



PAMZ | Parkland Airshed
Management Zone

PARKLAND AIRSHED MANAGEMENT ZONE

QUALITY ASSURANCE PLAN

December, 2011

Created By:

FOCUS

TABLE OF CONTENTS

Table of Revisions	3
Distribution Record	4
List of Terms and Definitions.....	5
1.0 Introduction	7
1.1 PURPOSE	7
1.2 HOW TO USE THIS QAP.....	7
1.3 QAP REVISION HISTORY.....	7
1.4 PAMZ OVERVIEW	8
2.0 Organization	12
2.1 PAMZ ORGANIZATIONAL CHART	12
2.2 ROLES AND RESPONSIBILITIES	12
2.3 MEMBERS.....	14
3.0 Management of Change.....	15
3.1 NEW EXECUTIVE DIRECTOR.....	15
3.2 NEW PRIMARY CONTRACTOR	15
3.3 NEW PAMZ CHAIR.....	15
3.4 RE-ISSUANCE AND REVISIONS TO QAP.....	16
3.5 CHANGES TO PAMZ MEMBERSHIP	16
3.6 CHANGES TO MONITORING REQUIREMENTS OF PAMZ.....	16
4.0 Document Control and Revisions.....	18
4.1 CONTROLLED DOCUMENT MANAGEMENT	18
4.2 CONTROL OF RECORDS	19
4.2.1 Transfer of Ownership.....	21
4.2.2 Disaster Recovery and Backup Plan	22
4.3 CONTROL OF DATA	24
4.3.1 Data Quality Objectives	24
4.3.2 Criteria for Measurement Data	24
4.3.3 Data Collection System.....	26
5.0 Internal Audits	28
5.1 INTERNAL STATION AUDITS.....	28
5.2 MANAGEMENT OF CORRECTIVE ACTIONS	29
5.3 AUDIT FORM	29
5.4 DATA PROCEDURE AUDIT	30
6.0 Non-compliance, Preventative Maintenance and Corrective Action	32
6.1 PROCEDURES FOR REPORTING AND INVESTIGATING	32
7.0 Subcontracting of Environmental Monitoring	34
8.0 Purchasing of Services and Supplies	34
8.1 PROCUREMENT AND ACCEPTANCE TESTING OF EQUIPMENT.....	35
8.2 SUPPLIES AND CONSUMABLES	35
8.3 PURCHASED SERVICES	35

9.0	Technical Requirements.....	36
9.1	PERSONNEL.....	36
9.2	PHYSICAL LOCATION AND CONDITIONS.....	36
9.2.1	PAMZ Air Monitoring Rationalization Plan.....	36
9.2.2	Site Documentation.....	38
9.2.3	Laboratory Facilities.....	38
9.2.4	Data Processing and Storage.....	39
9.3	EQUIPMENT.....	39
10.0	Environmental Monitoring Methods.....	42
10.1	METHODS REQUIRING VALIDATION AND AENV AUTHORIZATION.....	42
11.0	Method Validation.....	43
12.0	Estimation of Uncertainty Measurement.....	43
13.0	Calibration.....	45
14.0	Calibration Records.....	48
15.0	Sampling Plan and Procedures.....	48
15.1	CONTINUOUS SAMPLING PLAN.....	48
15.2	PASSIVE SAMPLING PLAN.....	49
16.0	Sample Handling.....	51
16.1	CONTINUOUS DATA.....	51
16.2	INTERMITTENT/LABORATORY SAMPLE HANDLING.....	51
16.3	SAMPLING METHODOLOGY.....	52
17.0	Sample Acceptance Procedure.....	53
18.0	Reporting.....	54
18.1	REGULAR REPORTING.....	54
18.2	ENVIRONMENTAL MONITORING RESULTS OBTAINED FROM SUBCONTRACTORS.....	56
18.3	FORMAT OF REPORTS.....	56
18.4	AMENDMENT TO ENVIRONMENTAL MONITORING RESULTS.....	56
18.5	SUBMISSIONS OF ENVIRONMENTAL MONITORING DATA AND REPORTS.....	57

Appendix A

PAMZ Internal Standard Operating Procedures

Appendix B

Contractors Air Quality Monitoring Standard Operating Procedures TOC

Appendix C

Laboratory Contractor's (Maxxam) QAP Summary and Air Related Standard Operating Procedures

List of Terms and Definitions

AMD	Air Monitoring Directive, Alberta Environment
AENV	Alberta Environment
COC	Chain of Custody
CWS	Canada-Wide Standard
Department	Refers to Alberta Environment sector involved with PAMZ
Director	Employee of the Government of Alberta, designated as a Director under EPEA
EC	Environment Canada
EPA	Environmental Protection Agency (US)
EPEA	Environmental Protection and Enhancement Act (Alberta Legislation)
Equipment	Refers to all sampling, measurement, test, calibration, software and support equipment used for environmental monitoring
EUB	Energy and Utilities Board (Alberta)
External Audit	An audit organized by Alberta Environment
Final Data	Data that has undergone QA/QC processing
Internal Audit	An audit organized by PAMZ
IRG	PAMZ Issues Response Group
NIST	National Institute of Standards and Technology
NMHC	Non-Methane Hydrocarbon
NOx	Oxides of Nitrogen
Non-Routine Sampling	Sampling performed beyond the scope of the PAMZ Monitoring Plan; can include specific sampling complete as part of a specific project, sampling completed in partnership with other organizations, sampling completed as part of an investigation for use internally, or any other sampling completed without a requirement for reporting to Alberta Environment
NRCB	Natural Resources Conservation Board
PAMZ	Parkland Airshed Management Zone

PM	Preventative Maintenance
PM _{2.5}	Particulate Matter with an aerodynamic diameter less than 2.5 micrometres (commonly referred to as <i>fine particulate</i>)
QAP	Quality Assurance Plan
QA	Quality Assurance
QC	Quality Control
Quality Assurance	An integrated system of management activities to ensure that a process, item, or service is of the type and quality needed and expected
Quality Control	The overall system of technical activities that measure the attributes and performance of a process, item or service and defined standards to ensure quality requirements are met
Raw Data	Data that has not undergone QA/QC Processing
SPAN	The full scale of the analyzer referenced
SPOG	Sundre Petroleum Operators Group
Staged Audit	An audit completed by members of PAMZ to increase knowledge regarding the station operation and instrumentation, or to provide a basic review of network prior to an Internal Audit being completed
THC	Total Hydrocarbons
TRS	Total Reduced Sulphur
TWG	PAMZ Technical Working Group

1.0 Introduction

1.1 Purpose

The purpose of this Quality Assurance Plan (QAP) is to provide a source of reference for Parkland Airshed Management Zone (PAMZ) quality assurance requirements as they relate to Alberta Environment's revised Air Monitoring Directive (AMD).

The QAP provides details on requirements for the control and management of documents and data, guidance on internal audit procedures and corrective action protocols, and serve as a central reference document for details on monitoring methodologies, calibration procedures and sample handling protocols for PAMZ. The QAP also provide the user(s) with information on Quality Assurance (QA) and Quality Control (QC) protocols to ensure accurate and credible data is being collected and reported through the PAMZ network.

1.2 How to Use this QAP

The Quality Assurance Plan has been developed to address revisions completed to Alberta's AMD as they apply to the operation of the Parkland Airshed Management Zone. The objective of this dynamic document is to define the people, processes, equipment and methodologies involved in the measuring, collecting, recording and reporting ambient air quality data. This document will combine the Quality Assurance (QA) and Quality Control (QC) processes within one single reference document.

1.3 QAP Revision History

This Quality Assurance Plan (QAP) was developed specifically for the Parkland Airshed Management Zone (PAMZ) and as such the Executive Director will be responsible for making and distributing any revisions to this document. The Executive Director, the Chair and the Primary Contractor responsible for ambient air quality data will receive a copy of this document and any subsequent revisions. Should the Contractor change it is the expectation of PAMZ that the QAP be returned to the Executive Director immediately following the official announcement of the new Contractor.

Parkland Airshed Management Zone QAP Distribution List:

Executive Director: Mr. Kevin Warren
PAMZ Chair: Mr. Al Simcoe
Maintenance Contractor: FOCUS

The *Table of Revisions* and *Distribution Record* are used to record any updates and revisions to the QAP as well as record who has received a copy of the revisions.

1.4 PAMZ Overview

PAMZ Vision:

Our air is clean, clear, fresh and free from emissions that affect humans, animals or the environment.

PAMZ Mission:

We lead in monitoring air quality and applying innovative strategies to manage the air we breathe.

The primary objective of the PAMZ is to monitor ambient air quality in the west central region of Alberta in an effort to develop relevant, credible information that can be used to manage regional air quality, protect environmental health, and influence policy. Other monitoring objectives of the network are to:

- Establish existing, or baseline, concentrations
- Assess trends in air quality
- Judge compliance with provincial standards

These objectives are the foundation of a network design in accordance with the Alberta Air Monitoring Directive (AMD).

PAMZ boundaries encompass a 45,000 square kilometre area of west central Alberta including the City of Red Deer (See Figure 1).

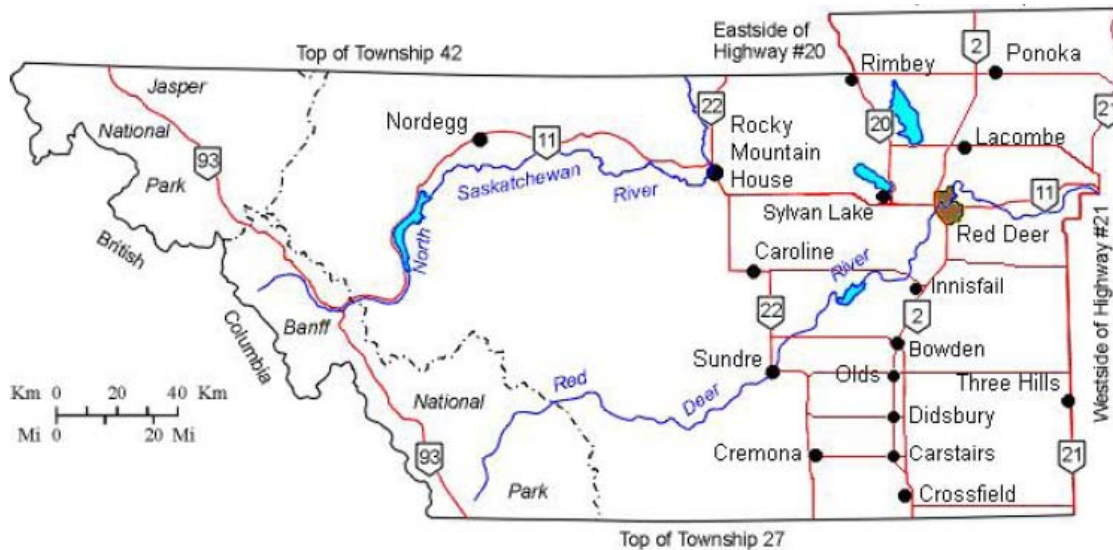


Figure 1. Parkland Airshed Management Zone Boundaries

The boundaries were determined based upon the following criteria:

- A large number of stakeholders in the region were interested in pursuing the zonal air quality monitoring approach
- Emission sources, associated impacts and concerns, and stakeholders are all located in a specific geographical area
- Atmospheric transport within the proposed zone boundaries has been quantified by air modeling exercises
- Multiple emission sources are present

A map showing the PAMZ permanent continuous monitoring locations and passive monitoring network is presented in Figure 1.

The entire monitoring network also includes two portable monitoring units. The Martha Kostuch Station is located throughout the zone at six locations per year for two months each separated by approximately a six-month period. Its purpose is to address air quality concerns or issues that have been identified and prioritized by the PAMZ Issues Response Group.

The David McCoy Station is located at the Crossfield-Carstairs site for a different quarter of every year in a four-year cycle and for the remainder of the year the unit is moved to three other locations for one quarter each throughout the zone the PAMZ Technical Working Group (TWG) has identified to address geographic or technical data gaps.

