SLOCAPCD Proposed Addendum to ARB QAPP
(QA Manual Vol II 11/1/1984 and 4/3/2000)
Document and Justification

2.0.0 Objective

Proposed Modifications:

Proposed Deletion to Section:
None

Proposed Addition to Section:
The San Luis Obispo County Air Pollution Control District (SLOCAPCD) agrees to adhere to the Roles and Responsibilities agreement with the Air Resources Board (ARB) dated June 9, 2014, and the District agrees to follow the current ARB QAPP document (version November 1, 1984 and April 3, 2000), with exception of those sections specified in this SLOCAPCD QAPP addendum. SLOCAPCD agrees to follow ARB SOPs or utilize its own SOPs that have been approved by ARB

Justification for Proposed Modification:
Section 2.0.0 does not specify PQAO arrangements between ARB and SLOCAPCD. The proposed addition is helpful to avoid confusion on the roles of the two organizations and is helpful in putting many of the other addenda in the correct context.

2.0.1. General Operating Procedures

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.1

Proposed Addition to Section:
Table 2.0.1 represents the routine tasks utilized by the San Luis Obispo County Air Pollution Control District (SLOCAPCD) for the operation of their air monitoring network, where the checks are documented, and the normal or required frequency.

Table 2.0.1: Typical Air Monitoring Activities

TASK	DOCUMENTED ON	FREQUENCY
Review of Hourly, Calibration and Chart Data	AirVision Annotation	Daily
Data QC and Validation	Errata Log	Daily and as needed
In-person Site Check	Site Log	Weekly (typical) Monthly (minimum)
Preventive Maintenance	Site Log QC Tab	Specific to task
Gas Analyzer Zero/Precision/Span Checks (Auto-Cal)	AirVision Database (Server)	Daily (typical) Bi-weekly (minimum)
Gas Analyzer Manual Calibrations (not full multi-points)	Multi-Point Cal Site Worksheet	As needed
Gas Analyzer Multi-point Calibration	Multi-point Cal Site Worksheet	6 months
Meteorological System Calibrations	Met Cal Worksheet	6 months (Temperature) 6 months (Sonic Z/S Test) Annual (Sonic Wind Sensors Certification)
BAM Verifications	Site Log PM Verifications Tab	Bi-weekly (minimum)
BAM Calibrations	Multi-point Cal Site Worksheet	Annual

2.0.1.1 Documentation

All tasks performed in the operation of a monitoring network must be clearly documented. Electronic workbooks for each calendar year are created to allow for easy documentation of these tasks. All calculations resulting from data entry in these workbooks are automatically performed and presented. When each workbook is created each year, calculated cell formulas are checked by comparison to manual calculations to ensure the accuracy of all data in calculated cells. Additionally, most entry and calculated cells are conditionally formatted to turn red or yellow to indicate an out of tolerance entry or result. Cells where entry is allowed are white; cells where entry is not allowed, such as a calculated result, are light brown. These workbooks reside on the station computer or operator's laptop and are periodically transferred to the District server for access from the office and long term storage (H:\tech\data\station qc sheets). These workbooks are configured so that after each entry, in addition to the worksheet being saved, a PDF file is automatically created and archived creating an unchangeable copy that can be used to demonstrate the authenticity of the workbook entries. EPA has approved this method of demonstrating the authenticity of the workbook entries. These documents must be archived at the District office permanently.

CAN Protocol

Corrective Action Notification (CAN) is the ARB protocol for notifying the PQAO of non-routine, unexpected, and/or systemic issues with instrumentation or data. SLOCAPCD will respond to CANs initiated by ARB. For internal issues identified by SLOCAPCD staff, the District has in place a thorough system for investigating and documenting instrument issues and/or suspect data that may be invalid or influenced in some way; this is called the Errata Log or Sheet. The Errata Log is kept up to date daily and updated when data review is performed and/or revised if any data validation or certification activity indicates that a change to data status is warranted. The Errata log is archived annually. The SLOCAPCD will utilize the CAN protocol for the notification of issues that could be considered critical to the data validation process or for issues considered to be systemic problems with instrumentation or deficiencies with QC protocols.

Table 2.0.1.1 below summarizes the electronic workbooks used in the District monitoring network to document field activities:

Table 2.0.1.1 – Electronic Workbooks used for Field Operations

WORKBOOK	TABS/SHEETS	USE
SiteLog	Log	Document all site activities
	Errata	Document data values that may be invalid or influenced in some way
	Site Check	Document checking major systems in site
	Instrument Q.C./Maintenance	Document maintenance activities, record and analyze meta data from automated analyzers.
	BAM Verification	Document bi-weekly flow, temp, pressure, leak, and time verifications
MPCal	Gas Parameter Cal Sheet	Document manual calibrations of gas analyzers
	BAM PM Cal Sheet	Document full calibration of BAM PM10 and or PM2.5 samplers
Mass Flow Calibration	Cylinder Data	Document S/N, concentration, and certification of gas cylinders used in the monitoring site
	Trend Summary	Summarize historical MFC calibration/verification results to identify trends
	Individual Cal Sheets	Enter data for each MFC calibration/verification
Ozone Standard Certification	Summary of 1X6 Comparisons	Summary of all 1X6 comparisons performed on site ozone standard
	Raw 1X6 Comparisons	Enter data for each 1X6 comparison
	Certification Sheet	Sheet that presents certification data for a full 6X6 comparison
Meteorological Calibration	Summary of Historical Results	Summary of past calibrations
	Individual Cal Forms	Enter data for each calibration

Monitoring network operations performed in the office are also documented mostly with electronic workbooks with the exceptions being the monthly data validation check sheets (Level 1, Level 2, Level 3) that are paper forms. Table 2.0.1.2 below summarizes these documents and forms.

