

**DIVISION OF ENVIRONMENT
QUALITY MANAGEMENT PLAN**

PART III:

**AMBIENT AIR MONITORING
STANDARD OPERATING PROCEDURES**

Revision 5

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SECTION 1

INTRODUCTION

1.1 Purpose

This document is the Standard Operating Procedures (SOP) for Ambient Air Criteria Pollutant Monitoring, administered by the Monitoring and Data Unit of the Air Monitoring and Planning Section, Bureau of Air (BOA), Division of Environment (DOE), Kansas Department of Health and Environment (KDHE). The purpose of the SOP is to provide routine operating procedures to achieve uniformity in ambient air monitoring and ensure the validity of all data produced in the course of operations. Where applicable, this SOP references the Air Monitoring and Planning Sections Ambient Air Monitoring Quality Assurance Program Plan (AAM QAPP).

The provisions of this SOP apply to ambient air monitoring conducted by the Air Monitoring and Planning Section. The SOP also applies to ambient air monitoring performed by two local health/environment departments that submit data to the Monitoring and Data Unit for review and forwarding to the United States Environmental Protection Agency (EPA).

1.2 Technical Qualifications

All personnel involved in conducting procedures outlined by this document for ambient air monitoring are required to have the necessary experience and training to perform the monitoring activities correctly. For contracted operations, KDHE field staff will be responsible for all calibrations, maintenance, and quality assurance checks, except as noted in the applicable contract.

All personnel involved in operating and maintaining analyzers or samplers shall be familiar with environmental field measurement techniques. Each individual must be attentive to detail to report and provide quality data. Each individual responsible for a monitor must be qualified to operate, calibrate, audit, and troubleshoot the analyzer/sampler. In addition, they must use common methods to determine temperature, pressure, and flow rate while in the field.

Qualifications under Section 14, Ozone Mapping System, include computer skills, experience with remote data transfer via FTP, familiarity with Agilaire, LLC AirVision software, and AIRNOW access for the Ozone Mapping System (OMS). Any data management or processing trainee must have the same qualifications, observe an experienced trainer perform procedures, perform procedures while under the observation of an experience trainer, and complete any accessible training courses provided by EPA for continuing education.

1.3 Document History

The Ambient Air Monitoring Standard Operating Procedures (AAM SOP) were originally written in 2000, and subsequently updated in 2006, 2011, and 2016. The AAM SOP is used in conjunction with the Ambient Air Monitoring Quality Assurance Program Plan (AAM QAPP) to meet EPA requirements to establish and maintain a viable quality assurance and quality control program. Additional information regarding these requirements is available in Section 1 of the AAM QAPP. This latest revision (Revision 5) of the AAM SOP incorporates changes to the formatting, rearrangement of sections including the combining and adding of sections, and general changes to the standard operating procedures.

SECTION 2

CONTINUOUS GASEOUS MONITORING

2.1 Overview

This section describes the procedures for operating, calibrating, auditing, and maintaining continuous gaseous analyzers. The following ambient air pollutants are measured by these procedures: carbon monoxide (CO), nitrogen dioxide (NO₂), nitric oxide (NO), oxides of nitrogen (NO_x), ozone (O₃), sulfur dioxide (SO₂), ammonia (NH₃), and hydrogen sulfide (H₂S).

2.2 Calibration

2.2.1 Purpose

Calibration establishes the relationship between actual pollutant concentration input and the response of the instrument. This relationship is used to convert subsequent analyzer response values to corresponding pollutant concentrations until superseded by a later calibration of the analyzer.

2.2.2 Principle and Applicability

Calibrations are performed at the monitoring site by allowing the analyzer to sample a gaseous standard containing a known pollutant concentration. During calibration the analyzer operates in its normal sampling mode and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and also as much of the ambient air inlet system as practicable. Each analyzer must be calibrated in accordance with its manufacturer's operation manual and the specific guidance herein provided.

The type and quality of gaseous standards used are specified in 40 CFR 58, Appendix A, Section 2, 40 CFR 58, Appendix B, Section 2, and 40 CFR 50, Appendices C, D, and F. (See also AAM SOP Section 10 below, "Certification of Standards".) Multi-point calibrations consist of a zero (0) and four (4) upscale points, the highest being a concentration between 80 percent and 90 percent of the full-scale range of the analyzer under calibration. For the gaseous pollutants the verification/calibration is considered acceptable if all calibration points fall within 2% full scale (expressed as PPM or PPB) of the best fit straight line. Additionally, for ozone only, the linearity error is recommended to be < 5%. NCore trace level analyzer calibrations will consist of a zero (0) and three (3) upscale points, the highest being a concentration between 80 percent and 90 percent of full scale.

2.2.3 Frequency of Calibration

Calibration of an analyzer is performed at the time of installation. Recalibration must be performed no later than six (6) months after the most recent calibration.

Subsequent to any of the following occurrences, the zero and span drift must be checked (see paragraph III.B below, "Continuous Analyzer Zero and Span Check") to determine whether recalibration is necessary: an interruption of analyzer operation lasting more than a few days; repairs which might affect calibration; physical relocation of the analyzer; or any other indication of significant analyzer inaccuracy.

2.2.4 Equipment

- 1) Source of zero-air (cylinder, scrubber, and oxidizer)
- 2) Traceable calibration standards (see AAM SOP Section 10)
 - a) Permeation tube and connecting tube (for NO₂, SO₂, NH₃, and H₂S)
 - b) Gas Cylinder (for CO [balance air], SO₂, and NO)
 - c) U.V. standard photometer (for O₃)
- 3) Regulator Valves
- 4) Tubing and connectors
- 5) Vented manifold or "T" fitting to prevent pressurization of analyzer
- 6) Dilution system or permeation oven
- 7) Calibrated dilution or GPT system

2.2.5 Calibration Procedure

- 1) For proper calibration of any analyzer avoid pressurization of the system by using a vented manifold or "T" fitting. Use of a flow meter on the bypass or vented port of certain pressure sensitive monitors will cause erroneous readings. Follow all applicable calibration instructions in the instrument manufacturer's operation manual.
- 2) Initiate a flow of zero-air gas through the analyzer. Adjust zero in accordance with the analyzer manufacturer's recommended procedures if necessary.

Record the resultant instrument reading.

- 3) Initiate a flow of a known gas concentration between 80 percent and 90 percent of the full-scale range of the analyzer. If necessary, adjust the monitor in accordance with the analyzer manufacturer's procedures. Record the resultant instrument reading.
- 4) Initiate a flow of a known gas concentrations for three (3) additional upscale concentrations spread approximately equally over the measurement scale range. For NCore trace level analyzers, initiate a flow of known gas concentrations for two (2) additional upscale concentrations spread equally across the measurement scale range. Record the resultant instrument readings.
- 5) The operator records the following information in order to document the calibration and submits it to the Data Manager: type of QC, pollutant, date, time of day, analyzer make and model, analyzer ID number, person doing QC, location or site ID, known gas type (if applicable), known gas name (if applicable), known gas ID number (if applicable), permeation tube ID (if applicable), calibration equipment type (if applicable), calibration equipment name and ID number (if applicable), known concentrations, analyzer readings, ambient temperature (if applicable), ambient barometric pressure, (if applicable) and percent differences for each upscale concentration point. These records shall be recorded by using either permanent ink on paper or computer-generated spreadsheets.

2.2.6 Troubleshooting

Troubleshooting will be performed according to the manufacturer's operating manual.

2.3 Zero and Span Check

2.3.1 Purpose

The zero and span check is used to verify calibration of a continuous monitoring instrument. Zero and span checks are required to provide decision points for recalibration of analyzers and/or for invalidation of monitoring data.

2.3.2 Principle and Applicability

This procedure compares the monitor reading of an artificial test gas zero concentration and an artificial test gas of a pollutant at one (1) upscale concentration between 80% and 90% of the measurement range.

.3.3 Frequency of Zero and Span Checks

A zero and span check shall be performed at least once every two (2) weeks.

2.3.4 Equipment

- 1) Source of zero-air (cylinder, scrubber, and oxidizer)
- 2) Traceable calibration standards (see AAM SOP Section 10)
 - a) Permeation tube and connecting tube (for NO₂, SO₂, NH₃, and H₂S)
 - b) Gas Cylinder (for CO [balance air], SO₂, and NO)
 - c) U.V. standard photometer (for O₃)
- 3) Regulator Valves
- 4) Tubing and connectors
- 5) Vented manifold or "T" fitting to prevent pressurization of analyzer
- 6) Dilution system or permeation oven
- 7) Calibrated dilution or GPT system

2.3.5 Zero and Span Check Procedure

- 1) The zero and span check is performed at the monitoring site. The known gas must be certified according to AAM SOP Section 10, "Certification of Standards". When performing this procedure, the operator will comply with the instructions of the manufacturer's operation manual.
- 2) During this procedure the analyzer operates in its normal sampling mode and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and as much of the ambient air inlet system as practicable.
- 3) Initiate flow of a zero-air gas through the analyzer. After the monitor reading has stabilized, record the resultant data logger value. Minor zero adjustment (less than 5ppb) between calibrations is allowed. Excessive zero drift or instability requiring repeated adjustments will be investigated by the operator.
- 4) Recalibrate an O₃, SO₂, or NO₂ analyzer if zero point is out by more than ± 5

- ppb. Recalibrate a CO analyzer if zero point is out by more than ± 0.6 ppm.
- 5) Initiate flow of a known gas concentration between 80 percent and 90 percent of the full-scale range of the analyzer. Record the known concentration (K) and the resultant data logger value (R).
 - 6) Calculate and record the percent difference (PD):
$$PD = ((R-K)/K) * 100$$
 - 7) Recalibrate an ozone analyzer if PD exceeds $\pm 7\%$ during zero/span check.

Recalibrate CO, SO₂, and NO₂ analyzers if PD exceeds $\pm 10\%$ during zero/span check.

If PD exceeds $\pm 15\%$, invalidate data back to the last valid zero/span check which meets the appropriate acceptance PD criteria, or the last calibration. Investigate potential operational problems and perform necessary maintenance or repairs. Recalibrate the analyzer. Span adjustments are not allowed between calibrations.

All zero and span checks must be documented in a chronological format. Record the following on a span check form: site ID, pollutant, analyzer identification (serial number), date, time of day, identification of standards used, name of person conducting the check, identification of other equipment used, unadjusted zero reading, adjusted zero reading (if applicable), known span concentration and span reading. These records should be recorded by using either permanent ink or computer-generated spreadsheets.

- 8) Submit the results to the data manager.

2.3.6 Troubleshooting

Troubleshooting will be performed according to the manufacturer's operating manual.

2.4 Collection of Data Including Operating Procedures

2.4.1 Operating Procedures

Install the monitor following the instructions in the manufacturer's operating manual. Connect the monitor to the data logger following the instructions in the manufacturer's operating manual and the data logger operating manual. The data logger will be set to Central Standard Time throughout the year. Operate the monitor following the instructions in the manufacturer's operating manual.

2.4.2 Preventive Maintenance

- 1) For all analyzers, preventive maintenance is performed according to the instructions in the analyzer instrument manual provided by the manufacturer. All preventive maintenance actions are recorded.
- 2) Sampling lines are inspected every month and cleaned annually or when necessary.
- 3) Sampling line filters are inspected monthly and replaced when necessary.
- 4) For analyzers using selective scrubbers/converters (SO₂, NH₃, H₂S) verify scrubber/converter efficiency periodically and replace when necessary.
- 5) For any preventive or remedial maintenance actions taken, the action is recorded and kept on file. Documentation must include analyzer identification, analyzer location, date of maintenance, name of person who performed maintenance, and type of maintenance performed.

2.4.3 Safety Precautions

- 1) General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts. (Note: Some internal adjustments may require the equipment to be powered on.)
- 2) General safety precautions related to the handling and use of compressed gases must be observed during the calibration and QC procedures for continuous analyzers. Never attempt to use the contents of a compressed gas cylinder without an appropriate pressure regulator. Do not remove valve protector cap until ready to make connections. Keep valve pointed away from yourself and anyone else. Vent valve briefly to clear opening of dirt and debris before making connection. Never hammer on a cylinder valve or use excessive force in opening or closing. After making connections, check for leaks with soapy water. Close cylinder valve and release all pressure from a device before disconnecting. Never apply oil to a compressed gas valve or regulator. Never expose a compressed gas cylinder to a temperature above 125 degrees Fahrenheit. Vent and use compressed gases only with adequate ventilation.

2.5 One-Point QC Check (Analyzer Precision Check)

2.5.1 Purpose

The one-point QC check (Analyzer Precision Check) is performed in order to monitor analyzer performance. Evaluation of precision data, together with accuracy audit data, provides an indication of overall quality of monitoring data.

2.5.2 Principle and Applicability

Precision of continuous analyzers is monitored by means of one-point calibration checks at approximately the level of the National Ambient Air Quality Standards (NAAQS) for the appropriate pollutants.

2.5.3 Frequency of One-Point QC Check (Analyzer Precision Check)

One-point QC check (Analyzer Precision Check) are performed on the same schedule as zero and span checks (i.e., at least every two (2) weeks).

2.5.4 Equipment

- 1) Source of zero-air (cylinder, scrubber, and oxidizer)
- 2) Traceable calibration standards (see AAM SOP Section 10)
 - a) Permeation tube and connecting tube (for NO₂, SO₂, NH₃, and H₂S)
 - b) Gas Cylinder (for CO [balance air], SO₂, and NO)
 - c) U.V. standard photometer (for O₃)
- 3) Regulator Valves
- 4) Tubing and connectors
- 5) Vented manifold or “T” fitting to prevent pressurization of analyzer
- 6) Dilution system or permeation oven
- 7) Calibrated dilution or GPT system

2.5.5 One-Point QC Check (Analyzer Precision Check) Procedure

- 1) The one-point QC check is performed at the monitoring site. The known gas must be certified according to AAM SOP Section 10, "Certification of Standards". When performing this procedure, the operator will comply with the instructions of the manufacturer's operation manual.
- 2) During this procedure, the analyzer operates in its normal sampling mode and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and also as much of the ambient air inlet system as practicable.
- 3) Perform the one-point QC check (Analyzer Precision Check) by initiating a flow of a known gas between 0.005 PPM to 0.080 PPM (0.5 PPM to 5 PPM for CO) through the analyzer. For NCore trace level analyzers, use the concentration range specified in the EPA NCore Technical Assistance Document. Record the known concentration (K) and the resultant monitor reading (R).
- 4) Calculate and record the percent difference (PD):
$$PD = ((R-K)/K) * 100$$
- 5) Recalibrate the analyzer if PD exceeds $\pm 7\%$ for ozone, or if PD exceeds $\pm 10\%$ for CO, SO₂ or if PD exceeds $\pm 15\%$ for NO₂ and invalidate data back to the last valid QC check which meets the appropriate acceptance PD criteria, or the last calibration. Investigate potential operational problems and perform necessary maintenance or repairs.
- 6) Record the following: site ID, pollutant, analyzer identification, date, time of day, identification of standards used, name of person conducting the check, identification of other equipment used, one-point QC known concentration, data logger readings and PD. These records should be recorded by using either permanent ink or computer-generated spreadsheets.
- 7) Submit the results to the data manager.

2.6 Continuous Analyzer Audit

2.6.1 Purpose

The performance audit is performed in order to verify analyzer performance. Evaluation of audit data, together with precision check data, provides an indication of overall quality of monitoring data.

2.6.2 Principle and Applicability

Traceable gases, dilution apparatus, and transfer standards utilized in audits must be different from those employed in other QC procedures. Audit results must fall within 15% of actual values for acceptance.

2.6.3 Frequency of Audits

Each analyzer must have an audit conducted at least once per year.

2.6.4 Equipment

- 1) Components dedicated to audit procedures whenever possible
- 2) Source of zero-air (cylinder, scrubber, and oxidizer)
- 3) Traceable calibration standards from sources different than those used for other quality control operations (see AAM SOP Section 10)
 - a) Permeation tube and connecting tube (for NO₂, SO₂, NH₃, and H₂S)
 - b) Gas Cylinder (for CO [balance air], SO₂, and NO)
 - c) U.V. standard photometer (for O₃)
- 4) Regulator Valves
- 5) Tubing and connectors
- 6) Vented manifold or "T" fitting to prevent pressurization of analyzer
- 7) Dilution system or permeation oven
- 8) Calibrated dilution or GPT system

2.5.5 Audit Procedure

- 1) Use a different known gas than is used for other QC operations. Perform the audit prior to adjusting the monitor. Whenever possible, audits should be performed by someone other than the regular site operator.
- 2) The audit is performed at the monitoring site. The known gas must be certified according to AAM SOP Section 10, "Certification of Standards".

When performing this procedure, the operator and/or auditor will comply with the instructions of the manufacturer's operation manual.

- 3) During this procedure the analyzer operates in its normal sampling mode and the gaseous standard must pass through all filters, scrubbers, conditioners, and other components used during routine ambient sampling, and as much of the ambient air inlet system as practicable.
- 4) Provide known concentrations of at least three of the following audit levels. (As a general rule, try to choose concentrations such that the highest level is near the NAAQS or the highest three year site or network concentration.)

Audit Level	Concentration Range, ppm			
	O ₃	SO ₂	NO ₂	CO
1	0.004-0.0059	0.0003-0.0029	0.0003-0.0029	0.020-0.059
2	0.006-0.019	0.0030-0.0049	0.0030-0.0049	0.060-0.199
3	0.020-0.039	0.0050-0.0079	0.0050-0.0079	0.200-0.899
4	0.040-0.069	0.0080-0.0199	0.0080-0.0199	0.900-2.999
5	0.070-0.089	0.0200-0.0499	0.0200-0.0499	3.000-7.999
6	0.090-0.119	0.0500-0.0999	0.0500-0.0999	8.000-15.999
7	0.120-0.139	0.1000-0.1499	0.1000-0.2999	16.000-30.999
8	0.140-0.169	0.1500-0.2599	0.3000-0.4999	31.000-39.999
9	0.170-0.189	0.2600-0.7999	0.5000-0.7999	40.000-49.999
10	0.190-0.259	0.8000-1.000	0.8000-1.000	50.000-60.000

- 5) Record the following: site ID, pollutant, analyzer identification, date, time of day, identification of standards used, name of person conducting the audit, identification of other equipment used, known concentrations, data logger and monitor readings. These records should be recorded by using either permanent ink or computer-generated spreadsheets.
- 6) Submit the results to the data manager.

2.6.6 Audit Failures

Audit failures shall be addressed as described in AAM SOP Section 13.

2.7 Special Guidance for Episode Monitoring

2.7.1 Purpose

Additional quality control requirements are implemented during any ambient air pollution episode monitoring that is conducted.

2.7.2 Applicability

For the purpose of quality control, an air pollution episode is any measured ambient air concentration equal to or greater than an Air Quality Index (AQI) of 150 or more.

Pollutant concentrations corresponding to an AQI value of 150 appear below:

<u>Pollutant</u>	<u>Averaging Time</u>	<u>Concentration (PPM)</u>
SO ₂	1 hour	0.185
CO	8 hours	12.40
Ozone	8 hours	0.095
NO ₂	1 hour	0.360

2.7.3 Procedures

- 1) Continuous analyzer 1-point QC, zero and span checks will be performed at least weekly for the duration of the episode.
- 2) Subsequent to an episode each analyzer which was used to monitor an episode shall be subjected to a performance audit.

2.8 Data Acquisition and Processing

Pollutant concentration data are automatically transported electronically over wireless modem or phone line to a central office computer. Records of field activities (calibrations, preventive maintenance actions, one-point QC checks, zero and span checks, and audits) are initialed and provided to the Data Manager on a schedule set by said individual. Additional details can be found in the AAM SOP Sections 3 and 4.

SECTION 3

CONTINUOUS PARTICULATE MATTER MONITORING

3.1 Overview

This section describes the procedures for operating, calibrating, auditing, and maintaining continuous particulate matter monitors. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. Each monitor or monitor series has an individual chapter to described procedures that are unique to that instrument. A listing of monitors included in this SOP is below:

Tapered Element Oscillating Microbalance (TEOM) 1400/1405 Series
Filter Dynamics Measurement System (FDMS) 8500, TEOM1405F, and TEOM 1405DF
Teledyne API T640

3.2 Tapered Element Oscillating Microbalance (TEOM) 1400/1405 Series

3.2.1 Instrument Description

This chapter describes the procedures for the calibration, operation, and maintenance of a TEOM 1400/1405 Series continuous PM₁₀/PM_{2.5} monitor. Thermo Environmental Instruments Inc. (formerly Rupprecht & Patashnick) manufactures the Tapered Element Oscillating Microbalance (TEOM) 1400/1405 Series.

3.2.2 Calibration

- 1) Perform the analog output calibration every 12 months shortly prior to the flow controller calibration below. Follow the instructions in the "Procedures for Analog Calibration" section of the Operating Manual. Analog calibrations are especially important for 1405 models using a serial connection to the data logger.
- 2) Perform all instrument calibrations and checks (leak check, flow calibration, temperature calibration and pressure calibration) every 12 months, shortly after the analog calibration. Follow the instructions in the "Flow Controller Calibration" Section of the Operating Manual for the appropriate type or brand of flow controller.
- 3) Follow troubleshooting instructions as provided by the manufacturers operating manual.

3.2.3 Collection of Data Including Operating Procedures

1) Safety

General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts.

2) Principle and Applicability

This method employs a gravimetric principle. Ambient air is drawn through a PM₁₀/PM_{2.5} inlet at a constant flow rate, continuously weighing a glass filter element upon which the particulate matter is deposited. Mass concentrations are calculated at ten (10) minute intervals, the instrument is capable of providing not only total mass accumulation, but also 30-minute, 1-hour, 8-hour, and 24-hour averages of the mass concentration. The use of a hydrophobic filter element (i.e., Teflon-coated borosilicate glass) together with warming of the air stream to 50 degrees Celsius minimizes the necessity for humidity equilibration. Data retrieval is accomplished by periodically downloading from a digital data logging device to a portable computer or via a data logger and modem.

3) Installation and Assembly

Follow the instructions in the instrument-operating manual.

4) Downloading Stored Data

i) Connecting to a Computer

i) Connect an IBM AT-compatible computer to an RS-232 port using the 9-to-9 pin computer cable provided with the instrument. If the computer has a 25 pin RS-232 port, use the 9-to-9 pin computer cable in combination with the 9-to-25 pin computer adapter provided with the monitor. Be sure that the unused RS-232 port on the instrument is not attached to any cable or device.

ii) Execute a communications program (e.g., TEOMCOMM; see section 6.5 of the operation manual) to prepare for the download.

iii) Ensure that the communications software is set for the same communication parameters as the instrument. The default settings of the monitor are: 9600 baud, 8-bit word length, 1 stop bit, and NO parity. See

Appendix C.2 if it is suspected that these instrument parameters have been changed.

iv) Set the communications software to the appropriate mode (e.g., "Data Capture").

v) Change the RS-232 mode on the control unit to the desired setting using the "Set RS-232 Mode" screen.