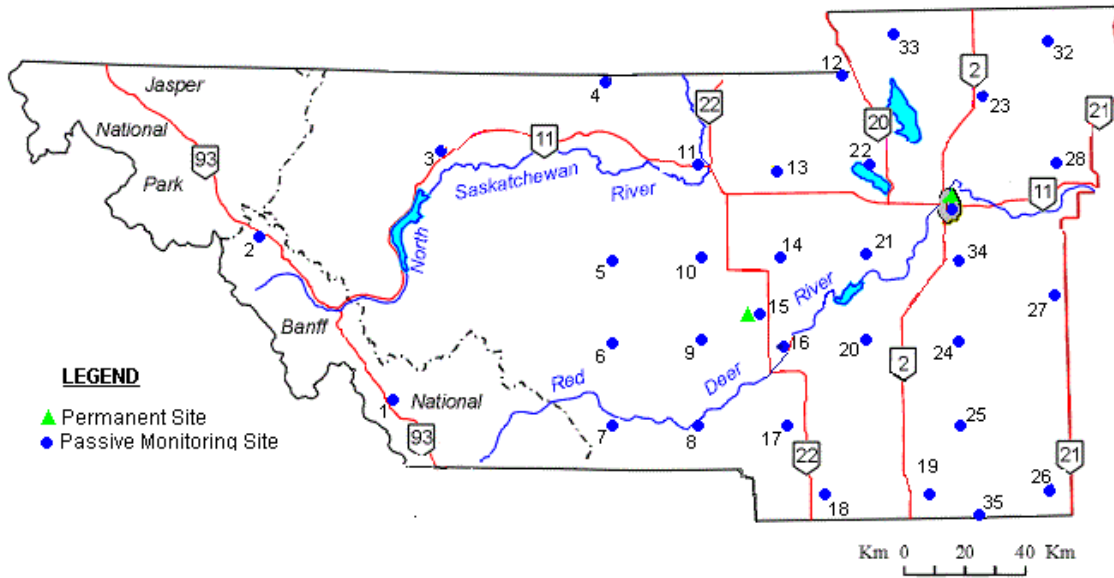


Figure 2. PAMZ Permanent & Passive Monitoring Network (December 2011)

Table 1 lists the specific parameters monitored at the permanent and portable sites.

Table 1 PAMZ Ambient Air Monitoring Program Monitoring Sites and Parameters Measured

Continuous Pollutant Analyzers & Meteorological Sensors	Station Name			
	Caroline	Red Deer Riverside	Peregrine Portable	Raven Portable
Sulphur Dioxide (SO ₂)	x	x	x	x
Ozone (O ₃)	x	x	x	x
Hydrogen Sulphide (H ₂ S)		x		
Oxides of Nitrogen (NO _x)	x	x	x	x
Nitric Oxide (NO)	x	x	x	x
Nitrogen Dioxide (NO ₂)	x	x	x	x
Respirable Particulates (PM _{2.5})	x	x	x	x
Carbon Monoxide (CO)		x		
Methane (CH ₄) / NMHC		x	x	
Total Reduced Sulphide (TRS)	x		x	x
Total Hydrocarbons (THC)	x	x	x	x
Wind Speed & Direction (WS/WD)	x	x	x	x
Temperature (TMP)	x	x	x	x
Relative Humidity (RH)	x	x	x	x
Global Radiation (W/m ²)	x		x	
Passive Monitors	(37 locations)			
Sulphur Dioxide (SO ₂)	x			
Ozone (O ₃)	x			
Nitrogen Dioxide (NO ₂)	x			

Source: PAMZ Website: <http://www.pamz.org/> (accessed December 21, 2011)

2.0 Organization

2.1 PAMZ Organizational Chart

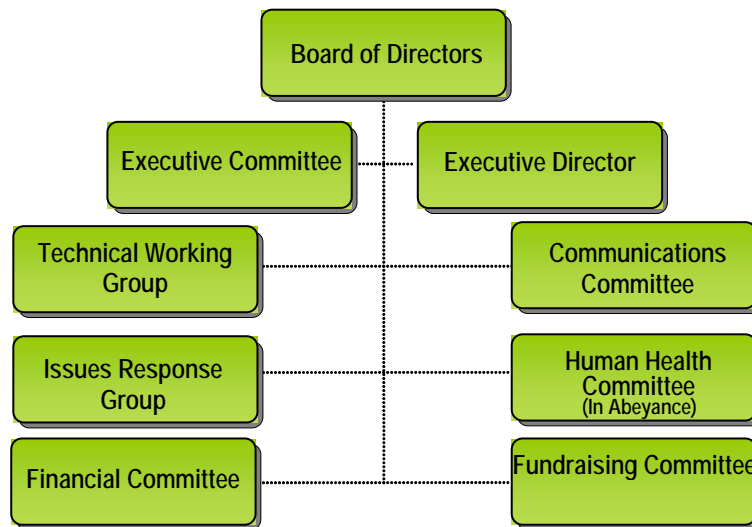


Figure 3. PAMZ Organizational Chart

The Parkland Airshed Management Zone is made up of a four stakeholder groups representing public, government, industry, and non-government organizations. A Board of Directors manages the Association's activities. The PAMZ Board appoints and dissolves various Groups and Committees that assist in the promotion of PAMZ objectives or functions of the Association. These committees and groups are provided in the Organizational Chart above and additional details on these can be found on the PAMZ website (www.pamz.org).

2.2 Roles and Responsibilities

The Parkland Airshed Management Zone was incorporated under the Societies Act in April 1997. The Society was initiated because of concerns regarding air quality issues within the zone as well as the emergence of zonal air quality monitoring and management under the Clean Air Strategic Alliance (CASA). The CASA framework guides the work performed by PAMZ. The framework includes

management by consensus as well as publicly accessible data and information from monitoring activities.

PAMZ's mission to develop and implement a zone approach to monitoring and managing air quality has identified the organizations roles and responsibilities as follows:

- Monitoring will respond to air quality concerns in the zone
- Monitoring will measure air quality in the zone and provide evidence of changes or trends over time
- Results will be clearly communicated to the public and government
- Monitoring will be compatible with the provincial ambient monitoring network
- Program will be scientifically credible and will include appropriate QA/QC
- Program will make use of existing data where feasible
- Program will strive for continuity of existing monitoring
- Program to be cost effective and to be developed and operated within a set budget

A project organizational chart is provided as Figure 3. Responsibilities of the key project participants are listed below.

PAMZ - Executive Committee - The Executive Committee, through the process of multi-consensus decision-making, is responsible for implementing tactics and achieving the PAMZ business plan objectives. Executive committee positions are as follows:

- Chairman
- 1st Vice-Chair
- 2nd Vice-Chair
- Treasurer
- Secretary
- Past Chair
- Executive Director

PAMZ - Executive Director - The Executive Director is contracted to manage the PAMZ air quality management program, oversee the implementation and evaluation of zonal air quality management strategies, serve on all committees and act as an ambassador for the association.

Primary Contractor – Program Manager – is the primary point of contact between the PAMZ – Executive Director and the Contractor. The Program Manager is responsible for all contracting activities, and for all project technical and fiscal reporting, the coordinating field activities; semi-annual site audit, maintenance,

and calibration visits; field service visits; any necessary remedial repairs; and verifying all calibration standards.

Primary Contractor - Information Manager – is responsible for management and direction of all data collection, reduction, validation, archiving, and reporting activities.

Primary Contractor - Quality Assurance Coordinator – is responsible for air monitoring procedures and training; quality assurance policies, plans, and procedures; data validation and data quality assessment and report.

Primary Contractor - Data Specialists - is responsible for daily data retrieval activities; identification and communication of operational problems to the technical manager; data validation, data archive, and data reporting.

Primary Contractor - Technical Services Supervisor - is responsible for technical assistance for station installation, operation, and maintenance; calibration and quality control standards; air monitoring equipment evaluation, procurement and acceptance testing; air monitoring equipment calibration; parts and inventory control; and major equipment repair.

Primary Contractor - Air Monitoring Field Specialists –are responsible for daily review of the network operations, site audit, maintenance, and calibration visits, trouble shooting activities, performing and managing all equipment laboratory repairs, calibrations, and preventative maintenance.

Additional technical and administrative support personnel may be used as necessary upon direction of the Program Manager.

2.3 Members

Membership in PAMZ includes industry, municipalities, non-government organizations, government, health regions, local landowners and the general public.

PAMZ seeks funding for its programs from its membership as well as other financial opportunities available to the organization including government grants and donations. Membership in specific committees and groups within PAMZ requires membership within PAMZ as well as having an interest in being involved with the committee. A listing of the current members on the various committees, groups and the Executive can be found on the PAMZ website (www.pamz.org).

3.0 Management of Change

The following details reference to procedures applicable to periods of transition. Examples of these periods include, but are not limited to:

- key personnel changes within PAMZ organization
- changes of regulatory requirements of member companies and applicable to the operation of PAMZ
- updating of controlled documentation
- Ownership changes of members and/or Prime Contractor

In the event that PAMZ finds itself in a period of transition, the following applies to the different individual circumstances:

3.1 *New Executive Director*

Change in the individual(s) in the role of Executive Director will result in the temporary assumption of all the responsibilities associated with this position by the PAMZ TWG Chair. All authorities and decisions assigned to the previous Executive Director will now reside with the PAMZ Chair. These responsibilities will reside with the PAMZ Chair until such a time as the position of Executive Director can be filled or should the PAMZ Board decide otherwise.

3.2 *New Primary Contractor*

Change in the individual or company assuming the role of Primary Contractor will result in the submission of the previous Primary Contractor's copy of the Controlled QAP Documentation. In the event of an unexpected change in this role, or the unlikely breach of the Primary Contractor's Contract, the PAMZ Executive Director shall be responsible to find an individual or company to temporarily fulfill the responsibilities of the Primary Contractor. If the change in Primary Contractor is expected, it is the expectation of PAMZ that responsibilities of this role will be transferred between the two individuals, or groups, resulting in minimal disruption to the operation of PAMZ.

The following section of this document will also apply to this event:

3.3 *New PAMZ Chair*

In the event of the designation of a new PAMZ Chair, any responsibilities outlined in this document and assigned to the PAMZ Chair will be temporarily assumed by

the PAMZ Vice-Chair. These responsibilities will reside with the PAMZ Vice-Chair until such a time as the PAMZ Board of Directors designate a different individual.

3.4 Re-issuance and Revisions to QAP

Revisions to the QAP documentation will follow details provided for in Section 4.0 of this document and the referenced documentation found in that section. It is the responsibility of the Executive Director to inform all key personnel of the changes/re-issuance

3.5 Changes to PAMZ Membership

Membership changes resulting in key personnel changes, whose roles are associated with this document, are handled as identified above. Other changes to the PAMZ membership that result in the reassessment of the PAMZ Monitoring Plan are to be addressed through this document specifically with the Executive Director and the Primary Contractor.

Additional Information applicable to a change in PAMZ Membership that could affect the operation of PAMZ can be found in Sections 9.0, 10.0, and 11.0.

3.6 Changes to Monitoring Requirements of PAMZ

Should a change in membership or a request from a member company result in the reassessment of the PAMZ monitoring plan and potential new monitoring requirements, it is the responsibility of the Primary Contractor and the Executive Director to ensure that PAMZ remains compliant with the AMD and other member company's monitoring requirements.

Additional Information applicable to a change in the monitoring PAMZ Monitoring Plan requirements can be found in Sections 9.0, 10.0, and 11.0.



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4.0 Document Control and Revisions

4.1 *Controlled Document Management*

A requirement of this QAP is the inclusion of a system for updating the controlled documents as well as the associated operating procedures. This QAP uses a standardized indexing format to allow for easy updating and replacement of pages within the document. The indexing format is found in the top right corner of each page; including the following information:

Date (of revision)
Volume
Revision Number
Page

The “Date” identifies the time when the referenced revision was completed and accepted for inclusion into the controlled document. The “Volume” identifies the specific volume in the PAMZ series (should additional volumes be required). The “Revision Number” represents the most current version of the QAP documentation (Revision No. 1 was used to represent the first version). “Page” indicates the number of the specific page as well as the total number of pages in the document.

In order to aid in the updating and revision procedures, blank pages have been inserted throughout the document to allow for additional text and revisions with minimal replacement of pages.

When a revision is required to the QAP documentation, a new revision number will be included on the replacement pages to indicate that these pages have been revised. A Table of Revisions is included after the Table of Contents, this table is to be used to identify and track any revisions made to specific sections in the document. The Table of Revisions includes the effected sections, page numbers, date of revision, the revision number as well as the individual who made the revision. It is required that the Table of Revisions be completed any time a revision is made to the controlled document. An updated Table of Revisions needs to be distributed with the revised content to those individuals responsible to make the updates to the controlled documents.

Finally, a distribution record needs to be completed in duplicate to track distribution of all revisions to the controlled document. One Distribution Record is maintained with the Controlled Document retained by the Executive Director of PAMZ. This record remains with the document at all times and is updated as new revisions are completed and distributed to the holders of the other controlled

documents. Each time a revision is to be distributed the *revision package* needs to include a copy of the distribution record, to remain with the revised Controlled Document.

The Revision Package will include:

- the *Revised Section* content to replace the outdated pages in the Controlled Documents,
- an updated *Table of Revisions*, and
- an updated *Distribution Record*

Additional details on procedures for revising and reprinting of the QAP Manual can be found in the following PAMZ documentation located in Appendix A:

PAMZ03: Quality Assurance Plan Documentation Revision/Updating Procedure

4.2 Control of Records

All digital data, data acquisition system documentation, and other documents for the current and previous monitoring years will reside in the Contractor database and archive files. The following types of documentation and records will be used in the program:

- Field documentation, including field log and laboratory sheets, daily summaries, equipment audit results, calibration results, quality control checks, and records of procedures and maintenance performed. These documents will be maintained and stored by the Contractor for a period of 10 years.
- Ambient data (raw and validated) will reside on the Contractor database for the life of the program. Validated data will be submitted monthly to the Alberta Environment database within the following 45 days of months end in accordance with the AMD and PAMZ. Validated data will also be uploaded to the CASA Data Warehouse Website within 45 days of month's end.
- Lab analysis reports, QC checks, problems and corrective actions/resolved, the QAP and QAP revisions, QA audit reports, final reports will be archived on the Contractor database.