Table 2.0.1.2 - Electronic Workbooks and Forms used for Central Office Operations

WORKBOOK/ CHECK SHEET	USE	LOCATION
Errata	Record and document data points validation or invalidation	H:\TECH\DATA\Station_QC_Docs\errata
Ozone Transfer Standard Certification Workbook	Document the certification of the District ozone transfer standard	H:\tech\worksht\ozone\transferstandard\transfer standard_Certification.xls
BAM Flow Verification to AQS string Workbooks	Links to site documents to create AQS strings for bi-weekly BAM flow checks	H:\TECH\DATA\Station_QC_Docs\Precision Records\BAMprec2.xlsx
Level 1 Data Validation Check sheet	Paper check sheet used to document that each step of the data validation process was performed on a site's monthly data set.	H:\TECH\DATA\Station_QC_Docs\QCchecksheets\Level 1data checksheet_rev2.docx
Level 2 Data Validation Check sheet	Paper check sheet used to document the review of the Data Validation Check sheet by a second independent person.	H:\TECH\DATA\Station_QC_Docs\QCchecksheets\Level 2 data checksheet_rev1.doc
Level 3 Data Validation Check sheet	Paper check sheet used by the Monitoring Manager for final approval to upload data to AQS.	H:\TECH\DATA\Station_QC_Docs\QCchecksheets\Level 3 data_sum&review.doc
Hourly Data Screening Workbook	Automatically screens hourly data for a variety of possible data collection errors, instrument malfunctions, outliers, weather effects, etc. prior to submission to AQS	H:\TECH\DATA\DATA SCREENING\New BAM Screen\NewDataScreen-2.xlsm
Equipment Tracking Workbook	Tracks location and periods of deployment for major equipment	H:\TECH\MonitoringAdmin\Asset Tracking\Monitoring_Tracking_Assets_2015.xlsx
BAM10 and 2.5 Data Screening Workbook	Automatically screens PM10 and PM2.5 BAM data for a variety of possible errors including differences between the BAM internal record of data and data from the site data logger.	H:\TECH\DATA\DATA SCREENING\New BAM Screen\BAMScreen.xlsm

WORKBOOK/ CHECK SHEET	USE	LOCATION
CARB CAN Form 064	Document and report to ARB data or instrumentation issues that might be considered critical or originate from systemic instrument problems or QC protocols deficiencies	http://arb.ca.gov/aaqm/qa/pqao/can/can_form.pdf

2.0.1.2 Remote Review of Hourly, Calibration and Chart Data

Hourly, chart (minute), and auto-cal data is automatically transferred from each site data logger to the District central polling computer using AirVision software at least each hour. Detailed instructions on utilizing AirVision is contained in the AirVision user's manual. This data is reviewed each work day to confirm the correct operation of all station systems.

Review of Hourly Data

Generate a daily summary of hourly values using AirVision for each previous day back to the last day the review was performed. Scan the reports looking for missing data, outliers, flags applied by the data logger or AirVision Automatic Data Validation Process (ADVP) and obvious bad data values. Pay special attention to the following items:

1. Review station temperature for each station to ensure it is within the typical range of values adhering to EPA guidance from the QA Manual Vol II Appendix D and ensure that there are not rapid changes in the station temperature that could influence analyzer/BAM sampler operation. High station temperature is an indication that the station temperature control system is not operating correctly and corrective action must be taken ASAP to prevent damage to station instrumentation.
2. Review meteorological parameter values. Look for atypical speeds and directions for that site and season. Watch for repeating hourly values (especially wind direction at 360 degrees and speed near zero) as this could indicate a sensor failure. Watch for spikes in wind data for sites with sonic sensors as these sensors can intermittently produce erroneous data resulting from a variety of interference, including water droplet(s) covering one of the transducer elements, perching birds or insects blocking the signal.
3. Review gas pollutant values. Watch for high and low outliers for that particular pollutant. Look for rapid shifts in value that are not accompanied by simultaneous shifts in wind direction/speed. Negative values over the method limit of detection require immediate investigation and/or adjustment of the instrument.
4. Review BAM 1020 PM values. If the site has both PM2.5 and PM10, ensure that most values of PM10 are greater than PM2.5. Look for high and low outliers based on the historical data from this site. Watch for low values that do not change as this could be a sign of a failure. Validation of negative values over the method limit of detection will be treated according to published EPA guidance and with ARB support. As required, QA policy changes will be reviewed and discussed with ARB and EPA, resultant updates to guidance documents or protocols will be prepared for ARB approval . Any questionable hourly data values need to be investigated to determine if they may be a sign of a failure or out of tolerance condition with that analyzer/sensor. If questionable data is observed in the hourly data review, review of calibration data and chart data often resolve whether there is or is not a problem. Changes to any data point validation status will be recorded in the site corresponding errata log. If warranted, SLOCAPCD will issue a CAN according to CAN Protocol guidance in section 2.0.1.1.

