQPS has notified all of the State and Local agencies involved in the NATTS that it will calculate network/program bias using round robin samples. Please see Reference 1.

### **Precision Algorithm**

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

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

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

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

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

### **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.

### **24.26 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 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. Quality Management Plan for the National Air Toxics Trends Assessment Monitoring Program, EPA document, 454/R-02-0006, November 2002
2. Guidance for the Data Quality Assessment Process EPA QA/G-9 U.S. Environmental Protection Agency, QAD EPA/600/R-96/084, July 1996.
3. 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.

**TECHNICAL REPORT DATA***(Please read Instructions on reverse before completing)*

1. REPORT NO. <b>EPA-454/B-07-004</b>	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE <b>Quality Assurance Guidance Document – Model Quality Assurance Project Plan for the National Air Toxics Trends Stations</b>	5. REPORT DATE <b>12/07</b>	
	6. PERFORMING ORGANIZATION CODE	
7. AUTHOR(S): <b>Dennis Mikel</b>	8. PERFORMING ORGANIZATION REPORT NO.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS <b>U.S. Environmental Protection Agency Office of Air Quality Planning and Standards Research Triangle Park, NC 27711</b>	10. PROGRAM ELEMENT NO.	
	11. CONTRACT/GRANT NO.	
12. SPONSORING AGENCY NAME AND ADDRESS  <b>Office of Air Quality Planning and Standards Air Quality Assessment Division U.S. Environmental Protection Agency Research Triangle Park, NC 27711</b>	13. TYPE OF REPORT AND PERIOD COVERED	
	14. SPONSORING AGENCY CODE <b>EPA/200/04</b>	
15. SUPPLEMENTARY NOTES		
16. ABSTRACT <p>The Quality Assurance Document for the National Air Toxics Trends Stations was written for air pollution control agencies to use as a model for the quality assurance project plans that the agencies need to fulfill their QA requirements. This model QAPP incorporates all of the elements needed to satisfy the R-5 EPA Requirements for Quality Assurance Project Plans.</p>		
17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
	<b>Air Pollution control</b>	
18. DISTRIBUTION STATEMENT  <b>Release Unlimited</b>	19. SECURITY CLASS ( <i>Report</i> ) <b>Unclassified</b>	21. NO. OF PAGES <b>142</b>
	20. SECURITY CLASS ( <i>Page</i> ) <b>Unclassified</b>	22. PRICE