When nonconformities occur, and require reporting, as a result of data validation, independent audit reports, or as a result of malfunction, the procedures and associated documentation requirements outlined in Section 6.0 of this document will be followed. Section 6.0 also includes reference to corrective action procedures and associated documentation required by PAMZ.

The following is a list of documents in use with this QAP system and the individual(s) responsible for record keeping and revisions to each document.

Table 2. Document Listing and Responsibilities

Document	Approval / Revision Authority	End Use
Quality Assurance Plan	PAMZ Executive	ALL
Air Monitoring Directive	Alberta Environment	ALL
Calibration Reports	Contractor (Technical Service Supervisor)	ALL
Ambient Air Monitoring Equipment SOPs	Contractor (Contract Program Manager)	ALL
Instrumentation Maintenance Reports	Contractor (Contract Program Manager)	ALL
Site Inspection Reports	Contractor (Field Specialists)	ALL
Site Documentation	PAMZ Executive Director/Contractor (Information Manager)	ALL
Parts Inventory List	Contractor (Technical Service Supervisor)	ALL
AMD Exceedence Reports	PAMZ Executive Director	ALL
External Audit Reports	Alberta Environment	ALL
Internal Audit Reports	PAMZ Executive Director	ALL
Nonconformance Report	PAMZ Executive Director	ALL
Monthly and Annual Compliance Reports	Contractor (Information Manager) /PAMZ Executive Director	ALL
Stakeholders Annual Report	PAMZ Executive Director	ALL

The documents listed above as well as the data collected, following the protocol outlined in these documents, are reviewed and approved by the authorities identified above. A document control procedure has been implemented to prevent the use of obsolete or invalid documents; details of this procedure are included below:

- I. **Controlled Documents:** documents housed in electronic files (databases)
 - a. Electronic files are made available to users unauthorized to make changes on a 'Read Only' basis through posting on the PAMZ Website. Users are required to ensure they are using the most recent posted version
 - b. Hard copies made of electronic-based/controlled files are valid for a maximum of 1-year after the print date (unless a change has been made to the specific document)
 - c. In the event that revisions made require reprinting of the hard copies of the document, all affected personnel will be notified and either

receive a revised copy or will be asked to print the revised document. It is the responsibility of the authorized individual(s) making the changes to notify all affected personnel of the changes

- d. The PAMZ Executive Director will record all changes made to this Quality Assurance Plan (QAP) in the Revision Summary Section. Changes will be highlighted indicating the revised sections
- e. The PAMZ Executive Director manages the distribution list included in Section 1.3. The Executive Director is responsible for updating the distribution list and identifying who was issued updated versions and where the *Controlled Copies* can be found

- II. ***Uncontrolled Documents***: all hard copy documents are considered uncontrolled documents unless they have been identified as a “Controlled Copy”
- III. All forms are controlled by an expiry date and a master list
- IV. All Controlled documentation requires the inclusion of the following information: authorized author identification, revision number and expiry date

The utilization of document control protocols insures that obsolete documents are removed and if identified may be retained for archiving purposes.

There is no maximum number of revisions allowed to take place prior to the five-year review. As such, the revision status (number identification) will continue chronologically as updates and revisions have been approved and reissued. Update identification occurs as following: Revision One is followed by Revision Two, and so on.

Approval is required from the Executive Director of PAMZ to issue a new edition of the PAMZ QAP. Once every five years the QAP will be reissued as a new volume and all revision numbering will be reset to status ‘1’ as well as the reissue date.

4.2.1 Transfer of Ownership

In the event of transfer of ownership of the record maintenance contractor the contractor will provide all electronic files and hardcopy documents to the Executive director immediately following the termination of the employment contract. Electronic files include the air quality database data files as well as all

operational files stored electronically. Provision of these files is to be done so in a format agreed upon by both parties, or outlined in the contract.

4.2.2 Disaster Recovery and Backup Plan

The Contractor computer system requires a comprehensive protection system with levels of security to protect against external and internal attacks. The security systems are under continuous review and upgrade to meet changes in technology.

Raw Data Acquisition – In the event of a network file server failure each monitoring system at each trailer will have the ability to download data on to a zip drive or flash card. This replication of data storage will ensure that if the data logger at a site fails, data will not be irretrievably lost.

Backup and Archive of Data, Software, and Documentation - Using current state-of-the-art technology, backups of data, operating system, and application software are created as follows:

Station data is polled a minimum of every 4 hours and brought into a central server database maintained and operated by the Contractor. At some portable locations with sporadic or no cellular coverage, data is retrieved weekly by the contractor. Backups are created by the contractor on a monthly basis and stored off site in a secured format.

Facilities – In the event of a catastrophic event that destroys or disables the Contractor's offices (such as a fire), it will be necessary to quickly re-establish operations. It is the expectation of PAMZ that the contractor will have the ability and contacts in place to expedite a contingency plan to result in re-establishing the network connections and data retrieval for PAMZ.



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4.3 Control of Data

4.3.1 Data Quality Objectives

The following information is provided as brief summary of the details included in the Contractor's Standard Operating Procedures. It is the expectation of PAMZ that the Contractor will have developed and documented at a minimum those procedures listing in Appendix B. Included in this list is reference to validation procedures for both continuous and passive data.

The series of referenced SOPs include items on completeness, lower detection limits, accuracy and zero and span deviations. For additional details regarding the validation procedures used for both continuous and intermittent data, please see the Contractor's associated SOP(s).

System operation, data quality, and data completeness is assessed each day by reviewing the data received from the data logger electronically. Any inconsistencies noted in the data are reported to the Contractor's Program Manager and/or the PAMZ Executive Director, who will initiate appropriate corrective actions. A field specialist would be dispatched to evaluate, correct, and document the problem.

4.3.2 Criteria for Measurement Data

Sampling specifications for each parameter are summarized in Table 3. Each parameter has specific performance criteria.

PAMZ requires that the contractor has documented SOPs for the operation, maintenance and calibration of all the instrumentation identified in the applicable tables.

It is the Primary Contractor's responsibility to have SOPs developed and in place to properly operate, maintain and calibrate all the instrumentation they are responsible for within the PAMZ network. A full listing of the required SOP documentation can be found in Appendix B of this document.

Table 3 below presents the PAMZ's current instrumentation and the corresponding sensor and sampling specifications.

Table 3. Gaseous Pollutant Monitoring Program Sensor and Sampling Specifications

Parameter	Instrument Make and Model	Units of Measure	Instrument Sampling Frequency
Sulphur Dioxide (SO ₂)	API Model 100A, 101A TECO 43C	ppb	1 – second samples 1-minute, 5-minute, and 60-minute averages SO ₂ concentrations
Ozone (O ₃)	API Model 400 Series TECO 49C	ppb	1 – second samples 1-minute, 5-minute, and 60-minute averages O ₃ concentrations
Nitrogen Oxides (NO _x), Nitrogen Dioxide (NO ₂), Nitrogen Oxide (NO)	API Model 200A, 200E TECO 42C	ppb	1 – second samples 1-minute, 5-minute, and 60-minute averages NO _x , NO ₂ , NO concentrations
Respirable Particulates (PM _{2.5})	TEOM 1400A, Met One BAM 1020	µg/m ³	1 – second samples 1-minute, 5-minute, and 60-minute averages PM _{2.5} concentrations
Carbon Monoxide (CO)	TEI 48C TECO 48C	ppm	1 – second samples 1-minute, 5-minute, and 60-minute averages CO concentrations
Total Hydrocarbons (THC)	Rosemount 400A TECO 51C-LT	ppm	1 – second samples 1-minute, 5-minute, and 60-minute averages THC concentrations
Total Reduced Sulphides (TRS)	API Model 100A	ppb	1 – second samples 1-minute, 5-minute, and 60-minute averages TRS concentrations
Hydrogen Sulphide (H ₂ S)	TECO 45C	ppb	1 – second samples 1-minute, 5-minute, and 60-minute averages H ₂ S concentrations
Methane / NMHC (CH ₄)	TECO 55C Methane / NMHC	ppm	1 – second samples 1-minute, 5-minute, and 60-minute averages CH ₄ /NMHC concentrations
Wind Speed & Direction (WS/WD)	Met One 010/020	km/hr deg	1 – second samples 1-minute, 5-minute, and 60-minute averages WS/WD
Temperature (TMP) Relative Humidity (RH)	Met One RH/Air Temp Probe 083D	°C %	1 – second samples 1-minute, 5-minute, and 60-minute averages TMP and RH
Solar Radiation (SR)	Met One 096	W/m ²	1 – second samples 1-minute, 5-minute, and 60-minute averages SR

4.3.3 Data Collection System

All data are captured onsite by an Omron Programmable Logic Controller (PLC) data acquisition system (DAS). The Omron PLC is configured to collect and store analog signal data from all analyzers and sensors operating in each monitoring station. The PLC also controls all system functions like daily zero spans, pump controls, etc. Data collected by the PLC is then transmitted to a central data server via cellular or land telephone lines. Data collected on the server is then disseminated to all parties with authority to access the data.

The data system collects all data on the data server where the suite of programs reside in order to review air quality data to verify operations of air quality monitoring sites within the network. The complete software system has supplemental programs that help ensure high quality network operations and data by performing the following functions:

- Allow the operator to review current and recent past air quality data, guide the operator through calibration, maintenance, operation, troubleshooting procedures, and serves as the primary on-site quality assurance documentation archive.
- Facilitate flagging of data for reasons identified from the field technicians, or recorded functions.
- Facilitate baseline correction of continuous ambient air quality data.
- Facilitate generation of monthly reports for submission to PAMZ
- Facilitate generation of the data in an acceptable format for submission to the CASA data warehouse.



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5.0 Internal Audits

The Internal Audits section has been divided into two distinct audit forms; Internal Station Audits and Internal Data Procedure Audits. The internal station audit section will discuss activities required during regular audits completed at scheduled stations within the PAMZ network. The Internal Data Procedure Audits section discusses the activities to review data handling and reporting procedures to ensure on-going compliance to the AMD.

5.1 Internal Station Audits

It is the responsibility of the Executive Director to arrange the completion of an internal station audit of the environmental monitoring and reporting activities at a minimal scheduled frequency of every three years¹. This internal audit will ensure protocol is being followed and to ensure conformity to the AMD and the policies found in the associated Quality System. Alberta Environment requires the use of a third party to complete this task, but indicates that under exceptional circumstances (for example; limited financial resources to hire a third party audit team which would represent an unreasonable expense). Alberta Environment is also presently mandated to complete external audits of stations using trained personnel within their organization.

The completion of an Internal Audit must be done so by trained and qualified personnel. Qualifications required to perform an Internal Audit depend on the objectives of the audit. If PAMZ is performing the audit to gain knowledge within the organization (Staged Audit); members of the Technical Working Group with an interest in the auditing the network are considered qualified to perform an Staged Audit using the associated SOP (PAMZ01: Internal Audit Procedure). Audits performed to satisfy the requirements outlined in the AMD are required to be completed by personnel certified as auditors, and with experience in performing environmental audits and whose qualifications are deemed satisfactory by the PAMZ TWG. Findings of non-conformance to the AMD must be identified and discussed with the Executive Director of PAMZ as well as the Contractor(s) responsible. Corrective actions shall take place immediately to ensure the conformance to the AMD. Follow-up checks on any audit findings shall be completed at PAMZ's earliest convenience. The Executive Director shall perform a management review of the audit results in order to address any potential changes to the QAP or other associated protocols in light of the internal audit results.

¹ Alberta Environment, 2006 Amendments to the Air Monitoring Directive, 1989 (AMD 2006). Part I in the Monitoring and Reporting Directive Series. Refers to Section 2.5: Internal Audits.

In some circumstances it may be advantageous to schedule Internal Station Audits at one or two stations each year; to avoid a large time demand to complete audits at each station within PAMZ within one year.

Reference Documents(s):

SOP #PAMZ01 – Procedure for Completing Internal Station Audit
QAP Form #1: Internal Station Audit and

5.2 Management of Corrective Actions

When non-compliance occurs as a result of independent audit reports or internal audits, a non-conformance report is issued to the Owner (PAMZ) and the Contactor. The Contractor's Quality Assurance Division investigates the non-compliance issue and makes recommendations to the PAMZ Executive director, for corrective and preventative actions with the goal of addressing and preventing the problem from reoccurring.

5.3 Audit Form

The form of the audit will consist of an audit plan to be prepared by the auditing party. The following elements are included in the plan to maximize the efficiency and effectiveness of the audit.

Audit Title – the title that would be used on check sheets and reports.