Review of Calibration Data

Auto calibration data is stored in the AirVision database, and can be displayed graphically or in tabular format. Review the data looking for outliers, trends that may indicate excessive drift, or analyzer response nearing or exceeding adjustment and/or validation thresholds.

Table 2.0.1.3 below present's adjustment and validation thresholds.

Parameter	Check	Adjustment Criteria	Validation Threshold
Ozone	Zero	<0, >1 ppb	<+/-3 ppb
	Precision	>+/- 5%	>+/-7%
	Span	>+/- 5%	>+/-7%
NO/NOx	Zero	<0, >1 ppb	<+/-3 ppb
	Low Point	>+/-7%	>+/-10%
	Span	>+/-7%	>+/-10%
NO2	Zero	<0, >1 ppb	<+/-3 ppb
	Precision	>+/-7%	>+/-10%
	Span	>+/-7%	>+/-10%
	Converter Efficiency	Average CE<97%	Average CE <96%
SO2	Zero	<0, >1 ppb	<+/-3 ppb
	Low Precision	>+/-7%	>+/-10%
	Span	>+/-7%	>+/-10%

1. Any auto-cal values that appear out of tolerance or unusual must be immediately investigated and action taken if the analyzer is out of tolerance. Sometimes an auto-cal value from the data system does not correctly reflect the actual analyzer response or there was a problem with the calibration system that caused the auto-cal response to appear out of tolerance. Review of chart data for any auto-cals with unusual responses would be the first step in investigating unusual or out of tolerance auto-cal results. The final step in investigating an auto-cal result would be to make an in-person site visit, reviewing operational data for the analyzer in question and if needed, perform a manual calibration to confirm the auto-cal result. If the investigation determines that the calibration system did work correctly for the auto-cal, the auto-cal result in AirVision is invalidated and the ambient data is considered valid. Changes to any data point validation status will be recorded in the site corresponding errata log. If warranted, SLOCAPCD will issue a CAN in accordance to section 2.0.1.1,

Review of Chart Data

Chart data (1 minute averages) are automatically polled and stored by AirVision. Charts can be displayed from this data using AirVision data tools. Generate charts for each site (typically pollutant's charted separately from meteorological parameters, but in some cases it is helpful to have met parameters with pollutant) and review the charts back to the last point in time where the charts were reviewed (typically reviewed to the last work day). Pay special attention to the following:

1. The data values from the chart are typical for the site, parameter and season.
2. The variability of the chart trace is typical for the parameter.
3. Ozone typically has a diurnal pattern with the peak in the afternoon.
4. For sites with NOx and ozone, any rise in NOx should be accompanied by a similar drop in ozone. The ozone and NOx traces should be somewhat mirror images of each other.

5. For sites with sonic wind sensors, watch for rapid shifts in both wind speed and direction. These sensors can occasionally produce erroneous data when blockage of the signal or interference on the transducer causes a spike to zero or full scale.
6. Watch for rapid shifts in pollutant values, especially ozone. Check to see if the shift in pollutant value occurs at the same time as a shift in wind speed and/or direction.

Any questionable chart data needs to be investigated to determine if they may be a sign of a failure or out of tolerance condition with that analyzer/sensor.

1. Following the review of hourly, calibration, and digital chart data document the review and any findings in AirVision. As stipulated before, and in accordance to proposed section 2.0.1.1, changes to any data point validation status will be recorded in the site corresponding errata log. If warranted, SLOCAPCD will issue a CAN according to protocol.

2.0.1.3 Site Check

On each in-person visit to the monitoring station, and at least once each month, the operator will normally perform a "site check". The purpose of the site check is to have the operator check all major aspects of the monitoring station either to confirm and document that everything is operating as expected, or to identify a problem or condition that may affect data being gathered. A "site check" sheet and individual check sheet for each instrument is included in the site log workbook to address the specific systems of each monitoring station. The operator shall use these check sheets to verify and document each item that needs to be checked. Should the operator uncover a problem it must be documented on the check sheet, and the operator must take immediate steps to correct the condition. Any observed condition that may possibly affect the validity of data from one or more measured parameters must also be noted on the Errata tab in the site log workbook.

In addition to the specific check sheets that have been designed to address the most common possible problems at a monitoring station, the station operator needs to be aware of any operational changes in any and all equipment at the monitoring station. Investigating changes in sound, smell, or appearance could possibly help to identify a significant problem with one or more instruments in the monitoring station. In addition, the site operator needs to also be attentive to changes in the station surrounding environment. Changes in the land use for instance have significant influence in the data from an air monitoring station. The sooner the change is detected, the less likely it will have an adverse impact on the data from the monitoring site. Any pollutant activities observed, like construction or demolition and changes in the vicinity of the monitoring station in terms of sources of air pollution like traffic increase, wood burning, cooking, etc. must be documented in the site log.

The following sequence of checks to be made at each station during each site check is recommended, not so much that the sequence itself has significance, but because a given sequence becomes habitual and a station operator will be less likely to miss an item.

The basic procedures for performing a site check are as follows:

1. Approach the station. Observe the surroundings, shelter, rooftop equipment, door and locks for signs of damage or deterioration.

2. Enter the station and observe the interior for unusual temperature, noises or smells.
3. Begin entry in the station log with date, time and tech's name or initials.
4. Complete the sitecheck sheet in the sitelog workbook.
5. Complete all equipment Check sheets in the sitelog workbook and load operational data from each analyzer.
6. Review chart data whenever necessary to investigate a potential problem.
7. Complete the Log entry in the sitelog workbook with entries for all significant activities performed and mark any periods of interruption of ambient data in the Data Logger Errata Sheet.

