National Park Service
U.S. Department of the Interior

Air Resources Division

GASEOUS POLLUTANT MONITORING PROGRAM

QUALITY ASSURANCE PROJECT PLAN (QAPP)

October 2004

Prepared for the:

National Park Service
Air Resources Division
12795 West Alameda Parkway
Denver, CO 80228

Prepared by:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
Fax: 970-484-3423

A1 TITLE AND APPROVAL SHEET

QUALITY ASSURANCE PROJECT PLAN
FOR THE
NATIONAL PARK SERVICE
AIR RESOURCES DIVISION
GASEOUS POLLUTANT MONITORING PROGRAM

Approved by:

National Park Service, Air Resources Division Gaseous Pollutant Monitoring Program Program Manager, John Ray	Date
John D. Ray	10-15-04
National Park Service, Air Resources Division Air Quality Monitoring Specialist, David Maxwell	Date
	10/13/04
Air Resource Specialists, Inc. Program Manager, David Dietrich	Date
	10/13/04
Air Resource Specialists, Inc. Quality Assurance Manager, Gloria Mercer	Date

A PROJECT MANAGEMENT

This section describes project management for the National Park Service Gaseous Pollutant Monitoring Program (NPS GPMP), including project history and objectives, roles and responsibilities of the participants, and document disposition. This section includes the following subsections:

A1 Title and Approval Sheet
A2 Table of Contents
A3 Distribution List
A4 Project/Task Organization
A5 Problem Definition and Background
A6 Project/Task Description
A7 Quality Objectives and Criteria for Measurement Data
A8 Special Training Requirements/Certification
A9 Documentation and Records

The following guidance has been used in the development of this Quality Assurance Project Plan (QAPP):

- 40 CFR 50, Appendix D. *Measurement Principle and Calibration Procedure for the Measurement of Ozone in the Atmosphere*

- 40 CFR 58, Appendix A. *Quality Assurance Requirements for State and Local Air Monitoring Systems (SLAMS)*

- 40 CFR 58, Appendix B. *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)*

- *EPA Quality Assurance Handbook for Air Pollution Measurement Systems:*

- Volume I, Principles
  - Volume II, Ambient Air Specific Methods
  - Volume IV, Meteorological Measurement Systems

- *EPA On-Site Meteorological Program Guidance for Regulatory Modeling Applications*

- *EPA Guidance for Quality Assurance Project Plans (QAPPs)*

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A3 DISTRIBUTION LIST

The following individuals and/or organizations will receive copies of the approved Quality Assurance Project Plan (QAPP) and any subsequent revisions:

National Park Service Air Resources Division (NPS ARD)
John Ray, Gaseous Pollutant Monitoring Program, Program Manager
David Maxwell, Air Quality Monitoring Specialist

Air Resource Specialists, Inc. (ARS)
David Dietrich, Program Manager
John Faust, Network Operations Section Manager
Joe Adlhoch, Information Management Center (IMC) Section Manager
Gloria Mercer, Quality Assurance Manager*

US Environmental Protection Agency, Region VIII

* Indicates individual who will maintain the official, approved QAPP.

A4 PROJECT/TASK ORGANIZATION

The U.S. Department of the Interior, National Park Service, established and manages the Gaseous Pollutant Monitoring Program. Air Resource Specialists, Inc. (ARS) is the prime contractor for this monitoring effort. A project organizational chart is provided as Figure 1. Responsibilities of the key project participants are listed below.

Gaseous Pollutant Monitoring Program (GPMP) Program Manager – John Ray (NPS) directs the technical aspects of the Gaseous Pollutant Monitoring Program, including reviews of ARS performance, analyzing and approving data from the NPS GPMP, and reviewing and approving quality assurance procedures. He serves as the Contracting Officer's Technical Representative (COTR) for the program.

Air Quality Monitoring Specialist – David Maxwell (NPS) reviews data from the network and provides other support as directed by the GPMP program manager. He serves as the Contracting Officer's Representative (COR) for the program.

Program Manager – David Dietrich (ARS) is the primary point of contact between National Park Service Air Resources Division and Air Resource Specialists, Inc., and is responsible for all contracting activities, and for all project technical and fiscal reporting.

Quality Assurance Manager – Gloria Mercer (ARS) is responsible for management of all quality control and quality assurance activities for the program.

Network Operations Section Manager – John Faust (ARS) is responsible for coordinating field activities; semiannual site audit, maintenance, and calibration visits; field service visits; any necessary remedial repairs; and verifying all calibration standards.

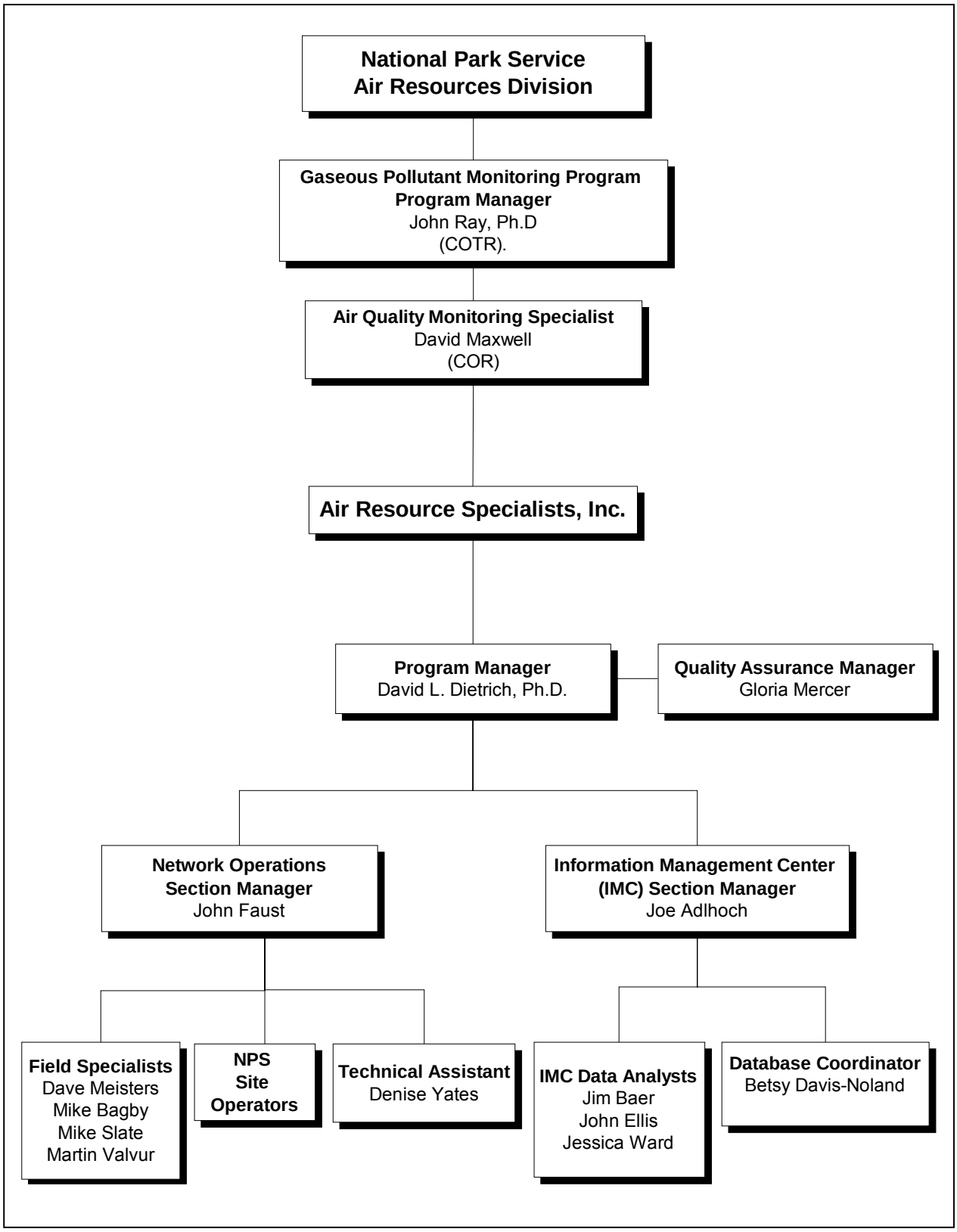

Figure 1. National Park Service Gaseous Pollutant Monitoring Program Organizational Chart.

Information Management Center (IMC) Section Manager – Joe Adlhoch (ARS) is responsible for management and direction of all data collection, reduction, validation, archiving, and reporting activities.

Field Specialists – Dave Meisters, Mike Bagby, Mike Slate, and Martin Valvur (ARS) are responsible for daily reviews of network operations, site audit, maintenance, and calibration visits, assisting site operators with troubleshooting activities, and performing or managing all equipment laboratory repairs, calibrations, and preventive maintenance.

NPS Site Operator(s) – NPS staff at individual national parks will service and maintain the monitoring sites. They are responsible for routine operation of the monitoring equipment and field documentation of all collected data.

Technical Assistant – Denise Yates (ARS) is responsible for maintaining the network equipment inventory, project Web page, and for compiling and distributing weekly and quarterly technical progress reports and monthly financial reports.

IMC Data Analysts – Jim Baer, John Ellis, and Jessica Ward (ARS) are responsible for daily data retrieval activities; identification and communication of operational problems to the network operations section manager; and data validation, data archive, and data reporting.

Database Coordinator – Elizabeth Davis-Noland (ARS) is responsible for all components of the project database.

Additional technical and administrative support personnel may be used as necessary upon direction of the ARS program manager.

A5 PROBLEM DEFINITION AND BACKGROUND

The primary objective of the Gaseous Pollutant Monitoring Program is to measure existing levels of air pollution in National Park Service units. This objective is mandated by the Clean Air Act of 1963 (including the 1970, 1977, and 1990 amendments) and the Organic Act of 1916, which assign the Federal Land Managers the responsibility of protecting the natural resources in national parks. Data on the concentrations of air pollutants in the parks are needed to support the permit review, biological effects, and research functions of the Air Resources Division and to assist parks in evaluating their resource management needs. Accordingly, the Air Resources Division (ARD) has established a network of stations to monitor ozone (O_3), sulfur dioxide (SO_2), carbon monoxide (CO), oxides of nitrogen (NO_x), and meteorological conditions in the parks. This QAPP specifically addresses these longer-term trend GPMP monitoring sites. Note that the NPS ARD also conducts shorter-term air quality monitoring including passive ozone, portable ozone, and special studies monitoring in selected parks. In addition, ARD cooperates with other national and state programs that monitor ambient gases, meteorology, deposition chemistry, particulate matter, ultraviolet radiation, and visibility. The operational protocols for these unique sites are not included in this QAPP. The GPMP monitoring sites in each park are selected to represent the air within the park. Other monitoring objectives of the network are to:

- Establish existing, or baseline, concentrations in NPS units;
- Assess trends in air quality in NPS units;
- Judge compliance with national air quality standards;
- Assist in the development and revision of national and regional air pollution control policies for rural areas;
- Provide data for national and regional pollution control policies;
- Provide data for atmospheric model development and evaluation; and
- Identify those air pollutants with the potential to injure or damage park biological resources, monitor these pollutants, and correlate measurable effects to these resources to existing ambient levels of these pollutants.