Audit Number and Audit Date – an assigned number for reference that also includes the audit date.

Scope - that identifies the boundary of the audit and identifies the groups/or activities to be evaluated.

Purpose – what the audit should achieve.

Standards – standards are the criteria against which performance is evaluated. Since standards must be clear and concise and consistent with other audits of similar nature, an audit checklist should be used to ensure that the full scope of the audit is covered.

Audit Team - identification of the audit team leader and members with qualifications and experience provided.

Auditees - a list the technical staff, Program Managers, QA representative, and other management that should be available for the audit. The selection of these individuals is at the discretion of the Executive Director and is to be provided to the Audit Team prior to completing the audit.

Documents – a list of all documents that should be available in order for the audit to proceed efficiently. Documents could include SOPs, raw data, previous audit reports, etc. This list will be developed in cooperation with the Audit Team and the Executive Director prior to the audit commencing, but may be based on details provided in the Internal Audit Procedure (PAMZ01).

Timeline – a timeline of when auditors and auditees will be notified of the audit in order for efficient scheduling and full participation of all parties.

If PAMZ completes an in-house audit of the stations, a template has been developed to be used as a check-list to complete the internal audit. The form can also be used a reference for third parties, if PAMZ so desires.

The internal Audit Form can be found in Appendix A in the Procedure for Completing Internal Station Audits (PAMZ01).

5.4 Data Procedure Audit

Data Procedure Audits are an on-site review and inspection of the entire ambient air monitoring program to assess its compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data. This audit also includes siting requirements and their compliance with the AMD. The data procedure audit is performed by the Contractor every three years (or at a frequency determined by PAMZ). Additional information on site selection and documentation may be found in Section 9.2.

The Data Procedure Audit report should include all of the elements presented in Section 4.3 of this document.



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6.0 Non-compliance, Preventative Maintenance and Corrective Action

6.1 Procedures for Reporting and Investigating

When nonconformities occur as a result of data validation, independent audit reports, or as a result of malfunction, a nonconformance report is issued by the Contractor and provided to the PAMZ Executive Director (or their Designate). Corrective actions dealing with an ambient air station are documented in the associated Standard Operating Procedure. The Contractors Quality Assurance Division also reports to the appropriate authority (PAMZ Executive Director) in accordance to the AMD.

The following information provides a summary of actions and communications required in the event of a non-conformance issue reported within the PAMZ network:

A nonconformance issue occurs:

- The Contractors Quality Assurance Division investigates the incident of non-conformance and then makes written recommendations to the PAMZ Designate for corrective and preventive actions with the goal of addressing and preventing the problem from reoccurring (if amendments are required to the associated Contractor SOP, these will be completed and updates issued to all technicians involved in the operations within the PAMZ network)
- If required, the PAMZ Designate reports the event to Alberta Environment (1-800-222-6514, or 780-422-4505 – Edmonton Local Number); provides details of the event as well as receives the *Reference Number* for that particular incident from the Alberta Environment Representative
- If the non-conformance issue deals with a previously submitted report, the report will be regenerated by the Contractor and provided to the PAMZ Designate
- If required, PAMZ Designate follows up with the required 7-day letter (submitted to Alberta Environment) and, if applicable, resubmits the report
- Details of the non-conformance are reviewed and discussed at the next TWG meeting

The following information provides a summary of the actions and communications required in the event of an exceedence (non-compliance to Ambient Air Objectives of Alberta Environment and/or Environment Canada) being reported within the PAMZ network:

An exceedences event occurs:

- Exceedence is identified at station (either through automated alarm system or through on-line data monitoring) by Contractor
- Contractor is responsible to confirm legitimacy of alarm (confirm)
- Contractor must notify PAMZ designate (attempt communication in the following ordered sequence):
 - Executive Director (1)
 - Technical Working Group Chair (2),
 - Past TWG Chair (3)

And provide details of the confirmed exceedences

- PAMZ Designate contacts Alberta Environment at 1-800-222-6514 (or Edmonton Local Number: 422-4505) and provides details of exceedence and any other information known at the time of the phone call; AENV Representative provides PAMZ designate with a reference number (for future reference to event)
- PAMZ Designate calls SPOG (if exceedences at Caroline Station), or the EUB and NRCB and provides details of exceedence
- SPOG, and/or EUB and/or NRCB investigate potential sources in area of exceedence and provide information back to the PAMZ Designate
- PAMZ Designate completes the 7-day follow-up letter and submits it to Alberta Environment (Enforcement and Monitoring Division)
- Exceedence details are reviewed at the next Technical Working Group meeting
- All details of exceedences and corresponding communications and documents need to be retained by PAMZ for a minimum of three years.

7.0 Subcontracting of Environmental Monitoring

7.1 Selection and hiring of subcontractors

It is the responsibility of the PAMZ to ensure that subcontractors performing environmental monitoring, reporting or maintenance activities on behalf of PAMZ do so in a method compliant with the requirements of the AMD. Should the Primary Contractor subcontract work out to satisfy their responsibility to PAMZ, detailed information about all the subcontractors used must be recorded and presented to PAMZ. It is also the responsibility of the Primary Contractor to ensure that the subcontracted party hired by the Primary Contractor is capable to fulfill the requirements of the AMD. Contractors should have a Quality Assurance Plan in place that can be provided to PAMZ within 5 days, if requested.

7.2 Current PAMZ Subcontractors

Maintenance Subcontractor

FOCUS CORP
Contact: Jeff Cooper
(780) 401 1356
Jeff.Cooper@focus.ca

Data Subcontractor

Whiteley Enterprises
Contact: Sharon Whiteley
(403) 201 1420
sharon@whiteleyenterprises.ca

Sampling Subcontractor

Gene's Maintenance Services Leduc Alberta
Contact: Gene Lesoway
(780) 910 7696

8.0 Purchasing of Services and Supplies

This section details the procedures used for procuring, inspecting, testing, and accepting instruments, supplies and consumables that directly or indirectly affect data quality. By having documented inspection and acceptance criteria consistency can be assured.

8.1 Procurement and Acceptance Testing of Equipment

The PAMZ Executive Director will be responsible for identifying air monitoring equipment needs and approving equipment purchases. The following protocol will be used in procurement of air monitoring equipment:

8.1.1 Equipment evaluation and selection. Prior to purchase, the equipment's performance will be evaluated and other users queried in regard to the performance, dependability and ease of operation.

8.1.2 Purchase specifications. The purchase contract will state the performance specifications that ensure only equipment of the desired quality is obtained, require a minimum one-year warranty, and indicate payment will not be made until the equipment has passed an acceptance test.

8.1.3 Acceptance Testing. Prior to payment, the equipment will be tested to ensure that it meets the requirements listed in the purchase specifications. For analyzers, the minimum test consists of checking zero drift, span drift, voltage stability, temperature stability, and linearity. Acceptance test reports will be prepared and archived by the operations program manager or the technical services supervisor.

8.2 Supplies and Consumables

The contractor's air monitoring field specialists are responsible for performing routine preventative and corrective maintenance. Such consumables as inlet filters, charcoal canisters, desiccant, and daily span gases do not require acceptance testing. Charcoal canisters and desiccant are replaced as needed and the daily span gas is replaced as needed. It is the responsibility of the Contractor to ensure that supplies and consumables used meet the requirements provided by the equipment manufacturer and/or as otherwise required by Alberta Environment for the purpose of completing environmental monitoring. The Contractor responsible shall also retain any certification or records verifying that the product used adheres to a specific assured quality, or has been approved for use.

8.3 Purchased Services

The PAMZ Executive Director is responsible to ensure that services purchased meet the requirements of the PAMZ network and the company (contractor) is aware and will abide to requirements found within this document and the AMD.

Laboratory services purchased must meet, or exceed, the requirements outlined in this document and/or the AMD. Laboratories completing the requested service must also be accredited for that work through the Canadian Association for Environmental Analytical Laboratories (CAEAL). CAEAL certification must be provided by the laboratory at the request of PAMZ.

9.0 Technical Requirements

9.1 Personnel

A detailed training program for all air quality personnel is documented upon the completion of the training. Certifications will be kept current and can be accessed in the employee's personnel file. The Contractor Program Manager will be responsible for verifying all staff members are fully informed on the specific monitoring and data management configurations for the PAMZ monitoring program. Training, as appropriate, is provided in the following areas:

- Management and Leadership Skills
- Total Quality Management Systems
- Quality Assurance and Quality Control Techniques and Procedures
- Analytical Techniques and Procedures
- Equipment Maintenance and Utilization
- Contractor's Policies and Procedures
- Workplace Hazardous Materials Information Systems (WHMIS)
- Transportation of Dangerous Goods (TDG)
- Safety
- First Aid
- H₂S Alive

9.2 Physical Location and Conditions

9.2.1 PAMZ Air Monitoring Rationalization Plan

PAMZ technical working group examined the modeling results of six studies conducted in the PAMZ region. The studies are summarized in Table 4.

Table 4. Summary of Modeling Studies in Region

Study	Parameters Modeled	Location of Highest Predicted Disposition
Husky	SO ₂ and Total Sulphur Deposition	- in the vicinity of Caroline fields - south/southeast of Husky Ram River
Shell	SO ₂ and Total Sulphur Deposition	- in the vicinity of Caroline fields - south/southeast of Husky Ram River
Shell	SO ₂ Modeling (1998)	- in the vicinity of Caroline fields - east of Husky Ram River
Shell	SO ₂ Modeling (1998)	- in the vicinity of Caroline fields
WCAS	SO ₂ and Total Sulphur Deposition	- Rocky Mountain House - Crossfield
WCAS	NO _x and Total Nitrogen Deposition	- northeast of Calgary

The results of the studies were compared with the location, availability and capabilities of current monitoring efforts. The first permanent station location was determined to be located in the Sundre/Caroline vicinity where it noted to be an area of higher predicted levels of sulphur dioxide.

The second location was determined to be located within the city of Red Deer. The site was deemed to be compatible with the provincial ambient monitoring network. The Red Deer location provided opportunities to investigate air quality concerns introduced with the large populated area with parts of the city situated in a river valley. It was further observed that the City of Red Deer is also adjacent to a major transportation corridor and near industrial sites.

The site for one of first portable monitoring units was determined to be in the Crossfield location for one quarter of every year. This location was identified by dispersion modeling as an area of high total nitrogen disposition and oxides of nitrogen.

PAMZ also has an extensive passive network consisting of approximately 32 passive monitors. The monitors are located in a grid system formation. The formation includes a passive monitor every three townships by three townships where possible given limited road access in parts of the zone. A 33rd passive station is operated at the Martha Kostuch Station primarily for data validation purposes.

The placement of the samplers also took into consideration common conditions for comparability. Items considered included the exposure to similar conditions, a location away from buildings or obstacles, a location free from local topographical influence, and also away from local emission sources.

PAMZ also worked with Alberta Environment and approval holders for the selection of the parameters that are monitored. Operating plans, sources of emissions, dispersion modeling, human and environmental health, and available

technology were also assessed to determine which parameters would be monitored.

9.2.2 Site Documentation

The Contractor is responsible to ensure Site Documentation records are kept and changes to siting of instrumentation is updated and distributed to the PAMZ Executive Director. Included in the site documentation will be a description of the physical location of the all environmental monitoring equipment and confirmation that this equipment is placed in conditions suitable to the operational requirements of the specific instrumentation. Any changes made that may influence the conditions surrounding the instrument and result in affecting the quality of the results of the instrument(s) must be monitored, recorded and mitigated. Should the quality of the instrument's results not reflect the ambient conditions and no feasible mitigation plan exist, a secondary site selection may be required to ensure accurate and representative results be collected. Updated site documentation is required for new monitoring locations for the portable stations as well as any new station brought on-line within the PAMZ program or if any equipment changes are made at the present monitoring locations.

9.2.3 Laboratory Facilities

The Contracted Laboratory is responsible to ensure that methodologies and procedures used in the handling, analysis and reporting of environmental monitoring data meets, or exceeds, the requirements outlined in the AMD and PAMZ. Standard operating procedures for the use, sampling handling, analysis and reporting of passive data have been developed by the Laboratory Contractor and must be adhered to throughout the sample handling procedure.

Additional details related to the collection, sampling handling, analysis and reporting can be found in Appendix B.

The Laboratory Contractor is responsible to review and update these SOPs as required to remain in compliance to the AMD and must also identify the person responsible for making the required updates. For additional information on the Laboratory Contractor's QA/QC Procedures please see Appendix D: *Maxxam Laboratory's QAP Summary and Air Related Standard Operating Procedures*.

PAMZ is responsible to ensure that the Laboratory Contractor is CAEAL Accredited and may ask for associated certification indicating services provided have been approved by the Canadian Association for Environmental Analytical

Laboratories. Additional information on this program can be found on the CAEAL website: <http://www.caeal.ca>.

Specific projects implemented by PAMZ, but without any required reporting to Alberta Environment are not required to complete the associated analysis by a CAEAL Accredited Laboratory. However, it is recommended that laboratories used to complete analysis for these specific projects have proven experience and are recognized by PAMZ as being credible in the scientific community. Preference may be given to laboratories with CAEAL Accreditation.