2.0.1.4 Calibration and Standards

Calibration of an air quality analyzer establishes and documents the quantitative relationship between actual pollutant concentration input and the analyzer's response. This relationship is used to convert subsequent analyzer response values to corresponding pollutant concentrations. Since the response of most analyzers has a tendency to change somewhat with time, the calibration must be updated periodically to maintain a high degree of accuracy.

District sites measuring gas parameters are equipped with dedicated in-station calibration systems. These systems consist of a dilution calibration system with an ozone generator/ozone transfer standard, zero air generator, and certified multi-blend compressed gas cylinder. In the case of a station with only ozone monitors, the calibration system consists of an ozone generator/ozone transfer standard and internal zero air generator. The calibration system is configured to input test atmospheres directly to the sample inlet for sampling by all gas analyzers in their normal sample path. In addition to using the calibration system for manual calibrations, they are programmed to automatically perform at a minimum: Level 1 zero; span; and/or precision checks. These auto-calibration checks are normally programmed to occur between 22:00 to 06:00. The results of these auto-calibrations are recorded by the site data logger and transmitted to the District central computer. Results of these daily auto-calibration checks are reviewed on a daily basis to assist in identifying any measurement system operating out of specification so that immediate corrective action can be implemented.

<u>Standards Certification and Traceability:</u>
All calibration equipment and material must be periodically certified, establishing traceability to primary standards. The following table lists calibration standards used in the operation of District monitoring stations, the certification methodology used, and the certification period.

Table 2.0.1.4 - Standards Certification and Traceability

STANDARD	CERTIFICATION METHOD	CERTIFICATION PERIOD
NO,SO2 Multi-blend Cylinders	EPA Protocol	EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards
Hastings Bubble Meter	Considered a Primary Standard	N/A
Definer Flow Standard	Considered a Transfer Standard	1 year
Dilution Calibrator Mass Flow Meters	Multi-point Cal w/ Primary Flow Standard	3 months
Portable Temperature Sensor	Multi-point Cal w/ NIST Thermometer	1 year
Delta Cal BAM flow, temp, pressure standard	Performed by manufacturer by comparison to primary or higher standard.	1 year
Ozone Primary Standard (API 401)	Performed by EPA at Region 9 lab or ARB at their lab, comparison to Standard Reference Photometer	1 year
Ozone Level 3 Working Standards (API 700, API 703, Dasibi 1008-PC)	6X6 comparison (or 1X6 update to 6X6) to Primary Standard	6 months
Digital Relative Humidity Standard	Factory Calibration	Yearly

Justification for Deviation:
Section 2.0.1 was written over 30 years ago. The procedures for general station operation included in the proposed modification to reflect newer equipment and newer technology utilized by the SLOCAPCD. The electronic workbooks utilized for documenting station operation have been demonstrated to dramatically increase accuracy and efficiency over older paper forms. Additionally, the digital strip charts dramatically increase efficiency and reduce driving to sites by allowing remote evaluation of charts. Experience with the digital charts, set up to provide a second back-up of data on the site computer, have shown less loss of data, than with the older paper strip charts due to the mechanical nature of the paper charts.

2.0.2 Data Acquisition

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.2

Proposed Addition to Section:
The SLOCAPCD's data acquisition from ambient monitoring stations is accomplished with the use of ESC/Agilaire 8832 or equivalent data loggers. These data loggers store minute, hour, and calibration data from the gas analyzers, PM samplers, and meteorological sensors (where available). Each monitoring station is equipped with the station data logger and, if feasible, a desktop computer. Alternatively, a laptop computer can be used to interface with the data logger. The site computer/laptop is configured with Digitrend software or similar digital software that polls the station data logger once a minute to obtain the most recent data collected.

Justification for Deviation:
The proposed replacement text reflects the different equipment utilized by the SLOCAPCD.

2.0.2.2 Responsibility

Proposed Modifications:

Proposed Deletion to Section:
"The section lead technician and the section specialist or engineer are responsible for reviewing the work done by the field technician as the second level of review in the data validation chain."

Proposed Addition to Section:
Replace with:
The District technician that is not designated as the station operator for a particular site is responsible for reviewing the work done by the station operator as the second level review in the data validation chain.

Justification for Deviation:
The proposed replacement text reflects the organizational structure of the SLOCAPCD. This difference is organizational roles and structure and is necessary due to the much smaller size of SLOCAPCD.

2.0.2.3a Environmental Monitoring Company Model SM-2000 Station Manager Data Logger/Environmental Systems Corporation 8800 Data Loggers

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.2.3a

Proposed Addition to Section:

Environmental Systems Corporation/Agilaire 8832 or Equivalent Data Loggers

The 8832 and 8816 data loggers are microprocessor based data acquisition systems designed specifically to acquire, process, store, and telemeter air monitoring data. The standard unit consists of a microprocessor, analog to digital converter, memory, power supply, and battery backup for the clock and data storage. Data from these data loggers are polled over telephone lines, wireless cell modems and/or internet connection using the AirVision software by the District's central polling computer, located at the District office. Additionally, data from these loggers are polled by a computer over local connections using Digitrend or similar software.

Once the data has been transmitted to the District office, it is inserted into a SQL database by the AirVision software. AirVision is the central data management software for the District. AirVision allows monitoring staff to access and manipulate air quality data gathered by the data loggers.