These objectives are the foundation of a network design in accordance with the EPA regulations of 40 CFR, Part 58, Appendix D, which, although addressing primarily health-effects based monitoring in areas of high population, are generally pertinent to the Gaseous Pollutant Monitoring Program. A map showing the GPMP-specific monitoring station locations is provided as Figure 2. Table 1 lists the specific GPMP parameters monitored at each site.

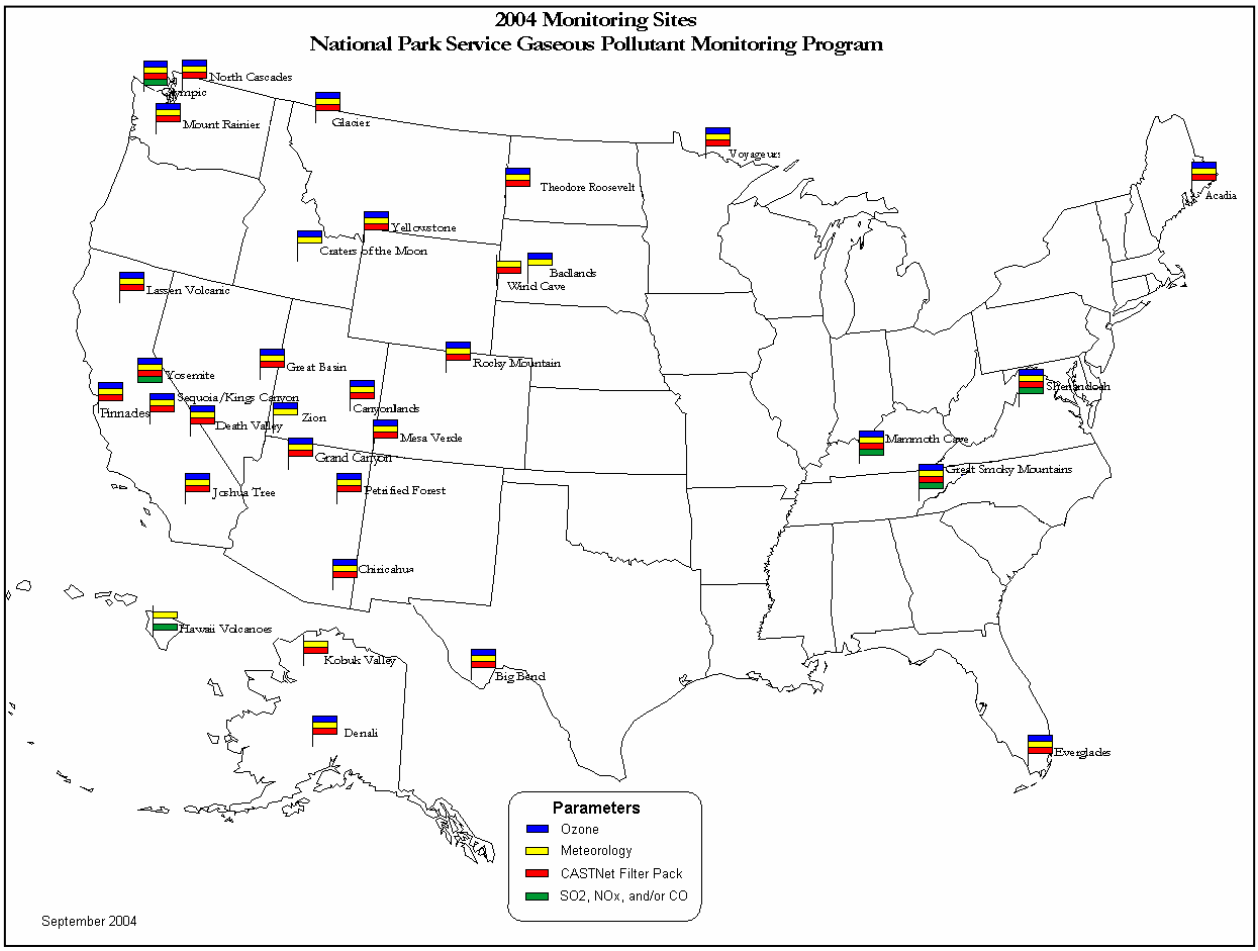

Figure 2. National Park Service Gaseous Pollutant Monitoring Program Monitoring Locations.

Table 1. National Park Service Gaseous Pollutant Monitoring Program Monitoring Sites and Parameters Measured.

Site Operating Information		Pollutant Analyzers					Meteorological Sensors						
Site Name and Abbreviation		O_3	SO_2	NO_x	CO	CASTNet	WS/WD	TMP	SOL	PPT	DTP	RH	W
Acadia NP	ACAD	X				X	X	X	X	X	X	X	X
Badlands NP	BADL	X					X	X	X	X		X	
Big Bend NP	BIBE	X				X	X	X	X	X	X	X	X
Canyonlands NP	CANY	X				X	X	X	X	X	X	X	X
Chiricahua NM	CHIR	X				X	X	X	X	X	X	X	X
Craters of the Moon NM	CRMO	X					X	X	X	X			
Death Valley NP	DEVA	X				X	X	X	X	X	X	X	X
Denali NP and Preserve	DENA	X				X	X	X	X	X	X	X	X
Everglades NP	EVER	X				X	X	X	X	X	X	X	X
Glacier NP	GLAC	X				X	X	X	X	X	X	X	X
Grand Canyon NP	GRCA	X				X	X	X	X	X	X	X	X
Great Basin NP	GRBA	X				X	X	X	X	X	X	X	X
Great Smoky Mountains NP	GRSM												
Cades Cove	-CC	X					X	X	X	X		X	
Clingmans Dome	-CD	X					X	X	X	X		X	
Cove Mountain	-CM	X	X	X	X		X	X	X	X		X	
Look Rock	-LR	X				X	X	X	X	X	X	X	X
Hawaii Volcanoes NP	HAVO												
Visitors Center	-VC		X				X	X	X	X		X	
Observatory	-OB		X				X	X		X		X	
Joshua Tree NP	JOTR	X				X	X	X	X	X	X	X	X
Kobuk Valley NP	KOVA					X	X	X	X	X	X	X	X
Lassen Volcanic NP	LAVO	X				X	X	X	X	X	X	X	X
Mammoth Cave NP	MACA	X	X	X	X	X	X	X	X	X	X	X	X
Mesa Verde NP	MEVA	X				X	X	X	X	X	X	X	X
Mount Rainier NP	MORA	X				X	X	X	X	X	X	X	X
North Cascades NP	NOCA	X				X	X	X	X	X	X	X	X
Olympic NP	OLYM	X	X			X	X	X	X	X	X	X	X
Petrified Forest NP	PEFO	X				X	X	X	X	X	X	X	X
Pinnacles NM	PINN	X				X	X	X	X	X	X	X	X
Rocky Mountain NP	ROMO	X				X	X	X	X	X	X	X	X
Sequoia/Kings Canyon NP	SEKI												
Ash Mountain	-AM	X					X	X		X		X	
Lower Kaweah	-LK	X					X	X	X	X		X	
Lookout Point	-LP	X				X	X	X	X	X	X	X	X
Shenandoah NP	SHEN	X	X			X	X	X	X	X	X	X	X
Theodore Roosevelt NP	THRO	X				X	X	X	X	X	X	X	X
Voyageurs NP	VOYA	X				X	X	X	X	X	X	X	X
Wind Cave NP	WICA					X	X	X	X	X	X	X	X
Yellowstone NP	YELL	X				X	X	X	X	X	X	X	X
Yosemite NP	YOSE												
Turtleback Dome	-TD	X				X	X	X	X	X	X	X	X
Merced River	-MR	X		X	X		X	X	X	X		X	
Zion NP	ZION	X					X	X	X	X		X	

Monitoring Site Names
NP - National Park
NM - National Monument

Pollutant Analyzers
O_3 - Ozone
SO_2 - Sulfur Dioxide
NO_2 - Oxides of Nitrogen Analyzer
CO - Carbon Monoxide
CASTNet - Dry Deposition Filter Pack

Meteorological Sensors
WS/WD - Wind Speed / Wind Direction
TMP - Temperature
SOL - Solar Radiation
PPT - Precipitation
DTP - Delta Temperature
RH - Relative Humidity
W - Wetness
X - Installed and operational as of September 2004

A6 PROJECT/TASK DESCRIPTION

A6.1 Description of Work

Work performed for the program has been divided into six (6) tasks as detailed below:

1) Equipment Procurement and Inventory – Prior to installation in the field, ARS will be responsible for acquiring all necessary monitoring equipment. Upon receipt, equipment will be assembled in the ARS air quality laboratory and tested to ensure proper operation. All site-specific equipment inventories will be maintained by ARS.

2) Site Selection and Installation – ARS will work in conjunction with the National Park Service to select appropriate monitoring sites and coordinate the installation of necessary utilities. After monitoring equipment is tested in the ARS air quality laboratory, it will be installed at the monitoring locations, calibrated, and data collection will begin.

3) Routine Operations – All routine on-site servicing operations will be performed by NPS site operator(s) on a weekly basis. NPS staff have received training on equipment operation, maintenance, and data collection/documentation, including the use of DataView (ambient air quality monitoring station management software utilized by the GPMP network). ARS field specialists will review the operational status of the network daily, including data quality assurance indicators (zeros, spans, and precision), provide site operator technical support, initiate corrective actions to address any identified inconsistency, and perform any required remedial maintenance on all program monitoring instrumentation and support equipment.

4) Audits, Maintenance, and Calibrations – ARS field specialists will be responsible for semiannual on-site internal performance audits, maintenance, and calibrations of all gaseous and meteorological monitoring equipment systems. The results of all audit and calibration visits are posted to the GPMP project Web site.

5) Data Management and Reporting – The IMC data analysts will retrieve gaseous and meteorological data and system documentation from the monitoring systems by telephone modem each day. The data analysts and the field specialist (assigned technician-of-the-week) will independently review the incoming data to verify proper operation of the monitoring systems. Suspected instrument malfunctions will be investigated immediately and corrective actions will be implemented. All digital files include validated data, associated validity codes, and quality assurance references. All raw and validated data will be archived in the program database and on CD-ROM. All validated data are also uploaded monthly to the EPA national Air Quality System (AQS) database and to the NPS Data Retrieval Web page.

6) Program Management and Administration – Coordination of overall project management and reporting requirements will be performed by the network operations section manager, IMC section manager, and ARS program manager. Weekly e-mail progress reports will be sent to the GPMP program manager and NPS air quality monitoring specialist, and the ARS program staff. Quarterly contract status reports and annual data reports will be sent to the GPMP program manager and NPS air quality monitoring

specialist, the ARS program manager, the network operations section manager, the IMC section manager, site operators, and park air quality supervisors. In addition, each of these reports, along with a variety of other network documentation, will be posted on the GPMP project Web site.

