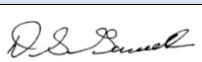
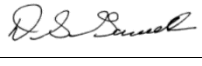
Quality Assurance Project Plan for the Phillips 66 Wilmington Fence-Line Monitoring Program

Revision 2

Phillips 66 Wilmington Refinery

Document Control			
Revision #	Revision Date	Description	Signature
1	10/08/2019	Original Draft	
2	10/11/2019	Update	

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List of Acronyms

APCO – Air Pollution Control Officer for the SCAQMD

BTEX – Benzene, Toluene, Ethylbenzene, Xylenes

CARB – California Air Resources Board

DQO – Data Quality Objectives

EPA – Environmental Protection Agency

FTIR – Fourier Transform Infrared Spectrometer

GPS – Global Positioning System

H_2S – Hydrogen Sulfide

LDL – Lower Detection Limit

MQO – Measurement Quality Objectives

MET – Meteorological Station.

N_2O – Nitrous Oxide

OEHHA – Office of Environmental Health Hazard Assessment

OGD – Operations Guidance Document

PPB – Parts Per Billion

QAPP – Quality Assurance Project Plan

QA/QC – Quality Assurance / Quality Control

SCAQMD – South Coast Air Quality Management District

SO_2 – Sulfur Dioxide

SOP – Standard Operating Procedure

TRI – Toxic Release Inventory

UV-DOAS – Ultraviolet Differential Optical Absorption Spectroscopy UDL – Upper Detection Limit

Section 1 – Fence-Line Monitoring Overview

The South Coast Air Quality Management District (SCAQMD) adopted Rule 1180, which requires refineries to develop and submit an air monitoring plan for Air Pollution Control Officer (APCO) approval in order to establish and operate a fence-line monitoring system. The SCAQMD also published guidelines for refineries to meet the fence-line monitoring requirements. Phillips 66's policy is to comply with all local and federal environmental regulations, including the fence-line monitoring provisions of SCAQMD Rule 1180. This includes meeting all downwind fence-line siting requirements and reportable quantifiable detection levels. As per the SCAQMD guidance document, siting of the fence-line air monitoring system includes the evaluation of meteorological data, as well as seasonal and recurring short-term meteorological events, such as quarterly wind roses. It also includes dispersion modelling. Site locations for the fence-line equipment were selected to strategically position the fence-line monitors using the predominant and variable meteorological conditions and topographical terrain features within the refinery.

Description of the Fence-Line Monitoring Program

A complete description of the fence-line monitoring program is included in the Phillips 66 Air Monitoring Plan. The program is comprised of open-path air monitoring systems for the detection and quantification of gases listed in Table 1.2, as well as point source monitoring systems for the detection of hydrogen sulfide (H_2S) and Black Carbon. Figure 1.1 presents a map of the refinery showing the locations of the air monitoring equipment. Table 1.1 presents the Global Positioning System (GPS) coordinates for each piece of equipment.

Figure 1.1 - Map of Fence-Line Monitoring Program

Table 1.1 - Monitoring Site Locations

Location Identifier	Equipment	Latitude	Longitude	Elevation (feet)
1	Optical Tent, FTIR Base, Point Monitors	33.766807	-118.291154	15’
2	UV and FTIR Retroreflector	33.772144	-118.294543	30’
3	UV Source, FTIR Retroreflector	33.775155	-118.295673	35’
4	Open-path Analyzers	33.780597	-118.295448	6’
5	UV and FTIR Retroreflector, UV Source, Point Monitors	33.777255	-118.289207	33’
6	Optical Tent, FTIR Base	33.778171	-118.282526	15’
7	UV and FTIR Retroreflector	33.771105	-118.281467	25’
8	Point Monitors	33.766781	-118.282506	0.5’
9	UV and FTIR Retroreflector	33.766907	-118.285506	41’
10	Point Monitors	33.774702	-118.282306	0.5’
11	Meteoritical Station	33.778308	-118.292729	0.5’