Justification for Deviation:
The proposed replacement text reflects the different equipment and software utilized by SLOCAPCD.

2.0.2.4 Strip Chart Recorders

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.2.4

Proposed Addition to Section:
Digital Strip Charts are created with one minute data points acquired from the station data logger with the use of either Digitrend or AirVision software. Local charts, available for use in the air monitoring station, are created using Digitrend software and the site computer. Charts for use in the District office, are created using AirVision software. Both methods of generation of chart data utilize the exact same one minute averages acquired by the station data loggers, so the charts will be identical regardless of the software utilized to generate them.

Both sets of software used to generate electronic charts provide functions for scaling by engineering units or percent of scale, color of trace, annotate charts with meaningful notes, and scale Y-axis (time) to be displayed. Additionally, both programs allow toggling between graphic and tabular display of data.

The user's manual for both sets of software provide detailed information on configuring and using the various options of the charting software.

Justification for Deviation:
The revision proposed for Section 2.0.2.4 reflects the use of different equipment (electronic vs. paper charts) used at SLOCAPCD. Additionally, the digital strip charts dramatically increase efficiency and reduce driving to sites by allowing remote evaluation of charts. Experience with the digital charts have shown less loss of data, than with the older paper strip charts due to the mechanical nature of the paper charts

2.0.2.5 Data Transmission to Headquarters

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.2.5

Proposed Addition to Section:
Air Quality data is transmitted to the District office using AirVision software. Data are polled over telephone lines, wireless cell modems and/or internet connection by the District's central polling computer, running AirVision. Workstations for air monitoring staff are equipped with AirVision client software allowing connection to data stored on the central polling computer and server.

Justification for Deviation:
The revision to Section 2.0.2.5 reflects the different software utilized at SLOCAPCD.

2.0.2.6 Review and Correction of Data Acquisition System Station Technician – First Level Reviewer and Second Specialist – Second Level Reviewer

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.2.6

Proposed Addition to Section:
Tools used in review of data from air monitoring stations:
Data editing, calibration control charts, monthly data matrix, and other data reports are accomplished with the use of the AirVision software. Detailed instructions for operating AirVision are outlined in the AirVision user's manual.

The main tool to determine validity of data from gas analyzers are manual calibrations (typically multi-point calibrations) and daily auto-calibrations. Multi-point calibrations are performed every six months or before (if the analyzer is operational) and after any repairs or maintenance that could influence the linear response of the analyzer. Manual zero/span checks are performed before and after any analyzer adjustment, repair, or maintenance that could change the analyzer response, but not change the linear nature of the analyzer. Auto-calibrations are performed on all gas analyzers every night, usually between 22:00 and 06:00 hours. Auto-calibration consist of a zero concentration, a span between 75% and 85% of full scale, and a precision check span close to typical ambient concentrations. The manual and auto-calibration checks are performed by automatically introducing a standard gas of a known concentration (the "expected value") through the probe (e.g.

into the sample inlet that all gas analyzers sample from) and automatically recording the monitor's response. By comparing the monitors response to the expected value, the degree of accuracy (i.e. expressed as % difference from true) of the monitor is determined. It is important to note that at times calibration systems fail, so it is important to ensure the validity of each calibration performed. Additionally, gas analyzers are programmed to gather operational data once each day for critical components in the analyzer. This operational data is another tool in determining validity of data from gas analyzers.

One important tool to determine validity of data from BAM particulate samplers utilized by SLOCAPCD are the bi-weekly flow, leak, time, temperature, and pressure verifications performed on the samplers. Additionally, BAM samplers automatically perform a calibration span test every hour and monitor internal critical components, limits and ranges. The BAM software automatically generates an operational status bit in the internal data files noting a failure or out of tolerance condition for one or more of the components evaluated by the sampler for each hourly cycle of the sampler. This added information is another useful tool used in determining validity of PM data from BAM samplers.

Validity of meteorological data are determined by bi-annual calibrations verifications as well as visual comparisons of sensor readings to current meteorological conditions performed as part of each site check.

Reviewing these QC checks performed on gas analyzers, BAM PM samplers, and meteorological sensors is an important part of identifying failed or failing equipment. Procedures such as the remote review of hourly, calibration and chart data (section 2.0.1.2) and site checks (section 2.0.2.3) attempt to provide as soon as possible detection of a potential problem with a sampling system. Whenever a possible problem is detected, immediate investigation, and as needed corrective action must be taken. Results from the investigation and data validation determination will be recorded in the Errata Log and issuance of a CAN will be according to guidance in section 2.01.1.

<u>Criteria for Determining Data Validity:</u>
Station data loggers are programmed to automatically invalidate any hour of data where less than 75% of the hour was valid. Any hand-processed data must also follow this criterion.

Air quality data for gas pollutants is validated by bracketing the data with valid calibration checks that demonstrate that the measurement system is operating within the required specifications. In addition, equipment operational data is reviewed to ensure all operational parameters are within required specifications.

The following table lists the calibration criteria for data validation for each gas parameter.