A6.2 Measurements

The gaseous and meteorological parameters measured by the NPS Gaseous Pollutant Monitoring Program are listed below:

Gaseous — Ozone, sulfur dioxide, carbon monoxide, and oxides of nitrogen data will be reduced to yield a quality assured digital data set of 1-hour averages. Prescribed monitoring data reduction and analysis protocols will be applied. Monthly plots of all gaseous parameters will be supplemented with data summary tables, stackplots, and pollutant rose plots.

Meteorology — Ambient temperature, delta temperature, relative humidity, wind speed, wind direction, precipitation, wetness, solar radiation, and barometric pressure data will be reduced to yield a quality assured digital data set of 1-hour averages. Prescribed monitoring data reduction and analysis protocols will be applied. Monthly plots of all meteorological parameters will be supplemented with data summary tables, stackplots, and wind rose plots.

A6.3 Schedule

The Gaseous Pollutant Monitoring Program schedule is presented in Table 2.

Table 2. Gaseous Pollutant Monitoring Program Project Schedule.

Task Description	Due Date
Data Collection	Ongoing
Weekly Progress Reports	Weekly – the Tuesday following the week of record
Monthly Data Reports	Monthly – within 45 days of the end of each calendar month (includes e-mail distribution of report and data upload to the NPS Data Retrieval Web site)
Monthly EPA AQS data uploads	Monthly – within 60 days of the end of each calendar month
Quarterly Contract Status Reports	Quarterly - within 15 days of the end of each calendar quarter
Annual Data Report	Annually – within 6 months of the end of the calendar year
Audits, Maintenance, and Calibration	Weekly inspection by on-site operator
	Semiannual internal performance audits, preventive maintenance, and calibrations of gaseous and meteorological systems performed by field specialists at six-month intervals
	Site visit reports are due within 30 days of a site visit
	External audits of gaseous and/or meteorological instruments may be conducted by an independent auditor at any time
Data Archive	Continuous

A6.4 Reporting Requirements

Reporting requirements for the program are summarized above in the project schedule. In general, the reports will include:

- Progress Reports:
  - Pending network issues
  - Site status board entries
  - Site visitation schedule
  - Reporting and data requests
  - Pending contract information

- Data Reports:
  - Summary tables and plots of data collected during the monitoring period
  - Data comparisons with national and state standards
  - Calibration and/or audit results
  - Data collection statistics for raw and validated data
  - Data precision statistics
  - Data upload to NPS Data Retrieval Web site
  - CD of raw and validated data
  - Data uploads to EPA AQS and NPS Data Request Web site

- Site Visit Reports:
  - Internal performance audit results
  - Summary of parameter maintenance
  - Notes and observations
  - Completed calibration forms

A6.5 Disaster Recovery and Data Backup Plan

The ARS computer system has comprehensive protection and levels of security to protect against external and internal attacks. The security systems are under continuous review and upgrade to meet changes in technology. To be fully prepared in the event of a natural disaster or malicious attack, ARS developed and currently maintains a clearly defined disaster recovery plan to ensure recovery from catastrophic computer system failure. Details of this plan are summarized below.

Raw Data Acquisition - In the event of a network file server failure, each IMC workstation is configured for stand-alone data collection. Daily automated data polls and auxiliary data acquisition can be made from any workstation. ARS owns several laptop computers with similar software on-board and network sites can be called from off-site locations if necessary.

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:

- Nightly tapes Monday through Friday
- Each Friday tape is stored off-site for 6 weeks
- Each month-end tape is stored off-site and is never overwritten

The procedure is industry standard to ensure the level of integrity necessary for recovering from a significant computer or disk failure.

Database Recovery - Database tables are backed up each night after the database is automatically downed for a 'cold archive' ensuring synchronization of all tables and fail-safe recovery. The raw, ASCII data files collected from the sites during each daily data acquisition step are written quarterly to two writable CDs for off-site storage at NPS ARD and off-site ARS facilities in Fort Collins. Should the ARS computer system fail or the database files become corrupted, any of these system backups can be used.

Computer Hardware Maintenance Support - ARS maintains extended warranty service for up to 3 years on all file servers with on-site service within 24 hours. Beyond the 3-year coverage, ARS relies on long-standing relationships with reliable vendors for fast response in parts replacement. ARS' computer staff is experienced in on-site hardware maintenance.

Facilities - In the event a catastrophic event destroys or disables ARS offices and the IMC (such as flood or fire), it will be necessary to expediently reestablish operations. ARS has established strong working relationships with office equipment suppliers, computer suppliers, and office space owners, and has a sound credit rating. Available lines of credit are in-place so that office space, equipment, and computers can be leased or purchased quickly. In addition, insurance to cover catastrophic events allows the company to quickly reestablish operations at ARS' current offices or an alternate location. Hardcopy site documentation could be destroyed in a catastrophic event. This documentation could be retrieved directly from monitoring sites that keep long-term records.

Personnel - Although the GPMP contract represents a very important part of the ARS workload, as least 25 other employees at ARS have similar backgrounds and expertise. ARS sufficiently cross-trains employees to ensure complete coverage of work even under normal operating schedules of vacation, sick leave, holiday, and extended leave. ARS collects data from over 100 air quality stations daily and has a consistent record of service to clients.

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

A7.1 Data Quality Objectives

The minimum valid data recovery objective for the program is greater than 75% for all gaseous and meteorological data per calendar quarter (or all possible hours during the operational season). Automatic zeros and spans are performed daily on most ambient gas analyzers; data lost during calibrations, maintenance, and audits are considered invalid. As a result, the maximum percent valid for ambient gas data typically cannot be greater than 95.8%.

A7.2 Criteria for Measurement Data

A7.2.1 Measured Parameters

Table 3 presents sampling specifications for each parameter. Each parameter has specific measurement performance criteria.

Gaseous — Gaseous data must be collected in accordance with EPA equivalent method or primary standard protocols. Detailed discussions of gaseous measurement performance criteria are presented in SOP 3100, *Calibration of Ambient Air Quality Analyzers.*

Meteorology — Detailed discussions are presented in SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems.*

Table 3. Gaseous Pollutant Monitoring Program Sensor and Sampling Specifications.

Parameter	Sensor	Units	Sample Frequency	Notes
Ozone	Monitor Labs 8810 Dasibi 1003-AH Dasibi 1003-PC TEI 49 and 49C API Model 400 Series	ppb	1-second samples hourly average O_3 concentrations	
Sulfur Dioxide	TEI 43C TEI 43TL	ppb	1-second samples; hourly average SO_2 concentrations	
Carbon Monoxide	TEI 48C	ppm	1-second samples; hourly average CO concentrations	
Oxides of Nitrogen	TEI 42C	ppb	1-second samples; hourly average NO, NO_2 and NO_X concentrations	
Ambient Air Temperature	RM Young Climatronics Rotronics MP-101A Vaisala HMP 45C	°C	1-second samples; hourly averages	Sensors in motor aspirated radiation shield
Delta Temperature	RM Young Climatronics	°C	1-second samples; hourly averages	Sensors in motor aspirated radiation shield
Ambient Relative Humidity	Rotronics MP-101A Rotronics MP-601A Vaisala HMP45AC	%	1-second samples; hourly averages	Sensor in motor aspirated radiation shield
Wind Speed	Climatronics F460 RM Young #05305	m/s	1-second samples; hourly averages	
Wind Direction	Climatronics F460 RM Young #05305	degrees true	1-second samples; hourly averages	
Standard Deviation of Wind Direction	Climatronics F460 RM Young #05305	degrees	Calculated using Ymartino method	Datalogger calculated
Precipitation	Climatronics 100097-1-90	mm	Hourly total	
Wetness	RM Young	%	Hourly total	
Solar Radiation	RM Young	Watts/meter^2	1-second samples; hourly averages	
Barometric Pressure	Climatronics Vaisala	mmHg	1-second samples; hourly averages	

A7.2.2 Data Collection System

All data are captured on-site by a data collection system (DCS). A typical DCS configuration in the GPMP network is represented in Figure 3 and consist of a datalogger, telephone and modems, DataView computer, printer, and supporting hardware. The primary datalogger used in the network is the ESC 8816. Several sites with power restrictions apply Campbell 21X or 23X dataloggers.

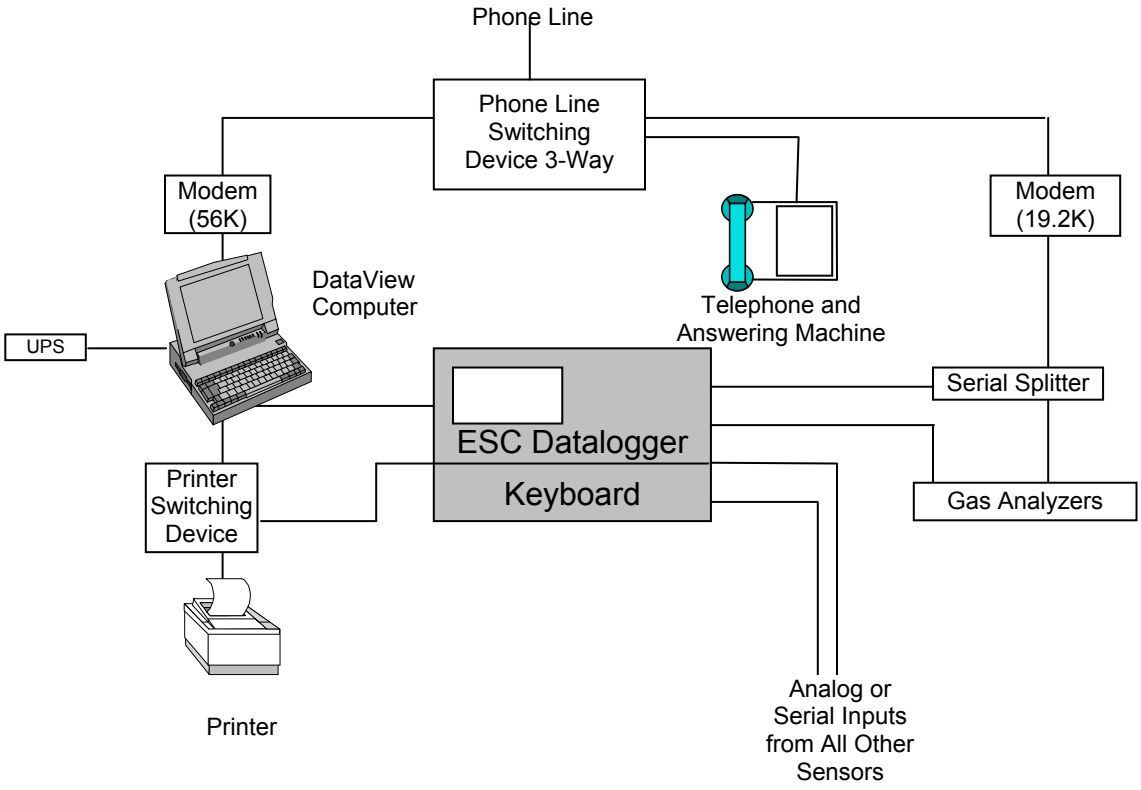

Figure 3. Typical NPS Data Collection System Configuration

Telephone modems provide a remote link to the sites for data and documentation collection and operational status assessment. The DataView system is comprised of a laptop computer, supporting hardware, and a comprehensive suite of software tools for reviewing air quality data and documenting operations at air quality monitoring sites. DataView supplements (but is independent of) the datalogger and helps ensure high quality network operations and data by performing the following functions:

- DataView provides the station operator with a "window to air quality" that offers a rich, windows-based graphic environment to review current and recent past air quality data, guides the operator through calibration, maintenance, operation, and troubleshooting procedures, and serves as the primary on-site quality assurance documentation archive.