All air monitoring equipment for the P66 Wilmington fence-line system are specified to collect data on five-minute averages. Atmospheric conditions beyond the control of the refinery that affect accurate measurements, such as dense fog, shall not be counted against data completeness requirements if appropriate meteorological measurements document time periods when these conditions exist. The specific criteria for validating data involving the screening for weather-related events or other issues associated with data quality is included in Section 4 – Quality Management System. Data from the monitoring stations will be transmitted to an Internet website where the real-time results can be viewed by the public. The real-time website page will be incorporated into a larger website that will present additional resources to assist in the interpretation of the data. Tables 1.2 and 1.3 summarize the gases included in the fence-line program and the technology used to detect them. In addition, the detection limits (LDLs) are included for the longest and shortest path-lengths. LDLs are generated by the equipment and are normally set to be at least two times the manufacturer’s claimed detection limit. This is done to minimize the occurrence of false detections being reported to the real-time public website, as these lower limits are often generated under ideal conditions. If the system is operating in less than ideal conditions, such as when there’s fog or rain, the system will generate false detections.

Table 1.2 – Detection Limits for Gases Monitored by Open-Path Systems

Technology		Min Path		Max Path
OP-FTIR		**600 meters**		**700 meters**
		(PPB)		**(PPB)**
1,3 Butadiene		11		10
Acrolein		30		27
Acetaldehyde		33		29
Ammonia		4		2
Carbonyl Sulfide		3		5
Cyclohexane		4		150
Formaldehyde		5		6
Hexane		6		150
Hydrocyanic Acid		50		17
Methane		75		150
Methanol		7		6
Nitrogen Dioxide		34		52
Propylene		15		150
Styrene		33		18
Total Non-Methane Hydrocarbons		32		150
OP-UV				
Benzene		2		1
Ethyl Benzene		20		17
Sulfur Dioxide		3		2
Toluene		3		3
Xylene		2		1

Table 1.3 – Detection Limits for Gases Monitored by Point Source Samplers

Point Source Monitor	Detection Limits	
	LDL	**UDL**
Hydrogen Sulfide (ppb)	2	10000
Black Carbon (µg/m^3)	0.05	100

Section 2 – Project Management

Fence-Line Monitoring Task Organization

The program is organized between the refinery and the contractor tasked with operating and maintaining the systems. Figure 2.1 shows the organizational structure for the Monitoring Program.

Key Phillips 66 Personnel

Program Manager - The Program Manager is responsible for overseeing the work performed by the contractor for the fence-line system. This includes overseeing the contractor's operation and maintenance of the fence-line monitoring system and ensuring the program is operated in a safe manner.

Key Contractor Personnel

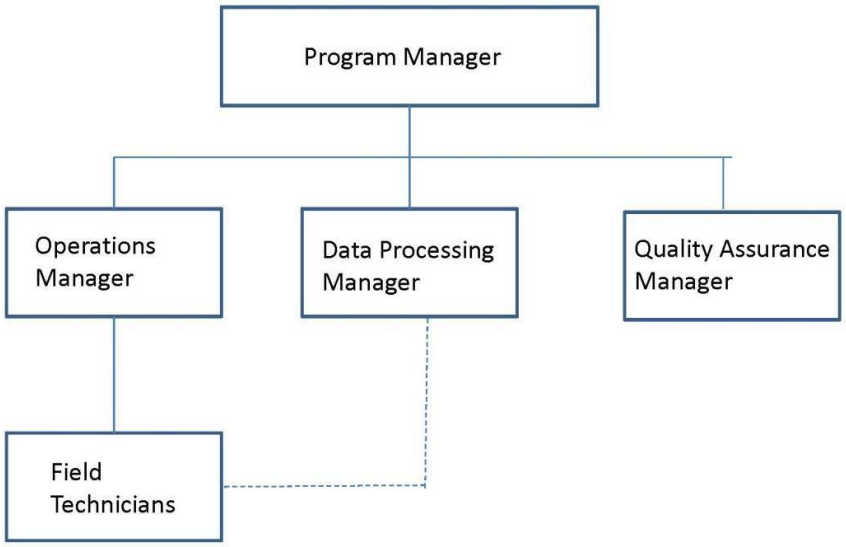
Contractor Program Manager – The Contractor Program Manager is responsible for overseeing the day-to-day operation of the fence-line program and is the primary interface between the contracted staff and Phillips 66 staff. Other duties include ensuring all contractor personnel perform all work in a safe manner and follow all standard operating procedures associated with the fence-line monitoring program.