9.2.4 Data Processing and Storage

Data collected by all monitoring systems within the PAMZ is transferred and stored on the central data server. This server is currently located at the office of the contractor. All data processing for flagging, baseline correction and reporting is completed on this system at the contractor's office. Data and associated documents are stored on this computer and are backed up in reference to the Data Handling procedure.

9.3 Equipment

The Contractor is responsible for selecting acceptable sampling equipment that that is required to meet, or exceed, the environmental monitoring requirements as determined by PAMZ. The selected equipment and operation of this equipment will also meet the requirements of the AMD, as revised from time to time. The Contractor is also responsible to ensure that proper calibration equipment and methodologies are used to meet, or exceed, the performance requirements set forth by the manufacturer and/or the AMD.

The prevention of tampering or unauthorized adjustments to the instrumentation will be minimized through secured sites and only trained personnel maintaining, operating and calibrating the associated environmental monitoring equipment. It is the Contractor's responsibility to ensure only trained personnel maintain, operate and adjust the equipment used to complete the monitoring objectives of PAMZ. PAMZ is responsible to ensure that all stations/sites are reasonably secure to minimize the potential for harmful vandalism that may invalidate the environmental monitoring results.

The Contractor shall maintain and update (as required) an inventory of each station's equipment as well as records providing details on all of the equipment used to satisfy the air monitoring objectives of the PAMZ. These records shall include the following (as outlined in section 2.9.16 of the AMD (2006)):

- Unique identifiers for the equipment (manufacturer's name, equipment type, make and model number, serial number)
- Performance Certification of equipment indicating compliance to the requirements for environmental monitoring equipment
- Operating manual, or reference to the location of the equipment's operating manual
- Detailed calibration records for each piece of equipment requiring routine calibrations
- Maintenance plan and records of all routine and non-routine maintenance performed, or scheduled for the future
- Detailed records of any damage, malfunction, modification, or repair to the equipment (Service Reports)

Laboratory equipment and methodologies used by Contracted Laboratories will also meet the requirements outlined in the AMD. Supporting information and documentation may be requested from the Laboratory Contractor to ensure compliance to the details of this QAP and the AMD.



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10.0 Environmental Monitoring Methods

The Contractor is responsible to ensure that applicable environmental monitoring methods described in this QAP and the AMD (as amended) regarding environmental monitoring instrumentation are utilized in the operation and maintenance of the PAMZ instrumentation. Should changes to the PAMZ monitoring network be required to satisfy Approval details, these changes will be discussed and decided upon through the PAMZ Executive. It is the responsibility of the Contractor to ensure decisions made by the PAMZ Executive can be instated and to ensure instrumentation used to satisfy specific Approval requirements is well maintained and meets, or exceeds, the performance requirements outlined by the manufacturer, this document and the AMD (as amended).

It is the Contractor's responsibility to establish, maintain and implement documented procedures that accurately reflect all activities required for the environmental monitoring activities. If required, these procedures should provide additional details beyond those required in the AMD to ensure that the environmental monitoring instrumentation is operated consistently and correctly. The Contractor shall provide confirmation of the ability to properly use an environmental monitoring method validated by AENV prior to commencing the in-field sampling. Confirmation of this ability must be provided initially with the installation of the equipment as well as each time there is an instrument change, personnel change or method amendment. The Contractor shall not deviate from these authorized methods unless the change has been documented, has supporting technical documentation and has been authorized by the Director (AENV). All applied environmental methodologies shall be documented in the Contractor's QAP. The Contractor's QAP must adhere to the requirements of the AMD; specifically to those outlined in clause 2.9.25 (a) to 2.9.25 (r) and a copy must be available upon request to the Audit Team.

10.1 Methods Requiring Validation and AENV Authorization

Environmental monitoring methodologies that are not specified in the AMD (as amended) for a particular environmental monitoring activity need to be validated and authorized for use by Alberta Environment. The Contractor and PAMZ must utilize an environmental monitoring method that has been validated in accordance to details found in the *Method Validation* section in the AMD. The Contractor may utilize methods if they are found appropriate for use in the associated monitoring program, have been validated using validation protocols accepted by AENV and if authorization from AENV has been received for use of these methods. Should a new method be required, the Contractor needs to

provide at a minimum the following details to AENV in order to apply for written authorization for use:

- Specific purpose for the environmental monitoring method
- Any supporting documentation for use of the method in other jurisdictions, and preferably those that have been published by a recognized authority on air monitoring

11.0 Method Validation

Any non-standard methods, or methods used outside of their normal purpose require confirmation that they are suitable for use in the current situation where data will be reported to AENV. In order to validate a specific method for use, validation protocols specified in the AMD are required to be used. If no suitable validation protocol can be found; the Contractor must propose a validation protocol to Alberta Environment which must be authorized by the Director in writing prior to utilization of that proposed method validation protocol. The Contractor must also document the results obtained from the validation procedure, identify the procedure used to complete the validation process and provide a statement indicating if this method is suitable for its intended use.

12.0 Estimation of Uncertainty Measurement

Estimation of uncertainty relating to ambient air monitoring analyzers and sensors is calculated and documented by the systems manufacturer. These uncertainty estimates can be found in operations manuals for the instruments or sensors, or can be obtained by contacting the manufacturer directly.



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13.0 Calibration

Continuous Monitors

The purpose of multipoint calibrations for continuous pollutant analyzers is to verify the accuracy and linearity of the analyzer's response. The instrument is challenged using gasses with known concentrations and the instrument is adjusted to respond accurately to those concentrations. Gaseous parameter analyzers within PAMZ require four upscale concentrations for these calibrations and a zero reference. These multiple responses are used to prove the linearity of the instrument's response. The responses derived from the multiple responses are evaluated statistically and compared to criteria limits to determine if the analyzer is within specifications acceptable to AENV and PAMZ or not. Criteria limits are identified in Table 6 below. Routine calibrations of the air quality instruments will be performed upon initial installation and every month thereafter. With respect to the Portable Stations (Matha and McCoy) are calibrated upon installation and then again upon removal; the instruments located inside the David McCoy Station are also calibrated during the second month of monitoring. Meteorological systems will be calibrated upon initial installation and at annual intervals thereafter. Additional calibrations will be performed on an as-needed basis, such as in the event of equipment repair or replacement. All calibrations will be based on the guidance provided in the AMD, Appendix A and/or manufacturer's recommendations. PAMZ gaseous calibrations are performed monthly using NIST referenced EPA Protocol gas standards.

Gas analyzers are automatically challenged daily with zero and known span gas concentrations. The daily span gas checks are compared to the previous multipoint calibration reference to ensure there has been no change in the analyzer's response. Any changes in analyzer response can be readily identified in the daily data reviews in order to initiate an action plan to address the situation.

Calibration procedures applicable to the routine operation and maintenance of the particulate matter continuous analyzers (TEOM and MetOne BAM) are presented in the Primary Contractor's associated SOPs for these instruments.

Calibration methods and corresponding procedure reference for each of the air quality and meteorological parameters are summarized in Table 5. Calibration acceptance criteria are provided in Table 6.

All calibration results and all calibration and maintenance actions must be fully documented on the Contractor's instrument-specific digital calibration spreadsheets. These digital forms guide the field specialist through the

calibration steps and record all calibration values, make all calculations, and compare the calibration results to acceptance criteria. The forms provide immediate feedback of calibration results. Additional notes and explanations can also be entered on the forms. The forms are the primary documentation for each maintenance visit. Within 2 days of each site visit, the forms and any additional supplemental explanations are completed and stored at the contractor's central site. These forms are available to the Program Manager, Field Supervisor, Data Specialists and the PAMZ Executive Director at any time.

For additional details on the Contractor's associated SOPs, please refer to Appendix B of this document.

Table 5. Calibration Methods for the Monitored Parameters in the PAMZ Program

Measurement Variable	Calibration Method	SOP #
Ozone (O ₃)	Multipoint by UV photometer transfer standard (traceable to a NIST-certified primary standard)	Refer to Appendix B
Sulfur Dioxide (SO ₂)	Multipoint mass flow dilution of EPA Protocol gas or dilution of permeation device	Refer to Appendix B
Total Reduced Sulphur (TRS)	Multipoint mass flow dilution of EPA Protocol gas, or dilution of permeation device	Refer to Appendix B
Carbon Monoxide (CO)	Multipoint mass flow dilution of EPA Protocol gas	Refer to Appendix B
Nitrogen Dioxide (NO ₂)	Multipoint mass flow dilution of EPA Protocol gas and gas phase titration of ozone and NO for NO ₂ converter check	Refer to Appendix B
Particulate Matter (PM _{2.5})		Refer to Appendix B
Temperature	Water bath comparisons to a certified transfer standard or collocated comparisons to a certified transfer standard	Refer to Appendix B
Relative Humidity	Collocated comparisons to a certified transfer standard	Refer to Appendix B
Wind Direction	Alignment using two landmarks, orientation to true north, and linearity with a directional protractor	Refer to Appendix B
Wind Speed	Rotational rate at zero and three upscale speed levels using a selectable speed anemometer drive	Refer to Appendix B
Solar Radiation	Collocated comparisons to a certified transfer standard	Refer to Appendix B

Table 6. Calibration Acceptance Criteria in the PAMZ Program

Parameter	Calibration Method	Criteria	Calibration Acceptance Criteria
Gas Max difference	Gas primary or transfer standard (0 and 4 upscale points)	Max error	$\leq \pm 5.0\%$ at any designated point
Gas Average difference	Gas primary or transfer standard (0 and 4 upscale points)	Average error	$\leq \pm 5.0\%$ average of all points
Gas Slope (m)	Gas primary or transfer standard (0 and 4 upscale points)	Actual	$0.950 \leq m \leq 1.050$
Gas Intercept (b)	Gas primary or transfer standard (0 and 4 upscale points)	Actual	$\leq \pm 3.0$ ppb for NO_x and SO_2 $\leq \pm 0.3$ ppm for CO
Gas Correlation (r)	Gas primary or transfer standard (0 and 4 upscale points)	Actual	$r > 0.9950$
Data Acquisition System Time	Compare with GMT time	Max error	$\leq \pm 2$ minutes
Data Acquisition System Voltage	Known voltage inputs	Max error	$\leq \pm 0.003$ VDC
Meteorological Translator Cards	Compare with calibrated voltmeter	Max error	$\leq \pm 0.005$ VDC of designated zero value; and ≤ 7 0.1% of span
Temperature	Three water baths and certified thermometer (0°C, 20°C to 30°C, 30°C to 50°C) Or collocated transfer standard (non-immersible sensors)	Max error Max error	$\leq \pm 0.5^\circ\text{C}$ (RM Young) $\leq \pm 0.2^\circ\text{C}$ (Climatronics) $\leq \pm 1.0^\circ\text{C}$ (Rotronics/Vaisala)
Relative Humidity	RH sensor transfer standard	Max error	$\leq \pm 5.0\%$ RH error
Wind Speed	Compare to calibrated motor at 4 speeds	Max error	$\leq \pm 0.2$ m/s at < 5 m/s $\leq \pm 5.0\%$ at ≥ 5 m/s
Wind Speed Starting Threshold	Weighted torque disk	Max error	≤ 0.3 g-cm (RM Young) ≤ 0.2 g-cm (Climatronics)
Wind Direction Alignment	Solar azimuth, Precision compass, USGS map	Max error	$\leq \pm 5^\circ$ from true degrees at any designated point
Wind Direction Linearity	45° increment inputs	Max error	$\leq \pm 3^\circ$ at any designated point
Wind Direction Starting Threshold	Weighted torque disk	Max error	≤ 9 g-cm (RM Young) ≤ 6 g-cm (Climatronics)
Wetness	Add simulated water on sensor	Response	-5 to 5 DAS value dry 95 to 105 DAS value wet
Solar Radiation	Collocated transfer standard	Average error	$\leq \pm 5\%$

14.0 Calibration Records

It is the Contractor's responsibility to ensure calibration results are documented and retained. See Appendix B for details on calibration procedures and documentation.

These records are to include:

- specifics of the site where the instrument is located
- date, start time and end time
- specifics on the equipment being calibrated (serial number, make/model, operating test parameters, etc.)
- the calibration method used
- notes on any environmental conditions that were observed at the time of the calibration that may have influenced the results
- specifics on the calibration system and the reference used.
- calibration data referencing the data system used to report the data.
- evidence that the measurements are traceable

Should the Contractor subcontract the calibration procedures, documentation satisfying the requirements outlined in the AMD must be received by the Primary Contractor.

These records must be retained by the Contractor for a minimum period of three years. It is also required by AENV that access to these records be archived at the various ambient air monitoring stations; either electronically or in hardcopy.