- The DataView computers are easy to use. The screens and displays are clear and concise. The Checklist Instructions on DataView that guide the operator through

weekly site visits are specifically configured for the instruments installed at each site. Changes to DataView can be remotely uploaded to accommodate any changes to monitoring instrument manufacturers or station configurations.

- Operator station visit documentation (including calibration results, log notes, etc.), is entered into DataView and the Information Management Center (IMC) downloads this information daily by telephone modem. The site operator has the option to print hardcopies of the computer screens; however, there is no regular exchange of paperwork from the site operator to the IMC. In the event of computer failure, hardcopy backup forms identical to the DataView screens are available on-site to be completed by the operator and faxed to the IMC.

- DataView screens and displays are programmed to include site-specific defaults (i.e., date, time, site name), calculation routines, comparisons with past data, and other algorithms that will help ensure the most efficient and complete site documentation. Based on collected data, programs will automatically post messages, flags, or alarms on the computer screen to inform the operator of issues that require action.

- Hardcopy strip charts and handwritten log sheets and forms of continuous gas analyzer data are no longer required for data validation. If the diagnostic parameters indicate a problem, the IMC can remotely log on to DataView and/or the datalogger to review electronic strip charts and individual data points to help and resolve problems. Selected data or plots resident on DataView will be downloaded by the IMC to document and evaluate problems.

- The DataView computer is capable of storing a minimum of three months of continuous gas analyzer data (1-minute data) and three months of hourly data for all parameters. This information will be used to support on-site data displays and remote access for validation, troubleshooting, or emergency data recovery.

- DataView contains digital versions of all appropriate SOPs, TIs, and Checklist Instructions as a ready reference to assist with operation guidance, troubleshooting, and refresher training.

The specifics of DataView applications are described in the Introduction to DataView and the related Checklist Instructions.

A7.3 Data Quality Indicators

A7.3.1 Precision

A precision check will be performed by challenging each pollutant analyzer with a known concentration of gas (18% of instrument, full scale) from the on-site gas dilution calibrator or transfer standard. The percent difference between the analyzer and the input concentration is then calculated as:

$$Percent\ \ difference = \frac{analyzer\ response - input\ concentration}{input\ concentration} x100$$

The pollutant analyzer must respond within 10% of the input concentration. To meet EPA criteria a successful precision check must be completed at least every 14 days of operation. The majority of GPMP monitoring stations will perform precision checks daily. At some sites, due to configuration limitations, precision checks will be performed once per week.

A7.3.2 Accuracy

The accuracy of field measurements will be determined by challenging an instrument with a known concentration of gas from a source other than the on-site calibrator. This source must be traceable to NIST (National Institute of Standards and Technology) standards. ARS maintains documentation of NIST-traceability for all applicable equipment and monitoring standards. The accuracy checks on all systems occur during the semiannual ARS audit, maintenance, and calibration visits or during an independent performance audit.

A8 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

ARS staff working on this project are experienced in ambient air quality and meteorological monitoring systems. Field specialists will be required to undergo tower training by a certified instructor (ARS' fall protection safety plan manager) and First Aid/CPR certification, which will occur annually by an independent instructor. These certifications must be kept current. Certifications will be maintained in the employee's personnel file. The ARS network operations section manager will be responsible for verifying all staff members are fully informed on the specific monitoring and data management configurations for this program. Staff will be informed/trained on a one-to-one basis. NPS site operators will be trained on-site by ARS field staff.

A9 DOCUMENTATION AND RECORDS

All hardcopy records, digital data, DataView documentation, and other documents for the current and previous monitoring years will reside in the IMC database and archive files. The preceding five years of hardcopy records will be housed in an off-site storage facility. The following types of documentation and records will be used in the program:

- Field documentation, including log sheets, daily summaries, audit results, calibration results, quality control checks, and records of procedures and maintenance performed.

- Project data (raw and validated) will reside in the IMC database and will be available for use during the life of the project. All raw data will be archived on CD-ROM quarterly and delivered to the National Park Service Air Resources Division. Validated data will also be uploaded to the NPS Data Retrieval Web site and EPA AQS database for public access and archive.

- A disaster recovery and data backup plan for all NPS data files is in place, as defined in Section A6.5.

- Monthly and annual data reports will be provided according to the schedule defined in Section A6.3.

- Project-related standard operating procedures and technical instructions are controlled documents that will be maintained in the ARS Quality Assurance Documentation Library. A copy of the documents will be maintained on-site (in both hardcopy and digitally on DataView). This Quality Assurance Project Plan (QAPP) is also a controlled document. The quality assurance manager will be responsible for keeping the document current and maintain a distribution list (see Section A3). Parties on the distribution list will receive updated versions of the plan as they are made.

B. MEASUREMENT/DATA ACQUISITION

This section describes the project design and implementation, including collecting, handling, analyzing, managing, and validating the data. This section includes the following subsections:

B1 Sampling Process Design
B2 Sampling Methods Requirements
B3 Sample Handling and Custody Requirements
B4 Analytical Methods Requirements
B5 Quality Control Requirements
B6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements
B7 Instrument Calibration and Frequency
B8 Inspection/Acceptance Requirements for Supplies and Consumables
B9 Data Acquisition Requirements for Non-Direct Measurements
B10 Data Management

B1 SAMPLING PROCESS DESIGN

The sampling procedures have been designed according to National Park Service Gaseous Pollutant Monitoring Program protocols for gaseous and meteorological monitoring. The sampling frequencies and instrumentation are described in Section A7.

The program is designed to collect gaseous and meteorological data in selected national parks throughout the United States, including Alaska, Hawaii, and the U.S. Virgin Islands.

B2 SAMPLING METHODS REQUIREMENTS

Sampling methods for gaseous and meteorological data collection are discussed below. Data collection procedures are detailed in SOP 3350, *Collection of Ambient Air Quality and Meteorological Monitoring Data.*

Gaseous — Gaseous raw data (ozone, sulfur dioxide, carbon monoxide, and oxides of nitrogen) will be collected daily via telephone modem from the on-site datalogger. Data will be stored in ASCII format in site-specific daily raw data files. If telephone service is not available, data will be downloaded weekly via the on-site laptop computer using DataView. Raw data stored on the datalogger includes hourly averages.

Meteorology — Meteorological data will be retrieved daily via telephone modem from the on-site datalogger. Data will be stored in ASCII format in site-specific daily raw data files. If telephone service is not available, data will be downloaded weekly from the on-site laptop using DataView. Raw data can include ambient temperature (ºC), delta air temperature (ºC), ambient relative humidity (%), scalar wind speed (m/s), vector wind speed (m/s), wind direction (º), standard deviation of wind direction (º), precipitation (mm/hr), wetness (% on 100), solar radiation (w/m^2), and/or barometric pressure (mmHg). Any data collection problems will be immediately reported to the network operations section manager who will implement corrective actions.

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sample handling methods for gaseous and meteorology data collection for the Gaseous Pollutant Monitoring Program are discussed below.

Gaseous — Gaseous sample handling (ozone, sulfur dioxide, carbon monoxide, and oxides of nitrogen) will be performed automatically via telephone modem from the analyzers to ARS; data values will be contained in digital files.

Meteorology — Meteorology sample handling will be performed automatically via telephone modem from the sensors to ARS; data values will be contained in digital files.

In the event of prolonged telephone line failure at a site, the operator upon direction from the IMC, can create a CD of all digital hourly average raw data (for as long as 90 days) on the DataView computer. DataView continuously backs up the datalogger. The operator can periodically (generally weekly) mail the CD to the IMC for processing. If there is a prolonged power outage at the site, the operator can ship the DataView laptop computer to the IMC for data retrieval up to the time of the power outage. A backup laptop will be shipped to the site in exchange.

B4 ANALYTICAL METHODS REQUIREMENTS

Analytical methods for gaseous and meteorology data collection for the Gaseous Pollutant Monitoring Program are discussed below. Detailed procedures can be found in SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation*. Validation of O_3, SO_2, CO, NO_x and all meteorological parameters include three validation levels: Level 0, Preliminary, and Final. A flowchart detailing these procedures is presented as Figure 4.

Level 0 data validation:

The data validation process begins with a visual review and screen. Data analysts will:

- Collect data via modem.
- Visually review daily numeric raw data.
- Initially screen the daily data for anomalies.
- Visually review graphed raw data on stackplots on a daily basis.
- Review DataView site documentation from the site operators.
- Check daily calibration data (zero and span values) for the expected range.

After data for the site/day are verified, they will be screened for anomalies by a computer program. This program applies anomaly flags (Level 0 validation codes). These flags will be added to any datalogger flags that were loaded with the raw data from the datalogger. Once the data have been verified, screened, and all problems reported, the data will be stored in the ARS IMC database. Corrective action will be initiated to resolve any noted inconsistencies and the problem and actions will be entered in the Site Status Log.