Contractor Quality Assurance Manager – The Contractor Quality Assurance Manager is responsible for ensuring all standard operating procedures (SOPs) are updated and maintained. Additional responsibilities include maintaining all records associated with the real-time monitoring databases, as well as summarizing and storing all data quality records associated with the fence-line monitoring program.

Contractor Data Processing Manager – The Contractor Data Processing Manager is responsible for ensuring the data and measurement quality objectives.

Contractor Field Technician – The Contractor Field Technician is responsible for the day-to-day operation of the fence-line monitoring system. This includes following an equipment operation verification and maintenance schedule to assure data quality.

Figure 2.1 – Phillips 66 Fence-Line Air Monitoring Program Organization Chart



Personnel Qualification and Training

The operators of the monitoring equipment shall be trained in the operation, maintenance and operation verification of the equipment, as well as have resources to troubleshoot any technical issues. All personnel will undergo annual equipment-specific refresher training. Training will be provided by an instructor who has undergone vendor-specific training for each analyzer. The Quality Assurance Manager will document the training and verify field technicians have successfully completed it. The following are the basic skills and training of each personnel:

Field Technicians

- Key Performance Areas
    - Perform routine maintenance and quality checks, as required, and record data in accordance with these tasks.
    - Perform routine site visits to perform QA/QC or maintenance.
    - Perform minor onsite repairs.
    - Inform superiors when consumable purchases and instrument maintenance are required.
    - Monitor alarms and work with the operations manager to troubleshoot and solve them in a timeous manner.
    - Align open-path systems.
    - Assist Operations Manager with instrument commissioning and other requirements.

- Qualifications and Experience
    - Knowledge or Community College/College degree in one of:
        - Chemistry
        - Environmental
        - Engineering
    - Understanding of Quality systems such as ISO 17025
    - Three years' experience

Data Processing Manager

- Key Performance Areas
    - Data processing and validation on a daily basis and compilation of resultant reports.
    - Delivery of results to the client for daily, monthly and calibration reports, including report preparation.
    - Ensure that reporting is completed in a prompt manner and within quality guidelines.
    - Monitor alarms and work with the Operations Manager to troubleshoot and solve them in timeous manner.
    - Verify gas detections for approval by the Program Manager.

- Qualifications and Experience
    - Knowledge or Community College/College degree in one of:
        - Chemistry
        - Environmental
        - Engineering
    - Understanding of Quality systems such as ISO 17025
    - Three years' experience

Operations Manager

- Key Performance Areas
    - Work with customers and Program Manager to maintain a schedule of site work for the technical teams.
    - Maintain a workflow system to manage the progress and completion of projects in a systematic and transparent manner.
    - Keep technical teams updated with any changes in schedules.
    - Arrange safety inductions and communicate these to team members.
    - Ensure that sufficient stock of the consumables required for the work is available.
    - Collate and review the raw data and ensure all log sheets and sampling datasheets are correctly filled in and signed.
    - Ensure a safe working environment is maintained at all times.
    - Keep records of all data consistent with the company's Quality Management System.
    - Ensure the quality and presentation of all reports and client communications.
    - Act as a Technical Signatory and sign reports.

- Qualifications and Experience
    - Science or Environmental College Degree (Post Graduate qualification preferable)
    - Business or administrative qualification advantageous
    - At least five years' industrial engineering experience

Program Manager

The Program Manager will coordinate the activities for all technical aspects of the project, participate in management meetings, and ensure that the program meets its objectives for providing a service of high technical quality to its clients. The Program Manager will coordinate with the Quality Department on quality matters.