If using a two-way RS-232 protocol, enter the appropriate parameters in the "Com 2-way Settings" screen.

If using the TEOMCOMM software, select the "AK Protocol" from the "Set RS-232 Mode" screen, and enter the following values on the four lines of the "Com 2-way Settings" screen:

RS-Para 1	52
RS-Para 2	75048
RS-Para 3	13010
RS-Para 4	0

vi) Test the connection by checking that the data can be sent and retrieved using the commands appropriate to the selected RS-232 protocol.

ii) Data Downloading to RS-232 Port

i) Following steps of Section 6.3 of the instruments operating manual

ii) Connect an appropriate personal computer to the RS-232 port

iii) Select the "Fast Store Out" mode from the "RS-232 Mode" screen. The internal logger begins to transmit data via the RS-232 port IMMEDIATELY once the mode is chosen; to capture all desired data, it is thus important to connect the computer PRIOR to selecting the "Fast Store Out" mode.

iv) The monitor will transmit all stored data from the present location of the storage-to-print pointer (usually where the last download left off) through the last value stored in the internal data logger.

v) When the end of the storage buffer is reached, return the instrument to a different RS-232 mode (e.g., "None" mode) to locate the storage-to-print pointer just after the last data record transmitted. This ensures that the next download will begin where the previous one left off.

vi) The location of the storage-to-print pointer can be set manually. This can be accomplished from any RS-232 mode by bringing the "View Storage" screen onto the four-line display (press <Store>). Use the navigational keys to display the record at which the pointer should reside, and then press <Ctrl><Last/First> to locate the pointer just before this record.

- iii) The instrument also has the capability for connection via a modem as described in the operation manual (Connecting to a Computer through a Modem).
- iv) The instrument also has the capability to be connected to a data logger, using the analog I/O port and selecting the appropriate program register code (PRIII).
- v) For 1405 TEOM models, data may be downloaded via the USB port to a USB drive.

5) Maintenance

Routine maintenance procedures for the instrument are summarized below. Follow instructions for "Periodic Maintenance" in the instruments operating manual and keep a written record of these maintenance actions.

<u>Procedure</u>	<u>Interval</u>
Replace Mass Transducer filter	Monthly, or when MT filter near 100% load
Clean PM ₁₀ /PM _{2.5} Inlet	Monthly
Change sample flow in-line filter	6 months or prior if necessary
Change by-pass flow in-line filter	6 months or prior if necessary
Clean air inlet system	6 months or prior if necessary

3.2.4 Quality Control Sampling

1) Audits

- i) Perform the mass transducer calibration verification every 12 months. Follow either one of the procedures for "Mass Transducer Calibration Verification" in the Operating Manual.
- ii) Perform the flow audit procedure every 5-7 months. Follow the instructions for "Flow Audit Procedure" in the Operating Manual. As part of this audit, perform the temperature sensor audit, pressure sensor audit, leak check and date/clock check as described in the Operating Manual.

2) Verifications

- i) Perform a single point flow rate verification of the main and auxiliary flows every month at the normal flow of the monitor. Use an external flow standard as the known flow and the monitor flowmeter as the monitor reading. Flow verifications within $\pm 4.1\%$ for $PM_{2.5}$ or $\pm 7.1\%$ for PM_{10} may be adjusted (at operator's discretion) using the software calibration method. $PM_{2.5}$ flow verifications $> \pm 4.1\%$ (sampler/flow standard) or $> \pm 5.1\%$ (sampler/design flow) will require analyzer re-calibration and the data back to the last acceptable flow verification will be invalidated. PM_{10} flow verifications $> \pm 7.1\%$ (sampler/flow standard) will require analyzer re-calibration and the data back to the last acceptable flow verification will be invalidated.
- ii) Perform a leak check every month. The net main flow (check with switching valve in both base and reference positions) leak rate limit is ≤ 0.15 Liters/minute. The net auxiliary flow leak rate limit is ≤ 0.60 Liters/minute.
- iii) Verify that temperature and pressure sensors are within tolerance levels every month. Temperature sensors shall be $\leq \pm 2$ degrees Celsius. Pressure sensors shall be $\leq \pm 0.013$ atmospheres.
- iv) Verify that the instrument date and time is within ± 2 minutes every month.

3.3 Filter Dynamics Measurement System (FDMS) 8500, TEOM 1405F, and TEOM 1405DF

3.3.1 Instrument Description

This chapter describes the procedures for the calibration, operation, and maintenance of a Filter Dynamics Measurement System (FDMS) 8500 Series continuous $PM_{10}/PM_{2.5}/PM_1$ monitor. The Series 8500FDMS Monitor consists of three basic components: the 8500 module, TEOM Series 1400a sensor unit, and the TEOM Series 1400a control unit.

This section also applies to the model 1405(D)F, FDMS TEOMs with all three components housed in one unit. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. Thermo Environmental Instruments Inc. (formerly Rupprecht & Patashnick) manufactures the Filter Dynamics Measurement System (FDMS) 8500, model 1405F, and model 1405DF.

3.3.2 Calibration

- 1) Perform the analog output calibration every 12 months shortly prior to the flow controller calibration below. Follow the instructions in the "Procedures for Analog Calibration" section of the Operating Manual. Analog calibrations are especially important for 1405 models using a serial connection to the data logger.
- 2) Perform all instrument calibrations and checks (leak check, flow calibration, temperature calibration and pressure calibration) every 12 months, shortly after the analog calibration. Follow the instructions in the "Flow Controller Calibration" Section of the Operating Manual for the appropriate type or brand of flow controller.
- 3) Follow troubleshooting instructions as provided by the manufacturers operating manual.

3.3.3 Collection of Data Including Operating Procedures

1) Safety

General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts.

2) Principle and Applicability

This method employs a gravimetric principle. Ambient air is drawn through a PM₁₀/PM_{2.5} inlet at a constant flow rate, continuously weighing a glass filter element upon which the particulate matter is deposited and calculating near real-time mass concentrations. The instrument computes the 1-hour, 8-hour, 12-hour and 24-hour averages of the mass concentration. There are five air stream flows in the FDMS 8500/1405F Series Monitors: the main flow, base flow, reference flow, bypass flow and the purge flow. Details of each flow are outlined in the operating

manual ("Theory of Operation"). Data retrieval is accomplished by periodically downloading from a digital data logging device to a portable computer.

3) Installation and Assembly

Follow the instructions in the instrument-operating manual.

4) Downloading Stored Data

i) Connecting to a Computer

i) Connect an IBM AT-compatible computer to an RS-232 port using the 9-to-9 pin computer cable provided with the instrument. If the computer has a 25 pin RS-232 port, use the 9-to-9 pin computer cable in combination with the 9-to-25 pin computer adapter provided with the monitor. Be sure that the unused RS-232 port on the instrument is not attached to any cable or device.

ii) Execute a communications program (e.g., RPCOMM; refer to the operation manual) to prepare for the download.

iii) Ensure that the communications software is set for the same communication parameters as the instrument. The default settings of the monitor are: 9600 baud, 8-bit word length, 1 stop bit, and NO parity.

iv) Set the communications software to the appropriate mode (e.g., "Data Capture").

v) Change the RS-232 mode on the control unit to the desired setting using the "Set RS-232 Mode" screen.

If using a two-way RS-232 protocol, enter the appropriate parameters in the "Com 2-way Settings" screen.

If using the RPCOMM software, select the "AK Protocol" from the "Set RS-232 Mode" screen.

vi) Test the connection by checking that the data can be sent and retrieved using the commands appropriate to the selected RS-232 protocol.

ii) The instrument also has the capability for connection via a modem as described in the operation manual (Connecting to a Computer through a Modem).

- iii) For 1405F TEOM models, data may be downloaded via the USB port to a USB drive.

5) Maintenance

Routine maintenance procedures for the instrument are summarized below. Follow instructions for "Routine Maintenance" in the instruments operating manual and keep a written record of these maintenance actions.

<u>Procedure</u>	<u>Interval</u>
Replace Mass Transducer filter	30 days or when MT filter near 100% load
Clean PM ₁₀ /PM _{2.5} /VSCC Inlet	Monthly
Change purge (cooler) filter	At each MT filter change
Change sample flow in-line filter	6 months or prior if necessary
Change by-pass flow in-line filter	6 months or prior if necessary
Clean air inlet system	6 months or prior if necessary
Rebuild sample pump	18 months or as needed
Valve cleaning	18 months or as needed
Drier replacement	18 months or as needed
Cooler cleaning	18 months or as needed

3.3.4 Quality Control Sampling

1) Audits

- i) Perform the mass transducer calibration verification every 12 months. Follow the procedure in the Operating Manual ("Verification Procedures").
- ii) Perform the flow audit procedure every 5-7 months. Follow the instructions for "Flow Audit Procedure" in the Operating Manual. As part of this audit, perform the temperature sensor audit, pressure sensor audit, leak check and date/clock check as described in the Operating Manual.

2) Verifications

- i) Perform a single point flow rate verification of the main and auxiliary flows every month at the normal flow of the monitor. Use an external flow standard as the known flow and the monitor flowmeter as the monitor reading. Flow verifications within $\pm 4.1\%$ for $PM_{2.5}$ or $\pm 7.1\%$ for PM_{10} may be adjusted (at operator's discretion) using the software calibration method. $PM_{2.5}$ flow verifications $>\pm 4.1\%$ (sampler/flow standard) or $>\pm 5.1\%$ (sampler/design flow) will require analyzer re-calibration and the data back to the last acceptable flow verification will be invalidated. PM_{10} flow verifications $>\pm 7.1\%$ (sampler/flow standard) will require analyzer re-calibration and the data back to the last acceptable flow verification will be invalidated.
- ii) Perform a leak check every month. The net main flow (check with switching valve in both base and reference positions) leak rate limit is ≤ 0.15 Liters/minute. The net auxiliary flow leak rate limit is ≤ 0.60 Liters/minute.
- iii) Verify that temperature and pressure sensors are within tolerance levels every month. Temperature sensors shall be $\leq \pm 2$ degrees Celsius. Pressure sensors shall be $\leq \pm 0.013$ atmospheres.
- iv) Verify that the instrument date and time is within ± 2 minutes every month.

3.4 Teledyne API T640 and T640X

3.4.1 Instrument Description

This chapter describes the procedures for the calibration, operation and maintenance of a Teledyne API Model T640 which is a continuous $PM_{2.5}$ monitor, and the T640X which measures both $PM_{2.5}$ and PM_{10} continuously. Both T640 and T640X are particulate matter mass monitors that use scattered light spectrometry for measurement.

3.4.2 Calibration

There are three checks of the monitor that can be calibrated. These calibrations are performed after all verifications are conducted. Calibrations only need to be performed for the checks not meeting their expected performance criteria. The checks that can be calibrated are conducted in the following order, as necessary:

- i) Pressure sensor calibration;

- ii) Flow sensor calibration and re-verification; and
- iii) PMT calibration using SpanDust™.

3.4.3 Collection of Data Including Operating Procedures

1) Safety

General safety precautions related to electrical hazards must be observed at all times when working with electrical equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electrical equipment in wet conditions, as frequently encountered at field monitoring sites. Electrical equipment should be switched off and disconnected prior to servicing of internal parts.

2) Principle and Applicability

This method employs a mass monitor that uses scattered light spectrometry for measurement of particulate matter. Ambient air is drawn through an inlet utilizing an internal vacuum pump, an aerosol sample conditioner, and a sample flow controller. The instrument can compute mass concentrations using data rates between 10 seconds and 48 hours, all of which are user selectable. Data retrieval, instrument setup, control, and access to diagnostic information can be accomplished through the front panel, or via RS232, Ethernet, or USB com ports available locally or by remote connection.

3) Installation and Assembly

Follow the instructions in the instrument-operating manual.

4) Downloading Stored Data

- i) The instrument has the capability for connection via a modem as described in the operation manual (Software Setup and Operation).
- ii) Data may also be downloaded via the USB port to a USB drive following the steps in the operation manual, 3.2.6.1 Downloading DAS (Data Acquisition System) Data.

5) Maintenance

Routine maintenance procedures for the instrument are summarized below. Follow instructions for “Routine Maintenance” in the instruments operating manual and keep a written record of these maintenance actions.

<u>Procedure</u>	<u>Interval</u>
Clean Inlet	Monthly
Check Pump Performance	Monthly
Check for leaks	Monthly
Inspect inner and outer sample tubes	Monthly or as needed
Check/Adjust the instrument date and time is within ± 2 minutes	Monthly
Check/Adjust PMT with SpanDust™	Quarterly
Inspect and clean optical chamber and RH/T sensor	Every six months or as needed
Change Disposable Filter Unit	Annually or when Pump PWM Value exceeds 80%

3.4.4 Quality Control Sampling

1) Audits

- i) Flow audits will be performed every 5-7 months and should be performed by someone other than the normal operator. Audits will be performed according to the verification procedures in the instrument operating manual. The standards used will be NIST traceable and different than the standards used for regular calibration and verification. When a flow audit is performed, a temperature audit, pressure audit, leak/zero check and date/clock check is also recommended.

2) Verifications

There are five basic verification checks listed below. All verifications should be conducted first before any calibrations, and then calibrations can be conducted where necessary. Verifications are conducted before calibrations as this is necessary to document the “as found” conditions of the instrument. Three of the verifications can be calibrated, if necessary. There is no adjustment for either the zero test or ambient temperature and as such failure of one or both of these checks results in the need to troubleshoot rather than adjust a setting. The Zero Test, Pressure sensor, Ambient Temperature sensor, and Flow sensor verifications are all performed monthly. The PMT verification using SpanDust™ is performed

quarterly. The five checks should always be performed in the specific order as shown below:

- i) Perform a zero/leak check;
- ii) Pressure sensor verification;
- iii) Temperature sensor verification;
- iv) Flow sensor verifications;
- v) PMT verification using SpanDust™.

Once all verifications are completed, calibrations may be conducted where necessary, for pressure, flow, and the PMT.

3.5 Cooper Environmental Xact 625i

3.5.1 Instrument Description

This chapter describes the procedures for the calibration, operation and maintenance of a Cooper Environmental Xact 625i which is a continuous particulate matter speciation monitor. The Xact 625i uses reel-to-reel filter tape sampling and non-destructive energy dispersive X-ray fluorescence analysis to measure specified metals in the ambient air. The Xact 625i is established as a source-oriented monitor near the Exide Technologies facility in Salina, Kansas. This monitor is configured to analyze the presence of lead within the ambient air at a high time-resolution and is collocated with the NAAQS Hi-Vol intermittent particulate matter samplers near the Exide Technologies facility.

3.6 Data Acquisition and Processing

Pollutant concentration data are automatically transported electronically over wireless modem or phone line to a central office computer. Records of field activities (calibrations, preventive maintenance actions, precision checks, zero and span checks, and audits) are initialed and mailed or hand carried to the Data Manager on at least a monthly basis. If data must be transferred from the monitor to a computer in the event of error the steps to do so are included in the specific chapter for the instrument. Additional details can be found in the AAM SOP Sections 3 and 4.

SECTION 4

INTERMITTENT PARTICULATE MATTER SAMPLING

4.1 Overview

This section describes the procedures for operating, calibrating, auditing, and maintaining intermittent particulate matter samplers. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. Each monitor or monitor series has an individual chapter to described procedures that are unique to that instrument. A listing of monitors included in this SOP is below:

HiVol

Rupprecht & Pataschnick (R&P) Partisol-Plus Model 2025 Sequential PM_{2.5}

4.2 HiVol

4.2.1 Instrument Description

Pre-weighed filters are exposed to an airflow (approximately 40 cubic feet per minute (CFM) for a single 24-hour period (from midnight to midnight (CST)) for the gravimetric determination of total suspended particulate (TSP), lead, and particulate matter less than ten (10) microns in diameter (PM₁₀). This sampling is carried out according to a fixed schedule (once every three (3) or six (6) days) established on an annual basis (USEPA sampling schedule). After exposure, the filters are weighed in a laboratory to determine the net weight gain. The net weight gain and the measured flow rate are used to determine the TSP or PM₁₀ concentration in the air. In addition to gravimetric analysis, lead samples are further analyzed by one of several EPA reference or equivalent methods to determine the lead concentration in the air.

4.2.2 Calibration

1) Purpose

This procedure is used to calibrate HiVol sampler air flow. Orifice calibration units utilized for this procedure are certified by calibration against a positive displacement meter (See Section 10 of AAM SOP). Sampler calibration is performed at the monitoring site. After calibration using a certified calibrator, the air flow is adjusted (for mass flow-controlled samplers only) to approximate a standard design flow (QS) setpoint. The QS setpoint for each site location is listed on the calibration form. The QS setpoint corresponds to a field or actual flow of 40 CFM (mass flow controlled PM₁₀) and 44 CFM (mass flow-controlled TSP/Lead) based on the annual average pressure and temperature at the site.

QS setpoint = design flow x annual avg. pressure / standard pressure x (annual avg. temp. +273) / 273

2) Frequency

- i) Upon receipt
- ii) At twelve (12) month intervals, if not more frequently
- iii) After motor maintenance
- iv) Any time the flow rate measuring device is repaired or replaced

3) Procedure

- i) This procedure is done initially and at least once a year. Perform this procedure on site. On the PM₁₀/TSP Calibration/Audit form, circle calibration, record site ID, type (for example, PM₁₀ or TSP), date, person doing the calibration, HiVol motor ID, orifice ID, barometric pressure (P) in millimeters of Mercury (mmHg), temperature in degrees Celsius.
 $T = \text{degrees C} + 273,$
 $F = (P/760) * (298/T).$
- ii) Connect the orifice calibrator to the inlet of the sampler. Perform a leak check by plugging up the orifice holes and running the motor. This check will detect fairly large air leaks, but small leaks will go undetected.
- iii) Install a filter and run the motor for five minutes.
- iv) Adjust the flow to get four (4) different flow rates for a sampler with a transducer. The standard flow (QS) setpoint should fall between the high and low flow rates chosen. The QS setpoint for each site location is listed on the calibration form. The QS setpoint corresponds to a field or actual flow of 40 CFM (PM₁₀) and 44 CFM (TSP) based on the seasonal average pressure and temperature at the site. The QS setpoint for lead samples collected with a HiVol will be between 40–60 cfm and is not subject to the annual or seasonal temperature/pressure averages calculation. The QS set points in CFM are shown below:

<u>Location</u>	PM ₁₀	<u>TSP</u>
Goodland	36.8	40.5
Concordia	39.7	43.7
Dodge City	38.0	41.8
Chanute	40.3	44.3
Wichita	39.7	43.7
Topeka	40.6	44.7
Kansas City	40.5	44.6
Hays	39.0	42.9

- v) At each flow, read and record the orifice manometer reading (VIII) in inches.
- vi) At each flow, calculate $Y = H * F$ and record Y.
- vii) At each flow, using the orifice calibration curve and Y, determine QS. Record QS.
- viii) At each flow, read and record the transducer reading (I).
- ix) Create a calibration curve of I versus QS.
- x) Remove the orifice calibration unit.
- xi) Adjust the flow so that QS is equal to the QS set in the table on the calibration form.
- xii) Record QS and I.

4.2.3 Operating Procedures

1) Removal of Exposed Filter Element

- a. Open timer door and move switch to the "on" position.

- b. Verify that the HiVol motor and transducer are working properly.
- c. Move the power switch to the "Off" position and record the elapsed timer reading on the appropriate envelope. Remove the transducer chart and place in the filter envelope and install a new chart on the transducer.
- d. Remove filter cassette from the sampler and disassemble, folding the filter with the exposed side toward itself and place in the appropriate envelope.
- e. Sign or initial the envelope.

2) Installation of New Filter Element

- a. Place a new filter in the filter cassette with the identification number toward the support screen. Assemble the cassette (this may be completed prior to visiting the site).
- b. Record the site number, filter identification number, the sample date, and the "Start" elapsed time on the filter envelope.
- c. Install the filter cassette on the sampler and secure.
- d. Verify the timer is set for the correct sample period. Mechanical six or seven-day timers may be advanced to the correct time (CST) and/or date by rotating the timer wheel. Consult the operator's manual to reset an electronic timer.
- e. Flow adjustment is made during calibration. Do NOT try to readjust. Handle filters with care! Torn filters, or filters with pieces missing cannot be analyzed.

Be sure to record ALL required data on the appropriate envelope.

Samplers must run between 23 and 25 hours. Contact field staff supervisor if samplers run outside these limits, or if malfunctions are encountered.

3) Preventative Maintenance and Troubleshooting

- i) For all analyzers, preventive maintenance and troubleshooting are performed according to the instructions in the analyzer instrument manual provided by the manufacturer. The schedule in the instrument manual is followed. All preventive maintenance actions are recorded.

- ii) For TSP and PM₁₀ samplers, inspect the unit (brushes, motor, housing, flow controller and transducer) at six (6) month intervals. At a minimum replace the motor brushes. Following the replacement of brushes, run the motor at reduced voltage for one half hour to allow proper seating of brushes. Replace other components if needed or desired. Perform a multipoint calibration. At least one calibration is done every 12 months on each unit.
- iii) For PM₁₀ monitors, disassemble the size-selective inlet (SSI) for access to all impaction areas including the uppermost level. Clean thoroughly and apply oil to the shim at six (6) month intervals. Check all SSI gaskets and cassette gaskets at six (6) month intervals.
- iv) For any preventive maintenance actions taken, the action is recorded and kept on file. Documentation must include analyzer identification, analyzer location, date of maintenance, name of person who performed maintenance, and type of maintenance performed.

4) Inspection and Voiding Exposed Filters

- i) Quartz (or glass) HiVol filter elements must be inspected prior to analysis to determine whether all required sample information has been included; and to evaluate the physical condition of each filter to determine suitability for analysis.
- ii) Reasons to Void Filters
 - i) Filter torn before or during sampling.
 - ii) Part of filter missing or hole in filter.
 - iii) Sampler ran for less than 23 hours or more than 25 hours.
 - iv) Site unknown.
 - v) Date unknown.
 - vi) Flow rate unknown.
 - vii) Elapsed time unknown.
 - viii) Tare weight unknown.
 - i) More than one filters for the same site and date.
 - j) Unusual contamination (e.g., bird droppings).
 - k) Did not run.
 - l) Improper handling of filter or filter improperly installed on sampler.

4.2.4 Precision

1) TSP/Lead

Operation of collocated samplers at TSP sites is optional, however collocation may be required for certain lead sites. At each of these collocated sites, one of the samplers is designated duplicate and the other is 'regular'. Each duplicate sampler is to be located more than two (2), but less than four (4) meters away from the regular sampler. At each site the duplicate sampler operates during the same period as the regular sampler.

The results from each sampler are reported to USEPA's AQS with the other precision and accuracy data.

2) PM₁₀

Precision is provided by having at least 15% of sites with collocated PM₁₀ HiVols. Even if the official PM₁₀ sampler operates more than one in six days, the duplicate sampler operates at least once in twelve days.