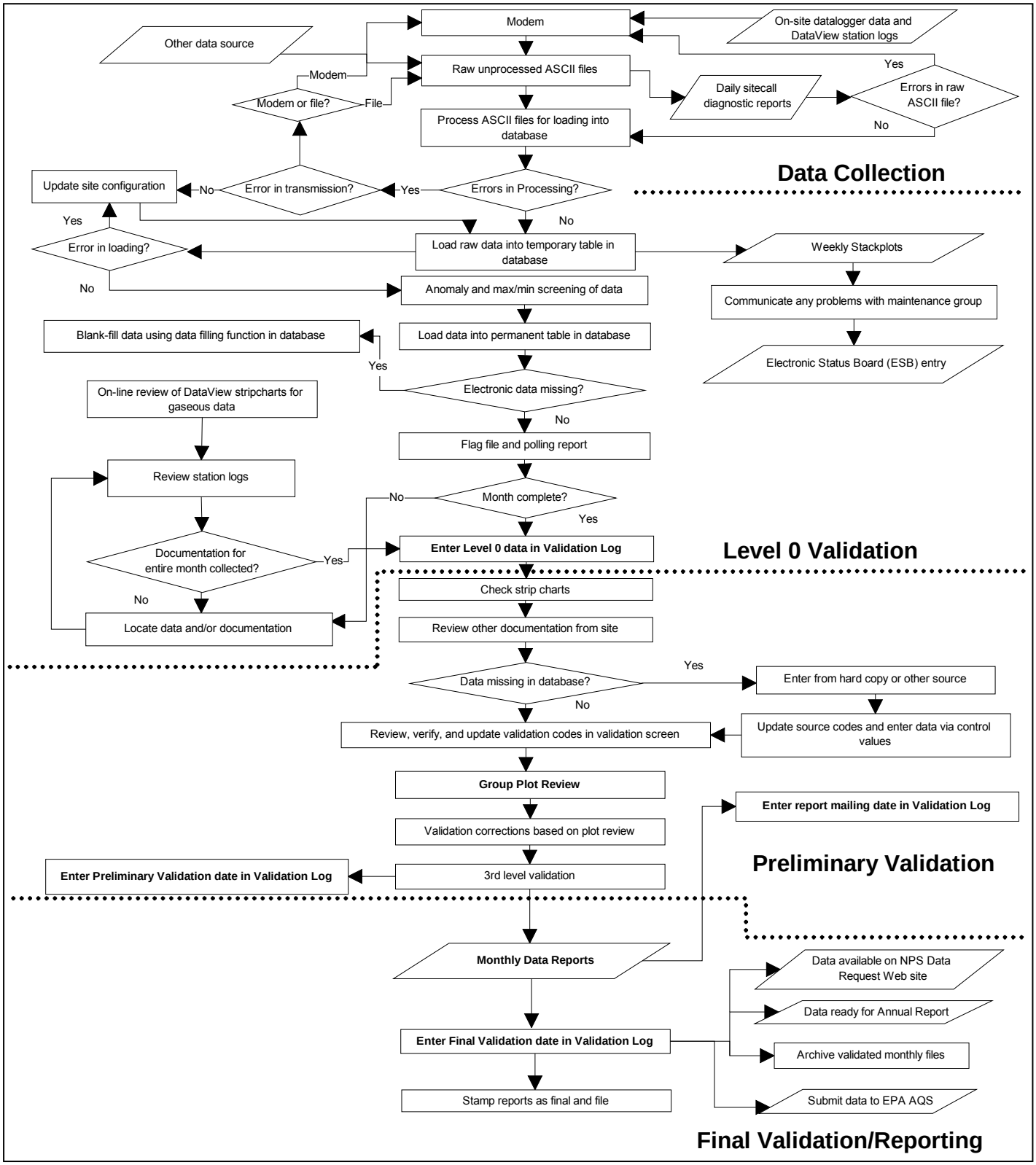

Figure 4. Gaseous Pollutant Monitoring Program Data Validation Flowchart.

<u>Preliminary data validation:</u>

Preliminary validation will determine whether each data value meets validation acceptance criteria. Data analysts will:

- Review site documentation.
- Review the ARS Site Status Log.
- Record and review comments on the raw data stackplots.
- Review daily summaries.
- Review trip reports.
- Review calibration plots.
- Enter and review any internal performance audit data received for the site/month into the IMC database.
- Enter and review any external, independent performance audit data received for the site/month into the IMC database.
- Enter validation codes into and adjust values in the IMC database as needed.
- Update the ARS Data Validation Log.
- Review validated data stackplots.
- Review electronic stripcharts via DataView laptop at site.

Validation acceptance criteria and the methods for determining if a data value meets the criteria are usually related to one of the following events or limitations:

- Data are out of instrument specifications.
- Data exceed minimum or maximum expected value.
- Data exceed minimum or maximum expected rate of change.
- Station temperature is out of specified limits.
- Zero and span check data are within specified limits.
- Data are affected by calibration check.
- Less than 45 minutes of data are available (hourly averaging period).
- Instrument or datalogger was affected by acts of nature.
- Instrument or datalogger was affected by power failure.
- Data capture was affected by a datalogger failure.
- Data were affected by operator maintenance or calibration check.
- Data were affected by site operator error.
- Data were affected by instrument malfunction or failure.
- Data were below lower detectable limit.

After placing comments on stackplots, data analysts will enter validation codes for each hourly average value for each parameter into the IMC database. A complete list of validation codes can be found in Table 4-2 of Technical Instructions 3450-5010, Ambient Air Quality and Meteorological Monitoring Data - Preliminary Validation. The codes entered come directly from the commented stackplots and are also guided by the datalogger and anomaly screening and datalogger flags, although sometimes an anomaly screening flag is also a validation code. All flags are tracked by date and source.

Final data validation:

Data analysts will complete validation:

- Participate in a group plot review that includes input from the NPS program manager, NPS air quality specialist, ARS program manager, the section managers, field specialists, and site operators. The review will be used to resolve all questionable validation issues.
- Make necessary validation code changes in the IMC database based on the group plot review discussion.
- Generate and review monthly data reports.
- Resolve all inconsistencies and label the data as final.

If a validation error is found after the data are labeled as final, the following steps will be taken:

- The final validation date in the Data Validation Log for the site/month will be deleted.
- The necessary changes will be made in the IMC database.
- A detail log record explaining the changes made will be added to the Data Validation Log for the site/month.
- A new Final validation date will be entered in the Data Validation Log for the site/month.
- Data will be corrected in the NPS Data Retrieval Web site and EPA AQS systems.

The changes are explained in the comments section of the Final Validation Checklist for the site/month.

B5 QUALITY CONTROL REQUIREMENTS

Quality control requirements for gaseous and meteorology data for the Gaseous Pollutant Monitoring Program are discussed below.

Gaseous — Gaseous analyzers will be serviced upon acceptance testing of a new instrument, upon installation or removal from a monitoring location, whenever control limits are exceeded, prior to any corrective action or maintenance that affects its operation, or at a maximum interval of six months. Specific control limits are presented in SOP 3100, *Calibration of Ambient Air Quality Analyzers.*

Meteorology — Meteorological sensors will be serviced upon acceptance testing of a new instrument, upon installation or removal from a monitoring location, whenever control limits are exceeded, prior to any corrective action or maintenance that affects its operation, or at a maximum interval of six months. Specific control limits are presented in SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems.*

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

B6.1 Inspection and Acceptance Testing

Gaseous — Newly purchased gaseous analyzers are calibrated at the manufacturer and will be calibrated after receipt at ARS. Sensors will be accepted if documentation of the calibration is received with the analyzer and after successful calibration at ARS. Refer to SOP 3100, *Calibration of Ambient Air Quality Analyzers,* for calibration procedures.

Meteorology — Newly purchased meteorological sensors are calibrated at the manufacturer. Sensors will be accepted if documentation of the calibration and calibration results are received with the sensor. Refer to SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems,* for calibration procedures.

B6.2 Maintenance

Tables 4 and 5 summarize the maintenance procedures for the gaseous and meteorology measurement systems.

Gaseous — Regular inspections of the gaseous monitoring systems will be performed weekly by the site operator at every site visit and scheduled maintenance is performed on a longer-term schedule. These maintenance procedures are detailed in the following standard operating procedures and technical instructions:

- SOP 3178 *Station Operator Maintenance Procedures for Gaseous Monitoring Sites Using the DataView System*
- SOP 3000 *Procedures for Semiannual Maintenance Visits to a National Park Service Ambient Air Monitoring Station*
- SOP 3100 *Calibration of Ambient Air Quality Analyzers*

Meteorology — Regular meteorological sensor inspections will be performed weekly by the site operator and scheduled maintenance will be performed semiannually. These maintenance procedures are detailed in the following standard operating procedures and technical instructions:

- SOP 3176 *Station Operator Maintenance Procedures for Meteorological Monitoring Sites Using the DataView System*
- SOP 3000 *Procedures for Semiannual Maintenance Visits to a National Park Service Ambient Air Monitoring Station*
- SOP 3150 *Calibration and Routine Maintenance of Meteorological Monitoring Systems*

Table 4. Gaseous Monitoring System Routine Operations and Maintenance Requirements.

Ozone, Sulfur Dioxide, Carbon Monoxide and Oxides of Nitrogen Routine Field Procedures

Regular Inspections	Frequency
• General site/system inspection.	Every 7 days by site operator
• Document the site visit and pertinent events in the DataView station log.	
• Check alarm and reminder messages on DataView and respond as required.	
• Check central messages in DataView and/or the phone message system and respond if required.	
• Review the stackplots of individual parameters to identify any downtime or data inconsistencies. Verify station temperature stayed between 20ºC and 30ºC for the previous week; adjust AC or heater if necessary.	
• Complete the DataView station visit checklist for each instrument.	
• Verify adequate supply of expendables (desiccant, charcoal, sample filters).	
• Verify that the previous week's zero, span, and precision checks were in tolerance.	
• Check the gas (O_3, SO_2, CO, and $NO_{X)}$ analyzer's Teflon inlet filters; change if required.	Every 14 days
• Complete a multipoint calibration on the O_3, SO_2, CO, and NO_X analyzers.	
• Change desiccant in zero air system	Monthly, or as required
• Contact ARS at any time to resolve questions or obtain assistance.	As Required
Scheduled Maintenance	Semiannual by ARS
• Pre-adjustment multipoint internal performance audit on all gas analyzers.	
• Maintenance, leak checks, and calibration of gas analyzers, the dilution system, and zero air system.	
• Post-adjustment multipoint calibration check on all gas analyzers.	
• Calibration check of the datalogger analog voltage inputs.	
• Change charcoal in zero air system.	
• Implement any required datalogger or DataView software upgrades.	
• Verify that site operator is performing all duties. Retrain as required.	
• Document all audits, maintenance, calibrations, and actions on ARS computer-based maintenance and calibration spreadsheets.	
• Inventory all equipment at the site.	
• Prepare written trip report within 30 days of visit.	
Automatic Calibration References	As indicated below
• Gas calibration checks (zeros, spans, and precisions) occur daily and are automatically controlled by the datalogger (at some sites, due to configuration limitations, precision checks occur weekly). The spans are set to challenge each analyzer at 80% of each analyzer's full scale, and precisions are set to challenge the analyzers at 18% of full scale. Note that three SO_2 instrument configurations are used in the network, each with different full scale values.	

Name of Event	Zero	O_3 Span (ppb)	SO_2Span (ppb)	CO Span (ppm)	NO_x Span (ppb)	O_3 Prec (ppb)	SO_2 Prec (ppb)	CO Prec (ppm)	NO_x Prec (ppb)
Target Concentration	O%	400	40, 80, or 800	15.6	80	90	9, 18, or 90	3.5	18
Full Scale	N/A	500	50, 100, or 1000	20	100	500	50, 100, or 1000	20	100
Frequency	Daily	Daily	Daily	Daily	Daily	Daily or Weekly	Daily or Weekly	Daily or Weekly	Daily or Weekly

Table 5. Meteorological System Routine Operations and Maintenance Requirements.