- Key Performance Areas
    - Oversee the monitoring program.
    - Update program documentation.
    - Train employees.

- Qualifications and Experience
    - College Degree with Honors qualification or higher, specializing in Environmental Services, Science or Engineering
    - Minimum five years' experience in Environmental Management or Consulting

Quality Manager

The Quality Manager will coordinate quality assurance programs and formulate quality control policies. They also work to improve an organization's efficiency and profitability by coordinating continuous improvement processes.

- Key Performance Areas
    - Oversee the quality process.
    - Update quality system documentation.
    - Train employees.
    - Manage the corrective action process.
    - Analyse data to facilitate continuous improvement.

- Qualifications and Experience
    - College Degree with Honors qualification or higher, specializing in Environmental Services, Science, quality or Engineering
    - Minimum three years' experience in Quality Management

Section 3 – Description of Hardware

Sample Analysis

Samples will be collected using UV DOAS air monitors for the measurement of Benzene, Ethylbenzene, Sulfur Dioxide, Toluene, and Xylene. Open-path FTIRs will be used for the measurement of 1,3 Butadiene, Acrolein, Acetaldehyde, Ammonia, Carbonyl Sulfide, Cyclohexane, Formaldehyde, Hexane, Hydrocyanic Acid, Methane, Methanol, Nitrogen Dioxide, Propylene, Styrene, and Total Non-Methane Hydrocarbons. Each analyzer has a vendor specific method for collecting and quantifying data. A description of each specific analytic method is listed below:

Open-path FTIR

The analytical method employed by the FTIR is a multiple regression technique that separates the total amount of light absorbance by the various gases and then outputs a result for each gas. The results of the analysis will include residuals that can be used to identify unknown gases. In addition, the system has the ability of undergoing data and quality assurance checks in the field by using a sealed gas cell.

Open-path UV DOAS

The system uses a multivariate method to quantify data. This analytic approach is critical in order to ensure false detections of gas do not occur. Each target gas has a spectral library of gases covering the concentration range of the analyzer. It also includes libraries of potential interfering gases such as oxygen and ozone. In addition, the system has the ability of undergoing data and quality assurance checks in the field by using a sealed gas cell.

Optical Tent

The optical tent air monitoring system uses a scanning open-path UV air monitoring system to collect data across several beam paths. The system will be set up to collect data across two separate paths along the fence line of the refinery.

Black Carbon Monitor

The Aethalometer collects and analyzes aerosol particles continuously. The aerosol-laden air stream is drawn through a spot on a filter tape at a measured flow rate. Simultaneously, the tape is illuminated by light and sensitive detectors measure the intensities of light transmitted through an un-exposed portion of the tape acting as a reference; versus the collecting spot. As optically absorbent material accumulates on the spot, the intensity of light transmitted through gradually decreases. The decrease in light intensity from one measurement to the next is interpreted as an increase in the amount of collected material. This increased amount is divided by the known air-flow volume to calculate the concentration.

H_2S Monitor

The H_2S analyzer uses the UV fluorescence principle to measure hydrogen sulfide at levels commonly required for ambient air monitoring.

Meteorological Station

Meteorological instruments will be operated according to the EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV PSD Measurement Quality Objectives.

Data Collection

Workstations

The analyzers use Microsoft Windows-based computer workstations to collect, analyze, and transmit data. The workstations will be industrial grade.

Routers

Computer routers will be used to network the analyzers together so the information from each system can be transmitted to the Internet.

Remote Restart Equipment

Internet-based remote restart equipment will be attached to critical parts of the monitoring system to ensure the equipment can be powered down and turned on remotely in the event a system requires a restart to clear an error status.

Cloud-based Data Storage

Data from the monitoring network will be stored on a cloud-based storage system with data backup capability.

Section 4 – Quality Management System

Throughout the measurement process, each analyzer will be checked for data quality. Each quality check is based on a core Data Quality Objective (DQO) that presents a description of the overall level of data quality to be met by the program. The DQO for the Rule 1180 fence-line monitoring program is to ensure the data obtained from the fence-line system meets the quality standards needed for presentation of data to the SCAQMD and the public. Measurement Quality Objectives (MQOs) are used to evaluate certain parameters needed to assure the validity of data generated by the monitors.