15.0 Sampling Plan and Procedures

15.1 *Continuous Sampling Plan*

The PAMZ Technical Working Group (TWG) developed the air quality sampling plan for the PAMZ to help address issues and concerns raised by stakeholders. For a brief summary refer to 8.2.1 PAMZ Air Monitoring Rationalization Plan.

While the PAMZ Technical Group was charged with designing the Air Monitoring Program, it is PAMZ Executive Director that is responsible for both implementing and maintaining the plan.

The Contracting parties that perform the sampling and analysis have in place Standard Operational Procedures (SOPs) that detail the method for operation, analysis and/or action through prescribed techniques and steps. The SOPs

ensure consistent conformance with the AMD, and serve as a *ready* reference and documentation of proper procedures.

15.2 Passive Sampling Plan

The PAMZ Technical Working Group developed the passive sampling plan for PAMZ. The passive monitors were located using a grid system. The use of the grid system was used to reduce bias in site selection while providing a simple and cost effective method of locating the passive monitors. The grid locates a passive monitor every three townships by three townships where possible.

Similarly to the continuous monitoring plan, PAMZ Executive Director is responsible for implementing and maintaining the passive network plan.

The Contracting parties that perform the sampling and analysis have in place Standard Operational Procedures (SOPs) that detail the method for an operation, analysis or action through prescribed techniques and steps. The SOPs ensure consistent conformance with the AMD, and serve as a ready reference and documentation of proper procedures.

Passive sampling completed beyond the scope of the required reporting (non-routine) for PAMZ does not require procedural compliance to the AMD. However, it is recommended that methodologies and procedures be used in the collection of this data that are compliant to the AMD, to minimize potential questioning and doubt raised by not following standardized protocols used elsewhere in the Province. Non-validated procedures and methodologies may be used in the collection of non-routine sampling but supporting documentation should be available if asked to justify decision for the use of the non-validated procedure or method.



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16.0 Sample Handling

16.1 *Continuous Data*

Sampling handling methods for gaseous and meteorological data collection for the PAMZ program are discussed below:

- Gaseous and particulate monitoring data is collected and stored onsite and transferred automatically via cellular or land-line telephone modem from the analyzers to the Primary Contractor's Data Acquisition System; data values are then stored as digital files
- Meteorological monitoring data is collected and stored onsite and transferred automatically cellular or land-line via telephone modem from the sensors to the Primary Contractor's Data Acquisition System; data values are then stored as digital files

In the event of telephone line failure at a site, the field operator upon direction of the Program Manager or Technical Services Supervisor can visit the site to manually download the data.

16.2 *Intermittent/Laboratory Sample Handling*

Sample custody is an integral part of the laboratory contractor's operations. The Chain of Custody procedure, where sample and subsequent analysis may be employed in specific situations, such as legal proceedings, is as follows:

- sampler picks up the clean sample containers and insulated sealable travel containers, travel and method blanks, chain of custody (COC) form from laboratory contractor
- Upon collection of the samples, the sampler completes the COC including the company name, contact, sampler's name, date and time of collection, number of samples, types of samples and analysis required
- The sampler fills in "Relinquished By" on the COC form and dates it. If a courier or transport company is used a note to this should be made on the COC by the client and if possible a courier tracking number recorded
- Sealed samples are placed in the appropriate mailer (i.e. lock bag, lock box or sealable container), ensuring that the COC form is also included
- The sampler or courier delivers the sealed or locked mailers directly to the laboratory
- The Logistics Division will receive the sealed or locked mailers directly from the courier or sampler. laboratory contractor will inspect each seal on

- each individual sample, log the condition of each on the COC and store the samples in a locked fridge. A carbon copy of the COC form is given to the client and the original COC is retained by laboratory contractor
- Each technician signs for each sample in the COC log book when taking possession, performing the analysis and then returning each sample to the COC fridge for storage at the end of each day or when the analysis is complete
 - The COC form and copies from the log book will be included with the analytical results

16.3 Sampling Methodology

Three categories of sampling techniques are used in the PAMZ ambient air monitoring program. These are:

- Continuous gaseous and particulate parameter sampling,
- Continuous meteorological parameter sampling, and
- Passive Sampling

As the PAMZ program continues to expand and respond to both industrial requirements and public interest, these categories may change over time to include specific sampling programs developed and implemented by PAMZ.

Continuous Gaseous Parameter Sampling

Gaseous and particulate parameters monitored in the PAMZ region include: carbon monoxide (CO), inhalable particulates (PM_{2.5}), methane (CH₄), nitrogen oxides (NO_x), ground-level ozone (O₃), hydrogen sulphide (H₂S), sulphur dioxide (SO₂), total hydrocarbons (THC), and total reduced sulphides (TRS). The gaseous raw data is collected on a continuous basis (analyzer data polled every 2 seconds) and collected in an electronic database operated by the Contractor. In addition, the monitoring system at each trailer will have the ability to perform manual data downloads. This replication of data storage will ensure that if the data logger at a site fails, data will not be irretrievably lost. The portable monitoring units may be accessed less frequently due to the nature of their operation. The location of the portable unit may, in certain cases, not provide the ability for remote access. These units will therefore be accessed weekly by contract personnel.

Hourly and 5-minute average raw data is available on-line through the PAMZ website (<http://www.pamz.org>). Final data is also electronically submitted to the Clean Air Strategic Alliance (CASA) electronic data warehouse (www.casadata.org). Stored raw data is available as 1-minute, 5-minute and

hourly averages and/or rolling averages as well as maximums are provided for certain parameters.

Continuous Meteorological Parameter Sampling

Meteorological data is retrieved on a continuous basis from the various continuous monitoring stations within PAMZ. PAMZ presently monitors continuously for wind speed and wind direction, temperature, relative humidity, and global radiation. The monitoring system at each trailer will have the ability to perform manual data downloads. This replication of data storage will ensure that if the data logger at a site fails, data will not be irretrievably lost. The portable monitoring units will be accessed less frequently due to the nature of their operation. The location of the portable unit may, in certain cases, not provide the ability for remote access. Contract personnel will therefore access these units weekly.

Hourly and 5-minute average raw data is available on-line through the PAMZ website (<http://www.pamz.org>). Hourly average final data is also electronically submitted to the Clean Air Strategic Alliance (CASA) electronic data warehouse (www.casadata.org). Stored raw data is available as 1-minute, 5-minute and hourly averages and maximums and/or std dev (for some parameters).

Passive Sampling

Passive sampling in PAMZ consists of a Passive Monitoring Program. The sample collection periods are monthly and the monitored parameters include SO₂, NO₂, and O₃. Information collected through the program is posted by PAMZ on their webpage.

Further details on the sampling methodologies and collection procedures can be found in Appendix B.

17.0 Sample Acceptance Procedure

Quality control is both corrective and proactive in establishing techniques to prevent the generation of unacceptable data. Quality control is used to ensure that measurement uncertainty is maintained within acceptable range. Figure 4 describes the process of accepting routine data, which also includes implementing and evaluating QC activities.

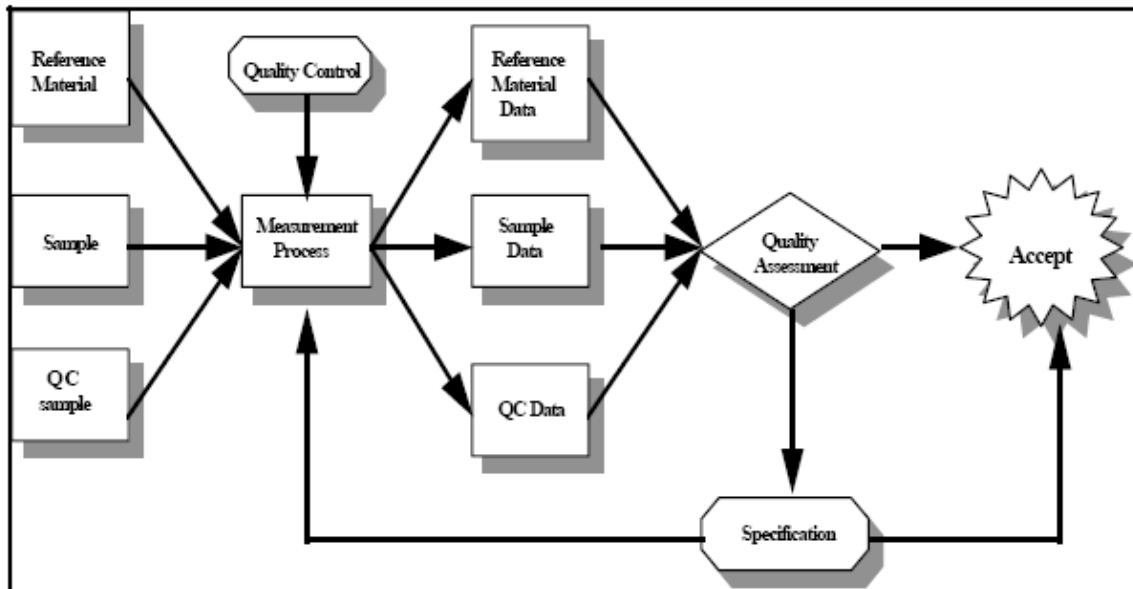


Figure 4. Flow Diagram of the Acceptance of Routine Data Values

Source: EPA Quality Assurance Handbook for Air Pollution Measurement Systems Vol II: Part 1

The Contractor is charged with the providing QA/QC'd accepted data. Continuous data is checked using a similar process all in house with the Contractor using the associated SOP.

Data received from the Contracted Laboratory(s) under goes a similar procedure however each Contractor involved has a different responsibility. Samples provided to the Laboratory are done so following a sample collection/handling procedure. This QA Sample is then delivered to the Contracted Laboratory for analysis. While in the Laboratory's control, the sample is handled and analyzed following the Lab's QA/QC procedures. When the analysis results are returned to the Contractor responsible for reporting, checks must be made on the supplied data to ensure that all QA/QC procedures have been followed and their results are verified. Providing no abnormalities occurred, the Primary Contractor then reports this information in the monthly report as QA/QC data. Should details be required on the QA/QC procedures implemented on the intermittent samples, all references can be provided regarding QA/QC procedures and results.

18.0 Reporting

18.1 Regular Reporting

PAMZ is authorized to submit monthly ambient air reports on the 15th of the second month following the month of reporting (eg: February's report is due by April 15). It is the responsibility of the Contractor to provide the PAMZ executive

director with a draft copy of the monthly report by the 20th day of the month following. This allows time for the Executive Director to review the report and have any changes completed prior to the required submission date. Annual reports are due by March 15, of the following year. It is the responsibility of the Contractor to complete the required annual reporting and provide the PAMZ Executive Director with a draft copy for review by February 20th. The annual report is then reviewed by the Executive director prior to the required submission date of March 15. The Annual Report must at minimum fulfill the requirements outlined in the AMD (as amended). It is also the responsibility of the Contractor to provide the PAMZ Executive Director with an annual summary report of data to be used in the PAMZ Stakeholders Annual General Report. The Contractor shall provide the requested information in an agreed upon format conducive to the objectives of PAMZ. This report is mailed to PAMZ members, is available on the PAMZ website and is provided to others on a request basis.

The Contractor is responsible to report data to Alberta Environment in a clear and concise manner. The report must present the data in an accurate and valid manner and should identify any data that did not pass the stated QA/QC requirements in the AMD. The monthly report may be presented to the government as a hardcopy or electronically. Should the data be submitted electronically, a copy is required on CD with all files in a read-write format to allow for further analysis by the Department. Future reporting activities may be completed on-line through the submission of formatted electronic files, it will be the responsibility of the PAMZ to ensure arrangements are made to satisfy this requirement when it is implemented within the Province of Alberta.

The Contractor is also responsible to submit continuous and passive data to the Clean Air Strategic Alliance (CASA) data warehouse (www.casadata.org). Data submissions must meet the required format for data submission, developed by CASA. Continuous data from the PAMZ network is reformatted to create a Continuous Data Electronic File (CDEF) which is sent to CASA on a monthly basis. Intermittent data collected from PAMZ is reformatted to create an Intermittent Data Electronic File (IDEF) prior to submission to CASA. The submitted files must undergo further electronic data checks implemented by CASA prior to posting of the data in an on-line public database. Errors discovered in the CDEF and IDEF files are communicated back to the Contractor for corrections prior to resubmission.

Additional details on the protocols for submission of data to the CASA Data Warehouse can be found in the Contractor's SOP for on-line data submission to CASA. A listing of the Primary Contractor's SOPs can be found Appendix B of this document.

The Contractor must ensure that monthly reports include all the specifics mentioned in Clauses 3.1.7(a) to 3.1.7(x) in the AMD (as amended); additional information may be required based upon the monitoring plan implemented by PAMZ and authorized by Alberta Environment.

18.2 Environmental Monitoring Results Obtained from Subcontractors

If the Primary Contractor subcontracts environmental monitoring and/or environmental reporting out to a third party, the subcontractor needs to be identified in the associated environmental reporting. The formats of the subcontractor's reports must be suitable to the requirements of the Primary Contractor. It is the responsibility of the Primary Contractor to ensure that any hired subcontractor(s) performing environmental monitoring work for PAMZ adhere to the requirements found in the AMD and this document.