Meteorological System Routine Field Procedures	
Regular Inspections	Frequency
• Inspect overall system.	Weekly
• Complete the DataView station visit checklist for each instrument.	
• Observe freedom of wind vane and anemometer propeller.	
• Document observed weather conditions.	
• Verify that wind, temperature, precipitation, wetness and relative humidity measurements appear reasonable.	
• Perform leak check, 10-tip test on rainfall sensor.	
• Document the station site visit and pertinent events in the DataView station log.	
Scheduled Maintenance	Every 6 months
• Pre-adjustment internal performance audit of all meteorological instruments.	
• Performance system maintenance:	
- Clean systems.	
- Replace wind speed bearings.	
- Replace wind vane potentiometer if required.	
- Replace RH sensor with laboratory calibrated sensor.	
• Post-maintenance calibration of all sensors that were replaced.	
• Verify site operator is performing all duties. Retrain as required.	
• Document all calibrations and actions on ARS computer-based maintenance and calibration spreadsheets.	
• Prepare written trip report within 30 days of visit.	

B7 INSTRUMENT CALIBRATION AND FREQUENCY

The purpose of calibration is to establish a relationship between the ambient conditions and an instrument's response. Challenging the instrument with known values and adjusting the instrument to respond properly to those values constitutes a calibration. Routine calibrations of the air quality instruments will be performed upon initial installation and every six months thereafter. Meteorological systems will be calibrated upon initial installation and at six-month 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 40CFR part 50 Appendix D, part 58 Appendix A, and part 58 Appendix B and/or manufacturer's recommendations. PSD guidelines suggest meteorological calibrations every six months and gaseous calibrations every three months (quarterly). GPMP meteorological calibrations are performed every six months and meet the EPA guidance. GPMP gaseous calibrations are also performed every six months due primarily to the fiscal considerations of this broad national network.

The quality of the GPMP gaseous data has not been compromised by this six-month interval for the following reasons. Gas analyzers are automatically challenged daily with known zero and span concentrations. Most sites also undergo an automatic daily precision check. At a few sites, precision checks are performed weekly. Any changes in analyzer response can be

readily identified in the daily data reviews and weekly plots. Note that all ozone sites have both an analyzer (with ozone generator) and calibrator (transfer standard) on site. The daily zero, span, and precision values are measured by both instruments. The independent measurement provided by the calibrator provides a direct on-site reference of the ozone concentrations. Any noted inconsistencies are immediately addressed. If any instrument is suspect, a fully-calibrated replacement instrument or identified replacement part will be sent to the site for operator action. If the problem is not resolved by these actions, an emergency repair/calibration trip is performed. This approach has yielded a continuous, traceable method to ensure ongoing high quality instrument performance.

Calibration methods for each of the air quality and meteorological parameters are summarized in Table 6. Calibration acceptance criteria for this project are provided in Table 7.

All calibration results and all calibration and maintenance actions will be fully documented on ARS instrument-specific computer-based calibration spreadsheets. These computer-based 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 30 days of each site visit, the forms and any additional supplemental explanations will be compiled into a written trip report.

Refer to SOP 3100, *Calibration of Ambient Air Quality Analyzers* and SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems* for detailed calibration procedures.

Table 6. Calibration Methods for the Monitored Parameters in the Gaseous Pollutant Monitoring Program.

Measurement Variable	Calibration Method
Ozone (O3)	Multipoint by UV photometer transfer standard (traceable to a NIST-certified primary standard)
Sulfur Dioxide (SO_2)	Multipoint mass flow dilution of EPA Protocol gas
Carbon Monoxide (CO)	Multipoint mass flow dilution of EPA Protocol gas
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
Temperature	Water bath comparisons to a certified transfer standard or collocated comparisons to a certified transfer standard
Temperature Difference (ΔT)	Water bath comparisons to a certified transfer standard
Relative Humidity	Collocated comparisons to a certified transfer standard
Wind Direction	Alignment using two landmarks, orientation to true north, and linearity with a directional protractor
Wind Speed	Rotational rate at zero and three upscale speed levels using a selectable speed anemometer drive
Precipitation	Simulated known precipitation rate using water
Wetness	Simulated using water placed on sensor
Solar Radiation	Collocated comparisons to a certified transfer standard
Barometric Pressure	Comparison to a hand-held calibrated sensor

Table 7. Calibration Acceptance Criteria in the Gaseous Pollutant Monitoring Program.

Parameter	Calibration Method	Criteria	Calibration Acceptance Criteria
Gas Max difference	Gas primary or transfer standard (0 and 5 upscale points)	Max error	≤ ±5.0% at any designated point
Gas Average difference	Gas primary or transfer standard (0 and 5 upscale points)	Average error	≤ ±5.0% average of all points
Gas Slope (m)	Gas primary or transfer standard (0 and 5 upscale points)	Actual	0.950 ≤ m ≤ 1.050
Gas Intercept (b)	Gas primary or transfer standard (0 and 5 upscale points)	Actual	≤ ± 3.0 ppb for NO_X and SO_2 ≤ ± 0.3 ppm for CO
Gas Correlation (r)	Gas primary or transfer standard (0 and 5 upscale points)	Actual	r > 0.9950
Data Acquisition System Time	Compare with NIST time	Max error	≤ ± 2 minutes
Data Acquisition System Voltage	Known voltage inputs	Max error	≤ ± 0.003 VDC
Meteorological Translator Cards	Compare with calibrated voltmeter	Max error	≤ ± 0.005 VDC of designated zero value; and ≤ ± 0.1% of span
Temperature	Three water baths and certified thermometer (0ºC, 20ºC to 30ºC, 30ºC to 50ºC)	Max error	≤ ±0.5°C (RM Young) ≤ ±0.2°C (Climatronics)
	Or collocated transfer standard (non-immersible sensors)	Max error	≤ ±1.0°C (Rotronics/Vaisala)
Temperature Difference	Three water baths (0ºC, 20ºC to 30ºC, 30ºC to 50ºC)	Max error	≤ ±0.2°C (RM Young) ≤ ±0.1°C (Climatronics)
Relative Humidity	RH sensor transfer standard	Max error	≤ ±5.0% RH error
Wind Speed	Compare to calibrated motor at 4 speeds	Max error	≤ ±0.2 m/s at <5 m/s ≤ ±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	≤ ±5° from true degrees at any designated point
Wind Direction Linearity	45º increment inputs	Max error	≤ ±3° at any designated point
Wind Direction Starting Threshold	Weighted torque disk	Max error	≤ 9 g-cm (RM Young) ≤ 6 g-cm (Climatronics)
Precipitation (Tipping Bucket)	Addition of known water volume	Max error	≤ ±5.0% of input volume
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	≤ ±5%
Barometric Pressure	Compare to calibrated unit	Max error	≤ ±1.5 mmHg

B8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Gaseous — Gaseous analyzers use inlet filters, charcoal canisters, desiccant, and span gas. These supplies do not require acceptance testing. Inlet filters are replaced by the site operator every 14 days. The charcoal canisters and desiccant are replaced as needed and the span gas is certified and replaced every two years.

Meteorology — Certain components of the meteorological sensors are replaced during each semiannual ARS calibration visit. These include the bearings and potentiometer in the wind sensors. The relative humidity sensor is replaced with a reconditioned unit.

B9 DATA ACQUISITION REQUIREMENTS FOR NON-DIRECT MEASUREMENTS

Information and non-direct measurements that will be used in conjunction with the Gaseous Pollutant Monitoring Program including data collected by agencies other than the National Park Service. These data will be retrieved by ARS from the EPA Air Quality System (AQS) database and will be included in the National Park Service Gaseous Pollutant Monitoring Program annual report.

B10 DATA MANAGEMENT

All gaseous and meteorological data will be collected each day via telephone modem. The IMC data analysts will verify that all data are received and data will be reviewed each business day to identify operational problems and data inconsistencies. Complete data validation will be performed on a monthly basis. Archiving of all raw data will be performed on a monthly basis and archiving of all processed data will be performed quarterly after data have been finalized. All files will be in ASCII format. Files will be stored in their original formats (non-compressed) on computer hard drives and on CD-ROM. Validated data will also be submitted to the EPA Air Quality System (AQS) database and archived on the NPS Data Retrieval Web site. Requests for data can be made via the Internet at http://www2.nature.nps.gov/air/data/request.hml. Hardcopies of supporting documentation will be archived on a continual basis. Complete procedures for data collection, processing, and archiving are presented in SOP 3350, *Collection of Ambient Air Quality and Meteorological Monitoring Data*, and SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation.*

C. ASSESSMENT/OVERSIGHT

This section describes the activities for assessing the implementation of the Gaseous Pollutant Monitoring Program and associated quality assurance/quality control (QA/QC) activities. This section includes the following subsections:

C1 Assessments and Response Actions
C2 Reports to Management

C1 ASSESSMENTS AND RESPONSE ACTIONS

System operation, data quality, and data completeness will be assessed each business day by reviewing the data downloaded by telephone from the datalogger. Any inconsistencies noted in the data will be reported to the IMC section manager and network operations section manager, who will initiate appropriate corrective action. Corrective action will begin with review of the inconsistency by a field specialist. If warranted, the field specialist will initiate or request that the data analyst begin troubleshooting activities with the site operator. If troubleshooting results indicate an analyzer or sensor has failed, a replacement unit will be shipped to the site and the malfunctioning unit returned for repair. If the problem is determined to be too complex for the site operator to fix alone, a field specialist will be sent to the site to evaluate and correct the problem.

Assessments of the program will include periodic internal performance audits of the instrumentation by trained ARS field staff. The audits will be based upon accuracy goals, which are described below:

Gaseous

Audits will be conducted using an ozone transfer standard (traceable to a NIST-certified primary standard) or a gas dilution/gas phase titration system and introducing a reference zero at three test atmospheres (using EPA protocol gases) to the analyzer through its normal sampling system, including the sample intake manifold, filters, and scrubbers.

The percent difference between the actual concentration of the audit test gas and the concentration indicated by the analyzer is used to determine if the analyzer is operating within specified limits. Analyzers whose reading for any single point differs from the test atmosphere by more than ± 10% are considered to be out of tolerance.

Audit challenge ranges and acceptable criteria for the gaseous analyzers are presented in Table 8.

Table 8. Gaseous Analyzers Audit Ranges and Acceptance Criteria.

Parameters	Audit Concentration Ranges (ppm)			Acceptance Criteria (difference between audit test gas concentration and analyzer response)
	Level 1	Level 2	Level 3	
O_3	0.03 – 0.08	0.15 – 0.20	0.35 – 0.45	±5% for any point
SO_2	0.03 – 0.08	0.15 – 0.20	0.35 – 0.45	±5% for any point
CO	3.0 – 8.0	15.0 – 20.0	35.0 – 45.0	±5% for any point
NO_2	0.03 – 0.08	0.15 – 0.20	0.35 – 0.45	±5% for any point

The meteorology equipment will be audited by ARS field specialists during the semiannual servicing visits. Refer to SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems* and SOP 3750, *Meteorological Monitoring Sensor Audit Procedures.*

Meteorology

Meteorological measurement systems will be audited in accordance with the EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV – Meteorological Measurements* (1995). Accuracy goals for the meteorological parameters are obtained from the EPA's *On-Site Meteorological Program guidance for Regulatory Modeling Applications*. The auditor will use NIST-traceable test equipment for all meteorological performance audits. Meteorological audit procedures are described below.