The collocated samplers are located at a distance of 2 to 4 meters from the regular sampler. On the days of collocated operation, each sampler will start and stop at the same time. The collocated samplers will be sited and operated according to 40 CFR 58 Appendix A, Section 3.3.

The resulting concentrations from each collocated sampler are reported to EPA AQS.

4.2.5 Audit

1) Purpose

- i) TSP/Lead accuracy audits are performed by directing air flow into the sampler being audited through a certified orifice calibration unit and recording the resultant flow reading. The orifice calibration unit used for the audit is different than that used in normal calibrations. The orifice calibration unit has been certified annually using the Roots meter at the EPA Region VII lab.
- ii) PM₁₀ accuracy audits are performed by directing air flow into the sampler being audited through a certified orifice calibration unit and recording the resultant flow reading. The orifice calibration unit used for the audit is different than that used in normal calibrations. The orifice calibration unit is certified using the Roots Meter at the EPA Region VII lab.

2) Frequency

- i) The flow rate of each TSP/Lead HiVol is audited at least once every six months. The result of each audit is reported to EPA AQS.

- ii) The flow rate of each PM₁₀ HiVol is audited at least once every six months. Approximately 50 percent of the PM₁₀ HiVols are audited each calendar quarter. The result of each audit is reported to EPA AQS.

3) Procedure

- i) Use a different orifice calibrator than is used for routine calibration.
- ii) On the PM₁₀/TSP/Lead Calibration/Audit form, circle audit, record the site ID, the type (for example, PM₁₀ or PM₁₀A, TSP, Lead), the date, the person doing the audit, the orifice ID, the barometric pressure (P) in millimeters of Mercury (mmHg), the temperature in degrees Celsius,
 $T = \text{degrees C} + 273$
 $F = (P/760) * (298/T)$.
- iii) Connect the orifice calibrator to the inlet of the sampler. Perform a leak check by plugging up the orifice holes and running the motor.
- iv) Install a filter and run the HiVol in normal sampling mode for five minutes.
- v) Read and record the orifice manometer reading in inches (VIII).
- vi) Calculate $Y = H * F$. Record Y.
- vii) Using the orifice calibration curve and Y, determine QS. Record QS.
- viii) Read and record the HiVol reading (I).
- xi) Using the HiVol calibration curve and I, determine the HiVol QS (HQS). Record HQS.
- x) For PM₁₀ only: If QS (for volumetric flow-controlled samplers, use sampler corrected flow) is not $\pm 10.1\%$ of the design flow setpoint, then take corrective action. Record any corrective action.
- xi) If QS is not $\pm 7.1\%$ of HQS, then take corrective action. Record any corrective action.

4.2.6 Flow Rate Verification

1) Purpose and Frequency

A flow rate verification is performed on each hi-vol sampler at least once per calendar quarter (for PM-10 hi-vols, the design flow is also verified). This check is performed using the same certified orifice calibrator with which the sampler was last calibrated. HiVol sampler flow rate/design flow rate checks are performed to confirm sampler calibration. HiVol flow rate/design flow rate checks are performed by directing air flow into the sampler being verified through a certified orifice calibration unit and recording the resultant flow reading. The orifice calibration unit used for this procedure **must be the same** as that used in normal calibrations. The orifice calibration unit has been certified annually using the Roots meter at the EPA Region VII lab.

2) Flow Rate Check Procedure – Mass Flow Controller

- i) Use the same orifice calibrator used for routine calibration of the sampler being checked.
- ii) On the HiVol verification form, record the site ID, the type (for example, PM₁₀ or PM₁₀A, TSP, Lead), the date, the person doing the audit, the orifice ID, the barometric pressure (P) in millimeters of Mercury (Hg), the temperature in degrees Celsius,
 $T = \text{degrees C} + 273$
 $F = (P/760) * (298/T)$.
- iii) Connect the orifice calibrator to the inlet of the sampler. Perform a leak check by plugging up the orifice holes and running the motor.
- iv) Install a filter and run the HiVol in normal sampling mode for five minutes.
- v) Read and record the orifice manometer reading in inches (VIII).
- vi) Calculate $Y = H * F$. Record Y.
- vii) Using the orifice calibration curve and Y, determine QS. Record QS.
- viii) Read and record the HiVol reading (I).
- ix) Using the HiVol calibration curve and I, determine the HiVol QS (HQS). Record HQS.
- x) Calculate the corrected design flow ($DF = F * 39.9$) and record DF.

- xi) For PM₁₀ only: If the QS is not $\pm 10.1\%$ of the corrected design flow (DVI), then take corrective action. Record any corrective action.
- xii) If QS is not $\pm 7.1\%$ of HQS, then take corrective action. Record any corrective action.

3) Flow Rate Check Procedure – Volumetric Flow Controller

- i) Record site ID, date, ambient temperature and ambient pressure on verification form.
- ii) Place the PM₁₀ cassette loaded with a blank filter on the filter support screen, tighten securely.
- iii) Turn sampler on. Allow sampler to warm up and check for leaks.
- iv) Connect manometer to the pressure tap on the filter housing and record filter pressure (P) in inH₂O on verification form.
- v) Turn sampler off and remove the PM₁₀ cassette loaded with a blank filter.
- vi) Place orifice transfer standard on the filter support screen, tighten securely.
- vii) Turn sampler on. Allow sampler to warm up and check for leaks.
- viii) With the manometer still connected to pressure tap on the filter housing, adjust the variable orifice valve to achieve the pressure recorded in step # 4.
- ix) Connect second manometer to the pressure tap on the orifice transfer standard and record pressure (inH₂O) on verification form.
- x) Convert P_f as recorded in step # 4 to mmHg and record on verification form.
- xi) Calculate pressure ratio (P_o/P_i). $P_o/P_a = 1 - (P_f/P_i)$.
- xii) Using the pressure ratio and ambient temperature, look up the actual flow rate (Q_i) from the look up table supplied with the volumetric flow controller. Record Q_a on verification form.

- xiii) Determine the standard flow rate (Q_{std}). $Q_{std} = Q_a (P_a / 760 \text{ mmHg} \cdot (298\text{K} / 273 + T_i))$. Record Q_{std} on verification form.
- xiv) Determine the orifice audit flow rate ($= \text{SQRT}(\text{orifice pressure} \cdot T_a / (P_i - P_b))$) and record on verification form.
- xv) Calculate the percentage difference between the actual flow rate and the orifice audit flow rate ($= (Q_a - \text{orifice audit flow}) / \text{orifice audit flow}$) and record on verification form.
- xvi) Determine the corrected sampler flow rate by using the percentage difference as calculated in step # 15 and the actual flow rate ($= Q_a \cdot ((1 - \text{percentage difference}) / 1)$) and record on verification form..
- xvii) Calculate the percentage difference between the corrected sampler flow rate and the design flow rate ($= (\text{corrected sampler flow rate} - \text{design flow rate}) / \text{design flow rate}$) and record on verification form.
- xviii) If the corrected flow is not $\pm 10.1\%$ of the design flow, then take corrective action. Record any corrective action.
- xix) If the actual flow rate is not $\pm 7.1\%$ of the orifice audit flow rate, then take corrective action. Record any corrective action.

4.2.7 Transporting, Transferring, and Storing Samples

Filters are collected in the field following the procedures above. The operator puts the filter into a custody envelope and the following are recorded on the custody envelope: site ID, date of run, elapsed time of run (and/or start and stop time), average flow rate (and/or the transducer chart is enclosed), and signed initials. The custody envelope (with the filter) is hand carried or mailed to KDHE Bureau of Air (BOA). Staff in the Air Monitoring Unit (AMU) of the Monitoring and Planning Section (MPS) check the envelope for the correct documentation. They also check the filter to see that it is not torn. After this check, the filters are sent to the KHEL or contract lab for analysis. After analysis, the PM-10 filters are sent back to the MPS for storage for at least one year. Lead samples are stored by the contract lab.

4.3 Rupprecht & Pataschnick (R&P) Partisol-Plus Model 2025 Sequential PM_{2.5}

4.3.1 Instrument Description

This section describes the procedures for measuring PM_{2.5} concentrations in the ambient air using Rupprecht & Pataschnick (R&P) Partisol-Plus Model 2025 Sequential PM_{2.5}

samplers. Following collection of samples and measurement of flow rates in the field, concentrations are determined by a contracting laboratory by micro-gravimetric analysis. The samplers collect one sample during a 24-hour calendar day, then stop and begin sampling at another day (hence, they are referred to as intermittent).

4.3.2 Sampler Temperature Sensors Verification and Calibration

1) Summary of Method

- i) Three temperature sensor calibrations (ambient air, filter compartment, and filter) should be performed upon installation of the sampler and annually thereafter. Additional temperature sensor calibrations should be performed upon failure of a temperature verification.
- ii) Ambient air and filter temperature verifications are performed and recorded every 4 weeks to insure specification compliance.
- iii) Verifications fail when the sampler's temperature measurement system differs by ± 2.1 degrees Celsius or more from the temperature measured by the temperature standard.
- iv) Temperature calibrations (ambient air, filter compartment, and filter) are performed upon failure of verifications.
- v) Verification and calibration is completed using an external thermometer (NIST-traceable mini-thermometer transfer standard, see AAM SOP Section 10).

2) Ambient Air Temperature Verification Procedure

- i) Ambient Air temperature verification is performed according to the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

3) Filter Temperature Verification Procedure

- i) Load an empty (i.e. no filter support screen or filter) filter cassette into sample position.
- ii) Remove the very sharp cut cyclone (VCSS).
- iii) Determine the current temperature at the filter temperature (degrees Celsius) sensor using an external thermometer.

iv) Verify that the value of the 'Filt Temp' displayed in the Audit Screen is within ± 2 degrees Celsius of the measured temperature. If this is not the case, you must perform the filter temperature calibration procedure described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

v) Remove external thermometer.

vi) Remove the empty filter cassette from the sample position.

vii) Reinstall the VSCC.

4) Temperature Calibration Procedures

i) Temperature calibrations (ambient air, filter compartment, and filter) are performed annually and upon failure of verifications.

ii) Temperature calibrations are performed as specified in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

5) Documentation

i) Record the sampler ID, date, person, temperature transfer standard (mini-thermometer) ID, all readings from the mini-thermometer, and corresponding temperature readings from the PM_{2.5} sampler.

ii) Submit this documentation to the Data Manager.

4.3.3 Sampler Pressure Sensor Verification and Calibration

1) Summary of Method

i) Perform the ambient pressure calibration upon installation of the sampler, and then annually or when out of specifications.

ii) To ensure compliance with specifications, perform the ambient pressure verification (single point) at least every 4 weeks.

iii) Pressure sensor verification and calibration is completed using a field barometer as a transfer standard. For certification of the transfer standard, see AAM SOP Section 10.

2) Ambient Pressure Calibration Procedure

- i) Follow the instructions in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

3) Single-point Ambient Pressure Verification Procedure

- i) Record the pressure value shown on the monitor.
- ii) Record the transfer standard reading.
- iii) Compare the values. The monitor value should be within +10.1 mm Hg of the measured ambient pressure. If this is not the case, perform the ambient pressure calibration referenced in 4.3.3 part 2.

4) Documentation

- i) Record the sampler ID, date, person, pressure transfer standard ID, all readings from the pressure transfer standard, and corresponding pressure readings from the PM_{2.5} sampler.
- ii) Submit this documentation to the Data Manager.

4.3.4 Sampler Flow Rate Verification, Calibration, and Audit

1) Scope and Application

- i) This procedure is intended for verification or calibration of flow rate for sequential PM_{2.5} samplers in the Kansas Ambient Air Monitoring Network using a transfer standard.
- ii) This procedure applies only to Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential PM_{2.5} samplers incorporated into the Kansas Ambient Air Monitoring Network.
- iii) The sampler flow rate measurement system must be calibrated using actual (uncorrected) flow rates at ambient temperature and pressure (as opposed to standard volumetric flow rate, which is corrected to standard temperature and pressure).
- iv) Single point flow rate verifications are performed every four (4) weeks.
- v) Multi-point flow rate calibrations are performed at installation of a sampler and annually thereafter.

- vi) Multi-point flow rate calibrations are performed annually and upon failure of a single point flow rate verification.
- vii) Failure of the flow rate verification occurs when the sampler's flow rate indicator differs by $\pm 4.1\%$ from the flow rate transfer standard and/or when the design flow differs from the flow rate transfer standard by more than $\pm 5.1\%$. Flow rate verification failure will result in the invalidation of data back to the last good flow verification.
- viii) Verification/calibration data are recorded in the site log and reported to the Data Manager on a quarterly basis.
- ix) A flow rate audit is performed according to the single point flow rate verification procedure (see paragraph III.C.7 below). The flow rate transfer standard used for a flow audit must be different from the transfer standard used for the sampler flow rate calibration. It is preferable (when possible) to have someone perform the audit who did not perform the sampler flow rate calibration.

2) Cautions

- i) Take care to minimize air leaks between the flow rate transfer standard and the sampler inlet.
- ii) The digital electronic manometer is sensitive to changes in temperature. Limit exposure to thermal gradients and allow time for thermal equilibration prior to use. Zero the manometer immediately prior to measurement. Obtain measurements as quickly as possible (as soon as a stable reading is obtained).
- iii) Replace the batteries in the digital electronic manometer when the low-battery indicator is displayed. Low batteries can cause erroneous readings.
- iv) Annual cross-checking the digital electronic manometer against a U-tube manometer is recommended.
- v) Wind may cause manometer fluctuations. A wind screen may need to be employed to improve manometer stability.

3) Equipment

- i) The flow rate standard employed should be capable of measuring flows in the range of 15-20 liters per minute. We use the Streamline Flow Transfer Standard with 10" H₂O electronic manometer.

- ii) The transfer standard must be certified. Certification must be NIST-traceable.
- iii) Annual recertification of the flow rate transfer standard is required. See AAM SOP Section 10 for certification procedure.

4) Single Point Flow Rate Verification Procedure

- i) Perform the flow verification procedure described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

5) Multi-point Flow Rate Calibration Procedure

- i) Perform the flow calibration procedure described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.
- ii) Reset the sampler flow rate to approximately 10% below the sampler's operational flow rate of 16.67 liters per minute (i.e., approximately 15.00 liters per minute), and repeat the flow calibration procedure.
- iii) Reset the sampler flow rate to approximately 10% above the sampler's operational flow rate of 16.67 liters per minute (i.e., approximately 18.34 liters per minute), and repeat the flow calibration procedure.
- iv) After the calibration is complete, perform a single point flow rate verification at the sampler's operational flow rate (16.67 liters per minute). The sample measured flow rate should be within 2.1% of the design flow.

6) Audit Procedure

- i) A flow rate audit is performed according to the single point flow rate verification procedure (see paragraph III.C.7 above). The flow rate transfer standard used for a flow audit must be different from the transfer standard used for the sampler flow rate calibration. The auditor should be a staff person who did not perform the sampler flow rate calibration. The audit flow rate limits are $\pm 4.1\%$ of the flow rate standard and $\pm 5.1\%$ of design flow.
- ii) A single point temperature sensor audit will be performed on both the ambient sensor and the filter sensor according to the temperature sensor verification procedure (see paragraph III.A.3&4). The temperature standard must be different from the temperature standard used for sampler

temperature sensor calibration. The auditor should be a staff person who did not perform the sampler temperature sensor calibrations. The temperature sensor audit limit is $\pm 2.1^{\circ}\text{C}$.

- iii) A pressure sensor audit will be performed according to the pressure sensor verification procedure (see paragraph (III.B.4)). The pressure standard must be different from the pressure standard used for sampler pressure sensor calibration. The auditor should be a staff person who did not perform the sampler pressure sensor calibration. The pressure sensor audit limit is ± 10.1 mm Hg.
- iv) An external leak check will be performed following the filter temperature sensor verification.
- v) The auditor will verify the sampler date and clock. The clock should be within ± 2 minutes of standard.
- vi) Each sampler will be audited at least once every six months. Audit failures shall be addressed as described in AAM SOP 13.

7) Documentation

- i) Record the sampler ID, date, person, flow rate transfer standard ID, all readings from the flow rate transfer standard, and corresponding flow readings from the $\text{PM}_{2.5}$ sampler.
- ii) Submit this documentation to the Data Manager.

4.3.5 Sampler Operations

1) Summary of Method

- i) The R&P Partisol-Plus Model 2025 Sequential Air Samplers incorporated into the Kansas Ambient Air Monitoring Network have been designated as reference samplers (method designation RFPS-0498-118). These samplers thus meet the requirements for operation in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as $\text{PM}_{2.5}$ in the Atmosphere.
- ii) The R&P Partisol-Plus Model 2025 Sequential Air Samplers incorporated into the Kansas Ambient Air Monitoring Network are operated in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

- iii) Whenever possible, the R&P Partisol-Plus Model 2025 Sequential Air Samplers incorporated into the Kansas Ambient Air Monitoring Network are operated in accordance with EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12.

2) Cautions

- i) Damage to the PM_{2.5} sampler may result if caution is not taken to properly install and maintain the device. Follow the manufacturer's instructions for maintenance of PM_{2.5} equipment, and for safe, secure installation.

3) Equipment

- i) Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential Air Sampler
- ii) PM_{2.5} Teflon filter elements 47mm in diameter. Each should be housed in an appropriate filter cassette.
- iii) Rupprecht & Pataschnick compatible Palmtop Data Acquisition System (PDAS) or equivalent or laptop computer, appropriate connecting hardware, and appropriate R&P communications and data management software.

4) Sampler Operation

- i) Operate each sampler in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

5) Field Maintenance

- i) Perform field maintenance monthly and quarterly in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual, and table 9-1 in section 9.0 of the EPA Quality Assurance Guidance Document 2.12, "Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods". This table appears in Appendix F of this document.
- ii) Cautions
 - i) Damage to the PM_{2.5} sampler may result if caution is not taken to properly install and maintain the device. Follow the

manufacturer's instructions for maintenance of PM_{2.5} equipment, and for safe, secure installation.

iii) Equipment

- i) Flow Audit Adapter for external leak check
- ii) 47 mm Leak Check disk in filter cassette for external leak check
- iii) VSCC for change out (must be properly cleaned)
- iv) An alcohol-based general purpose cleaner
- v) Cotton swabs
- vi) Small, soft bristle brush
- vii) Paper towels
- viii) Distilled water

- i) Miscellaneous hand tools
- j) Spares (i.e., O-rings, V-seals, silicone grease, etc.)

iv) Field Maintenance Procedures

- i) Field maintenance procedures are described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual and Table 9-1 in section 9.0 of the EPA Quality Assurance Guidance Document 2.12, "Monitoring PM_{2.5} in Ambient Air Using Designated Reference or Class I Equivalent Methods".
- ii) Perform external leak check upon installation of a sampler, and subsequently after every four (4) weeks of operation, before each flow rate verification. The leak check procedure is described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.
- iii) Replace or clean the VSCC monthly. This procedure is described in the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.

- iv) For each preventive or remedial maintenance activity, record the sampler ID, the date, the person, and the action taken.

4.3.6 Filter Handling and Transport

1) Scope and Application

- i) For PM_{2.5} monitoring KDHE/BOA employs Rupprecht & Pataschnick (R&P) Partisol-Plus Model 2025 Sequential Air Samplers which collect fine particulate on 47 mm diameter Teflon filter elements.
- ii) These filter elements are quite fragile, and PM_{2.5} samples must be protected from contamination and/or analyte loss which may affect analytical results. Special handling is required to ensure the integrity of these samples.
- iii) This SOP describes handling and transport of PM_{2.5} filter elements.

2) Summary of Method

- i) EPA provides unexposed 47 mm diameter Teflon filter elements.
- ii) The clean filters are sent to the contract analytical laboratory for proper physical inspection, conditioning and determination of tare weights. The primary KDHE/BOA contract specification requires that the contracting laboratory conduct all filter handling in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM_{2.5} in the Atmosphere. Whenever possible, the PM_{2.5} filter elements are also handled in accordance with EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec. 2.12. Deviations from Sec. 2.12 must be approved by KDHE/BOA per contract. All contract analytical laboratory activities are conducted in accordance with the laboratory's SOPs.
- iii) After tare weights have been determined at the contract laboratory, filter elements are shipped to KDHE/BOA and to local agencies conducting PM_{2.5} sampling under Memoranda of Agreement with KDHE/BOA. These filters must be exposed within thirty (30) days of determination of tare weight. To minimize opportunities for contamination, it is recommended that filter cassettes be loaded into magazines indoors whenever possible.

- iv) Filter elements are handled in the field in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM_{2.5} in the Atmosphere and the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual.
- v) Retrieval of exposed filter elements and associated data is accomplished in accordance with paragraph IV.G above. Filters must be retrieved within 7 days and 9 hours of exposure.
- vi) Exposed filter elements are transported to the contract analytical laboratory in equipment meeting the requirements specified in 40 CFR 50, Appendix L, Section 10.13. All sample transportation equipment and/or devices are provided and maintained by the contractor.
- vii) Post-exposure conditioning and determination of gross weights are conducted by the contract analytical laboratory in accordance with the laboratory's SOPs which must meet the requirements outlined in paragraph IV.I.2.b above.
- viii) Subsequent to determination of gross weights, the contract analytical laboratory stores all exposed filter elements under refrigeration at 4 degrees Celsius for a period of one (1) year.

3) Cautions

- i) Teflon filter elements are fragile. Handle with care, and never use damaged filter elements for sample collection.
- ii) PM_{2.5} samples are subject to contamination which may affect analytical results. Field personnel should not handle filter elements directly, but only when loaded in filter cassettes. Care must be taken to prevent exposure to sources of particulate matter at all times other than sampling. To minimize opportunities for contamination, it is recommended that filter cassettes be loaded into magazines indoors whenever possible.
- iii) PM_{2.5} samples are subject to loss of sample resulting from volatilization of certain chemical species and/or physical loss of particulate matter.
- iv) Sample loss due to volatilization is generally controlled by maintaining exposed filter elements at cool temperatures. Temperature control during handling and shipping is extremely

difficult, but efforts to avoid exposure to elevated temperatures (i.e., above 40III) are essential.

- v) Physical loss of particulate matter generally results from careless handling of exposed filter elements. This may result from dropping or jarring of cassettes as well as from abrasion of the filter element. Care should be taken to prevent accidental loss of particulate matter.
- vi) Cigarette smoke is a known source of fine particulate matter. All activities associated with filter handling, transport, and operation of PM_{2.5} airborne particulate samplers must be conducted in a smoke free environment.

4) Equipment

- i) Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential Air Sampler
- ii) PM_{2.5} Teflon filter elements 47mm in diameter. Each should be housed in an appropriate filter cassette.
- iii) Rupprecht & Pataschnick compatible Palmtop Data Acquisition System (PDAS) or equivalent or laptop computer, appropriate connecting hardware, and appropriate R&P communications and data management software.
- iv) (Electro) static-free bags with labels for filter cassettes
- v) Mini-cooler with reusable cooling medium and internal temperature monitoring device
- vi) Large zip-lock bag to hold and protect individual bagged samples in mini-cooler.