Throughout the measurement process, focus is placed on three specific elements of the monitoring program. These include the instruments themselves, the data collected, and the overall management of the program. Phillips 66's Quality Assurance Project Plan (QAPP) uses a four-level process to validate system performance. Each level builds on the prior level, including the level of technical expertise possessed by the individuals reviewing the information.

Level 0 checks are based on historical, real-world experience associated with operating and maintaining fence-line systems. Level 0 checks are automated real-time screening checks that are performed continuously. Levels 1, 2, and 3 checks are formulated around EPA Quality Assurance/Quality Control protocols published in documents such as:

Environmental Technology Verification (ETV) Protocol for Optical Remote Sensors
https://archive.epa.gov/nrmrl/archive-etv/web/pdf/01_vp_openpath.pdf

EPA – Compendium Method TO-16
https://www3.epa.gov/ttn/amtic/files/ambient/airtox/to-16r.pdf

Level 1 checks are performed on a daily or weekly basis depending on the task. Level 2 checks are performed monthly, and Level 3 checks are performed on a quarterly and/or annual basis and include an annual audit.

For each level of review, specific "Measurement Quality Objectives" (MQOs) have been developed. MQOs are defined as the specific performance criteria to evaluate whether the objective is met. When each of the MQOs are satisfied, it assures that the overall goals of the monitoring program (DQOs) are being met. If any one of these MQOs are not met, corrective action will be initiated to address the issue. Each MQO will be evaluated, and if necessary, updated as part of the Internal System Audit Plan as well as during the Annual Management Review. A summary of the MQOs for each instrument, data quality parameters, and program management process are listed in Table 4.1 below. A detailed description of the operational parameters associated with the specific elements of the fence-line system are included in the Operations Guidance Document (OGD) "FLM-QLT-GUI-001 OGD".

Table 4.1 – Summary of MQOs for Each Instrument

Check Type	Check	Frequency	Reference Doc
Level 0			
Instrumentation	Light signal from optical remote sensors	Real-time	FLM-QLT-GUI-001 Operations Guidance Document, FLM-QLT-SOP-002 Low Signal Alarm Response
Instrumentation	Instrument error codes	Real-time	FLM-QLT-SOP-001 General Alarm Response
Instrumentation	Environmental checks for UV	Real-time	Meteorological Data display on website, Wind Speed and Wind Direction for Alarm Detection
Program	Analyzer has low signal	Real-time	E-mail and text of Low Signal alarm. Alarm Ranges defined in FLM-QLT-GUI-001 Operations Guidance Document, FLM-QLT-SOP-002 Low Signal Alarm Response
Program	Analyzer off-line	Real-time	E-mail and text for offline alarm. FLM-QLT-SOP-001 General Alarm Response
Program	Workstation fails	Real-time	FLM-QLT-SOP-004 Field workstation malfunction
Program	Internet communication failure	Real-time	E-mail and text for offline alarm. FLM-QLT-SOP-001 General Alarm Response
Program	Gas detected above alarm value	Real-time	E-mail and text alarm for detection, FLM-QLT-SOP-006 for Manual Validation of Data