Table 2.0.2.1: Gas Pollutant Data Validation Criteria

Parameter	Check	Validation Threshold
Ozone	Zero	<+/-3 ppb
	Precision	>+/-7%
	Span	>+/-7%
NO/NOx	Zero	<+/-3 ppb
	Low Point	>+/-10%
	Span	>+/-10%
NO2	Zero	<+/-3 ppb
	Precision	>+/-10%
	Span	>+/-10%
	Converter Efficiency	Average CE <96%
SO2	Zero	<+/-3 ppb
	Low Precision	>+/-10%
	Span	>+/-10%

Periods of data bracketed by calibration checks with zero and span results below the data validation thresholds listed in the above table shall be validated as is with no adjustments made. Negative zero responses are allowed as long as value is within the detection limit as specified above. Negative ambient values greater than the method detection limit are not accepted by AQS, and must be invalidated. EPA maintains a list with gaseous federal MDL information which SLOCAPCD will use for determining data validation of negative values. The most recent online MDL list can be found at https://aqs.epa.gov/aqsweb/codes/data/Parameters-CRITERIA.html Post processing or adjusting pollutant data after it has been generated is no longer approved by EPA and shall not be performed. Periods of data bracketed by one or more checks that exceed the above data invalidation thresholds shall be invalidated. Only meteorological data may be adjusted, and only when adjustment factors and the start and end of the period to which the adjustment applies can be clearly identified and documented. In most cases of an out of tolerance result, the entire period of bracketed data will be invalidated. Gases average validation periods shall be in accordance to 40 CFR Part 50. However, the data analyst must use common sense and any other available information in deciding how to invalidate the data set in question. For example, if there was a particular instantaneous event that resulted in a shift in calibration results at one particular point in time that was easily identified, (state on the stripchart), the data analyst would only invalidate the period before or after the identified event.

BAM particulate sampler flowrate calibration checks are also used to bracket particulate data. Particulate data bracketed by “as is” flowrate verification or calibration checks that show the flowrate to be within +/-4% of true flowrate (at the normal operational flowrate) is validated without any data adjustment. Data bracketed by as is flowrate calibration checks that show the flowrate to be greater than +/- 4% of the true flowrate (at the normal operational flowrate) are invalidated. Additionally, sampler operational data is reviewed with the use of the BAM screening worksheet to ensure all operational parameters are within tolerance prior to validation. The screening workbook will also flag any negative BAM values. Hourly BAM measurements are subject to a certain degree of noise, and under very clean atmospheric conditions it is expected that the BAM will occasionally report slightly negative values. In the absence of evidence of malfunction, occasional hourly negative values in the range accepted by EPA AQS should not be invalidated and will be treated according to

published EPA MDL guidance for handling negative values. Similarly, the BAM 24 hour average validation period shall be based on approved EPA federal MDL values. Frequent or repeated negative hourly values and negative daily averages should, however, be viewed with skepticism and thoroughly investigated. Results from the investigation and data validation determination will be recorded in the Errata Log and issuance of a CAN will be according to guidance in section 2.01.1.

Meteorological data is also validated by bracketing data between two or more valid calibration checks that demonstrate the system to be operating within the required tolerance. Sonic wind sensors are calibrated once each year by sending the sensor to the factory for wind tunnel calibration, data from these wind tunnel calibrations are used to determine validity of wind data from sonic sensors. Every six months and before installation in the field and before removal for factory calibration, sonic sensors undergo an operational check out to ensure there are no gross operational errors and that the data logger is correctly configured. Temperature calibrations are performed every six months on site, and have a +/-0.5 DegC tolerance. Data from a meteorological parameter that is bracketed with valid calibration checks that demonstrate the system was operating within the above listed tolerances is validated without any adjustment to the data. If a measurement system exceeds the listed tolerance, and it is clear that the sensors readings changed at one instantaneous event than can be definitely determined, the data can be adjusted to correct this error. Comparisons between the sensor instantaneous readings and observed conditions that are performed as part of each site check are helpful in identifying when a failure likely occurred. However, if the change in sensor's response cannot be clearly identified to occur at one point, or if the change was gradual, the entire bracketed data set shall be invalidated. Resultant data will be recorded in the corresponding Errata Log and issuance of a CAN will be according to guidance in section 2.01.1.

<u>Ongoing Data Validation:</u>
The data validation process begins with station operation. As the station operator performs routine and other tasks, any and all periods of data that appear invalid or even questionable need to be documented in the Errata Log or Sheet. As the station operator is reviewing strip chart data, any and all observations that may influence the validity of data need to be recorded on the Errata Sheet. Any calibration that exceeds the validation/adjustment criteria listed above also needs to be noted on the Errata Sheet. Additional details that are not listed on the Errata Sheet should also be documented in the station log.

<u>Monthly Data Validation Process:</u>
Air monitoring data is processed in monthly batches by District monitoring staff. The first level validation is performed by the site operator and is summarized by Level 1 Data Validation Sheet presented below as Figure 2.0.2.1.