18.3 Format of Reports

The Contractor is responsible to ensure environmental reports follow the requirements of the AMD (as amended). Should new environmental reporting exist without guidance in the AMD; the PAMZ and/or Contractor will propose a reporting format to be authorized for use in writing by the Director.

18.4 Amendment to Environmental Monitoring Results

In the event that an error in data previously reported to Alberta Environment and/or other central reporting databases, is discovered, it is the responsibility of the Contractor, or the discovering party, to inform the PAMZ Executive Director of the error. Corrective action procedures should be followed to correct the issue and to minimize future occurrences. Amendments to the data previous submitted can only be achieved if authorized by Alberta Environment, or anyone else acting on behalf of Alberta Environment. In the event that authorization is required for the submission of amended data, the Contractor will consult with Alberta Environment (or Representative) to seek approval for resubmission in an agreed upon format that satisfies the requirements found in the AMD (as amended). Should an entire report be required for resubmission, the amended report will be well identified as a re-submission and will also reference the original report that is amended.

18.5 Submissions of Environmental Monitoring Data and Reports

Environmental monitoring reports must all adhere to the requirements of the AMD (as amended) and may be submitted to the Department via regular mail, facsimile, e-mail, or by electronic file. The reports and data can be sent to the following addresses:

Director
Environmental Assurance
Environmental Monitoring and Evaluation Branch
Alberta Environment
12th floor, Oxbridge Place
9820 – 106th Street
Edmonton, Alberta
T5K 2J6
Facsimile: (780) 427-7958
E-Mail: air.report@gov.ab.ca

Emergency Reporting Hotline
1-800-222-6514
(780-422-4505 – Edmonton Local Number)



Appendix A

PAMZ Internal Standard Operating Procedures

SOP#PAMZ01 – Procedure for Completing Internal Station Audits

Parkland Airshed Management Zone

Title: Internal Station Audits Quality Assurance Plan Standard Operating Procedures (SOP)		
Procedure No.: PAMZ01	Effective Date: April 1, 2007	Page No.: 59

1. Introduction and Scope

PAMZ believes in keeping their employees and contractors exposed to minimal risk and working in environments acceptable for the type of task to be completed. Internal Station Audits are checks of the physical aspects of operation of an ambient air monitoring station, including possible safety issues and support systems which can affect equipment operation.

2. Principle of the Method

Station audits are conducted by the PAMZ designated Auditors. The station audits are performed annually at predetermined sites to ensure all stations within the PAMZ network are audited within a three (3) year time period. Frequent inspection of all aspects of station operations includes visual inspections of:

- Safety related aspects of the station.
- Condition of safety equipment
- Cleanliness of the facility
- Aesthetics
- Operation and cleanliness of the sampling system.
- Condition of scrubber systems
- Operation on non-gaseous samplers
- Operation of meteorological equipment.

A copy of the Station Audit Form is included in Appendix 1.

3. Description of the Procedure

During the Internal Station Audit the Auditor(s) inspect the station(s) and complete the Internal Station Audit Form. The station audit function is an independent check of the daily and weekly checks performed by the field technicians. The Station Audit form identifies issues pertaining to:

- Station status interior and exterior
- Manifold condition



- Operation of manifold pump
- Condition of sample lines
- Condition of scrubbers
- Condition of instrument vent screens
- Operation of non-gaseous samplers
- Condition of meteorological equipment
- Safe storage of compressed gas cylinders
- Condition of fire extinguisher
- Station security (locks, fences, etc.)
- Other safety issues (ladders, clutter, etc)

The Auditors also note other aspects of the station which might affect operations or safety. The process follows the procedures used by NAPS which are outlined on the NAPS Network Performance Audit Station Summary. The Performance Audit Station Summary covers the following issues:

- Are exterior samplers properly mounted?
- Are emergency phone numbers posted?
- Are cylinders properly anchored?
- Are monitors properly mounted and secured?
- Are electrical outlets and power cords safe?
- Is the exit unobstructed?
- Is the sampling manifold clean?
- Is the manifold pump properly installed and operative?
- Is a water trap in place?
- Are manifold ports properly situated to prevent water from entering monitors?
- Are spare ports capped?
- Are monitor sampling lines connected to the manifold?
- Are sampling lines clean?
- Are monitors properly exhausted from room or scrubbed?



Whenever changes occur that warrant the inclusion of more information or check points on the check sheet it is the responsibility of the Auditors to update the form.

Follow-ups to station audit issues are reviewed by the Contractor and the PAMZ Executive Director.

4. Requirements for Reporting Against the Procedure

- Station audit form identifies issues.
- Station audit form is forwarded to the Program Manager and the PAMZ Executive Director.
- Corrective actions are noted on the station audit form.
- Persistent issues are raised at the monthly PAMZ TWG meetings.

5. Other Requirements

Deficiencies or persistent issues are electronically posted.

6. Operational Requirements

- Instrument Technicians are advised of corrective actions requiring their attention.
- The Program Manager and the PAMZ Executive Director are advised of serious issues and ensure that corrective action is taken.
- Corrective actions taken or initiated are updated at monthly TWG meetings.

7. Applicable Documents

Instrument Manuals
PAMZ Quality Assurance Manual
PAMZ Internal Station Audit Form

8. Literature References

9. Revision History

Revision 0 (new document)



PAMZ Internal Station Audit Form

Internal Station Audit

**Ambient Air Monitoring Network
Inspection Checklist**



Location:
Date:
Time: Start
Finish

Conducted By:

Name	Company
Organization/Personnel	Date
PAMZ Representative	
Network Manager or Technician	
Regulatory Agency	

Recent Inspections:

Parameter	ACCEPTABLE	UNACCEPTABLE	NOT APPLICABLE	Comments
Compound Condition				
Grass height, Snow removal				
Garbage removal				
Dead leaves and other flammable substances removed				
Fence condition				
Trailer Exterior				
Exterior paint condition				
Exterior free of signs of ware or vandalism				
Antenna cables and connections free of damage due to normal wear, moisture, or animal activities				
Emergency contact information easily visible on the outside of the trailer or compound				
What information is posted?				
Continuous Monitors Sample Inlet				



Parameter	ACCEPTABLE	UNACCEPTABLE	NOT APPLICABLE	Comments
Height above ground (should be at least the shelter height + 0.5 meters or a minimum 3 meters)				
Elevation angle less than 30° from sample inlet to top of any nearby obstacles				
Wind instruments				
Height above ground greater than 2.5 times shelter height (10 meters minimum)				
Height greater than 2 meters above any nearby obstacles				
Uniform surroundings for 100 meter radius or distance from any obstacle is greater than 10 times the obstacle height				
Trailer Interior				
Cleanliness				
General state of repair				
Absent of signs of leaks				
Function of temperature controls				
List of site technicians and contact information posted at the station				
Sampling				
Condition of the sampling manifold				
Sampling lines as short as possible, free of excessive bends, and secure (gently tug on lines)				



Parameter	ACCEPTABLE	UNACCEPTABLE	NOT APPLICABLE	Comments
Records available of sampling line changes				
When was the most recent sampling line cleaning/change?				
Sample lines extend at least 3/4" into the manifold				
Spare manifold ports are capped				
A water and large particle knock-out trap is provided on the manifold inlet and is clean				
Particulate filters used on instrument sample inlets				
Records available of filter changes				
When were the filters last changed?				

Monitored Parameters:

Check that the correct parameters are being monitored for the appropriate station):

	WD	WS	TEMP	RH	SR	O ₃	CO	H ₂ S	NO ₂	NO _x	NO	SO ₂	CH ₄	TRS	THC	PM _{2.5}
Caroline	X	X	X	X	X	X			X	X	X	X	X	X		
Red Deer Riverside	X	X	X	X		X	X	X	X	X	X	X			X	X
Portable Unit #1	X	X	X	X		X			X	X	X	X		X	X	X
Portable Unit #2	X	X	X	X	X	X			X	X	X	X	X	X	X	X

Function Checks

Function checks recorded on each visit (abnormal noise, unstable baseline, drift, spiking, warning lights, etc.)				
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Zero and Span Checks



Parameter	ACCEPTABLE	UNACCEPTABLE	NOT APPLICABLE	Comments
Records available of the zero and span checks				
Frequency of zero and span checks on continuous air monitors?				
Scale of span checks?				
Checks commenced on the hour and total cycle less than an hour				
Records available of when the zero air purifier(s) were changed				
Calibrations				
Records available of calibrations				
Analyzer/Equipment	Make		Date last calibrated	
Wind Speed & Direction				
Relative Humidity				
Solar Radiation				
H ₂ S				
NO ₂ , NO _x , NO				
SO ₂				
O ₃				
THC				
PM _{2.5}				
TRS				
CO				
CH ₄				



Parameter	ACCEPTABLE	UNACCEPTABLE	NOT APPLICABLE	Comments
Data				
System in place to ensure back-up of data is completed				
Frequency of data back up?				
In case of loss of station communication, how many days worth of data can be stored?				
When was the backup battery last tested?				
Safety				
Fire extinguisher easily accessible, properly mounted, and protected from weather				
Extinguisher is at least 18 lb capacity				
Extinguisher fully charged				
Extinguisher inspected monthly				
Extinguisher re-certified yearly				
MSDS readily accessible for substances kept at the station				
Documentation				
Quality Assurance Plan available				
Station logbook available				
Station documentation as per AMD 1989 Appendix A-2				
Other Parameters and General Comments				



Corrective Actions:

Issue/Concern	Suggested Corrective Action	Accountability (Name & Company)	Date Due	Date Completed

Appendix B

Contractor's Air Quality Monitoring Standard Operating Procedures Manual

Table of Contents

Focus Standard Operating Procedures

Section 1.0 - Continuous Analyzers

Description	Make	Model	Procedure Number
SO2 Analyzer	TECO	43A, 43C	FAQP-1.001
H2S Analyzer	TECO	45A, 45C	FAQP-1.002
NOx Analyzer	TECO	42, 42C	FAQP-1.003
Ozone Analyzer	TECO/API	49, 49C/400A	FAQP-1.004
CO Analyzer	TECO	48, 48CTL	FAQP-1.005
THC Analyzer	TECO	51CL	FAQP-1.006
MNMHC		55C	FAQP-1.007
NH3 Analyzer	API	202A	FAQP-1.008
Ethylene Analyzer	Peak	PPI	FAQP-1.009
PM Analyzer	Met One	BAM 1020	FAQP-1.010
PM Analyzer	Grimm	1.105	FAQP-1.011
		1400A, 1400AB,	
PM Analyzer	R & P	1400AB FDMS	FAQP-1.012
PM Analyzer	Met One	E Sampler	FAQP-1.013
Carbon Particulate Monitor	R & P	5400	FAQP-1.014

Section 2.0 - Meteorological Systems

Description	Make	Model	Procedure Number
	Met One		
Wind Speed/Direction	Instruments	010/020 & 014/024	FAQP-2.001
	Met One		
Wind Speed/Direction	Instruments	50.5H	FAQP-2.002
Wind Speed/Direction	RM Young	5103/5305	FAQP-2.003
	Met One		
Relative Humidity	Instruments	083D	FAQP-2.004
	Met One		
Solar Radiation	Instruments	Various	FAQP-2.005
	Met One		
Ambient Temperature	Instruments	062A	FAQP-2.006
	Met One		
Precipitation Gauge	Instruments	Various	FAQP-2.007

Section 3.0 - Intermittent Samplers

Description	Make	Model	Procedure Number
	General Metal		
HiVol TSP	Works	not sure	FAQP-3.001
Partisol Plus	R & P	2025	FAQP-3.002
Passive Sampling (all parameters)	Maxxam	PASS	FAQP-3.003
Partisol Hub	R & P	2000H	FAQP-3.004
Partisol Satellite	R & P	2000S	FAQP-3.005
VOC Sampler	Xontech	910A	FAQP-3.006
	Environment		
VOC Sampler	Canada	3-04, 4-08, 4-11	FAQP-3.007
Sapphire	Thermo-Miran	XL	FAQP-3.008
PM	Met One	E-Bam	FAQP-3.009
Tedlar Bags	n/a	n/a	FAQP-3.010
	General Metal		
PUF Sampler	Works	PSI	FAQP-3.011
VAPS Sampler	URG	3000	FAQP-3.012

Section 4.0 - Data Systems

Description	Make	Model	Procedure Number
DACS	Titan Logix	AP1000	FAQP-4.001
DACS	Omron	unknown	FAQP-4.002
DACS	Campbell Scient	21X	FAQP-4.003
DACS	ESC	8816/8832	FAQP-4.004
Data Handling Procedures			FAQP-4.005