5) Sample Collection, Preservation and Storage

- i) Collect and retrieve samples and associated data in accordance with paragraph IV.G above.

6) Sample Handling Procedure

- i) EPA personnel provide unexposed 47 mm diameter Teflon filter elements to the contract analytical laboratory.

NOTE: Steps 6.b through and including 6.h (below) are performed by contract analytical laboratory personnel.

The primary KDHE/BOA contract specification requires that the contracting laboratory conduct all filter handling in accordance with 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM_{2.5} in the Atmosphere. Whenever possible, the PM_{2.5} filter elements are also handled in accordance with EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12. Deviations from Sec. 2.12 must be approved by KDHE/BOA per contract. All contract analytical laboratory activities are conducted in accordance with the laboratory's SOPs. These SOPs are subject to KDHE review.

- ii) Conduct physical inspection of filter elements. Do not use damaged or imperfect filters for sampling.
- iii) Properly identify each filter (i.e., assign filter I.D.).
- iv) Condition filter elements in preparation for determination of tare weights.
- v) Determine tare weights of filter elements. This should be limited to an approximate number that can be exposed within thirty (30) days after weighing.
- vi) Perform all required Quality Assurance/Quality Control (QA/QIII) activities.
- vii) Load processed (tared) filter elements into filter cassettes for handling and sampling.
- viii) Properly package processed filter elements and ship them to KDHE/BOA and to local agencies conducting PM_{2.5} sampling under Memoranda of Agreement with KDHE/BOA.

NOTE: Steps 6.i through and including 6.r (below) are performed by KDHE/BOA or local agency field staff.

Filters must be exposed within thirty (30) days of determination of tare weight (i.e., the "Use before" date which appears on the filter bag label).

- ix) Install filters into samplers, loading magazine in accordance with the R&P Partisol-Plus Model 2025 Sequential Air Sampler Operating and/or Service Manual. Load appropriate filter/sample information

into sampler memory at this time. (To minimize opportunities for contamination, it is recommended that filter cassettes be loaded into magazines indoors whenever possible.)

- x) Initiate the sampler run to expose the filter element to a known volume of air for a designated length of time (usually 24 hours). Particulate matter is collected on the filter element.
- xi) Immediately prior to retrieval of filter elements, remove cooling medium from freezer. Place in mini-cooler with temperature monitoring devices. (Mini-cooler, cooling medium, and temperature monitoring devices are provided by the contract analytical laboratory.)
- xii) Retrieve filter elements (in cassettes) and associated data in accordance with the manufacturer's operating manual. Filters must be retrieved within 7 days and 9 hours of exposure.
- xiii) Each filter cassette retrieved corresponds to a separate static-free bag (provided by the contractor). Before placing the filters into the bags, write appropriate filter/sample information on the custody label attached to the bag. Place the filters into the bags with the exposed sample side up.
- xiv) Each bag should be custody label-side up, with the sample surface toward the custody label on the bag to ensure that the sample is shipped with the exposed surface upward. Always handle, transport, and/or store bagged samples custody label-side up.
- xv) Insert individually bagged filters into large zip-lock bag and place bag containing samples, with custody labels facing up, into mini-cooler.
- xvi) Transport mini-cooler to basement shop after retrieval of all filter elements. If filters will not be shipped within two (2) hours, remove cooling medium and zip-lock bag containing filters from cooler and place in freezer.
- xvii) Prepare mini-cooler for shipping. Place 2 ice packs in first, then wrap bubble wrap around the bag of sampled filters. Place this in the cooler on top of the ice packs. On top of the filters place 2 more ice packs and any packing material necessary to fill the cooler to the top to prevent unnecessary shifting of contents. Attach shipping label and seal cooler with tape.

- xviii) Ship mini-cooler(s) to contract laboratory via preferred carrier.
(Preferred shipping is negotiated with the contract analytical laboratory at the start of each contract period.)

NOTE: Steps 6.s through and including 6.cc (below) are performed by contract analytical laboratory personnel.

- xix) Upon receipt, open each mini-cooler received and record the minimum and maximum shipping temperature from the enclosed temperature monitoring device(s), and log in each sample. Alternatively, upon opening the cooler an infrared thermometer may be used to determine the maximum shipping temperature of the filters.
- xx) Condition exposed filter elements.
- xxi) Remove exposed filter elements from cassettes.
- xxii) Determine gross weights of the exposed filter elements.
- xxiii) Perform all required Quality Assurance/Quality Control (QA/QIII) activities.
- xxiv) Calculate net weight (i.e., weight of fine particulate).
- xxv) Ensure that all required Quality Assurance/Quality Control (QA/QIII) activities have been performed.
- xxvi) Calculate results, ensure that data flags have been assigned, process data, and prepare reports.
- xxviii) Transmit data in AQS format to KDHE/BOA. This is to be performed at least once per month.
- xxix) Store samples at 4oC for a period of at least one (1) year.
- xxx) Contact KDHE/BOA prior to discard of samples stored for more than one (1) year.

4.3.7 Laboratory Procedures

- 1) The KDHE contract analytical laboratory performs microgravimetric analysis according to the procedures specified in 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM_{2.5} in the Atmosphere. The contractor also performs all procedures specified in EPA's

Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12, or equivalent, with the approval of the Bureau of Air (KDHE/BOA).

- 2) The contract laboratory will follow applicable portions of paragraph IV.I above.
- 3) The contract laboratory will provide a QA Project Plan (QAPP) for approval by KDHE. The contract laboratory will follow their QAPP and applicable SOPs.
- 4) The contract laboratory will provide concentration data and flags if appropriate. A list of flags is shown in Appendix E below. It should be noted that these flags do not necessarily conform to EPA AQS flags. Also, a flag does not necessarily indicate invalid data.

4.3.8 Quality Control

1) Scope and Application

- i) Microgravimetric analysis of PM_{2.5} filter elements from samplers operating in the Kansas Ambient Air Monitoring Network is performed by a laboratory under contract with the Kansas Department of Health and Environment (KDHE). The contract specifically provides for one (1) KDHE Bureau of Air (KDHE/BOA) employee to perform one (1) site visit during each year of the life of the contract with expenses for travel and lodging covered by the contractor. The site visit can be done annually, or at any interval the air monitoring staff deems necessary. The purpose of this site visit is to provide an opportunity to conduct an inspection/audit for evaluation of overall laboratory performance of work as specified in the contract. Additional inspections/audits at KDHE expense are not precluded, and the United States Environmental Protection Agency (EPA) may also conduct similar activities independent of KDHE.
- ii) The contractor is to conduct analysis of PM_{2.5} filter elements in accordance with EPA's regulatory requirements (contained in 40 CFR 50, Appendix L) and section 2.12 of volume II of EPA's Quality Assurance Handbook for Air Pollution Measurement Systems (or equivalent procedures if approved by KDHE/BoA). This inspection/audit is intended to assure that the contract laboratory complies with this primary contractual specification.
- iii) The operator will run one (1) field blank for each ten (10) exposed filters sent to the contract analytical laboratory. Field blank results

shall be reported with the monthly sample results and shall be reported to AQS.

- iv) Replicate weighings and laboratory blanks are required. The KDHE contract analytical laboratory performs all QA/QC procedures specified in 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM_{2.5} in the Atmosphere. The contractor also performs all QA/QC procedures specified in EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, Sec.2.12, or equivalent, with the approval of the Bureau of Air (KDHE/BOA).
- v) KDHE conducts an inspection and audit of the analytical laboratory performing microgravimetric analysis of PM_{2.5} samples collected within the Kansas Ambient Air Monitoring Network. The KDHE inspector may participate in a group audit in cooperation with other State PM_{2.5} programs which utilize the same contractor.

2) Summary of Method

- i) The contractor is notified of the impending inspection by telephone, a date is agreed upon, and the date is confirmed in writing.
- ii) Round-trip travel arrangements are made.
- iii) Subsequent to arrival at the laboratory, an initial interview is conducted with appropriate laboratory management and staff personnel to explain the reason for the visit and outline the inspection/audit process.
- iv) The inspection and audit are conducted. The "Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of PM_{2.5} Filter Elements" (Appendix B below) is completed on site during the course of the inspection/audit. Open communication with laboratory staff during these activities is essential.
- v) An exit interview is conducted, and a preliminary summary of findings is presented to laboratory management personnel by the inspector.
- vi) A summary of findings and recommendations for any necessary corrective actions are included in a report.

- vii) A copy of the report is sent to appropriate contract laboratory management personnel. Written documentation of corrective actions taken by the laboratory is requested.
- viii) Written documentation of corrective actions is provided to KDHE/BOA by the contract laboratory.

3) Health and Safety Warnings

- i) Laboratory safety practices which minimize exposure to various chemical, electrical, and other hazards are warranted.

4) Cautions

- i). The inspector will be accompanied by laboratory personnel during the inspection.
- ii) Open two-way communication is essential.

5) Equipment

- i) Clipboard
- ii) Ballpoint Pen
- iii) “Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of PM_{2.5} Filter Elements” (Appendix B below)
- iv) Notepad

6) Inspection and Audit Procedure

- i) Contact the appropriate contract laboratory personnel by telephone or e-mail and establish a tentative date for the inspection and audit.
- ii) Follow up by mail with a written notification confirming the date of the inspection and audit.
- iii) Make round-trip travel arrangements.
- iv) At least five (5) days prior to the laboratory visit, reconfirm the date by telephone or Email.

- v) Upon arrival at the laboratory facility, conduct an initial interview with appropriate management and staff (technical and clerical) personnel. Brief them concerning the reason for the visit and explain the inspection/audit process.
- vi) Conduct the inspection and audit using the “Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of PM_{2.5} Filter Elements” (Appendix B below). Maintain open communication with all appropriate laboratory personnel. During the inspection/audit, make detailed notes to accompany the checklist.
- vii) The checklist will provide the structure for the course of the inspection and audit. The following are to be evaluated:
 - a) Analytical facility and weighing room
 - b) Microgravimetric balance performance
 - c) Microgravimetric balance maintenance
 - d) Filter conditioning
 - e) Filter handling
 - f) Filter weighing
 - g) Record keeping and calculations
 - h) Laboratory Quality Assurance Plan
- viii) Conduct an exit interview with appropriate laboratory management personnel. Present a preliminary summary of findings. The checklist will be signed by both parties (i.e., the inspector and the appropriate laboratory manager). Present laboratory management with a copy of the signed checklist.
- ix) Upon return from the inspection/audit trip, review the checklist and additional notes taken during the laboratory inspection/audit.
- x) Prepare a written report containing a summary of findings and recommendations for corrective actions for deficiencies noted.
- xi) Mail a copy of the report with a cover letter to appropriate laboratory management personnel. In the cover letter, be sure to establish a time

frame for correction of noted deficiencies and request written documentation of corrective actions taken by the laboratory.

- xii) Review the documentation of corrective actions provided by laboratory management.
- xiii) If deficiencies are not addressed or appear to persist, address relevant issues in writing, and request additional documentation. (Resolution of severe deficiencies may necessitate another laboratory visit. Because of the contractual agreement, payment for expenses may have to be negotiated.)
- xiv) Upon approval of laboratory performance, send a letter to appropriate laboratory management personnel.
- xv) A copy of the inspection and audit report and copies of all relevant correspondence are to be reviewed and filed by the Data Manager.
- xvi) The “Checklist for Inspection and Audit of Contract Laboratory for Microgravimetric Analysis of PM_{2.5} Filter Elements” appears in Appendix B below.

4.3.9 Transport, Transferring, and Storing Samples

1) Cautions

- a. Damage to the PM_{2.5} sampler may result if caution is not taken to properly install and maintain the device. Follow the manufacturer’s instructions for maintenance of the sampler and for handling of Teflon filter elements.
- b. Teflon filter elements are fragile. Handle with care, and never use damaged filter elements for sample collection.
- c. PM_{2.5} samples are subject to contamination which may affect analytical results. Field personnel should not handle filter elements directly, but only when loaded in filter cassettes. Care must be taken to prevent exposure to sources of particulate matter at all times other than sampling.
- d. PM_{2.5} samples are subject to loss of sample resulting from volatilization of certain chemical species; and/or physical loss of particulate matter. Sample loss due to volatilization is generally controlled by maintaining exposed filter elements at cool temperatures.

Temperature control during handling and shipping is extremely difficult, but exposure to elevated temperatures should be avoided. Physical loss of particulate matter generally results from careless handling of exposed filter elements. This may result from dropping or jarring of cassettes as well as from abrasion of the filter element. Care should be taken to prevent accidental loss of particulate matter.

- e. Cigarette smoke is a known source of fine particulate matter. All activities associated with filter handling, transport, and operation of PM_{2.5} airborne particulate samplers shall be conducted in a smoke free environment.

2) Equipment

- a. Rupprecht & Pataschnick Partisol-Plus Model 2025 Sequential Air Sampler
- b. PM_{2.5} Teflon filter elements 47mm in diameter. Each should be housed in an appropriate filter cassette.
- c. Rupprecht & Pataschnick compatible Palmtop Data Acquisition System (PDAS) or equivalent or laptop computer, appropriate connecting hardware, and appropriate R&P communications and data management software.
- d. (Electro) static-free bags with labels for filter cassettes
- e. Mini-cooler with reusable cooling medium and internal temperature monitoring device
- f. Internal (secondary) container to hold and protect samples in mini-cooler.

3) Custody Procedure

- a. A clean (pre-weighed) batch of filters is received from the contracting laboratory. A packing list is enclosed. The packing list has the contracting laboratory address, the name of the contact person at the operator's agency, the shipping date, the number of filters, and the ID number of each filter.
- b. Each clean filter (in its cassette) is in a plastic bag. The plastic bag has a custody label affixed to it. The filter ID number, the cassette ID

number, and the filter expiration date (“use before” date) have already been entered on the bag custody label by the contracting laboratory.

- c. The operator assigns each filter to a sampler, run date and whether or not it is a blank. The operator enters in a log the sampler ID, filter ID, cassette ID, blank or not, and the planned run date.
- d. In the remaining portion of this procedure, take the actions stipulated according to the operator’s manual. The filters (in their cassettes) are put into a filter cassette magazine so that they will run in order of the log entries above. Attach this magazine to the left-hand (supply) side of the monitor. For each filter added to the magazine, enter filter ID, blank or not, and cassette ID into the monitor to match the log entries above.
- e. After the monitor has sampled, the operator downloads data from the monitor. When picking up the filters, the operator verifies that the filters in the right-hand (storage) filter cassette magazine match the log entries above or the downloaded data.
- f. Using the log, and/or the monitor screens, and/or the downloaded data, the operator fills in the following on the bag custody label: site ID, sampler ID, sample date, sample volume, sampling elapsed time, status, and comments (if any). Put each filter cassette in the appropriate plastic bag with sample side of filter toward custody label (affixed to the bag).
- g. The operator records the pickup date and any comments in the log.
- h. The operator ships the filters every two weeks as specified by the contracting laboratory.

SECTION 5

CARBONYLS SAMPLING

5.1 Overview

This section describes the procedures for operating, calibrating, auditing, and maintaining a carbonyls sampling monitor. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. This monitor will be operating as a part of the EPA Photochemical Assessment Monitoring Stations (PAMS), which is anticipated to begin in Kansas in 2019.

Additional information will be provided in the section when a monitor has been chosen, installed, and is operating in the state of Kansas.

SECTION 6

AUTO-GAS CHROMATOGRAPH

6.1 Overview

This section describes the procedures for operating, calibrating, auditing, and maintaining an auto-gas chromatograph. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. This monitor will be operating as a part of the EPA Photochemical Assessment Monitoring Stations (PAMS), which is anticipated to begin in Kansas in 2020.

Additional information will be provided in the section when a monitor has been chosen, installed, and is operating in the state of Kansas.

SECTION 7

METEOROLOGICAL MONITORING

7.1 Overview

This section describes the procedures used by monitoring personnel when measuring the following ambient air parameters: wind direction, wind speed, temperature, relative humidity, barometric pressure, precipitation, ultraviolet radiation, and solar radiation. The objective of meteorological monitoring is to characterize ambient atmospheric conditions at a location where ambient air quality monitoring is performed.

7.2 Calibration and Troubleshooting

Meteorological instruments shall be installed and operated according to the manufacturer's instructions. Troubleshooting and repair of meteorological instruments shall be performed in accordance with the manufacturer's instructions.

Meteorological instruments are calibrated by the manufacturer and shall be recalibrated based upon the manufacturer recommendations.

7.3 Collection of Data Including Operating Procedures

7.3.1 Siting Guidelines

To meet World Meteorological Organization (WMO) standards, the wind sensor shall be positioned at 9 to 11 meters above ground level on a ten-meter tower. The temperature sensor, relative humidity sensor, barometric pressure sensor, and the solar radiation sensor shall be positioned at 3 to 5 meters above the ground. These height requirements minimize local influences associated with other ambient air monitoring equipment and shelters. There shall be as few obstructions around the sensors as possible.

7.3.2 Operations

Operate the monitors according to the manufacturer's instructions. The time of day shall be recorded as Central Standard Time (CST) throughout the year.

7.3.3 Maintenance

Each component of the meteorological monitoring system is operated in accordance with the appropriate manufacturer's instrument manual. Specific maintenance for each instrument is described below. Perform preventive maintenance according to the manufacturer's instructions and record all maintenance activities in the station log. Full

troubleshooting and maintenance shall be applied as soon as possible to any malfunctioning instrument.

Routine maintenance shall include visual inspection of equipment and verification of operation (i.e., check that data logger is receiving and storing meteorological data) at each scheduled site visit (i.e., every two weeks). Current measurements are to be evaluated to determine whether they are compatible with current conditions. Visual inspection and evaluation of current data against current conditions shall be performed within one week after a severe hailstorm or snowstorm (provided there is safe access to the affected site within one week).

1) Ultrasonic Wind Sensor

The alignment and overall physical condition of the ultrasonic wind sensor shall be checked annually.

2) Temperature Sensor

Clean the temperature/humidity sensor radiation shield at least twice per year.

3) Relative Humidity Sensor

Clean the temperature/humidity sensor radiation shield at least twice per year.
Replacement of the humidity sensing element (R. M. Young Co. Part No. 41372-02) at two year intervals is recommended.

4) Barometric Pressure Port and Sensor

Check the tubing between the pressure port and barometer for condensation at least twice per year, and whenever pressure data appears to be erratic or inconsistent with current conditions. (Note: Installation of a T-fitting and sump can minimize effects of condensation on barometric pressure measurement.)

5) Precipitation Sensor

Additional information will be provided in the section when a monitor has been chosen, installed, and is operating in the state of Kansas.

6) Ultraviolet Radiation Sensor

Additional information will be provided in the section when a monitor has been chosen, installed, and is operating in the state of Kansas.

7) Solar Radiation Pyranometer

Deposition of dust particles on the solar radiation pyranometer window can significantly reduce net solar radiation measurements. Clean the solar radiation pyranometer window with alcohol or water at least twice per year. Recalibration or replacement of the pyranometer shall occur at two-year intervals.

7.3.4 Logs

The station log is essentially a journal which documents all events at the measurement site. Routine site visits, scheduled calibration and maintenance visits, unscheduled maintenance and repairs, and all activities and findings shall be recorded in the station log. The station log provides documentation which may be helpful during data validation.

7.4 Data Acquisition and Processing

The monitors and data logger measure and record the applicable parameters via analog or digital connections. A data logger on site stores the data automatically. The central office AirVision server automatically polls the data logger via modem/phone line or TCP/IP. The central office AirVision server stores the data on an SQL database. The central office AirVision server shall be set to CST throughout the year. For further details, see AAM SOP, Sections 3 and 4. The Data Manager reviews the data on a quarterly basis, prior to submission to U. S. EPA's Air Quality System (AQS). Potential errors (e.g., wind speed above 100 miles per hour, solar radiation above 20 LY/hour at night, relative humidity above 100%, etc.) are evaluated.

SECTION 8

CEILOMETER MIXING HEIGHT MONITORING

8.1 Overview

This section describes the procedures for operating, calibrating, auditing, and maintaining a ceilometer to measure mixing height. Specific technical considerations and complete operating instructions are included in the operation manual provided by the manufacturer. This monitor will be operating as a part of the EPA Photochemical Assessment Monitoring Stations (PAMS), which is anticipated to begin in Kansas in 2019.

Additional information will be provided in the section when a monitor has been chosen, installed, and is operating in the state of Kansas.

SECTION 9

INSTRUMENT SELECTION, ACCEPTANCE, AND INSTALLATION

9.1 Overview

Analyzers, samplers, and instruments must meet certain criteria to be considered for purchase and ultimately utilized. This procedure is intended to define those criteria and provide guidance for final acceptance and installation.

9.2 Selection Criteria

- 1) All air monitoring data will be obtained through the use of reference or equivalent methods (REMs) for all pollutants having REMs designated by USEPA. REMs are defined in 40 CFR 50.1.
- 2) Continuous monitoring instrumentation employed for criteria pollutant monitoring shall conform to criteria contained in 40 CFR 58, Appendix C.
- 3) All instrument operators shall follow procedures outlined in specific manufacturers' operational manuals supplemented by AAM SOP.
- 4) All instruments will undergo 'Testing and Acceptance Criteria' as defined by EPA if purchased under EPA contract.

9.3 Acceptance Criteria

- 1) Following unpacking and assembly of any new monitoring instrument, an initial calibration shall be performed to confirm that the instrument is operating properly.
- 2) Instrument performance characteristics such as response time, noise, short-term zero and span drift, and precision shall be measured during or subsequent to initial calibration.
- 3) Acceptance of the instrument shall be based upon results of these performance tests. Results will be compared to published instrument specifications if such exist.

9.4 Installation

- 1) Monitoring site selection shall be in accordance with the purpose of the monitoring. Siting criteria for instruments and/or instrument probes are contained in 40 CFR 58, Appendix E.

- 2) Specific instrument requirements (e.g., electrical service requirements) may limit site selection.
- 3) Once physical siting requirements have been accommodated, installation should be conducted in accordance with specific manufacturer's recommendations and instructions.
- 4) Following installation, the instrument shall be recalibrated prior to actual use. Required QC procedures shall then be performed on schedule.

SECTION 10

CALIBRATION OF AUXILIARY FLOW METERS

10.1 Overview

This section describes the procedures for calibrating auxiliary flow meters, which exist on various calibration equipment. These flow meters are not used directly in measuring air pollutant concentration, but to dilute gaseous standards to appropriate concentrations for calibration of ambient air monitoring instruments. An example of this type of flow meter is a Vici/Metronics Calibrator rotameter.

10.2 Calibration

10.2.1 Calibration of Rotameter

1) Purpose

This procedure describes the calibration of a Metronics Calibrator rotameter using a BIOS Definer Flow Calibrator manufactured by MESA Laboratories INC.