Figure 2.0.2.1

San Luis Obispo County APCD Level 1 Data Validation Sheet

Monitoring Station:		Month:	
Technician:		Year:	

TASK	OK (Initial)
1) Ensure all raw data and site documentation has been transferred to the office.	
2) Print out raw monthly data for all hourly parameters.	
3) Review all raw data, site log entries, QC sheets, calibration records, and site errata sheets to get a feel for the monthly data set and site activities for the month.	
4) Run and review an annotations report on all parameters and note any data flagged by ADVP that may need invalidation or adjustment on the monthly printout.	
5) Review charts (minute data) for each parameter. CDF & Mesa2 only: Compare hourly BAM values between these sites. Note all periods of questionable data on monthly printouts. For SO_2 monitors, review 5-minute SO_2 data.	
6) Generate and print hardcopies of the raw, uncorrected auto-cal monthly control charts.	
7) Review the auto-cal responses and note any that appear to not be captured correctly. Correct or invalidate these auto-cal responses using the Calibration Data Editor.	
8) If any changes were made in the Calibration Data Editor, generate and print hardcopies of the cleaned-up auto-cal monthly control charts and note in Monthly Data Errata Sheet.	
9) Review manual calibration documentation, auto-cal control charts, and site errata sheets. Note any calibrations that exceeded the adjustment or invalidation thresholds.	
10) Review station temperature data. Note any periods exceeding the required temperature range for the equipment used at the monitoring station.	
11) Review all other site documentation noting any events that may require data adjustment or invalidation.	
12) Determine if any periods of hourly missing data can be filled with data from minute data or instrument downloads. Is so, fill in these periods and record on the raw hourly printouts.	
13) Investigate any items of questionable data noted above. Make a determination for each item whether the datum is valid, requires adjustment, or should be invalidated. Note this determination on the raw hourly printouts.	
14) Using the information recorded on the raw hourly printouts, make any necessary edits to the data set.	
15) Record all periods of missing data, invalidated data, or data adjustment on the Monthly Data Errata Sheet.	
16) For PM monitors, perform a data screen of BAM data using the BAM data screen tool. Investigate and take appropriate action on any potential errors identified by the screen.	
17) Perform a data screen on the finalized data set using the data screening tool. Investigate and take appropriate action on any potential errors identified by the data screening tool.	
18) Print the 3 Hour Report form, and review the hours identified as the highest for each pollutant to ensure that these hours are not anomalous.	
19) If the data screens or review of high values identify additional data needing correction or invalidation, make the appropriate edits, record the changes on the Errata Sheet, and rerun the data screens.	
20) Print copies of all final data. Compare to the annotated printout of pre-validation data and ensure that all needed data edits have been made.	
21) Assemble all final data and all final QC documents. Forward data packet for Level 2 review.	
22) After Level 2 and 3 data reviews are complete, upload the validated data and associated precision data to AQS. If Stat/CR reports identify problems, make any necessary edits, record them in the errata, rerun data screens, and upload the corrected strings. Run an AMP430 report and check that all intended data has made it into AQS.	

I certify that the _____ (month / yr) data for _____ (site) has passed the validation steps noted above and is complete and accurate to the best of my knowledge.

_____ (signature, date)

Part of the data validation is to run a series of data screening tests, as noted in the steps 16 and 17 of the Level 1 Validation sheet. These data screening steps apply an objective and consistent level of review that only a computer program can do. Using AirVision, monitoring staff creates an AQS formatted text file containing the QC finalized month's hourly data; then the data screens are run and the program identifies questionable data values. The data screens employ algorithms and data validation ranges, rate of changes, and other limits as tools for identifying suspected values; these data screening tools increase the reliability of the data review process and data accuracy. Following the completion of the first level validation process described above, a different monitoring staff AQ Specialist, that is not the designated site operator for the site data being reviewed, will perform the second level validation process. The second level validation process is designed to provide a review of the tasks performed by the first level validation to ensure all steps were followed and all determinations were accurate. The second level review utilizes the Level 2 Data Validation Sheet presented below as Figure 2.0.2.2.

Figure 2.0.2.2

San Luis Obispo County APCD
Level 2 Data Validation Sheet

Monitoring Station:		Month:	
Reviewer Name:		Year:	

TASK	OK?
1) Review Printed Data Set.	
2) Review Quality Control Documents.	
3) Review Errata and Precision Worksheets.	
4) Review Screening Worksheet.	
5) Review Site Log.	
6) OK to Release Data for Level 3 Review	

I certify that the _____ (month / yr) data for _____ (site)

has passed the Level 2 validation and is complete and accurate to the best of my knowledge.

_____ (signature, date)

The level 2 review is essentially the objective assessment of the QA/QC verification steps taken throughout the data production, capture and validation up to Level 1 review.
Following the completion of the Level 2 review, the data packet is submitted to the Monitoring Manager for Level 3 Data Validation. This review is summarized in the check sheet below presented as Figure 2.0.2.3.

Figure 2.0.2.3

SAN LUIS OBISPO COUNTY APCD

DATA MONTHLY SUMMARY & LEVEL 3 DATA VALIDATION

Site:	Month:	Year:

The table below summarizes the review of QC checks, QC verification maintenance, malfunctions, data completeness, for the data validation of criteria pollutants, meteorological and support parameters.

Parameter	QC Checks [1]	QC Verification[2]	QC Validation[3]	Malfunction Hours	% Data Completeness
	Y / N	Y / N	Y / N	#	%
O_3					
NO_2					
SO_2					
PM_{10}					
$PM_{2.5}$					
WSV					
WDV					
Sigma T					
AMT					
RMT					

1 Per EPA Reference: Data Validation per EPA QA Handbook Vol. II Appendix D:
2, 3, Per SLOAPCD Reference: SLO SOP, Section 5

Significant Events or Station Activities:
The monitoring station operated successfully with only routine instrument service and maintenance interruptions.

Quality control and quality assurance (QA/QC) checks were performed and documented meeting or exceeding all EPA/CARB requirements. All QA/QC records are retained on file at the District office to support any future inquiries about data validity.