Table 4.1 (cont.) – Summary of MQOs for Each Instrument

Level 1			
Instrumentation	System noise – FTIR, UV, Optical Tent	Monthly	FLM-QLT-SOP-007 MDL Determination
Instrumentation	Single point check - FTIR, and UV	Monthly	FLM-QLT-SOP-008 Fence-line QA checks
Data	Validate detects – FTIR, UV, and Optical Tent	Daily	FLM-QLT-SOP-006 for Manual Validation of Data
Data	Negative detects – FTIR, UV, and Optical Tent	Daily	FLM-QLT-SOP-006 for Manual Validation of Data
Data	Verification of detects above threshold	Daily	FLM-QLT-SOP-006 for Manual Validation of Data. Daily Report on detections
Data	Verify flow rate for BC	Weekly	SOP_CHEV_CO_9
Program	Equipment operation	3 x per day	SMS and e-mail alarms repeat every 4 hours
Program	Website operation	3 x per day	SMS and e-mail alarms repeat every 4 hours
Program	Data logging	3 x per day	SMS and e-mail alarms repeat every 4 hours
Program	Message board update	3 x per day	Not Applicable
Level 2			
Instrumentation	Detection limit FTIR, UV, and Optical Tent	Quarterly	FLM-QLT-QAPP-001 for Validation and Verification of Fence-line UV DOAS Systems, FLM-QLT-SOP-007 MDL Determination
Instrumentation	Precision FTIR, UV	Quarterly	FLM-QLT-QAPP-001 for Validation and Verification of Fence-line UV DOAS Systems, FLM-QLT-SOP-011 Determination of Precision
Instrumentation	Accuracy FTIR, UV	Quarterly	FLM-QLT-QAPP-001 for Validation and Verification of Fence-line UV DOAS Systems, FLM-QLT-SOP-009 Determination of Accuracy

Table 4.1 (cont.) – Summary of MQOs for Each Instrument

Check Type	Check	Frequency	Reference Doc
Level 2			
Instrumentation	Linearity FTIR, UV	Quarterly	FLM-QLT-QAPP-001 for Validation and Verification of Fence-line UV DOAS Systems, FLM-QLT-SOP-010 Determination of Linearity
Instrumentation	Multipoint calibration H2S	Quarterly	SOP_CHEV_CO_6
Data	Data trends associated instrumentation performance	Weekly	FLM-QLT-SOP-006 Manual Data Validation
Data	Differences between current data and historical data	Weekly	
Data	Insert data in final QA/QC data base	Weekly	FLM-QLT-SOP-013 MSQL Validation Upload
Program	Summary of calibration and maintenance activities	Monthly	FLM-QLT-SOP-008 Fence-line QA checks, Spectrometer Details Form, QA Check sheet
Program	Summary of problems and corrective actions	Monthly	Monthly Alarm Log, IMS-QLT-MAN-010 for Corrective Action, Corrective action report, IMS-QLT-MAN-008 for complaints and compliments
Program	Monthly summary report with OSE updated	Monthly	FLM-QLT-SOP-014 Monthly Reporting
Level 3			
Instrumentation	Annual service FTIR, UV	Annual	FLM-QLT-SOP-005 for Planned Maintenance, Critical Spares Tracking List
Instrumentation	Certification system brought to factory specs	Annual	FLM-QLT-SOP-014 Monthly Reporting
Instrumentation	Annual service for BC monitor	Annual	SOP_CHEV_CO_9
Instrumentation	Annual service for H2S	Annual	SOP_CHEV_CO_6
Data	Full reconciliation of data	Monthly	FLM-QLT-SOP-014 Monthly Reporting
Data	Supervisor check for data trends	Monthly	FLM-QLT-SOP-014 Monthly Reporting
Program	Complete system audit	Annual	Internal Audit Plan
Program	Program evaluation and upgrade	Annual	Annual Management Review

Instrument Specific - Quality Assurance/Quality Control

The following checks are used to determine that the hardware included in the fence-line air monitoring system is operating in a manner that meets all factory specifications. A complete listing of the specific parameters associated with vendor-specific equipment is included in FLM-QLT-GUI-001 OGD. It should be noted that any data that is considered to be invalid can be reviewed using spectral analysis by a trained data analyst.

Level 0 – Continuous, Real-time Operational Checks

Monitor system output to include:

- Light signal from optical remote sensing analyzers
- Analyzer error codes
- Operational environment of UV analyzers

Level 1 – Monthly Operational Checks

- System noise evaluation (FTIR, UV, and Optical Tent)
- Single point calibration checks (FTIR, UV)
- Flow rate (Black Carbon)

Level 2 – Quarterly Operational Checks

- Detection limit checks (FTIR, UV, and Optical Tent)
- Precision, linearity, accuracy checks (FTIR, UV, H_2S monitor)

Level 3 – Annual Operational Checks

- Annual servicing of instruments (FTIR, UV, H_2S monitor)
- Validate systems are meeting original factory acceptance specifications.