- Temperature and Temperature Difference - The entire temperature system will be physically challenged by actual measurement of known temperatures. Each temperature sensor will be immersed in three (3) temperature baths with NIST-traceable thermometers. The temperature tests will be performed at 0°C, ambient (approximately 20°C), and as near to full-scale as possible. Readings of the bath temperatures obtained with the NIST-traceable thermometer will be compared to the on-site datalogger output. Temperature differences (ΔT) systems will be assessed by simultaneously immersing both sensors in each of the three baths and noting the measured temperature difference between sensors. The data will be used to assess the accuracy and linearity of each sensor.

- Relative Humidity - The relative humidity monitoring system performance audit will be conducted using a reference relative humidity monitoring system. The humidity observation will be taken as near as possible to the sensor. Relative humidity data observed on the on-site datalogger will be compared to the reference readings.

- Wind Speed – The wind speed audit will consist of a dynamic test of the horizontal wind speed sensors using an R.M. Young model selectable anemometer drive. The sensor will be tested at zero plus three (3) shaft revolution speeds. The equivalent wind speed will be calculated corresponding

to the manufacturer's specified values for shaft RPM versus wind velocity and compared to readings obtained from the on-site datalogger. A bearing integrity check will also be performed using an R.M. Young torque disk.

- Wind Direction - Wind direction sensor audits will include the verification of sensor orientation, linearity, and bearing integrity. The wind sensor crossarm alignment relative to true north is checked, the wind direction vane is pointed toward and from at least two landmarks, and the datalogger's response is noted. In addition to the sensor orientation and linearity checks, the sensor bearings will be tested using an R.M. Young vane bearing torque gauge.

- Precipitation - The precipitation audit will consist of introducing three (3) known amounts of water to the bucket. The known amounts of water are compared with the readings from the on-site datalogger to establish sensor accuracy.

- Wetness – The wetness sensor audit will consist of introducing water to the sensor and comparing the readings from the on-site datalogger to establish sensor performance.

- Solar Radiation – The solar radiation audit will consist of collocating a certified LiCor pyranometer next to the station sensor. Five (5) simultaneous readings are collected. Readings from the audit standard and on-site dataloggers are compared to establish sensor accuracy.

- Barometric Pressure - The barometric pressure audit will consist of comparing the on-site sensor with a recently calibrated hand-held sensor.

Audit challenge ranges and acceptable criteria for the meteorological sensors are identical to the calibration acceptance criteria listed in Table 7.

Internal performance audit results will be provided as follows:

- The results of all internal performance audits are documented on ARS computer-based calibration worksheets. If the auditor determines that the sampler is operating outside of project accuracy goals (at the warning or fail levels), they will take immediate action to correct the noted problem during site maintenance and calibration.

- Fully documented written site visit maintenance reports (including internal performance audits) are normally completed within 30 days of an audit.

C2 REPORTS TO MANAGEMENT

Reports to management will include weekly and quarterly progress reports, as well as monthly and annual data reports. The schedule of distribution of these reports is presented in Section A6.3. ARS will deliver the following reports to NPS ARD.

Weekly Progress Reports	Weekly progress reports (via e-mail) contain technical information regarding network status and detail any network issues, resolution to those issues, site visits, reporting and data requests, any changes in contract information, and any significant events of note.
Monthly Data Reports	Monthly data reports are delivered within 45 days of month end and include a monthly summary of gaseous and meteorological data by site, and the monthly data collection statistics for all collected parameters for each site.
Quarterly Contract Status Reports	This quarterly e-mail report summarizes the status of each contract Task Order and Task Order amendment. No data are included in the report. The report is delivered within 15 days of the end of each calendar quarter.
Annual Data Reports	Annual data reports are delivered once per year and may include site specification information, data collection statistics, quarterly stackplots, diurnal plots of measured gases, pollutant roses, summary of meteorological data, summary of episodic pollution events, and comparison of collected gas concentrations to the National Ambient Air Quality Standards.
Site Visit Reports	Site visit maintenance reports contain detailed information regarding procedures performed and conditions found during semiannual and emergency site visits. They also contain completed calibration forms for all parameters checked.

D DATA VALIDATION AND USABILITY

This section describes the activities that occur after the data collection phase of the Gaseous Pollutant Monitoring Program is completed. This section includes the following subsections:

D1 Data Review, Validation, and Verification Requirements
D2 Validation and Verification Methods
D3 Reconciliation with User Requirements

D1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Gaseous and meteorological data undergo specific validation procedures detailed in Sections A7 and B4, and SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation.* Specific data validation criteria that will be used for all monitored parameters are listed in Table 9.

D2 VALIDATION AND VERIFICATION METHODS

Gaseous and meteorological data validation will be performed according EPA protocols, which are detailed in SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation*. Validation of gaseous data includes three levels: Level 0, Preliminary, and Final. These procedures are outlined in Section B4. ARS personnel will validate all data.

D3 RECONCILIATION WITH USER REQUIREMENTS

The National Park Service Air Resources Division established the Gaseous Pollutant Monitoring Program to measure existing levels of air pollution in the National Park Service units. Gaseous and meteorological monitoring systems were installed to provide scientifically defensible air quality data.

The monitoring program design will collect gaseous and meteorological data to characterize the extent, frequency of occurrence, and magnitude of air quality. Data are expected to provide a true representation of air quality in National Park Service units, and fulfill the NPS ARD goals and objectives, which are defined in Section A5.

Table 9. Validation Acceptance Criteria for the Gaseous Pollutant Monitoring Program.

Parameter	Calibration Method	Criteria	NPS Validation Criteria (Data Reasonableness)
Temperature (Climatronics or RM Young)	Three water baths and certified thermometer (0ºC, 20 to 30ºC, 30 to 50ºC)	Max error	≤ ±0.5°C from actual
Temperature (Rotronics)	Temperature transfer standard	Max error	≤ ±1.5°C
Temperature and Temperature Difference (Climatronics or RM Young)	Three water baths (0ºC, 20 to 30ºC, 30 to 50ºC)	Max error	≤ ±0.5°C
Relative Humidity	RH sensor transfer standard	Max error	≤ ±10.0%
Wind Speed	Selectable speed rpm motor	Max error	≤ ±0.5 m/s for values <5.0 m/s ≤ ±5.0% for values >5.0 m/s
Wind Speed Starting Threshold	Weighted torque disk	Max error	≤ 0.4 g-cm (Climatronics) ≤ 0.5 g-cm (RM Young)
Wind Direction Alignment	Solar Azimuth, Precision compass, USGS map	Max error	≤ ±5° from true degrees
Wind Direction Linearity	45º increment inputs	Max error	≤ ±5°
Wind Direction Starting Threshold	Weighted torque disk	Max error	≤ 8 g-cm (Climatronics) ≤ 11 (RM Young)
Precipitation (Tipping Bucket)	Addition of known water volume	Max error	≤ ±10.0%
Precipitation (Weighting Gauge)	Addition of certified weights, or known water volume	Max error	≤ ±10% or ≤ ±0.10 inches
Wetness Sensor	Mist with distilled water; and apply test resistance (230-240 Ohms)	Response	Confirmed sensor response as necessary to correct readings to full scale of 100 (equivalent to 1.0VDC)
Solar Radiation	Collocated transfer standard	Average error	≤ ±10%
Barometric Pressure	Collocated transfer standard	Max error	≤ ±3.0 mmHg or ±4.0 mb
Gas Max difference	Gas primary or transfer standard (0 and 5 upscale points)	Max error	≤ ±10.0% of actual
Gas Average difference	Gas primary or transfer standard (0 and 5 upscale points)	Average error	≤ ±10.0%
Gas Slope (m)	Gas primary or transfer standard (0 and 5 upscale points)	Actual	0.900 ≤ slope ≤ 1.100
Gas Intercept (b)	Gas primary or transfer standard (0 and 5 upscale points)	Actual	≤ ±5.0 ppb from actual for O_3 and SO_2 ≤ ±5.0 ppm for CO
Gas Correlation (r)	Gas primary or transfer standard (0 and 5 upscale points)	Actual	>0.9900
Data Acquisition System Time	Compare with NIST time	Max error	≤ ±2 minutes
Data Acquisition System Voltage	Known voltage inputs	Max error	≤ ±0.003 VDC
Meteorological Translator Cards	Compare with calibrated voltmeter	Max error	≤ ±0.005 VDC of designated zero value; and ≤ ±0.1% of span

REFERENCES

40 CFR 50, Appendix D. *Measurement Principle and Calibration Procedure for the Measurement of Ozone in the Atmosphere. (http://ecfr.gpoaccess.gov/)*

40 CFR 58, Appendix A. *Quality Assurance Requirements for State and Local Air Monitoring Systems, (SLAMS). (http://ecfr.gpoaccess.gov/)*

40 CFR 58, Appendix B. *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). (http://ecfr.gpoaccess.gov/)*

EPA Quality Assurance Handbook for Air Pollution Measurement Systems:
Volume I, A Field Guide to Environmental Quality Assurance.
(http://www.epa.gov/ttn/amtic/files/ambient/qaqc/r94-038a)
Volume II, Ambient Air Specific Methods
(http://www.epa.gov/ttn/amtic/files/ambient/qaqc/redbook.pdf)
Volume IV, Meteorological Measurement Systems
(http://www.epa.gov/scram001/guidance/met/vol4metmeas1.pdf)

EPA On-Site Meteorological Program Guidance for Regulatory Modeling Applications
(http://www.epa.gov/scram001/guidance/met/mmgrma.pdf)

EPA Guidance for Quality Assurance Project Plans (QAPPs)
(http://www.epa.gov/quality1/qs_docs/g5-final.pdf)

NPS GPMP Introduction to DataView, June 2000.

NPS GPMP Standard Operating Procedures and Technical Instructions (see Appendix A)

APPENDIX A

NATIONAL PARK SERVICE
GASEOUS POLLUTANT MONITORING PROGRAM

STANDARD OPERATING PROCEDURES,

TECHNICAL INSTRUCTIONS,

AND

CHECKLIST INSTRUCTIONS

APPENDIX A - Standard Operating Procedures and Technical Instructions

The following standard operating procedures (SOPs), technical instructions (TIs), and checklist instructions (CIs) will be used in executing this program. These documents were written by Air Resource Specialists, Inc. Please note that project-specific SOPs and TIs have not been written; this project relies in part on SOPs, TIs, and CIs that have been prepared to support other field studies. The general policies and instructions outlined in these procedures, however, are relevant to the National Park Service Gaseous Pollutant Monitoring Program, and as such, the listed SOPs and TIs are suitable for this particular study.