2) Procedure

- i) Following the operator's manual of the Metronics Calibrator and the BIOS, assemble a BIOS in line with the rotameter, needle valve, and pump.
- ii) Turn on the pump.
- iii) Adjust the needle valve until the rotameter indicator is about 20 percent of full scale.
- iv) Following the BIOS operator's manual, measure the flow (standard conditions) using the BIOS. Record the rotameter reading and the BIOS flow reading.
- v) Repeat the two steps immediately above for approximately 40, 60, 80, and 100 percent full scale of the rotameter.
- vi) Using spreadsheet software, run a regression with the rotameter readings as the first independent variable, the rotameter readings squared as the second independent variable, and the BIOS readings as the dependent variable. The resulting second-degree curve will be the calibration curve.

Print a table with the rotameter setting by 0.5 increments and the corresponding standard flow from the calibration curve.

3) Equipment

Rotameter, flow calibrator (generally, this will be a BIOS Dry-Cal flow calibrator), needle valve, and pump.

4) Use of Other Standards

The BIOS is a primary standard. Rotameters may also be calibrated against secondary standards such as wet test meters, dry gas meters, mass flow meters, and laminar flow elements, provided these secondary standards have been calibrated against a primary standard. The method of choice will vary, depending on the rate of flow to be measured; and/or the scale or limits of the calibration standard. The choice of method should be made by a qualified technician trained in the use of these methods of calibration.

10.2.2 Calibration of Mass-flow Meter

1) Purpose

This procedure describes the calibration of a Mass-flow Meter using a BIOS Definer Flow Calibrator (any series) or any other NIST traceable flowmeter. Mass Flowmeters are used in GPT/Gas Dilution Calibrators and other continuous analyzers. The specific equipment manufacturer's recommendations will be used for MFC calibrations instead of the generic MFC calibration shown below.

2) Procedure

- i) Following the operator's manual of the Mass-flow Meter and the BIOS, assemble BIOS in line with the Mass-flow Meter, needle valve or electronic flow control, and pump.
- ii) Turn on the pump.
- iii) Adjust the needle valve or electronic flow control until the Mass-flow Meter indicator is approximately 100 percent of full scale. Electronic adjustment of the MFC may be made according to the manufacturers recommendations.

- iv) Following the BIOS operator's manual, measure the flow (standard conditions) using the BIOS. Record the Mass-flow Meter reading and the BIOS flow reading.
- v) Repeat the two steps immediately above for approximately 10 percent of full scale and several equally spaced flows between 10 and 100 percent full scale of the mass-flow meter.
- vi) Using spreadsheet software, run a regression with the Mass-flow Meter readings as the first independent variable, the Mass-flow Meter readings squared as the second independent variable, and the BIOS readings as the dependent variable. The resulting second-degree curve will be the calibration curve. Print a table with the Mass-flow Meter setting by 0.5 increments and the corresponding standard flow from the calibration curve. Many modern day GPT calibrators incorporate regression capability in their system firmware.

3) Equipment

Mass-flow Meter, BIOS flow calibrator, needle valve or electronic flow control, and pump.

10.3 Troubleshooting

Perform troubleshooting actions according to the applicable manufacturer's manual.

10.4 Data Acquisition and Processing

The Data Manager files paper records of calibrations. Calibrations are documented by recording the date, personnel involved, the standard ID, the flow meter ID, the standard flow readings, the flow meter readers, and the calibration curve.

SECTION 11

CERTIFICATION OF STANDARDS

11.1 Overview

This section describes procedures for the certification of standards. These standards are used for calibrating and auditing air monitors. These standards are in the form of gaseous standards and flow standards. Gaseous standards are in the form of cylinders of gas, permeation tubes, and ozone photometers. Flow standards are in the form of PM₁₀/TSP orifice calibration standards and PM_{2.5} Streamline Flow Transfer Standards.

11.2 Certification of Gases

1) Purpose and Frequency

For continuous analyzers, standard pollutant gases utilized for calibrations, span checks, precision checks, and performance audits must be traceable to National Institute of Standards and Technology (NIST) gaseous Standard Reference Materials (SRM) or Traceable Reference Materials (NTRM). The certification of cylinders of gas are performed by the manufacturer according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards 1997 (EPA Protocol Gases). Procedures for each certification are provided below.

2) Zero-Air Procedure

- i) For SO₂, NO₂, O₃, zero-air is provided by a pressurized ozonated charcoal scrubber.
- ii) For SO₂, H₂S or NH₃, activated charcoal is an option to provide zero-air.
- iii) For CO, two methods are allowed: a catalytic oxidizer or zero gas cylinder.

3) Carbon Monoxide Certification Procedure

CO (balance gas air) cylinders are purchased as EPA Protocol Gases.

4) Nitrogen Dioxide Certification Procedure

The NO cylinders and NO₂ permeation tubes are purchased as EPA Protocol Gases. In a QC procedure in which an NO cylinder is used, the known NO₂ is established by Gas Phase Titration (GPT) in the following manner:

A span check is performed on the NO channel. After this is complete, ozone is then mixed with the NO from the cylinder, this causes NO₂ to be produced ($\text{NO} + \text{O}_3 = \text{NO}_2 + \text{O}_2$). The difference between the NO monitor readings before and after this mixing is used as the concentration of NO₂ produced.

5) Ozone Transfer Standard Certification

Once a year, the KDHE primary standard photometer is compared with the EPA Region VII primary standard photometer. The KDHE primary standard is maintained in the air monitoring shop. Transfer standard photometers are verified/re-verified with the KDHE primary standard each quarter. All verifications/re-verifications with the primary standard require at least six calibration points. The procedures in section 3 of the EPA Transfer Calibration of Air Monitoring Analyzers for Ozone Technical Assistance Document will be followed for verification/re-verifications. One transfer standard is designated for audits; the other standards are used for non-audit QC operations. Records of all comparisons are kept on file.

6) Sulfur Dioxide Certification Procedure

All SO₂ cylinders and SO₂ permeation tubes are purchased as EPA Protocol Gases.

7) H₂S Certification Procedure

The permeation rates of the H₂S permeation tubes are certified traceable to NIST standards by gravimetric analysis.

8) NH₃ Certification Procedure

The permeation rates of the NH₃ permeation tubes are certified traceable to NIST standards by gravimetric analysis. NO cylinders are purchased as EPA Protocol Gases.

11.3 HiVol Orifice Calibration Unit Certification

1) Purpose and Frequency

TSP and PM₁₀ Flow Certification: Each orifice calibration unit shall be calibrated USEPA Region 7's Roots meter (in Kansas City, KS) every twelve (12) months.

2) Procedure

- i) Connect the orifice to the inlet of the Roots meter. Connect a HiVol to the outlet side of the Roots meter.

- ii) Check for leaks by temporarily clamping both manometer lines (to avoid fluid loss) and blocking the orifice. Start the HiVol and note any change in the Roots meter reading. The reading should remain constant. If the reading changes, locate any leaks by listening for a whistling sound and/or retightening all connections, making sure that all gaskets are properly installed.
- iii) Turn off the HiVol. Unblock the orifice. Unclamp both manometer lines and zero both manometers.
- iv) Record the date, the orifice ID, the person's name doing the calibration, and the Roots meter ID on the orifice calibration form. Record the room temperature in degrees Celsius. Record the barometric pressure (P) in millimeters of Mercury (Hvii).

Calculate $T = \text{degrees C} + 273$.

Calculate $F = (P/760) * (298/T)$.

Record T and F on the orifice calibration form.

- v) Achieve five different but constant flow rates, evenly distributed, over the entire range of the calibrator.
- vi) Repeat steps g. through p. below for each flow rate. Allow the system to run for at least one minute in order for a constant motor speed to be attained.
- vii) Simultaneously read the Roots meter reading and start a stop watch. Record the Roots meter reading at the start of the stop watch as VI.
- viii) While the air is still flowing, read and record the Roots meter inlet pressure manometer in inches of Hg as PI.
- ix) While the air is still flowing, read and record the orifice manometer reading in inches of water as H.
- x) After at least 200 cubic feet of air have passed through the Roots meter at a constant rate, simultaneously read the Roots meter reading and stop the stop watch. Record the Roots meter reading when the stop watch was stopped as VF.
- xi) Calculate and record $VM = VF - VI$.
- xii) Record the elapsed time from the stop watch in hundredths of a minute as TE.

- xiii) Record $PR = PI * 25.4$.
- xiv) Record $VS = VM * ((P-PR)/760) * (298/T)$.
- xv) Record $QS = VS / TE$.
- xvi) Record square root $(H * VI)$.
- xvii) Using spreadsheet software, perform a linear regression with the independent variable being the square root of $(H * VI)$ and the dependent variable being QS. Using the resulting slope and intercept, build a table of $(H*VI)$ and the corresponding QS.

11.4 Streamline Flow Transfer Standard

The Streamline Flow Transfer Standard (FTS) is sent to the manufacturer for annual re-certification.

11.5 Calibration of the Barometric Pressure Transfer Standard

1) Purpose and Frequency

The BPTS is an aneroid barometer that is used in the field for PM_{2.5} intermittent monitor pressure sensor calibration. The BPTS is also used during PM₁₀/TSP intermittent monitor flow calibrations and audits. KDHE maintains a National Institute of Standards and Technology (NIST) traceable aneroid barometer as the authoritative standard (i.e. reference barometer).

The KDHE pressure calibration chamber shall be used to perform a five-point pressure verification/calibration annually. All verification checks are maintained in a log, and results are provided to the Data Manager/QA Officer. A multipoint pressure verification/calibration will be performed

- i) annually;
- ii) on new transfer standards;
- iii) when a transfer standard differs from the reference standard by more than 3mm Hg during a single point verification;
- iv) when a transfer standard has been dropped, or other damage is suspected;
- v) if a transfer standard has been modified or repaired.

2) Procedure

- i) Inspect the reference barometer for physical damage prior to use. Replace if damaged.
- ii) Allow time for temperature equilibration.
- iii) Compare transfer standard barometer with reference barometer at ambient conditions.
- iv) If the transfer standard barometer is adjustable, adjust to match the reference barometer.
- v) Place the transfer standard barometer(s) and the reference barometer in the pressure calibration chamber in such a manner that all dials are clearly visible through the glass in the access door.
- vi) Tighten clamping screws to seal chamber access door.
- vii) Repeat procedure as necessary to achieve agreement with reference barometer within ± 1 mm Hg. If transfer barometer is not adjustable, record pressure readings.
- viii) Connect pressure/vacuum source to chamber and adjust pressure to approximately 690 mm Hg equivalent on reference barometer. Record pressure readings.
- ix) Repeat step h above for a total of five (5) different pressures spaced approximately equal between 690mm and 770mm Hg. Record pressure readings.
- x) Compute a best fit curve for the transfer standard barometer. Transfer standard barometers exhibiting a non-linear relationship or a difference of more than ± 5 mm Hg for any point will be repaired or replaced.

11.6 Calibration of the Temperature Transfer Standard

1) Purpose and Frequency

The TTS is a mini-thermometer that is used in the field for PM_{2.5} intermittent monitor temperature sensor calibration and ambient meteorological sensor calibration/verification. The TTS is also used during PM₁₀/TSP/Lead intermittent monitor flow calibrations and audits. National Institute of Standards and Technology (NIST)-traceable mini-

thermometers are maintained as temperature transfer standards. Mini-thermometers are certified annually by EPA.

2) Procedure

- i) The calibration has been performed by or for the manufacturer of each mini-thermometer.
- ii) The operator or supervisor maintains a copy of certification of NIST-traceability for each mini-thermometer used.
- iii) Inspect each mini-thermometer for physical damage prior to use for comparison to temperature sensors.
- iv) Each mini-thermometer will be compared annually to a reference at EPA Region VII.
- ii) Replace any mini-thermometer which has been damaged.

11.7 BIOS Dry-Cal Flow Standard Certification

The BIOS Dry-Cal flow standards are sent to the manufacturer every year for maintenance and re-certification.

11.8 Documentation

All certifications performed in-house are documented by recording the date, operator's initials, the standard ID, the primary standard ID, the standard readings, and the primary standard readings. Manufacturer or third party certifications are documented by a certificate from the company performing the certification. All certifications are submitted to the Data Manager for filing.

SECTION 12

OPERATION OF STAINLESS STEEL FLASKS

12.1 Overview

This procedure describes the collection of ambient air samples in stainless steel spherical flasks. Clean spherical six (6) liter capacity stainless steel flasks can be used to sample ambient air. A grab sample can be obtained by opening a valve on an evacuated flask and subsequently closing the valve when a hissing sound ceases; this generally takes 1 - 2 minutes. Longer fill times (up to several hours) can be achieved through the use of a flow regulator. A larger volume of air can be sampled using a pump, which forces air into the sphere, pressurizing the system to nearly 15 psig, equivalent to twelve (12) liters of air at standard conditions.

All flasks should be prepared and cleaned by a contractor or an EPA laboratory.

12.2 Sampling Procedure

12.2.1 Grab Sample

- 1) Remove protective cap from inlet valve. Measure and record initial vacuum
- 2) When in position for sampling (e.g., within a plume), open valve about two (2) full turns.
- 3) Listen for hissing sound; if there is no sound, mark the sphere for return to the shop for cleaning, and start over using another sphere.
- 4) When hissing sound ceases (within 1-2 minutes), sampling is complete. Close the inlet valve securely.
- 5) Replace protective cap on inlet valve. Measure and record final vacuum.
- 6) Complete all necessary documentation as required by the laboratory.

12.2.2 Timed Sample

- 1) Remove protective cap from inlet valve. Measure and record initial vacuum.
- 2) Attach a flow controller to the valve and tighten securely.
- 3) When in position for sampling (e.g., within a plume), open valve about two (2) full turns.

4) There will be no sound as the sphere fills.

5) Calculate sampling time as:

$$\frac{6000}{\text{cc/min on flow controller}} = \text{minutes to sample}$$

6) When time has elapsed, close the valve securely.

7) Remove the flow controller. Measure and record final vacuum.

8) Replace protective cap on inlet valve.

9) Complete all necessary documentation as required by the laboratory.

12.2.3 Pressurized Sample

- 1) The six liter flasks are filled to 14.7 psig during sampling. This is 12 liters of air at standard conditions. Measure and record initial pressure.
- 2) Using a valve connected to the pump inlet, set a desired flow rate so that 12 liters are sampled.
- 3) When the sampling time is complete, close the sample inlet valve.
- 4) Attach a pressure gauge to the flask. Measure and record the final pressure in psig.
- 5) Make this calculation:

$$V = V1 \frac{(14.7 + P1) 298}{14.7 T1}$$

Where:

V = The volume sampled at standard conditions

V1 = Volume of the flask

P1 = Pressure measured in the flask (psivii)

T1 = Temperature in the flask (K)

- 6) Record: The starting and stopping time of the sampling, the flask number, the valve number, the valve setting, the flask pressure after sampling, the temperature in the flask, the volume sampled at standard conditions, the location, your name, and the date.

12.3 Quality Control Sampling

Duplicate (collocated) sampling is recommended whenever possible, depending upon sampling conditions and availability of extra stainless steel flasks. Comparison of results from such collocated samples facilitates evaluation of the precision of the sampling method together with that of the analytical method employed.

SECTION 13

DATA MANAGEMENT

13.1 Overview

This section describes the procedures used by personnel in the office to process the data that come from the field. These procedures can be divided into PM_{2.5} intermittent data, hourly data, quality control (QIII) data, PM₁₀/TSP intermittent data, submitting data to AQS, submitting site and monitor information to AQS, calculating local conditions data, and documentation of changes to AQS. This section does not include data polling because it is covered in Section 3 of the AAM SOP.

13.2 Intermittent Particulate Matter Monitoring

13.2.1 PM_{2.5}

1) Receipt of Filter Data

Field technicians send filter and interval data via E-mail after sampler is downloaded. The data, (in text format, with the name convention “sampleridf01date” (e.g., 20198f01may4.txt), is then transferred to a folder on the data person’s hard drive. The folder name corresponds with the month that the data is collected. Each sampler has a folder on the shared drive. There is also a ‘raw’ folder in each sampler folder.

2) Combine Filter Data

In each raw folder there is a file named “sampleridf01.txt” example: 20198f01.txt. This is the main filter data file that is used to combine filter data from multiple filter data files. This provides a single filter data file with an entire month of sample runs. The process is done by cut and paste operations in Notepad.

3) Visual Check of Filter Data

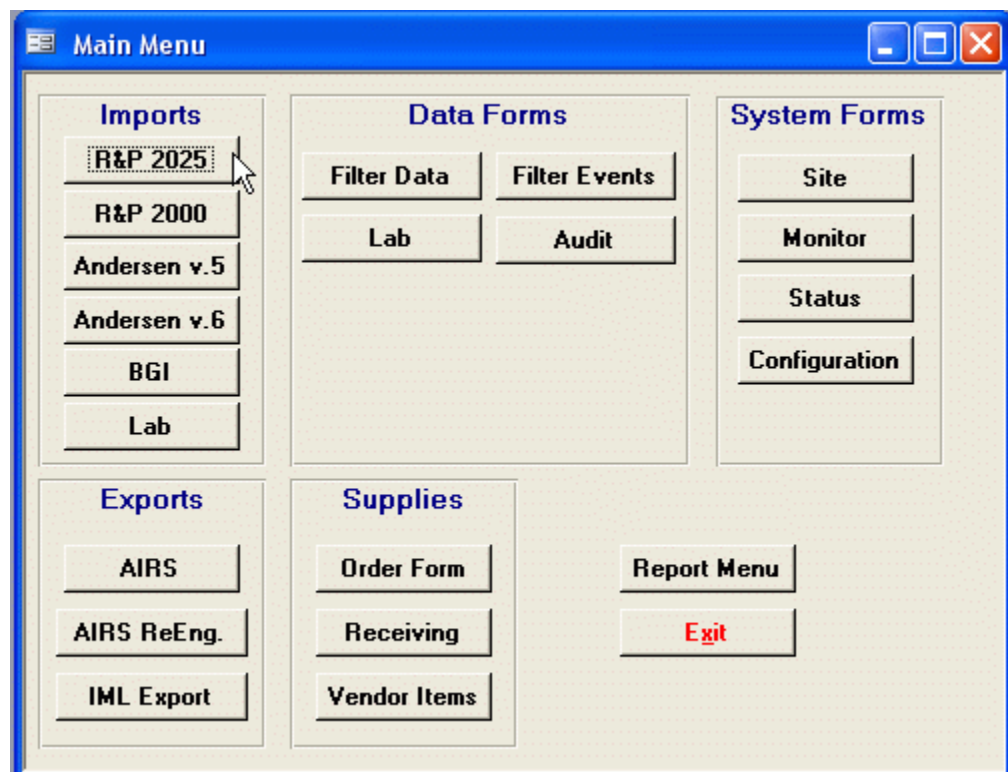
Open the combined filter data file, (e.g., 20198f01.txt), in the raw folder and visually check the filter data for the following. If any of the below data are missing, incorrect, duplicated, or out of range, write down the sampler id, sample date, and what is wrong with the data and contact the operator for explanations.)

- a. Check the 7 digit filter identification numbers and make sure there are no duplicates.

- b. Check that the elapsed time is > 23:00 hrs and < 25:00, except on blank samples.
- c. Check the average flow. It should be around 16.7.
- d. Check the Site ID and Sampler ID (e.g., Site ID 201730010 Sampler ID 20198). If not showing, it will be added later in the process. Contact operator and have them enter ID's into sampler.
- e. Check sample dates, according to EPA's Particulate Matter Monitoring Schedule, make sure to note missed sample days, duplicate sample days, etc. This information will be sent to the lab along with the finalized filter data. The interval data files are used to help identify whether a sampler was, or was not running on a given sample day.

4) Data Management

The data management tool used for PM_{2.5} data is the Particulate Data Management Tool (PDMT). The PDMT database was created by the company PES and funded by EPA and Mid-Atlantic Regional Air Management Association (MARAMI).



5) Importing PM_{2.5} Data

From the main menu of the PDMT database, look for the Import section and click R&P 2025. This opens the R&P Data Import Form. To import PM_{2.5} data do the following:

- a. Enter today's date.
- b. Click check box at #1.
- c. Enter Sampling Frequency (i.e., 3 or 6).
- d. Click #2 and Browse to sampler filter data in the raw folder.
- e. Click #5 Pulls up filter data in table format. This is where editing takes place. Example: site and sampler IDs. Also check the data one last time for duplicate filter IDs, sample dates and times.
- f. Click #8 to Append or Add the data to the main data tables.
- g. Repeat for all samplers, remembering to change the sample frequency when needed (e.g., collocated samplers run on a six day frequency).

The screenshot shows a software window titled "R & P Data Import". It contains a list of numbered steps, each with a checkbox and a description. Step 1 is selected. The form includes input fields for date and time, a dropdown for sampling frequency (set to 3), and buttons for selecting files and editing records.

Step	Description
<input checked="" type="checkbox"/> 1.	Enter Retrieval Date and Time (mm/dd/yy hh:mm) Enter Sampling Frequency (e.g. 1, 3, 6 or blank) [3] Day(s)
<input type="checkbox"/> 2.	Select Filter Text File
<input type="checkbox"/> 3.	Select Interval Text File
<input type="checkbox"/> 4.	Select Input Text File
<input type="checkbox"/> 5.	Edit Filter Text Records
<input type="checkbox"/> 6.	Edit Interval Text Records
<input type="checkbox"/> 7.	Edit Input Text Records
<input type="checkbox"/> 8.	Append Filter, Interval, Input imports into main data tables

6) Editing Query

There is a query (qryIMLFilter) set up to create a report of all samplers along with a month of filter data. The query date field needs to be updated to the corresponding month. To edit the query do the following:

- a. From the main menu of the PMDT database, look for the Report Menu button and click. This opens the Reports form.

Reports

Field Reports

- Filter Events
- Sampler Filter Data
- All Filter Report

Lab Reports

- Sample Summary Data
- Blank Filters
- Mass Concentration Graph

Status Reports

- Status By Location
- Status By Type
- Data Verification
- QA Reports

Reporting Parameters

Date From:

Date To:

Select Site:

Monitor ID:

Leave the site box blank for all sites.

Affects Concentration Graph Only

Ad hoc Queries | Ad hoc Reports | Close

- b. Click the Ad hoc Queries button.
- c. Scroll and find qryIMLFilter and click edit button.

Ad Hoc Queries

Select a Query to Edit. Be sure to save it under a different name.

qryQAReport	Edit
qryQAReportPreDave	Edit
qryQCAvgFlowSummary	Edit
qryQCSummary	Edit
qryRawIntervalText	Edit
qryIMLFilter	Edit

- d. This opens the query in design view. In the FT_Actual_Start_Date field, change the beginning and ending dates in the criteria cell. Click Save.
- e. Run query by clicking the Run icon (red!) in the upper left hand corner.
- f. Save changes and Close query.
- g. Close Ad hoc queries form.