Finalized Data For Record:

Data summaries for each measured parameter are reviewed, complete and passed the validations protocols noted above. This data set will be submitted to the USEPA AQS database.

Signature_____ _____
Aeron Arlin-Genet. Air Monitoring Manager Date

The Level 3 data review is the inclusion of the SLOCAPCD air monitoring oversight authority for the purpose of documenting the complete data QC review process and assuring adherence to data quality objectives and protocols set in the QAPP, QMP and SOPs utilized in the production of data that meets all the EPA and ARB criterion.

Justification for Deviation:
The revision to Section 2.0.2.6 reflects the different equipment, software, and size of organization at SLOCAPCD. Additionally, new information reflecting new equipment, validation protocols and tolerances that was not in use 15 years ago when the original text was written has been included.

2.0.2.7 Specific Criteria for Data Validity

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.2.7

Proposed Addition to Section:
After fulfilling all levels of data validation from section 2.0.2.6 and completing all Data Validation Sheets (Level 1 Figure 2.0.2.1, Level 2 Figure 2.0.2.2 and Level 3 Figure 2.0.2.3) the last QC step consists of transmitting the finalized text file to the AQS database using the USEPA AQS client software. During AQS data transmission the data is subjected to further scrutiny AQS where each data point is put through a series of statistical tests and final validation is determined. AQS will also calculate and post the official hourly and daily average, including data completeness is calculated. Data that passes all validation steps is posted in the EPA AQS database as final data for record and can be used for NAAQS comparability once certified. Data not passing these statistical tests is identified and not accepted until the issue is resolved. Data fixes must pass again the same failed screening test before they are accepted and posted for record. SLOCAPCD has sole upload

responsibility and authority over data from our district in the EPA AQS database and great care is taken to ensure data completeness and validity. ARB regularly downloads the District's air monitoring data from the EPA AQS database for incorporation in California's aerometric database. SLOCAPCD supports the data validation process from interpretation of EPA data validity rules from 40 CFR Part 50.

Justification for Deviation*:*
The proposed Section 2.0.2.7 reflects the difference in documentation methods and data validation protocols utilized at SLOCAPCD due to the use of different technology and the responsibility for uploading data for record unto the AQS data base, maintenance of the AQS site information, and annual certification of data.

2.0.3.1 Documentation

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.3.1

Proposed Addition to Section:
Documenting analyzer maintenance, analyzer operational checks, calibration dates, and other activities which may affect the data quality are important facets of an operator's job. SLOCAPCD utilizes electronic workbooks to document all tasks, including instrument relocation tracking as described in Section 2.0.1.1

Justification for Deviation:
The proposed revision to Section 2.0.3.1 reflects the difference in documentation methods utilized at SLOCAPCD due to the use of different technology and size of the District.

2.0.3.2 Station Log

Proposed Modifications:

Proposed Deletion to Section:
"and travels with that instrument at all times"

Proposed Addition to Section:
And is available electronically at all times

Justification for Deviation:
Revision reflects the use of electronic documents by SLOCAPCD.

2.0.3.3 Equipment Relocation Notification

Proposed Modifications:

Proposed Deletion to Section:
All of Section 2.0.3.3

Proposed Addition to Section:
The District utilizes an electronic workbook to document changes in location for major equipment utilized in the District's air monitoring network. Whenever an analyzer, calibrator, data logger, PM sampler, or sonic wind sensor is re-located the site operator responsible for the change in location, shall enter the date and new location in the Equipment Tracking Workbook. The workbook records the current location, as well as length in service, historical deployment locations and time periods. This information is useful in tracking re-occurring instrument problems, budget planning for replacements, as well as annual inventory tasks.

The electronic workbook is located within the SLOCAPCD server at :
H:\TECH\MonitoringAdmin\Asset Tracking\Monitoring_Tracking_Assets_2015.xlsx

In cases when a major piece of equipment is to be phased out and replaced with a new technology and/or a new analytical method is planned to be incorporated to the monitoring network, the SLOCAPCD shall communicate the PQAO with anticipation of the change, which will be during the planning process. SLOCAPCD shall seek ARB's input in regards to modifying or adding network instrumentation that is supported by ARB QA protocols and is part of the California Approved Sampler (C.A.S) list.

Justification for Deviation:
Revision to this section reflects the use of electronic workbooks for tracking of equipment. The small size of the District makes the use of a simple workbook to track equipment location more appropriate. Conforming to the SLOCAPCD-PQAO agreement, the district will make every effort to coordinate major equipment changes with ARB.

Hereby, the proposed SLOCAPCD addenda to the ARB QAPP July 2013 quality control document are submitted for review and approval. Upon signing of this document, the terms and contents within this addendum becomes approved for implementation and therefore applicable to the mutually accepted terms of the ARB-SLOCAPCD PQAO Roles and Responsibility agreement of June 9, 2014.

CALIFORNIA AIR RESOURCES BOARD

_____

Mike Miguel
Chief Quality Management Branch

Date: _____

SAN LUIS OBISPO COUNTY APCD

_____

Aeron Arlin-Genet
Planning, Monitoring and Outreach Division Manager

Date: _____

CALIFORNIA AIR RESOURCES BOARD

Mike Miguel

Chief Quality Management Branch

Date: 11/4/15

SAN LUIS OBISPO COUNTY APCD

Aeron Arlin-Genet

Planning, Monitoring and Outreach Division Manager

Date: 10 NOV 15