SOP 3000 Procedures for Semiannual Maintenance Visits to a National Park Service Ambient Air Monitoring Station

SOP 3050 Siting of Ambient Air Quality Monitoring Stations

SOP 3100 Calibration of Ambient Air Quality Analyzers

TI 3100-2000 Calibration and Routine Maintenance of Monitor Labs (ML) 8810 Ozone Analyzers

TI 3100-2001 Calibration and Routine Maintenance of Dasibi 1003-AH, 1003-RS, or 1003-PC Ozone Analyzers

TI 3100-2002 Calibration and Routine Maintenance of Thermo Environmental Instruments Model 49 (TECO 49) Ozone Analyzers

TI 3100-2003 Calibration and Routine Maintenance of API Model 400 Series Ozone Analyzers

TI 3100-2021 Calibration and Routine Maintenance of Thermo Environmental (TECO) 43C SO_2 Analyzers

TI 3100-2030 Calibration and Routine Maintenance of Thermo Environmental Instruments (TECO) Model 42 Oxides of Nitrogen Analyzers

TI 3100-2031 Calibration and Routine Maintenance of Thermo Environmental Instruments (TECO) Model 42C Oxides of Nitrogen Analyzers

TI 3100-2041 Calibration and Routine Maintenance of Thermo Environmental (TEI) 48C CO Analyzers

SOP 3150 Calibration and Routine Maintenance of Meteorological Monitoring Systems

TI 3150-2020 Calibration and Routine Maintenance of Campbell Scientific CS105 Barometric Pressure Sensors

TI 3150-2100 Calibration and Routine Maintenance of Climatronics F460 or Qualimetrics 12XX Wind Speed and Direction Sensor Systems

TI 3150-2102 Calibration and Routine Maintenance of Climatronics F460 Wind Speed and Wind Direction Sensors Used With a Campbell Scientific 21XL Datalogger

TI 3150-2103 Calibration and Routine Maintenance of R.M. Young Model 05305 Wind Monitor-AQ Wind Speed and Direction Sensor Systems

TI 3150-2105 Calibration and Routine Maintenance of Climatronics or Qualimetrics Temperature/Delta Temperature Systems

TI 3150-2113 Calibration and Routine Maintenance of R.M. Young Temperature/Delta Temperature Systems

TI 3150-2114 Laboratory Calibration and Repair of Rotronics MP-101A AT/RH Sensors, Rotronics MP-601A Relative Humidity Sensors, or Vaisala 45AC AT/RH Sensors

TI 3150-2115 Field Calibration and Routine Maintenance of Rotronics MP-101A AT/RH Sensors or Rotronics MP-601A Relative Humidity Sensors

TI 3150-2116 Field Calibration and Routine Maintenance of Vaisala HMP 45 AC AT/RH Sensors

TI 3150-2120 Field Calibration and Routine Maintenance of an R.M. Young Solar Radiation System

TI 3150-2130 Field Calibration and Routine Maintenance of Climatronics 100097-1-90 Precipitation Gauge

SOP 3160 Calibration of Data Acquisition Systems

SOP 3170 Calibration of Strip Chart Recorders

SOP 3176 Station Operator Maintenance Procedures for Meteorological Monitoring Sites Using the DataView System

CI 3176-3100 Weekly Station Visit Wind Speed / Wind Direction Sensor (Climatronics)

CI 3176-3101 Weekly Station Visit Wind Speed / Wind Direction Sensor (R.M. Young)

CI 3176-3105 Weekly Station Visit Temperature (Climatronics)

CI 3176-3107 Weekly Station Visit Relative Humidity (Climatronics)

CI 3176-3110 Weekly Station Visit Temperature / Delta Temperature Sensor (Climatronics)

CI 3176-3111 Weekly Station Visit Temperature / Delta Temperature Sensor (R.M. Young)

CI 3176-3115 Weekly Station Visit Air Temperature and Relative Humidity Sensor (Rotronics)

CI 3176-3116 Weekly Station Visit Air Temperature and Relative Humidity Sensor (Vaisala)

CI 3176-3120 Weekly Station Visit Relative Humidity Sensor (Rotronics)

CI 3176-3121 Weekly Station Visit Relative Humidity Sensor (Vaisala)

CI 3176-3130 Weekly Station Visit Solar Radiation Sensor (Climatronics)

CI 3176-3131 Weekly Station Visit Solar Radiation Sensor (R.M. Young)

CI 3176-3132 Weekly Station Visit Solar Radiation Sensor (Licor)

CI 3176-3140 Weekly Station Visit Wetness Sensor (R.M. Young)

CI 3176-3150 Weekly Station Visit Precipitation Sensor (Climatronics)

CI 3176-3151 Weekly Station Visit Precipitation Sensor (Texas Electronics)

SOP 3178 Station Operator Maintenance Procedures for Gaseous Monitoring Sites Using the DataView System

CI 3178-3101 Weekly Station Visit, Ozone Analyzer (Monitor Labs ML8810) Ozone Calibrator (Dasibi 1003-PC) CASTNet Dry Deposition

CI 3178-3102 Weekly Station Visit, Ozone Analyzer (Monitor Labs ML8810) Ozone Calibrator (Dasibi 1008-PC)

CI 3178-3105 Weekly Station Visit, Ozone Analyzer (Dasibi 1003-AH) Ozone Calibrator (Dasibi 1003-PC)

CI 3178-3106 Weekly Station Visit, Ozone Analyzer (Dasibi 1003-AH) Ozone Calibrator (Dasibi 1003-PC) CASTNet Dry Deposition

CI 3178-3110 Weekly Station Visit, Ozone Analyzer (TEI 49) Ozone Calibrator (Dasibi 1003-PC) CASTNet Dry Deposition

CI 3178-3111 Weekly Station Visit, Ozone Analyzer (TEI 49) Ozone Calibrator (Dasibi 1003-PC)

CI 3178-3113 Weekly Station Visit, Ozone Analyzer (TEI 49) Ozone Calibrator (TEI 49) CASTNet Dry Deposition

CI 3178-3115 Weekly Station Visit, Ozone Analyzer (TEI 49C) Ozone Calibrator (TEI 49C)

CI 3178-3116 Weekly Station Visit, Ozone analyzer (TEI 49C) Ozone Calibrator (TEI 49C) CASTNet Dry Deposition

CI 3178-3117 Weekly Station Visit, Sulfur Dioxide Analyzer (TEI 43C TL), Carbon Monoxide Analyzer (TEI 48C), Oxides of Nitrogen Analyzer (TEI 42C), and Gas Dilution Calibrator (TEI 146)

CI 3178-3121 Weekly Station Visit, Ozone Analyzer (API 400) Ozone Calibrator (Dasibi 1003-PC) CASTNet Dry Deposition

CI 3178-3122 Weekly Station Visit, Ozone Analyzer (API 400) Ozone Calibrator (Dasibi 1003-PC)

CI 3178-3130 Weekly Station Visit, Carbon Monoxide Analyzer (TEI 48C) Ozone Calibrator (TEI 146C)

CI 3178-3140 Weekly Station Visit, Ozone Analyzer (TEI 49C) Ozone Calibrator (TEI 49C) Oxides of Nitrogen Analyzer (TEI 42C) Gas Dilution Calibrator (TEI 146C)

CI 3178-3154 Weekly Station Visit, Ozone Analyzer (TEI43C) Ozone Calibrator (TEI 146)

CI 3178-3157 Weekly Station Visit, Oxides of Nitrogen Analyzer (TEI 42C) Gas Dilution Calibrator (TEI 146C)

CI 3178-3300 Multipoint Calibration, Ozone Analyzer (ML 8810) Ozone Calibrator (Dasibi 1003-PC)

CI 3178-3303 Multipoint Calibration, Ozone Analyzer (ML 8810) Ozone Calibrator (Dasibi 1008-PC)

CI 3178-3305 Multipoint Calibration, Ozone Analyzer (Dasibi 1003-AH) Ozone Calibrator (Dasibi 1003-PC)

CI 3178-3310 Multipoint Calibration, Ozone Analyzer (TEI 49) Ozone Calibrator (Dasibi 1003-PC)

CI 3178-3312 Multipoint Calibration, Ozone Analyzer (TEI 49) Ozone Calibrator (TEI 49)

CI 3178-3315 Multipoint Calibration, Ozone Analyzer (TEI 49C) Ozone Calibrator (TEI 49C)

CI 3178-3317 Multipoint Calibration, Sulfur Dioxide Analyzer (TEI 43C TL) Sulfur Dioxide Calibrator (TEI 146)

CI 3178-3320 Multipoint Calibration, Ozone Analyzer (API 400) Ozone Calibrator (Dasibi 1003-PC)

CI 3178-3300 Multipoint Calibration, Carbon Monoxide Analyzer (TEI48C) Gas Calibrator (TEI 146C)

CI 3178-3340 Multipoint Calibration, Oxides of Nitrogen Analyzer (TEI 42C) Gas Calibrator (TEI 146C)

CI 3178-3350 Multipoint Calibration, Sulfur Dioxide Analyzer (TEI 43C) Dynamic Gas Calibrator (TEI 146C)

CI 3178-3351 Multipoint Calibration, Sulfur Dioxide Analyzer (TEI 43C) Dynamic Gas Calibrator (TEI 146C) (Version 2)

CI 3178-3352 Multipoint Calibration, Sulfur Dioxide Analyzer (TEI 43C) (360ppb-440ppb) Dynamic Gas Calibrator (TEI 146)

CI 3178-3354 Multipoint Calibration, Sulfur Dioxide Analyzer (TEI 43C) Dynamic Gas Calibrator (TEI 146)

CI 3178-3356 Multipoint Calibration, Sulfur Dioxide Analyzer (TEI 43C) (760ppb-840ppb) Dynamic Gas Calibrator (TEI 146)

SOP 3180 Calibration of Mass Flowmeters and Mass Flow Controllers

SOP 3300 Certification of Ozone Transfer Standards

SOP 3340 Information Management Center (IMC) Concept and Configuration

SOP 3345 Day to Day Network Operations Technical Support for the National Park Service Gaseous and Meteorological Monitoring Program

SOP 3350 Collection of Ambient Air Quality and Meteorological Monitoring Data

TI 3350-4000 Collection of Ambient Air Quality and Meteorological Monitoring Data via Telephone Modem

TI 3350-4005 Collection of DataView Files via Telephone Modem

SOP 3450 Ambient Air Quality and Meteorological Monitoring Data Validation

TI 3450-5000 Ambient Air Quality and Meteorological Monitoring Data – Level 0 Validation

TI 3450-5010 Ambient Air Quality and Meteorological Monitoring Data – Preliminary Validation

TI 3450-5020 Ambient Air Quality and Meteorological Monitoring Data – Final Validation

SOP 3550 Ambient Air Quality and Meteorological Monitoring Data Reporting

TI 3550-5000 Ambient Air Quality and Meteorological Monitoring Data Monthly Reporting

TI 3550-5100 Ambient Air Quality and Meteorological Monitoring Data Annual Reporting

TI 3550-5200 Handling Requests for Ambient Air Quality and Meteorological Monitoring Data

TI 3550-5300 Submitting Ambient Air Quality and Meteorological Monitoring Data to the EPA AIRS Database

SOP 3650 IMC Manager's Maintenance Responsibilities for the Ambient Air Quality Data Base Management System (AQDBMS)

TI 3750-6116 Rotronics MP-100F or MP-101A AT/RH Sensor Audit Procedures (IMPROVE Protocol)