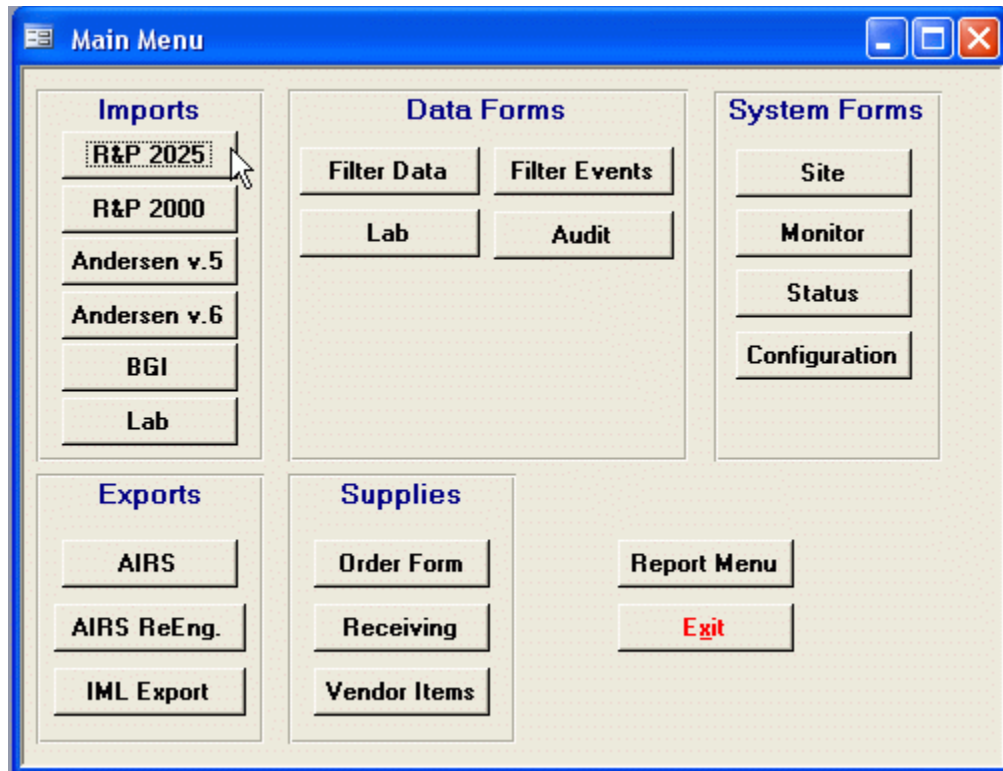
7) Printing Report

After editing the query, create a report of the monthly filter data for a final review. To create the report of filter data from all samplers do the following:

- a. In the Reports form, look for the Field Reports section.
- b. Click All Filter Report button.
- c. On the top right, click Acrobat tab and export to pdf file.
- d. Close Reports form.

8) Final Review

Review report one last time for items under Item 3 (Visual Check of Filter Data) in this document. This is also where to summarize all verifications of missing data, voided filters, missed runs, etc., to account for all sampling days for the month according to EPA's Particulate Matter Monitoring Schedule.



9) Create IML File

The filter data file that is sent to the contracted PM_{2.5} lab is created and exported to the hard drive in Microsoft Excel format. The path of the file is located under the IML Export button properties in the design view of the Main Menu. Follow the steps below to export and edit the filter data file:

- a. In the Main Menu, click on the IML Export button. You should receive a popup when export is completed.
- b. Open the created Microsoft Excel file and make sure each Time referenced column is formatted in 24:00 hour time.
- c. Highlight entire file and sort first by column FT_Site_ID2, Ascending, then by column FT_Actual_Start_Date, Ascending.
- d. Save according to name convention: (iml_month_year.xls; iml_05_05.xls). Month is equal to the month that the data represents.

10) Send Filter Data to Lab

Send PM_{2.5} filter data to contracting lab via e-mail. Include any information/explanation of voided filters, missed runs, machine malfunctions, etc. Attach the All Filter Report pdf file, and the Excel file to the email.

11) Submission of Filter Data to AQS

- a. Once PM_{2.5} filters are analyzed, the contract laboratory provides (via e-mail) Excel and AQS-format text files containing the analytical results.
 - i. Review the text files for any formatting errors.
 - ii. Check the Excel summary files to look for any errors or suspicious data.
 - iii. Check reported contract laboratory results by manual recalculation for three (3) samples chosen at random from the monthly report.
 - iv. Print off copies of each of the summary files for each site and file in the PM_{2.5}/PM₁₀ filter file for the appropriate quarter.
 - v. If high values are reported, notify supervisor.
 - vi. For any other questions pertaining to the data contact the contract laboratory to determine if data is valid or if re-analysis is needed.
- b. Once the Excel file and AQS-format file are correct, save the files and rename for the appropriate year and quarter. Submit AQS-formatted raw data file and then AQS-formatted precision data file to AQS.

13.2.2 PM₁₀ and TSP/Lead

- 1) Filters are collected in the field following the procedure in AAM SOP Sec. 2, paragraph IV. The operator puts the filter into a custody envelope and the following are recorded on the custody envelope: site ID, date of run, elapsed time of run (and/or start and stop time), average flow rate (and/or the transducer chart is encloseid), and signed initials. The custody envelope (with the filter) is hand delivered or mailed to the lab.
- 2) Technicians in the Air Monitoring Unit (AMU) of MPS check the envelope for the correct documentation. They also visually inspect the

filter to determine the suitability of the filter for analysis. After inspection, the status of the sample runs is entered into a database for tracking purposes. Then the filters are sent to the KHEL for analysis. After analysis, the filters are sent back to the AMU/MPS for storage for at least one year.

- 3) Filters are analyzed at KHEL. Results of filter analysis are emailed to data personnel in the AMU/MPS in Excel format. Review data spreadsheets from KHEL for errors and suspicious data. Notify supervisor if high values are reported. If errors or suspicious data are found, contact KHEL to inquire about the suspect values or to request reanalysis of the suspect sample(s).
- 4) Perform a “Sort” to the Excel file. This allows for easy viewing of collocated data.
- 5) Once all data has been reviewed for errors and incorrect formats, save the files as a *.csv file. After saving, open up the file in Notepad. Choose “Find and Replace” to replace “,” with “|”. Once all commas are replaced with pipes (|), save the file as a text file (e.g., 2005Qt1PM10). After saving, the file is in the correct format and ready for submission into AQS.

13.3 Continuous Monitoring

- 1) After the end of each month, perform preliminary editing in AirVision (a and b below). Print the monthly reports for all the monitors. In Average Data Editor, select all the appropriate monitors and the desired time interval.
 - a. Select “Set AQS Null Code” and enter an appropriate null data code (“AM” is a commonly used null data code for “Miscellaneous Void”). Click on “OK”. This adds the null code to any hour lacking a valid reading as well as a null code.
- 2) Scan through AirVision monthly reports for errors and suspicious data (high or low). Determine if suspicious data needs to be voided. Document the findings on the corresponding monthly report. Notify supervisor of high values. When looking through the monthly reports conditions as stated below need to be inspected further and could warrant voiding of data:
 - a. Values greater than:
 - 7 ppm (CO)

- 0.070 ppm (other gaseous parameters)
 - 25 mph (wind speed)
 - 360 degrees (wind direction)
 - $80 \mu\text{g}/\text{m}^3$ (PM_{2.5} hourly)
 - $50 \mu\text{g}/\text{m}^3$ (PM_{2.5} daily)
 - $150 \mu\text{g}/\text{m}^3$ (PM₁₀ hourly)
 - $100 \mu\text{g}/\text{m}^3$ (PM₁₀ daily)
 - 42°C (temperature)
 - 100% (relative humidity)
 - 1020 millibars (barometric pressure)
 - 135 Langley/hour (solar radiation)
- b. Check readings before and after any PC/Span checks (invalid PC/Span checks can lead to invalid data).
- c. Several zero values in a row for PM data.
- d. Large amounts of missing data (find out the causes by checking with the site operators and by checking monthly reports from site operators, emails, or previous verbal communications).
- e. If either wind speed or direction data is invalid, both need to be voided together for the same time interval due to the readings coming from the same met sensor.
- f. Check method codes for errors. Any invalid method codes should be changed in AirVision immediately following the replacement of a monitor.
- 3) Check the QA/QC records, monthly reports from site operators, and emails or verbal communications to determine if additional data should be voided.
- 4) Correct or delete errors or suspicious data found in steps 2 and 3 in AirVision. Code voided data with the appropriate null data codes. After editing, document the changes in the Agilaire system Record Log book.
- 5) Create an AQS format data file by either month or quarter. Import the data file into Microsoft Access and run the following queries:
- Record with no value and no null code (when the monitor was not on for a whole day)
 - Relative Humidity > 100%

- Wind Speed > 30 mph
 - Values (except temperature) < 0
- 6) AQS will reject any lines of data that meet all conditions stated in Step 5 except for Wind Speed > 30 mph. If the query does not highlight any lines of data that are out of range the file is ready for submission to AQS. If the query highlights data that is out of range, make the appropriate changes to the data and repeat process from step 4 on. Repeat this process until the data passes all queries. At this point, the AQS format file is ready for submission to AQS. Due to the structure of AQS, all AQS format files for raw data (hourly, PM_{2.5} and PM₁₀) must be submitted to AQS before QA/QC data can be submitted.

13.4 Quality Control Data

- 1) Every quarter, store all forms turned in by the field staff in a folder for that specific quarter.
- 2) Sort all QA/QC paperwork into five categories:
 - Gaseous Pollutants
 - Continuous PM_{2.5}/PM₁₀
 - Sequential PM_{2.5}
 - Sequential PM₁₀
 - Speciation and Others
- 3) Review all forms for errors and make corrections as needed.
- 4) Enter the dates of all QA/QC procedures into the QA/QC Summary Tables for tracking purposes.
- 5) Code precision and accuracy data with the appropriate method codes for each form. Enter the precision and accuracy data recorded on the forms by the field staff into AQSPA.
- 6) In AQSPA, generate and review summary reports for precision and accuracy data. Review these reports for errors or suspect values.
- 7) In AQSPA, generate AQS format files for precision and accuracy data for the quarter being reviewed. Generation of these files produced AQS-ready files. Due to the format of AQS, files for raw data (hourly, PM_{2.5} and PM₁₀) must be submitted before AQS will accept QA/QC files.

13.5 Meteorological Monitoring

- 1) A data logger on site stores the data automatically. The central office data computer automatically polls the data logger via modem and telephone line. Meteorological data are averaged over time so that hourly averages are stored for each parameter. The data loggers and central office data computer shall be set to Central Standard Time (CST) throughout the year.
- 2) Routine Quality Assurance of Meteorological Data

Routine QA of meteorological data includes components associated with both collection and validation of data.

- a. Data review, screening and validation are conducted on a continual basis. At no time shall more than one month of data be collected without that month's data being reviewed.
- c. Evaluate potential errors (e.g., wind speed above 55 miles per hour, solar radiation above 20 Langley's per hour (LY/hr) at night, relative humidity above 100%, etc.).
- d. Apply criteria in Table 4.1 below. Data outside these ranges or variations will be subjected to further review and evaluation.

Table 1. Screening Criteria for Meteorological Data

Parameter	Screening Criteria for Further Investigation
Wind Speed	<ul style="list-style-type: none">- is less than zero or greater than 55 miles per hour (mpviii)- does not vary by more than 0.5 mph for 3 consecutive hours- does not vary by more than 1 mph for 12 consecutive hours

Wind Direction	<ul style="list-style-type: none"> - is less than 0° or greater than 360° - does not vary by more than 1° for 3 consecutive hours - does not vary by more than 10° for 18 consecutive hours
Sigma Theta	<ul style="list-style-type: none"> - is less than 0° or greater than 90°
Temperature	<ul style="list-style-type: none"> - is less than -20°C or greater than 40°C - is extremely cool or warm for the current season - changes by more than 5°C from one hour to the next - does not vary by more than 0.5°C for 12 consecutive hours
Relative Humidity	<ul style="list-style-type: none"> - is less than 10% or greater than 100% - varies by more than 10% from one hour to the next
Barometric Pressure	<ul style="list-style-type: none"> - is less than 920 millibars (mii) or greater than 1080 mb - changes by more than 10 mb in 3 hours
Solar Radiation	<ul style="list-style-type: none"> - is less than 122 Langleys per hour (LY/hr) on a clear, sunny day - is greater than 20 LY/hr at night

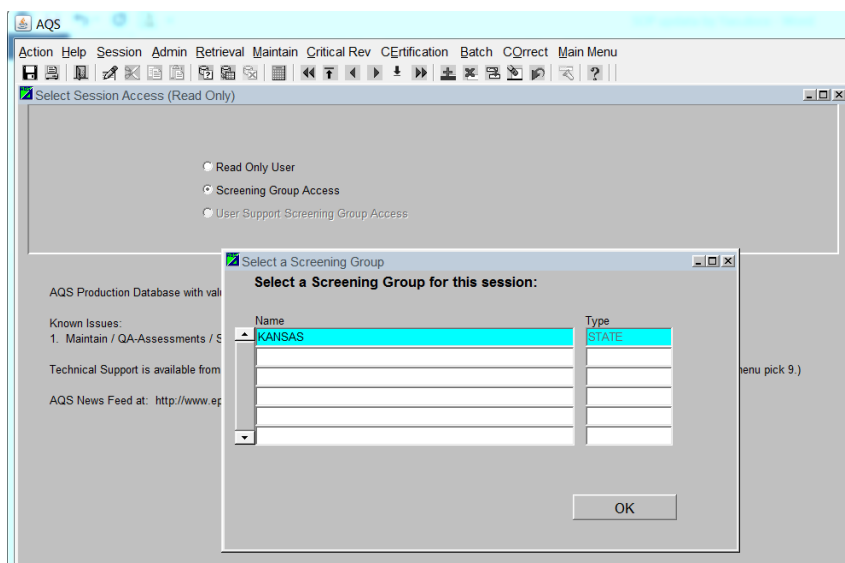
- e. Document data validation with initials, dates and notes on paper. Check all data transmitted from one form to another (e.g., field logbook to computer file) to assure accuracy.

- 3) Raw data are retained on file at KDHE/BOA for a minimum of three (3) years. After this time, hardcopy records and computer backup media may be catalogued by site and boxed for storage.
- 4) All data collected during a calendar quarter shall be spot checked for accuracy.

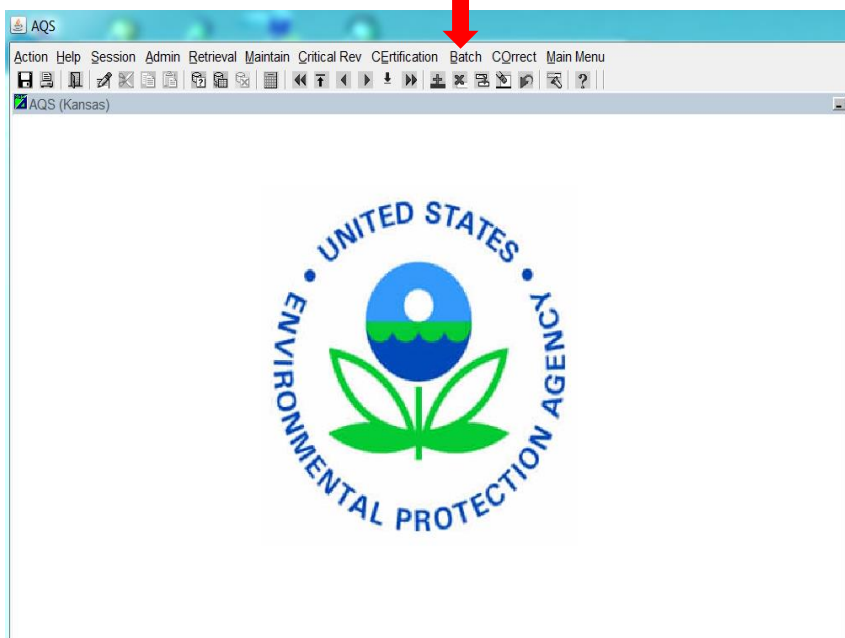
13.6 Submittal to AQS

13.6.1 Monitoring Data

- 1) On the AQS Logon window, enter the appropriate 3-character user id, your AQS password, and the database name: aqspod. Press the Connect button. After successfully logging on, the user will come to the “Select Session Access (Read Only)” screen. Select the “Screening Group Access” prompt from the table. Upon Selection, the “Select a Screening Group” screen will appear. Highlight “KANSAS” and click OK.



2) Select "Batch" from the main screen



- 3) Click on “Goto ENSC” to go to the Exchange Network log screen.

HISTORY AND STATUS

Submission Date	File Name	User Name	Records In File	Date (last)	Process Status	Recs Loaded	Recs Failing to Load	Stat/CR Finding Count	Records to Post	Skip'd Monitors	Records Posted
20150622 15:23	Precision 1Qt 2015 correct.tz	YAO TANG	88	20150622 15:23	LOAD-COMPLETED	88	0				
20150622 14:36	Precision 1Qt 2015 bt.zip	YAO TANG	168	20150622 14:36	LOAD-ERROR	80	88				
20150622 14:25	Audit 1Qt 2015 correct3.bt.zi	YAO TANG	2	20150622 14:25	LOAD-COMPLETED	2	0				
20150622 14:18	Audit 1Qt 2015 correct2.bt.zi	YAO TANG	10	20150622 14:18	LOAD-ERROR	8	2				
20150622 14:13	Audit 1Qt 2015 correct.bt.zip	YAO TANG	12	20150622 14:13	LOAD-ERROR	2	10				
20150622 13:31	Audit 1Qt 2015 bt.zip	YAO TANG	39	20150622 13:31	LOAD-ERROR	27	12				
20150622 13:26	Kansas_Pb_Strip_1Q2015.bt	YAO TANG	3	20150622 13:26	LOAD-COMPLETED	3	0				
20150622 13:24	SalinaPbMet1Q2015.bt.zip	YAO TANG	30	20150622 13:24	POST-COMPLETED	30	0	0	30	0	30
20150622 12:35	Salina Pb 1Qt 2015.bt.zip	YAO TANG	30	20150622 12:35	LOAD-ERROR	0	30				
20150622 12:34	Salina Pb 1Qt 2015.bt.zip	YAO TANG	30	20150622 12:35	POST-COMPLETED	30	0	0	30	0	30
20150622 11:08	KS PM10 1Qt 2015.bt.zip	YAO TANG	45	20150622 11:09	POST-COMPLETED	45	0	0	45	0	45

PROCESS CONTROL

Process selected file through:

Results and Reports:

PROCESS FLOW

```

graph LR
    FILE --> ENSC --> Stage --> TransferError{Transfer Error?}
    TransferError -- N --> Load --> Errors{Errors?}
    Errors -- Y --> Correct --> Load
    Errors -- N --> RawData{Raw Data?}
    RawData -- Y --> Post --> DONE
    RawData -- N --> Load
  
```

- 4) Enter user name and password, and then click the “LOGIN” button. After logging in, the “Exchange Network” screen will appear. On this screen, click the “Exchange Network Services” button.

Environmental Information | **exchange Network** | **SERVICES CENTER** | Logged In: ytang@kdheks.gov
[My Profile](#) | [Help](#) | [Contact Us](#) | [Logout](#)

[Home](#) | [My Services Center](#) | [Exchange Network Services](#) | [News & Data Channels](#)

MY SERVICES CENTER
 Quickly access the services and queries you use and check the status of your requests

EXCHANGE NETWORK SERVICES
 Send, get, and download information from Exchange Network partners

NEWS & DATA CHANNELS
 View news and data feeds from Exchange Network partners, subscribe to channels of interest, or contribute

My Quick Links

- » Exchange Network
- » Exchange Network Discovery Services (ENDS)
- » Production CDX Web

Check out our News Feed for the latest on what's happening with the Exchange Network Services Center

- 5) This leads the user to the “Services Directory”. On this screen, click the “Send Info” button.

Services Directory

This directory runs from Exchange Network Discovery Service (ENDS) metadata. It requires the commitment of our Network to keep it up to date and useful. For the BETA version, the Services Directory contains only services that support Submit, Query, Solicit, and Download operations. Select the name of the Service you wish to use.

Filter By: Keyword(s)

1 - 13 of 13 < Previous 1 Next >

Service Transaction	Dataflow	Service Name	Service Description	Node
Get Info	AQDE	AQDERawData	Queries or Solicits the Raw Data for the AQDE Flow. The return is an XML file that conforms to the AQS Version 2.0 Schema.	NewJerseyNodeV1_
Send Info	AQS	ProcessAQSDoc	Air Quality System Document Submissions	.NetNode2
Send Info	AQS	AQS Submit	AQS Submit: Send files to the Air Quality System (AQS).	NGNProd2.0
Get Info	AQS	GetAQSRawDataInsertByDate	AQS -	NV

- 6) After this, the “Express Request: AQS Submit” screen is opened. This allows user to load data and send data to AQS. After fill out the blanked area, click “SEND DATA” button.

Express Request: AQS Submit

Select a Document to Upload (max. size 1 GB):

Enter Sender's Email Address to Notify of Transaction Status Changes:

AQS User ID:

Additional Data Flow Specific Information:

Screening Group :

File Type :

Final Processing Step :

Stop On Error :

► [Provide information \(metadata\) about this Document \(recommended\)](#)

[Add this page to My Quick Links](#)

You are currently using the following Service:

Service Name
AQS Submit

Description
AQS Submit: Send files to the Air Quality System (AQS).

Transaction Type
Submit

Dataflow
AQS

Node
NGNProd2.0

Publisher
U.S. Environmental Protection Agency

[Click here for Additional service help information](#)

[Select a different Service](#)

- 7) Once the data has been transferred from Exchange Network to AQS, go back to the “Batch” screen on AQS. Click the “Refresh Sessions” button to check data status on loaded data.