Section 5.0 - Support Systems

Description	Make	Model	Procedure Number
Air Dryer	Pure Gas	unknown	FAQP-5.001
Zero Air Generator	Focus	unknown	FAQP-5.002
Zero Air Generator	API	701	FAQP-5.003
	Environmental		
Auto Zero/Span	Devices	200	FAQP-5.004
	R & R		
Calibrator	Environmental	MFC201	FAQP-5.005
		1009-MC, 5008,	
Calibrator	Dasibi	5009-CP	FAQP-5.006
		70, 77, 79, 87,	
		100, 8020A,	
Digital Multimeter	Fluke	8022A	FAQP-5.007
Dilution Calibrator	Envionics	1600/1603	FAQP-5.008
Flow Transfer Standard	Streamline	unknown	FAQP-5.009
	Air		
	Liquide/Whatm		
Hydrogen Generator	an	H2 Flow 150/75-32	FAQP-5.010
Permeation Calibrator	VICI	Dynacalibrator	FAQP-5.011
Primary Flow Calibrator	BIOS	101865	FAQP-5.012
Primary Flow Calibrator	BIOS	DC-2M	FAQP-5.013
Thermal Oxidizer	CD Nova	CDN-101	FAQP-5.014
Ocilloscope	Various	Various	FAQP-5.015

Section 6.0 - Operational Procedures

Description	Make	Model	Procedure Number
Dilution Calibration			FAQP-6.001
Permeation Calibration			FAQP-6.002
Continuous data validation			FAQP-6.003
Monthly reporting			FAQP-6.004
Passive data validation			FAQP-6.005
Corrective Actions & Non conformance			FAQP-6.006
Procedures for Reporting & Investigating Non conformance			FAQP-6.007
Procedure for Internal Station Audit			FAQP-6.008
Procedure for System Audit	Barb-complete		FAQP-6.009
Intermittent data validation			FAQP-6.010

Other SOPs referenced in FOCUS QAP Documents:

SOP#FOCUS01 – Procedure for Completing Internal Station Audits

SOP#FOCUS02 – Procedure for Response to Exceedence Issue Involving FOCUS Data

SOP#FOCUS03: Quality Assurance Plan Documentation Revision/Updating Procedure



Appendix C

Laboratory Contractor's (Maxxam) QAP Summary and Air Related Standard Operating Procedures

The following information was provided as a summary of the QA/QC plans in place at Maxxam Analytics:

Quality Assurance Plan:

Below please find the principles Maxxam will employ to ensure quality standards are met and maintained:

Maxxam's Quality Policy:

“To provide analytical results and services that consistently meet our customers’ specified requirements through the implementation of a comprehensive quality management system”.

Maxxam Analytics’ Quality Assurance Program strives to ensure the accuracy and integrity of the data generated. In our continued effort to exceed our client's expectations, the managers of Maxxam Analytics have adopted a quality philosophy in all aspects of its operations. Its goal is to offer a personalized service to our customers while combining the highest quality analytical results in the shortest delay possible.

All management and analysts are aware of their responsibility in reporting reliable data reflecting the exact chemical composition of the sample analyzed and support this policy by providing adequate documentation on all quality control measures carried out during analyses. This quality policy is not to be compromised either by internal instruction or external pressure and, in all instances, is to be considered a very large priority of all employees at MAXXAM Analytics Inc. At Maxxam, we understand the importance of reliable, high-quality data.

Management of Quality Program

The Regional Quality Assurance Manager reports directly to the President and is responsible for all aspects of MAXXAM’s quality systems. These Regional Quality Assurance Manager are also responsible for supervising QA staff and the establishment, implementation, maintenance and improvements to the quality system. Quality Assurance staff in each region perform the following functions:

- Monitor and assess the performance of the QA system.
- Produce periodic QA reports for management. These reports form the basis for evaluation and improvement of the QA system.
- Liaise with customers, regulatory agencies, and others on QA matters.

QA staff has the authority to intervene in the analytical process by requiring reanalysis or suspending an analytical method in the event QA objectives are not met.

The team is comprised of members with technical expertise in a variety of technical disciplines and Quality practices. Team members have associations that include:

- Standards Council of Canada (SCC)
- Canadian Association for Environmental Analytical Laboratories (CAEAL)
- American Society for Quality (ASQ)
- Society of Quality Assurance (ASQ)
- Pharmaceutical Sciences Group (PSG)
- Association of Analytical Chemists (AOAC)

Laboratory Accreditation

Maxxam is accredited by the Standards Council of Canada (SCC) or the Canadian Association for Environmental Analytical Laboratories (CAEAL) to ISO 17025 guidelines for specific tests listed in the scope of accreditation approved by the SCC. The scope of accredited tests varies among Maxxam's facilities as a result of regional differences in method requirements. Current scopes for each laboratory are available on the SCC web site at www.scc.ca, or CAEAL at www.caeal.ca.

Some of our laboratory units also operate under the Good Laboratory Practices (FDA, OECD) and some of our QA personnel are trained in the implementation of GLP regulations. Maxxam also has experience in the ISO 9000 series registration.

Continuous Improvement

Laboratory Audits

Maxxam has a documented procedure that describes how internal and external audits are conducted. All regions have QA Coordinators who are responsible for planning, implementing, reporting and following-up on internal and external audits. Records of implementation and effectiveness are kept on file for a period of at least five years.

As part of the internal auditing program at some of our locations, senior staff are trained in the internal audit process and participate in it by auditing laboratory departments other than their own. Results of these internal audits are presented to analysts and supervisors/managers and are reviewed annually with senior management.

External Audits are regularly conducted for compliance to standards and registries. Examples include: International Standards Organization (ISO) 17025 and 9001, Canadian Association for Environmental Analytical Laboratories (CAEAL,) Canadian Food Inspection Agency (CFIA), Programme d'Accréditation des Laboratoires d'Analyse Environnementale (PALAE) and the Canadian Council of Ministers of the Environment (CCME.) Maxxam has always been very receptive to client audits, when requested, and responds to all concerns as a result of audits conducted.

Corrective/Preventive Action Reports

Maxxam has a quality procedure that defines the responsibility and procedure used to ensure that corrective and preventative actions are adequately determined/documented and carried out. Corrective/Preventative actions are promptly implemented and the customer is immediately notified of any nonconformance or of an ineffective control. This procedure also aids in identifying the need for change to analytical processes, business practices, and/or quality systems. It is the responsibility of the Operational or Technical Managers to ensure corrective actions have been properly identified, resolved and meet customer satisfaction. Quality Assurance is responsible for follow-up to ensure the correction has been effective.

Internal Performance Studies

Maxxam has implemented an internal intra-laboratory studies program (at some locations) to verify the analytical performance of various analyses. The program entails the analysis of "double blind" samples (the analyst is not aware that the sample is a control and of its concentration) prepared by the Quality Assurance Department and submitted to laboratory personnel to be processed as regular samples. Based on the results obtained, a series of corrective actions may be initiated to improve upon the present analytical procedures.

Quality Improvement Meetings

Quality Assurance members chair monthly Quality Improvement meetings at all locations with key staff from Sales, Operations and Customers. In these meetings, staff review non-conformances and identify trends that may need to be corrected and suggest opportunities for improvement. Status of corrective actions are reviewed and updated. This is also an information session where audit responses are reviewed and upcoming events such as training sessions, audits and round robins identified. Minutes of these meetings are recorded and distributed to Supervisors and Managers.

Internal Quality Tracking Processes

Quality Assurance Training

Laboratory personnel are trained in accordance with the requirements of regulatory standards. Maxxam also employs a program of continuous training for Analysts and QA staff. Training records are included in employment files for each employee and form an integral part of the staff evaluation process.

Standard Operating Procedures

At Maxxam Analytics Inc., the Quality Assurance staff ensures that all quality documentation is adequately controlled and identified by location code, SOP No., date of issue and Revision No. and reviewed for accuracy and conformity before release, approved by authorized persons, available where required and archived when obsolete. Maxxam uses Quality Systems International (QSI) software for the control, review and approval of all quality documentation.

Performance Studies

Performance is monitored through check sample, proficiency sample, blind sample and round robin sample analyses. Results are communicated to Operations with any nonconformance, resulting in the initiation of a service record. MAXXAM currently participates in external sample programs provided by the following organizations:

- Canadian Association of Environmental Analytical Laboratories (CAEAL)
- American Society for Testing and Materials (ASTM)
- Alberta Research Council (ARC)
- Canadian Food Inspection Agency (CFIA)
- Ministère de l'Environnement du Québec (MENV)
- Clinical Microbial Proficiency Testing (CMPT)
- Association of American Feed Control Officials (AFFCO)

In addition to participating in external round robins, MAXXAM has a unique internal assessment program. Quality Assurance staff prepares a series of unknown samples and distributes them to all Maxxam laboratories for analysis. This internal program includes both organic and inorganic analytical methods and acts as a check to ensure precision, accuracy and consistency throughout the company.

Instrument Log Books

At all stages of the analysis, the need to record information in a consistent and orderly manner is of prime importance to ensure the traceability and reliability of results. The objectives achieved in the introduction of a logbook/workbook system are to encourage and develop a sense of responsibility for the quality of data reported and to emphasize the importance of the analyst's function in the overall process of data generation. All the logbooks/workbooks used are coded by the Quality Assurance Department to ensure a record of logbooks in circulation.

Instrument Calibration, Testing and Maintenance

Maxxam Analytics Inc. has a quality procedure to ensure that measuring and test equipment are in a known state of calibration and maintenance such that valid measurements are obtained. The measuring and test equipment is calibrated using certified standards, where available, that are traceable to national standards. Maintenance of measuring and test equipment, where applicable, is carried out according to defined requirements described in the specific Standard Operating Procedures of the analysis method. All instrument maintenance, defined as anything done to the instrument in order to optimize its performance or any general cleaning activities, is recorded in a logbook.

Quality Assurance and Operations Managers are responsible for the evaluation of technical requirements for analyses produced to ensure that adequate measuring and test equipment is available and that the equipment has the measurement and testing capability (accuracy and precision), stability and range to perform the intended application.

The frequency of re-calibration and maintenance requirements is established by Technical Managers and Quality Assurance who take into consideration: purpose, usage, type of instrumentation, stability, past history, sample matrix, commercial guidelines and the experience of personnel using the equipment.

Method validation/authorization

Maxxam Analytics' ensures that the methods used are adequately validated and fit for purpose. The Managers ensure that the appropriate methodology has been selected and that all necessary method validation requirements are carried out. Method validation ensures that performance requirements for accuracy, precision, detection limits etc. are met.

Systematic Quality Assurance Activities

Control Charts

One important aspect of Maxxam's Quality Assurance program which is used to monitor and evaluate the quality of data generated by the laboratory are control charts. Quality Control requirements are described in individual Analytical Standard Operating Procedures. It is the responsibility of the analyst to ensure that these requirements are met before reporting sample results. Laboratory Managers and Supervisors are responsible for ensuring that analysts are trained and proficient and NO data is released prior to meeting quality control requirements. The control charts provide a summary of the performance of our methods and allow us to observe any variability in the process. The effectiveness of this procedure is monitored with internal and external audits.

Maxxam Analytics Inc. has a quality procedure to evaluate data quality and monitor effectiveness of the respective method. This procedure describes statistical techniques such as Relative Percent Difference, Percent Recovery, and Method Detection Limits. It also describes general control chart terms such as Upper and Lower Warning and Control Limits, Mean, and how to identify bias and trends. Control chart limits (established by Quality Assurance and Technical Managers) can be based on historical and on-going test method performance (statistically defined) or protocol defined control limits (+/-2 standard deviations).

Precision/Accuracy tracking

Precision and accuracy is evaluated by control charting of reference standards, reference materials, certified reference materials and other materials with appropriate traceability.

Effectiveness of established precision and accuracy required for analytical methods is achieved by participation in external round robins such as CAEAL, Internal Quality Assurance Robin Program and Internal Audits.

Laboratory Duplicates/Replicates

Maxxam Analytics conducts duplicates, as required, with method analysis. The frequency and criteria for duplicates is described in each analytical method. If clients have additional requirements for duplicate analysis this is noted at login and samples analyzed and reported to client specifications.

Document Identity	Release Date	Author	Status
EINDSOP-00148 / 1 : Monitoring NO ₂ in the Atm. by using All-Season Passive Samplers	3/16/2006	Linda Lin	Approved - Released
EINDSOP-00149 / 1 : Monitoring SO ₂ in the Atm. by using All-Season Passive Samplers	3/13/2006	Linda Lin	Approved - Released
EINDSOP-00150 / 1 : Monitoring H ₂ S in the Atm. by using All-Season Passive Samplers	3/22/2006	Linda Lin	Approved - Released
EINDSOP-00151 / 1 : Mass Determination of Particulate Matter (PM 2.5 and PM 10)	6/5/2006	Linda Lin	Approved - Released
EINDSOP-00154 / 1 : Analysis of Hydrogen Sulphide on Static Sample Strips	3/13/2006	Levi Manchak	Approved - Released
EINDSOP-00197 / 1 : Monitoring O ₃ in the Atmosphere by Using Maxxam All-Season Passive Samplers	3/3/2006	Linda Lin	Approved - Released