AQS

Action Help Session Admin Retrieval Maintain Critical Rev Certification Batch CQrect Main Menu

BATCH (Kansas)

Process by File History

HISTORY AND STATUS

Submission Date	File Name	User Name	Records In File	Date (last)	Process Status	Recs Loaded	Recs Failing to Load	Stat/CR Finding Count	Records to Post	Skip'd Monitors	Records Posted
20150622 15:23	Precision 1QI 2015 correct.b	YAO TANG	88	20150622 15:23	LOAD-COMPLETED	88	0				
20150622 14:36	Precision 1QI 2015.bt.zip	YAO TANG	168	20150622 14:36	LOAD-ERROR	80	88				
20150622 14:25	Audit 1QI 2015 correct3.bt.zi	YAO TANG	2	20150622 14:25	LOAD-COMPLETED	2	0				
20150622 14:18	Audit 1QI 2015 correct2.bt.zi	YAO TANG	10	20150622 14:18	LOAD-ERROR	8	2				
20150622 14:13	Audit 1QI 2015 correct.bt.zip	YAO TANG	12	20150622 14:13	LOAD-ERROR	2	10				
20150622 13:31	Audit 1QI 2015.bt.zip	YAO TANG	39	20150622 13:31	LOAD-ERROR	27	12				
20150622 13:26	Kansas_Pb_Strip_1Q2015.bt	YAO TANG	3	20150622 13:26	LOAD-COMPLETED	3	0				
20150622 13:24	SalinaPbMet1Q2015.bt.zip	YAO TANG	30	20150622 13:24	POST-COMPLETED	30	0	0	30	0	30
20150622 12:35	Salina Pb 1QI 2015.bt.zip	YAO TANG	30	20150622 12:35	LOAD-ERROR	0	30				
20150622 12:34	Salina Pb 1QI 2015.bt.zip	YAO TANG	30	20150622 12:35	POST-COMPLETED	30	0	0	30	0	30
20150622 11:08	KS PM10 1QI 2015.bt.zip	YAO TANG	45	20150622 11:09	POST-COMPLETED	45	0	0	45	0	45

PROCESS CONTROL

Load Post Other

Process selected file through: Load File Post File Show User Log

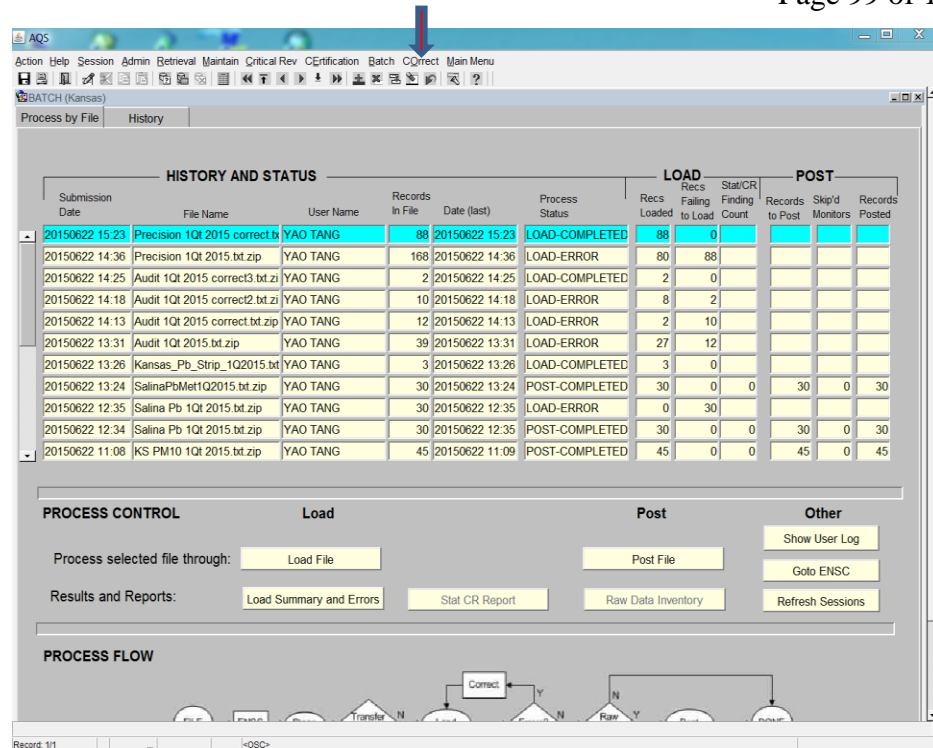
Results and Reports: Load Summary and Errors Stat CR Report Raw Data Inventory Goto ENSC

PROCESS FLOW

```

graph LR
    FILE --> ENSC
    ENSC --> Stage
    Stage --> TransferError{Transfer Error?}
    TransferError -- N --> Load
    TransferError -- Y --> Correct
    Load --> Error{Error?}
    Error -- N --> RawData{Raw Data?}
    Error -- Y --> Correct
    RawData -- Y --> Post
    RawData -- N --> Correct
    Post --> DONE
    Correct --> Load
  
```

- 8) All procedures (loading, statistic evaluation and postinvii) are automatically processed. If there is error, the “Process Status” column will show the error, and you will receive an email to let you know the detail. The user can either go to “COrrect” to correct the error or correct the error in the text file. To correct the error through online from “COrrect”, the user must select “COrrect” on the main menu and select the appropriate type of data to be corrected (i.e. site data, monitor data, raw data, precision data, accuracy data, etc.). After selecting the data type, the user must execute a query to bring up the lines of data that are in error. The lines of data that are in error will appear. Online corrected errors must be saved and reloaded and reposted. Errors can also be deleted and then corrected in a text file.



- 9) After all data is loaded to AQS you will receive an email. This email will contain three links about data load report, statistical evaluation report, scan report and raw data inventory report.

13.6.2 Site and Monitor Information

- 1) To add a new site, selecting **M**aintain and then **S**ite from main screen.
- 2) All Maintain screens open in Query mode, so the user must click on the "Cancel Query" button to enter data. Enter the appropriate State Code, County Code, and the chosen Site Id. The user may enter the values for state and county directly, or select them from the LOV (drop-down menu located next to the applicable parameters). Using the LOV ensure the value is valid according to AQS.

Site Identification

State Code: 20 Kansas
 County Code: 209 Wyandotte
 Site Id: 0021
 Status Ind: P

User Coordinates

Horizontal Datum: WGS84
 Latitude: 39.117219
 Longitude: -94.635605
 UTM Zone:
 UTM Easting:
 UTM Northing:
 Lookup Geography

Standard Coordinates: Datum: NAD83
 Latitude: 39.117219
 Longitude: -94.635605

Horizontal Method: 018 INTERPOLATION-MAP
 Horizontal Accuracy (Meters): 30.36
 Source Map Scale (Non-GPS): 24000

Vertical Measure: 259
 Vertical Accuracy (Meters): 0
 Vertical Datum: UNKNOWN

Vertical Method: 000 UNKNOWN

Street Address: 1210 N. 10TH ST., JFK RECREATION CENTER

Land Use Type: RESIDENTIAL
 Location Setting: URBAN AND CENTER CITY

City Code: 36000 Kansas City

Urban Area Code: 3760 KANSAS CITY, MO-KS

AQCR Code: 094 METROPOLITAN KANSAS CITY

Site Established Date (YYYYMMDD): 19990330
 Time Zone Name: CENTRAL

Owning Agency: 0563 Kansas Department Of Health And Environment

Check Completeness Create Monitor

- 3) Almost all fields on the **Basic Site Data** are required. The exception is Latitude/Longitude or UTM data. Either Latitude/Longitude or UTM data must be entered, but not both. Select the type of data that is most applicable for the site and enter it into the appropriate box. Leave the **Status Ind** as **F**.

- 4) Enter a Supporting Agency by selecting the **Agency Roles** tab. A Supporting Agency is required for entry of a new site. Proceed to complete applicable fields for the new site on any other tabs (**Additional Site Data, Tangent Roads, Open Paths, Comments, and Primary Monitor Periods**). If additional information is entered, Tangent Roads, Open Paths, and Comments must be numbered for that particular site. The number that is assigned for that particular site may then be used on the monitor records for that site.

The screenshot shows the AQ5 software interface. The title bar reads 'AQ5'. The menu bar includes: Action, Help, Session, Admin, Retrieval, Maintain, Critical Rev, Certification, Batch, Correct, Main Menu. The toolbar contains various icons for file operations and navigation. The main window title is 'Maintain Site (Kansas)'. Below the title is a tabbed interface with tabs: Basic Site Data, Additional Site Data, **Agency Roles** (circled in red), Tangent Roads, Open Paths, Comments, and Primary Monitor Periods. In the top right corner, there are input fields for 'Site' with values '20', '209', and '0021'. The main area contains a table with the following columns: Agency Role, Agency Code, Agency Desc, Begin Date, and End Date. The first row is populated with 'SUPPORTING', '0563', 'Kansas Department Of Health And Environment', '19990330', and an empty End Date field. There are 17 rows in total, with the first row being the only one with data.

Agency Role	Agency Code	Agency Desc	Begin Date	End Date
SUPPORTING	0563	Kansas Department Of Health And Environment	19990330	

- 5) When all information has been entered for a site, save the information. Site information at this point is entered completely. To enter monitor data for site, click on the **Create Monitor** button on the lower right section of the **Basic Site Data** screen. At this point, an informational screen will appear indicating that the site transaction is complete and the records have been saved. Click **OK** to continue on to the entry screens for the monitors for the site.
- 6) Fill in the required fields on the **Monitor Basic** tab located in the top box on the screen (the only remaining empty fields should be Parameter Code and POIII). Complete all fields for which information is available. Monitor data covers up to 17 screens of data accessed by the screen tabs in the right side of screen. Some of these fields are required while others are not. If the user tries to proceed without completing a required field, the user will receive a warning message about the missing field. For all monitors, Sample Period Begin Date, Monitor Type with a Begin Date, and Monitoring Objective Type, Agency Roles and Methods are required. When the user has completed the monitor screens, save the data.

AQS

Action Help Session Admin Retrieval Maintain Critical Rev Certification Batch COrrect Main Menu

Maintain - Monitors (Kansas)

State Code: 20 County Code: 209 Site Id: 0021 Parameter Code: 44201 POC: 1 Status Ind: P

Project Class: Meas Scale: URBAN SCALE Probe Location: OTHER Probe Vert Dist: 2 Samp Res Time: Close Date:

Dominant Source: Open Path Num: Probe Height: 4 Probe Hor Dist: 9 Unrest Air Flow: Last Samp Date: 20150331 Last Post Date: 20150622 Monitoring Agency (Owner): 0563 Kansas Department Of Health And En

Check Completeness Duplicate Monitor

Monitor Basic
Sample Periods
Type Assign.
Network Affiliations
Agency Roles
Objectives
Req Frequencies
QA Collocation
Methods
Exclusions
Pollutant Area
Tangent Road
Probe Obs.
Reg Compliances
Protocols
Channels
Comments

- 7) If more than one monitor is to be added to AQS, use the **Duplicate Monitor** button to enter remaining monitors as the same site. The user will be prompted for either a new parameter code or a new POC. If the new monitor is for the same parameter but a differing POC, AQS will automatically enter most of the data. The user will be prompted for fields that differ from the original monitor. If the next monitor as the site is for a different parameter, most of the monitor fields will need to be completed. When finished save all work.

SECTION 14

OZONE MAPPING SYSTEM

14.1 Overview

Ground-level ozone, a major component of smog, can exhibit an adverse impact on human respiratory health. People who live in communities that have a potential for elevated ozone levels can use timely, accurate information to make informed personal decisions concerning protection of their health and to know when to take actions to reduce local ozone levels.

The United States Environmental Protection Agency (U.S. EPA created the Environmental Monitoring for Public Access and Community Tracking (EMPACT) program to utilize new technologies to provide environmental information to the public in near real-time. One of the largest EMPACT projects is the Ozone Mapping Project, which utilizes frequently updated monitoring data to generate maps that provide communities with current information about ozone pollution in an easy-to-understand, color-coded format. These maps are created from hourly ozone data gathered from ozone monitoring networks across the country, and their color-coded contours indicate the relative level of health concern based upon the current ozone concentrations.

This procedure is to be used by Monitoring and Planning personnel to poll data loggers and transfer resultant continuous ozone data to the AirNow website maintained by the United States Environmental Protection Agency (EPA): <http://www.epa.gov/airnow/>. This SOP is intended to be used for procedural guidance and is not intended to supersede equipment manufacturer's manuals or procedures.

14.2 Data Acquisition and Processing

- 1) KDHE collects and submits ozone and continuous particulate monitor data to the AirNow Ozone Mapping System (OMS) throughout the year via the AirVision software. Monitors are polled continuously at an hourly interval on Central Standard Time (CST). Refer to the AirVision Reference Manual for a detailed description of software set-up and operation.
- 2) Automated QA/QC checks are performed by AirNow prior to the acceptance and generation of maps. These checks are beyond the control of KDHE BOA.
 - i) Any sites reporting which are not in the active reporting station file are not mapped.
 - ii) A check for missing hours of data is performed.

- iii) Range and rate-of-change data are evaluated. “Suspect” data are plotted; “Severe” values are not plotted.
- iv) If a single hourly value is missing a linear interpolation is performed between the preceding and following values to estimate the value for the missing hour.
- v) Time zones are standardized.

SECTION 15

CORRECTIVE ACTION

15.1 Overview

This procedure is intended to provide guidance for action to be taken based upon unacceptable quality assurance or quality control results.

15.2 Invalidation of Data

- 1) The operator of each monitor shall notify the Data Manager to void any data when there is good reason to suspect that the data are inaccurate.
- 2) Data shall be invalidated by the Data Manager based upon span checks according to the following rules:
 - i) If any span check exceeds 7% (for O₃) or 10% (for SO₂, NO₂ and CO), then the data going back to the last valid span check will be invalidated. If any 1 point QC check exceeds 7% (for O₃) or 10% (for SO₂ and CO) or 15% for NO₂, then the data going back to the last valid QC/span check will be invalidated
 - ii) If there are missing QC/span checks (required every two weeks), apply the following rules when invalidating:
 - i) More than one QC/span check missing, causes invalidation back to the last passing QC/span check.
 - ii) A failed QC/span check with no recalibration counts as missing.
 - iii) An audit with the span point less than or equal to 15% difference counts as a passing span check.
 - iv) A passing QC/span check that is greater than 5 weeks after or before any other span check does not validate any data.
 - v) A calibration with an initial span point less than or equal to 7% for O₃ or 10% for SO₂, CO or NO₂ counts as a passing span check.
 - VI) A recalibration is required if a zero reading exceed 0.61 ppm for CO or 0.0051 ppm for O₃, SO₂, and NO₂ monitors

- 3) Data may be invalidated by the Data Manager based upon audits or failure to adhere to the provisions of the QAPP and/or SOPs.
- 4) The Data Manager will maintain supporting documentation of invalidation.

15.3 Recalibration

Zero and span drift checks are performed regularly (at least every two (2) weeks) on continuous analyzers to determine whether recalibration is necessary. Interpretation of zero and span check results and corrective actions are detailed in AAM SOP Section 1 above.

- 1) When recalibration is required, potential operational problems must be investigated and required maintenance performed prior to recalibration.
- 2) Repeated calibration failures may necessitate removal of the instrument for diagnostic evaluation and repair.

15.4 Audit Failures

Results of annual performance audits are not used as sole criteria for data validation, because these audits are required only once per year for each analyzer. These audits, however, provide an indication of the accuracy of monitoring data.

- 1) The cause of any audit deviation of more than 15% from the actual value will be investigated.
- 2) A QC check (precision check, zero and span) shall be performed as soon as possible following an audit failure for validation of the failure. Corrective action will be taken subsequent to the QC check.
- 3) Instrument maintenance, repair, and/or recalibration will be performed as indicated.
- 4) Causes for reporting errors (i.e., wrong units, decimal place, etc.) will be investigated, and procedures developed to minimize the recurrence of such errors.

15.5 Equipment/Instrument Malfunction

Any deficiency in equipment/instrument performance discovered in the course of routine operation or during quality control procedures must be noted on the appropriate maintenance log sheet. Within the manufacturer's guidelines, the defective equipment/instrument may be serviced in the field, returned to the shop for repair, or returned to the manufacturer for repair or

replacement. If available, a back-up instrument shall be utilized during the interim to minimize loss of data.

15.6 Staff Performance Problems

In the event that Monitoring and Planning Section staff exhibit(s) difficulty with a given procedure, additional training shall be provided. Training includes but is not limited to dual site visits with more experienced staff to offer clarification on field procedures.

15.7 Intermittent 2.5 Particulate Matter Sampler Problems

- 1) If flow rate audits or verifications exceed 4%, the sampler is investigated and corrected, then recalibrated.
- 2) If the flow rate exceeds $\pm 5\%$ for greater than 5 minutes, a W flag is assigned in AQS.
- 3) If the flow rate exceeds $\pm 10\%$ for more than 1 minute, the data is invalid.
- 4) If the filter temperature exceeds the ambient temperature by more than 5°C for more than 30 minutes, an X flag is assigned in AQS.
- 5) If the coefficient of variation of flow rate is greater than 2%, the data may be invalidated.
- 6) If the sample period is less than 23 hours or greater than 25 hours, the data is invalid. There is an exception: if the sample period is less than 23 hours and the concentration determined by dividing the net weight by the volume (in cubic meters), that would have resulted had the sampler run for 24 hours (this is usually close to 24 cubic meters), gives a concentration greater than 15 micrograms per cubic meter, then that concentration is submitted to AQS with a Y flag. If this calculation yields 15 micrograms per cubic meter or less, then the data is invalid.
- 7) If the sampler runs on the wrong date, the data is valid. But the data does not count as valid when calculating percent completeness.
- 8) Any data affected by exceptional events (fires, construction, etc.) will be flagged according to the AQS flags listed in the AQS system.

- 9) If the sample is not collected from midnight to midnight (± 1 hour), it is invalid.
(Note: Sampling is conducted on the basis of Standard Time throughout the year.)
- 10) If the lab analysis followed exposure by more than 10 days and the sample was exposed to temperatures greater than 4°C , than the data is flagged by the lab as HT, but it is valid.
- 11) If the lab analysis followed exposure by more than 30 days, than the data is flagged by the lab as HT, but it is valid.
- 12) If the sample period followed tare analysis by more than 30 days, the data is flagged by the lab as XT, but it is valid.
- 13) If the sample temperature exceeded 25°C after removal from the sampler, the data is flagged by the lab as ST, but it is valid.
- 14) If the sample is not removed from the sampler within 177 hours of the end of the sample period, the data is flagged by the lab as SR, but it is valid.
- 15) If the associated lab blank mass change exceeds ± 15 micrograms, the data is flagged by the lab as LB, but it is valid.
- 16) If the associated field blank mass change exceeds ± 30 micrograms, the data is flagged by the lab as FB, but it is valid.
- 17) If the mean equilibration temperature prior to weighing is outside the range of 20°C to 23°C , the data is flagged by the lab as LC, but it is valid.
- 18) If the mean equilibration relative humidity prior to weighing is outside the range of 30% to 40%, the data is flagged by the lab as LC, but it is valid.
- 19) If the equilibration time prior to weighing is less than 24 hours for exposed samples, the data is flagged by the lab as EQ, this data is invalid.
- 20) If the working standard balance check is ± 3 micrograms from the certified value, the data is flagged by the lab as BC, but it is valid.
- 21) If there is contamination (e.g., insects or debris) on the filter, the data is flagged by the lab as CN, this data is invalid.
- 22) If there is a sampler malfunction such that the sampler did not run, the data is flagged by the lab as MM, this data is invalid.

- 23) If the filter is damaged, the data is flagged by the lab as FD, this data is invalid.
- 24) If the filter had a negative mass gain, the data is flagged by the lab as NM, this data is invalid.

15.8 Quality Control Actions

When a quality control (QIII) action results in the indication of a problem, the following corrective actions steps are taken:

- 1) Perform a visual inspection of the monitor for any malfunctions. Review the QC and maintenance logs for indication of a possible problem. Review recent data for unusual patterns. If a problem is defined, then repair or replace the monitor. If a monitor problem cannot be pinpointed, then continue with the following steps.
- 2) In cases where a known concentration standard or flow rate standard has been used, an investigation is carried out in order to determine if the standard is in error. This includes inspecting the calibration or certification documentation of the standard, checking the previous results of the standard when compared to other monitors, and inspecting the standard equipment for malfunctions. If the standard is in error, then repair or replace it. If a standard problem can not be found, then continue with the following steps.
- 3) Audit the monitor using a different standard.
- 4) In the case of collocated particulate matter samples which have a discrepancy, request that the laboratory check their data entry and/or reweigh the filters.
- 5) If nothing definitive has been found up to this point, cross-check the monitor, standard and procedure with other equipment/staff. If the problem remains undefined, then perform a multi-point calibration of the monitor. Future results (data and QIII) from the monitor in question shall be evaluated in detail.

SECTION 16

SITE/SYSTEM INSPECTION AND RECORDS AUDIT

16.1 Overview

Local Health Departments (LHDs) which conduct ambient air quality monitoring activities under Memoranda of Agreement (MOAs) with the Kansas Department of Health and Environment (KDHE) are evaluated to verify that the terms of their respective MOAs and annual workplans are being fulfilled. The KDHE Air Monitoring and Data Unit is also subject to these internal evaluations. Periodic physical inspection of continuous and intermittent samplers/monitors is conducted in order to verify that proper maintenance is being performed and that the samplers are in acceptable operating condition. Additional physical inspection of monitoring equipment will also be conducted in the event that field personnel note evidence of poor maintenance or neglect of equipment located at any monitoring site.

With prior notification, each local health department which participates in ambient air quality monitoring activities under an MOA with KDHE is visited by KDHE field personnel. When possible it is preferable that the KDHE send one (1) QA/QC person and one (1) field technician as an audit team. Files are checked for consistent documentation of quality assurance. Equipment maintained by the LHD is inspected in situ, preferably in the company of appropriate LHD personnel (or, in the case of a KDHE site, the field technician with primary responsibility for that site), to verify that it is being maintained in safe and acceptable operating condition. Any immediately evident problems are discussed with the LHD personnel (or appropriate KDHE field technician) as they are noted. A summary of the findings and any recommendations for corrective action are included in a report. A copy of the report is provided to the appropriate personnel.

16.2 Site Audit Procedure

16.2.1 Notification

- 1) Contact the appropriated LHD or KDHE personnel by e-mail, telephone or in person and establish a tentative date for the site audit.
- 2) Follow up by e-mail with a written notification to the appropriate LHD/KDHE supervisor.
 - i) If possible provide at least two weeks notice.
 - ii) State that a site audit has been tentatively scheduled for the date negotiated.

- iii) Enclose a copy of the "Air Quality Monitoring Checklist for Site/Systems Inspection and Records Audit" to facilitate preparation for the audit.

16.2.2 Records Audit

- 1) Upon initiation of the audit, obtain a copy of the completed checklist.
- 2) Use the checklist in conjunction with the "Site/Systems Inspection and Records Audit Checklist" for review of QA records.

Note: Steps i – iv below refer to "LHD"; all apply for KDHE sites and equipment.

- i) If the LHD is responsible for calibrations, verify that complete and up to date calibration information is on file. Recommend development of a written calibration schedule if not in use.
- ii) If the LHD is responsible for performance audits, verify that complete and up to date audit information is on file. Recommend development of a written audit schedule if not in use.
- iii) If the LHD is responsible for calibrations and/or performance audits, verify that a complete and up to date list of all standards and equipment used for such purposes, together with copies of manufacturers' certifications for permeation tubes and cylinders of compressed gases is on file.
- iv) Verify that complete and up to date maintenance information is on file. Recommend development of a written preventive maintenance schedule if not in use.

16.2.3 Physical Inspection

Periodic physical inspection of HiVol samplers is conducted in order to verify that proper maintenance is being performed and that the samplers are in acceptable operating condition. Condition of wiring is evaluated to ensure operator safety and minimize instrument down time. Continuous monitors are checked to ensure that they are powered up and recording data.

This inspection may also be performed on **any** equipment in the Kansas Ambient Air Monitoring Network. It may be performed independent of an LHD/KDHE site audit.

- 1) HiVol Sampler Site Audit

- i) If possible, have at least one (1) LHD or KDHE employee directly involved in sampler operation accompany the MPS inspector(s) to the site(s) selected for equipment inspection.
- ii) Conduct the inspection of equipment using the "HiVol (TSP/PM₁₀) Maintenance and Operational Checklist". Use a separate checklist form for each sampler. (See Sec. E. below.)
- iii) For a PM₁₀ sampler, check all hood latches for general condition, proper adjustment, and verify that all are properly engaged.
- iv) For a PM₁₀ sampler, inspect the shim (impaction plate) to verify that it is reasonably clean and properly lubricated.
- v) For a PM₁₀ sampler, inspect all gaskets (above and below shim) and note their condition. Look for evidence of leakage (e.g., "dust trails", etc.).
- vi) Check the filter element cassette gasket and note its condition.
- vii) Start the motor and check for even speed after a warm-up period.
- viii) Inspect electrical supply lines and visible internal wiring and connections. Note their condition.

2) PM_{2.5} Sampler Site Audit

- i) Verify that the current date/time and the sample start date/time are correct.
- ii) Verify that the cooling fans are operational and that the filters are being periodically cleaned.
- iii) Inspect accessible v-seals and o-rings.
- iv) Inspect the filter compartment, inlet and downtube to verify that they are reasonably clean.
- v) Verify that the impactor is being properly serviced.
- vi) Check the overall condition of the sampler (hinges, latches, loose screws?).
- vii) Inspect power cords, conduit, receptacles and any other associated electrical hardware.

viii) Check access for safety (ladders, walkways and railings).

3) Continuous Monitor Site Audit

Proper operation of continuous monitors is verified primarily by means of routine precision and span check procedures.

- i) Verify the continuous monitor(s) are powered on.
- ii) Verify that data are being recorded.
- iii) Verify that the recording device is registering data at the proper times.

16.2.4 Summary Report

- 1) Review all checklist forms completed during the site audit.
- 2) Prepare a brief summary of findings.
- 3) Include recommendations for corrective action(s).
- 4) Provide copies of the report to the appropriate personnel.

SECTION 17

TRAINING

17.1 Overview

This section describes the required training of sample collectors, equipment/instrument operators, auditors, data processors, and quality assurance staff.

17.2 New Employees

- 1) New employees (including recent transfers from other programs) shall receive a thorough indoctrination into the QA policies and procedures of the Ambient Air Quality Monitoring Program.
- 2) The Divisional Quality Assurance Management Policies and Procedures (Part I of the Division of Environment Quality Management Plan), the Bureau of Air Quality Assurance Management Plan (Part II), the Ambient Air Monitoring Quality Assurance Program Plans and associated SOPs, shall be required reading on the part of all employees.
- 3) All new employees shall participate in the orientation seminars offered by the KDHE Office of Personnel Services. New supervisors are also expected to complete the introductory course for supervisors. All employees have training requirements listed on performance evaluation forms.

17.3 Practical Training

17.3.1 Self-instructional

- 1) The first phase of training is self-instructional. Immediate access to monitors/samplers during this phase is recommended. Printed materials intended for study include the documents listed in 17.3.2 below.
- 2) Obtain access to monitors/samplers in order to develop familiarity and provide initial hands-on experience in preparation for the practical phase of training.

17.3.2 Printed Material

- 1) 40 CFR 50, Appendix L, Reference Method for the Determination of Fine Particulate Matter as PM_{2.5} in the Atmosphere;

- 2) Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II, USEPA, Environmental Monitoring Systems Laboratory, Research Triangle Park, NC;
- 3) Operating Manual: Partisol-Plus Model 2025 Sequential Air Sampler, Rupprecht & Pataschnick Co., Inc., 25 Corporate Circle, Albany, NY 12203;
- 4) Service Manual: Partisol-Plus Model 2025 Sequential Air Sampler, Rupprecht & Pataschnick Co., Inc., 25 Corporate Circle, Albany, NY 12203;
- 5) Ambient Air Monitoring Criteria Pollutants Quality Assurance Project Plan, Kansas Department of Health and Environment, Division of Environment, Bureau of Air, Monitoring and Planning Section, Topeka, KS;
- 6) Ambient Air Monitoring Standard Operating Procedures, Kansas Department of Health and Environment, Division of Environment, Bureau of Air, Monitoring and Planning Section, Topeka, KS;
- 7) Ambient Air Monitoring Non-Criteria Pollutants Quality Assurance Project Plan, Kansas Department of Health and Environment, Division of Environment, Bureau of Air, Monitoring and Planning Section, Topeka, KS;
- 8) 40 CFR 58, Appendix A, QA Requirements for SLAMS;
- 9) Other EPA printed materials as available;
- 10) Applicable Operator's Manual; and
- 11) EPA videotapes relating to sampler operation

17.3.3 On-the-job Training (OJT)

- 1) Overlap of OJT with self-study of printed materials may be necessary and facilitates learning. OJT provides hands-on experience that is derived from activities in the shop as well as in the field. OJT will be used for all personnel. The trainee will perform the following steps in order to complete OJT for a task.
- 2) Observe an experienced person doing the necessary task.
- 3) Study any available operational procedures for the task (See section 17.3.2).
- 4) Perform the task under the direct supervision of an experienced person.

- 5) Repeat the above steps until the supervisor judges the performance of the trainee to be satisfactory.
- 6) When working in the field with technical equipment and scientific instrumentation, unique problems may arise for which there is no precedent. The solutions to such problems must be achieved through application of paragraph 3.c above in conjunction with consultation with coworkers.

17.4 Continuing Education

Appropriate staff may attend continuing educational courses, workshops, or symposia offered by colleges, vocational educational institutions, or various governmental agencies. In order for an employee to participate, the subject matter must be applicable to a program or project, funding must be available, and supervisory and administrative approval must be secured in advance.

17.5 General Field Training

- 1) Practical training is emphasized. This includes on-the-job training (OJT) and hands-on experience for each of the following:
 - i) monitor/sampler operation;
 - ii) data collection;
 - iii) maintenance;
 - iv) calibration;
 - v) major repair or installation of equipment
- 2) To ensure consistent operation of all monitors/samplers within the Kansas Ambient Air Monitoring Network, all site operators must demonstrate proficiency in sampler calibration, operation, and data collection to the KDHE Field Technician Supervisor. KDHE/BOA will train, assist, and observe all new operators.
- 3) The Field Technician Supervisor will randomly accompany site operators to observe their on-site procedures.

17.6 Health and Safety Warnings

- 1) General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electronic equipment in wet conditions, as frequently encountered at field monitoring sites.
- 2) All Ambient Air Monitoring field personnel are required to review AAM SOP Section 18 (Field Personnel Safety).
- 3) General precautions for working with heavy equipment, and electro/mechanical equipment with moving parts must be observed.

17.7 Cautions

Although field equipment is manufactured to withstand environmental extremes, it is precision equipment with relatively fragile electronic and mechanical parts. All field equipment used for environmental measurements should be handled with care.

SECTION 18

PERSONNEL SAFETY

18.1 Overview

This section provides general guidance to assure the safety of Kansas Department of Health and Environment Bureau of Air (KDHE BOA) personnel while conducting routine field activities. This procedure is **not** intended to serve as an SOP for emergency response. General knowledge of basic safety practices and procedures are required for electrical hazards, ladder safety, vehicle and towing safety, and safe handling of compressed gasses. All Air Monitoring field personnel are required to attend webinars or presentations relating to relevant safety issues per individual performance evaluation forms.

18.2 General Safety

Air Monitoring field staff are required to operate and maintain monitoring equipment under diverse environmental conditions. Equipment may be deployed in a temperature-controlled shelter, on the rooftop of a multi-story building, or at ground level. Monitoring sites are located in both urban and rural areas. Air monitoring activities may entail obtaining a single 'grab sample' or collecting continuous data for a number of years at a dedicated monitoring site.

- 1) Field staff are encouraged to wear appropriate clothing during field activities to protect them from insect bites, sunburn, and/or excess heat or extreme cold exposure.
- 2) General precautions for working with heavy equipment, and electro/mechanical equipment with moving parts should be taken.
- 3) Staff should remain aware of situations where wrist watches, rings, etc., could become entangled in moving parts of equipment or tools.
- 4) Jewelry or other objects capable of conducting an electric current should be removed before working on equipment.
- 5) Field staff need to remain aware that capacitors in electronic equipment may retain a substantial charge after the device has been disconnected from the power source.
- 6) If weather conditions are very severe, field staff shall postpone or reschedule travel and inform the field staff supervisor.
- 7) If air monitoring activities are conducted at an industrial facility, field staff shall comply with the facility's safety plan/procedures.

18.3 Electrical Safety

18.3.1 General Information

General safety precautions related to electrical hazards must be observed at all times when working with electronic equipment. Electrical receptacles and equipment must be properly grounded. Use caution when servicing or operating electronic equipment in wet conditions, as frequently encountered at field monitoring sites. If possible, electrical equipment should be powered off and disconnected prior to servicing. Workers will report all electrical shocks to a supervisor and will use their own discretion in seeking medical attention or may be required by a supervisor to seek medical attention.

- 1) Most electrical accidents result from unsafe equipment installation, unsafe environment, or unsafe work practices.
- 2) Electrical shock can be prevented by using insulation, guarding, grounding, electrical protective devices, and safe work practices.
- 3) When working on electrical equipment the basic procedures to follow are:
 - i) de-energize equipment before inspection or repair, if possible
 - ii) use lockout/tagout procedures to ensure the equipment remains de-energized
 - iii) use insulating protective equipment
 - iv) keep electrical tools properly maintained
 - v) maintain a safe distance from energized parts
 - vi) exercise caution when working near energized lines
 - vii) use appropriate protective equipment

After transporting monitors, calibrators or other electrical equipment, check for loose circuit boards or electrical components before connecting to electric power and starting up.

18.3.2 Insulation

Before connecting electrical equipment to a power source, check the insulation of any exposed wires for defects. Insulation covering a flexible power supply cord or an extension cord, is especially susceptible to damage.

18.3.3 Tools

Appropriate and properly maintained tools help protect workers against electric hazards. Check each tool before using it. If a defect is found, immediately remove it from service and tag it so no one will use it until it has been repaired or replaced.

18.3.4 Grounding

- 1) Grounding a tool or electrical system means intentionally creating a low-resistance path that connects to the earth. This prevents the buildup of voltage that could cause an electrical accident.
- 2) Grounding is normally a secondary protective measure to protect against electric shock. It does not guarantee protection against electrical shock or injury due to an electrical current. It will, however, substantially reduce the risk, especially when used in combination with other safety measures.
- 3) An equipment ground helps protect the equipment operator. It furnishes a second path for the current to pass through from the tool or machine to the ground. This additional ground safeguards the operator if a malfunction causes the equipment's metal frame to become energized. The resulting flow of current may activate circuit protection devices.
- 4) All electric cords and receptacles shall be three-prong with ground (or four prong for 220V main power in new equipment shelters).
- 5) Field technicians shall carry a voltmeter and a receptacle tester to verify proper wiring connections and voltage.
- 6) All mobile shelters shall be grounded at the monitoring site with a standard 8-foot copper-clad ground rod, independent of any other grounding of electrical or telephone service.

18.3.5 Circuit Protection Devices

Circuit protection devices limit or stop the flow of current automatically in the event of a ground fault, overload, or short circuit in the wiring system. Well-known examples of these devices are fuses, circuit breakers, ground-fault circuit interrupters (GFCIs), and arc-fault circuit interrupters.

- 1) Ground-fault circuit interrupters (GFCIs) shall be used in wet locations, outdoor (including rooftop) sites, and other high-risk areas. These devices interrupt the flow of electricity within as little as 1/40 of a second to prevent electrocution. GFCIs compare the amount of current going into electric equipment with the amount of current returning from it along the circuit conductors. If the difference exceeds 5 milliamperes, the device automatically shuts off the electric power.
- 2) Repeated remote tripping of a GFCI by power line fluctuations may require replacement of the GFCI with a conventional circuit breaker.

18.3.6 Overhead Power Lines

- 1) Before working under or near overhead power lines, ensure a safe distance (i.e., at least 10 feet) to the lines.
- 2) Equipment at all monitoring stations shall be installed in a manner that maintains a safe distance to energized lines.
- 3) If work near energized lines is required, an observer shall be used to monitor work and warn of impending safe distance violation. Work activity shall be modified to preserve a safe working distance.

18.4 Ladder Safety

Ladder safety begins with the selection of the proper ladder for the job and includes inspection, setup, proper climbing and standing, proper use, care, and storage. In addition to the general safety rules for all ladders there are special rules for using stepladders and for single and extension ladders. The American National Standards Institute (ANSI) requires that a duty rating sticker be placed on the side of every ladder so users can determine if they have the correct type ladder for each task.

18.4.1 Ladder Selection

- 1) Be sure the ladder being used has the proper duty rating to carry the combined weight of the user and the material being installed.

- 2) A ladder's duty rating tells you its maximum weight capacity. There are four categories of duty ratings:

Type of Ladder	Duty Rating	Approved Use
Type IA	300 pounds	Extra-heavy duty/Industrial
Type I	250 pounds	Heavy-duty
Type II	225 pounds	Medium-duty
Type III	200 pounds	Light duty

- 3) The sections of an extension ladder should overlap enough to retain the strength of the ladder. The usable length of the ladder is shortened by the amount of the overlap. Recommended overlap lengths appear in the following table:

Length of Ladder	Required Overlap
Up to 36 feet	3 feet
Over 36 to 48 feet	4 feet
Over 48 to 60 feet	5 feet

- 4) Never splice or tie two ladders together to make a longer ladder.
- 5) Top support for a ladder is as important as good footing. The top should rest evenly against a flat, firm surface. If a ladder is to be leaned against roof gutters, the strength and stability of the gutters should first be tested.
- 6) When a ladder is used for access to an upper landing surface, it must extend three rungs, or at least three feet above the landing surface.
- 7) A ladder used for access to an upper landing surface should be secured against sideways movement at the top or held by another worker whenever it is being used.
- 8) Extend an extension ladder only from the ground. Determine the needed height, extend and lock the fly section securely in place then set it up against the wall. Check for stability and support before climbing.
- 9) If possible, the base of a long ladder should be secured to the ground and the top should be tied to the upper landing surface.
- 10) The technically proper angle for a non-self-supporting ladder is about 75 degrees above horizontal. This means that the base should be set out one-fourth of the ladder's height to its top support point.

For example, if a ladder is to be supported at a point 20 feet off the ground, its base should be set 5 feet out from the wall (20 feet divided by 4 = 5 feet). An easy way to measure this, if the ladder top will rest against the wall, is to pace off the length of the ladder or count the rungs, and divide by four to get the proper distance from the wall for placing the foot of the ladder.

- 11) If the job requires a ladder to be placed at an angle more or less than 75 degrees above horizontal, re-evaluate ladder selection or use an assistant to remain on the ground and provide support.

18.4.2 Ladder Inspection

- 1) Always check a ladder before using it. Check all ladders to see that steps or rungs are tight and secure. Be sure that all hardware and fittings are properly and securely attached. Test movable parts to see that they operate without binding or without too much free play. Inspect metal and fiberglass ladders for bends and breaks.
- 2) Never use a damaged ladder. Tag it "Defective" remove it from service.
- 3) Field staff shall regularly inspect and lubricate hinges and latches on folder ladders to assure proper operation and adjustment.

18.4.3 Ladder Setup

- 1) It is very important to learn and apply the proper methods for setting up ladders. Incorrect setup can cause damage to the ladder and excessive physical strain on the user. The following steps should be followed:
 - i) Lay the ladder on the ground with the base resting against the bottom of the wall and the top pointing away from the wall.
 - ii) Starting at the top of the ladder, lift the end overhead and walk under the ladder to the wall, moving hands from rung to rung as you go.
 - iii) When the ladder is vertical, and the top touches the wall, pull out the base so that the distance away from the wall is about one-fourth of the height to the point of support.
 - iv) Reverse this process to take down the ladder. Check for obstacles before moving backwards. Be careful to lower the ladder slowly to maintain control.

- 2) Place ladder feet firmly and evenly on the ground or floor. Make sure the ladder is sitting straight and secure before climbing it. If one foot sits in a low spot, build up the surface with firm material.
- 3) Do not try to make a ladder reach farther by setting it on boxes, barrels, bricks, blocks or other unstable bases.
- 4) Do not allow ladders to lean sideways. Level them before using.
- 5) Brace the foot of the ladder with stakes or place stout boards against the feet if there is any danger of slipping.
- 6) Never set up or use a ladder in a high wind, especially a lightweight metal or fiberglass type. Wait until the air is calm enough to insure safety.
- 7) Never set up a ladder in front of a door unless the door is locked or a guard is posted.
- 8) If a ladder must be used on ice or snow, use spike or spur-type safety shoes on the ladder feet and be sure they are gripping properly before climbing.
- 9) Use Safety shoes on ladder feet whenever there is any possibility of slipping.

18.4.4 Ladder Climbing and Standing

- 1) Keep the steps and rungs of ladders free of grease, oil, wet paint, mud, snow, ice, paper and other slippery materials. Also, clean such debris off your shoes before climbing a ladder.
- 2) Always face a ladder when climbing up or down. Maintain three-point contact (two hands and one foot, two feet and one hand) at all times.
- 3) Never carry heavy or bulky loads up a ladder. Use a hand line to hoist materials or equipment. Additional personnel may be necessary to complete task safely.
- 4) Climb and stand on a ladder with your feet near the center of the steps or rungs.
- 5) Do not overreach from a ladder. Always maintain control.
- 6) Never stand on the top two rungs of a straight or extension ladder.

18.4.5 Proper Use of a Ladder

- 1) Use only approved fiberglass ladders near energized power lines. If the overhead power line is 50 kV or less, then stay at least 10 feet away. For everything else, keep at least 35 feet away.
- 2) When using a ladder where there is traffic, erect warning signs or barricades to guide traffic away from the foot of the ladder. If this is not possible, have someone hold and guard the bottom of the ladder.
- 3) While on a ladder, do not try to move it by rocking, jogging or pushing it away from a supporting wall.
- 4) Never use a ladder when under the influence of alcohol, drugs or medications, or in ill health.
- 5) Never leave tools or materials on top of a ladder.
- 6) Never push or pull anything sideways while on a ladder. This puts side load on the ladder and can cause it to tip.
- 7) Allow only one person at a time on a ladder unless the ladder is specifically designed for two people.
- 8) Never use a ladder a horizontal platform, plank, scaffold, or material host.
- 9) Never use a ladder on a scaffold platform.

18.4.6 Proper Ladder Care and Storage

- 1) Maintain ladders in good condition.
- 2) Keep all ladder accessories, especially safety shoes, in good conditions.
- 3) Never use a metal or fiberglass ladder which has been exposed to fire or strong chemicals. It should be discarded.
- 4) Never store materials on a ladder.
- 5) Store fiberglass ladders where they will not be exposed to sunlight or other ultraviolet light sources.
- 6) Be sure that ladders are properly supported and secured when in transit.

- 7) Store ladders on racks, which give them proper support when not in use.
- 8) Metal bearings of extension ladder rung locks and pulleys should be lubricated periodically, and between regular maintenance periods whenever necessary.
- 9) Ropes on extension ladders should be in good condition. If they become frayed or badly worn, replace them.

18.4.7 Safety Rules for Stepladders

- 1) Never use a stepladder over 20 feet long.
- 2) Always open a stepladder completely and make sure the spreader is locked open before using.
- 3) Never substitute makeshift devices of wire or rope for stepladder spreaders.
- 4) Do not stand higher than the second step from the top of a stepladder. Especially, do not stand or sit on the top cap, or stand on the pail shelf, or on the back of the stepladder.
- 5) Do not straddle the front and back of the stepladder.

18.5 Vehicle and Towing Safety

18.5.1 Vehicle Safety

- 1) Any person operating a vehicle on behalf of the State of Kansas must possess a valid state-issued Driver's License.
- 2) Any person operating a vehicle on behalf of the State of Kansas is responsible for its safe operation.
- 3) All Kansas vehicle laws and rules of the road must be followed when operating any vehicle.
- 4) It is the responsibility of the driver to properly maintain the vehicle. Tires, lights, mirrors, windshield wipers and fluid levels shall be checked regularly. If using a vehicle on a temporary basis, report defects to the assigned driver to assure that corrective action/repair is performed.

18.5.2 Trailer and Towing Safety

- 1) Know the capacity of the trailer.
- 2) Do not overload the trailer. Overloading can cause serious injury or equipment damage.
- 3) Use a properly sized towing vehicle. Do not exceed vehicle weight or axle weight ratings.
- 4) Distribute weight so that trailer tongue weight is approximately 10% of the gross trailer weight (GTW). Do not let tongue weight exceed coupler and hitch rating.
- 5) Always use safety chains when towing. Cross safety chains under coupling to prevent tongue from dropping to ground.
- 6) Make sure hitch and ball are properly sized and are fully engaged. Use available locks or safety pins to secure the coupling.
- 7) Before departing, verify the following:
 - i) Tires on both the towing vehicle and the trailer are properly inflated.
 - ii) Trailer brake lights, turn signals and mirrors should be checked for proper operation.
 - iii) Double check the hitch for proper connection (and adjust brake controller if so equipped).
 - iv) Tow at an appropriate speed for load and weather conditions.

18.6 Safe Handling of Compressed Gases

General safety precautions related to the handling and use of compressed gases must be observed during the calibration and QC procedures for continuous analyzers.

- 1) Never expose a compressed gas cylinder to a temperature above 125 degrees Fahrenheit.
- 2) Transport compressed gas cylinders with valve protector caps in place. Remove valve protector cap only when ready to make connections.

- 3) Use the contents of a compressed gas cylinder only with an appropriate pressure regulator attached.
- 4) Keep valve pointed away from yourself and anyone else.
- 5) Vent and use compressed gases only with adequate ventilation.
- 6) Vent valve briefly to clear opening of dirt and debris before making connection.
- 7) After making connections, check for leaks with soapy water.
- 8) Close cylinder valve and release all pressure from device before disconnecting.
- 9) Never apply oil to a compressed gas valve or regulator.
- 10) Never hammer on a cylinder valve or use excessive force in opening or closing.

Appendix A

AAM SOP Revision History

Table A1. List of changes made during each revision.

Revision Number	Revision Date	Document Section	Revision Description
5.0	12/28/2018	Entire Document	Format changes to header, table of contents, titles, and subtitles. Added Appendix A to track changes in future revisions of the SOP. The combining and rearranging of sections for better understanding.
5.0	12/28/2018	Section 3	Addition of a chapter within Section 3 for Cooper Environmental Xact 625i continuous particulate matter for the purposes of source-specified lead monitoring.
5.0	12/28/2018	Sections 5, 6, 7, 8	Addition of section and/or section chapters in preparation for the PAMS network in Kansas.
5.0	12/28/2018	Entire Document	General changes to the procedures to account for updates in EPA guidance documents.