Data Management / Validation

The following checks are used to determine if the data included in the fence-line air monitoring system meets all data quality requirements. A complete listing of the specific parameters associated with vendor specific equipment is included in FLM-QLT-GUI-001 OGD. It should be noted that all data is collected and stored in its original format and data that fails to meet the data quality requirements is flagged with a code that lists the specific data check that failed.

Level 0 – Continuous, Real-time Operational Checks

Monitor Data Output:

- Utilize manufacture's analytic software for quantitative results and independent, secondary analytic software for qualitative results.
- Check ambient gases such as ozone and oxygen (UV), and methane, N_2O for FTIR.

Level 1 – Daily Review

- Identify detects where real-time MQOs indicate corrective action is needed, such as validating data when qualitative and quantitative detects do not reconcile (FTIR, UV).
- Flag data as being invalid due to weather related conditions or operational events, such as QA/QC, maintenance activities etc. (FTIR, UV).
- Identify gas detects above action levels.

Level 2 – Weekly Checks

Staff will review and provide validation with consideration of historical data and similar measurements. Once data is reviewed and validated it will be inserted into the final database.

On a weekly basis, data will be summarized and reviewed to identify:

- Data trends associated with instrumentation performance
- Differences between current data and historical data

Level 3 – Quarterly Checks

- Provide supervisor level reviews with consideration of interrelationships with other data.
- Provide a full reconciliation of data that had to be invalidated or corrected.
- Provide a summary of the monitoring data and performance of the fence-line monitoring system.

Monitoring Program Response

The entire fence-line monitoring system is continually monitored for system performance. This includes the instruments, workstations, and Internet communication hardware. If at any time an element of the system fails to meet normal performance criteria, a message is generated immediately to key personnel at Phillips 66 and the contractor, who will begin activities to correct the problem. The following checks are used to determine that the data included in the fence-line air monitoring system meets all data quality requirements. A complete listing of the parameters associated with vendor-specific equipment, as well as messages and times in the status of the equipment, is updated and included in the FLM-QLT-GUI-001 OGD.

Program Management

Level 0 – Continuous, Real Time System Checks

Automated notifications are generated when:

- Analyzer has a low signal
- Analyzer is off-line
- Workstation fails
- Internet communication failure
- Gas detected above alarm value

Level 1 – Daily System Checks

The contractor will monitor the fence-line system three times per day.

Systems will be checked for:

- Equipment operation
- Website operation
- Data logging
- Message board updates

Level 2 – Monthly Report and Review of Operational Performance

- Provide monthly summaries of calibrations and maintenance activities completed during the month and a summary of audit results completed during the month, if applicable.
- Provide a description of problems that occurred during the month, including such things as power failures or system component problems and their resolution or proposed corrective actions.
- Generate monthly reports summarizing gas detections, operational performance statistics (on-stream efficiency) and significant events associated with the fence-line monitoring system.

Level 3 – Annual Program Audit

The system will undergo an annual, independent audit for the entire monitoring program. Findings and observations will be addressed with corrective action plans.

A statue report of annual service by the equipment vendor will be reviewed and the maintenance program will be updated if necessary.

Section 5 – Instrument Maintenance

Instrument service and repair calls are conducted as needed, based on continuous evaluation of instrument error codes. In addition to service and repair calls conducted on an as-needed basis, preventive maintenance is conducted based on the schedules provided below. Instrument-specific parameters are included in the FLM-QLT-GUI-001 OGD.

Open-path Instrument Maintenance Schedule

Activity	Monthly	Quarterly	Annually
Visually inspect the system.	✓		
Confirm the alignment to verify there has not been significant physical movement. Note: this is automatically monitored as well.	✓		
Download data from detector hard drive and delete old files to free space, if needed.	✓		
Ensure there are no obstructions between the detector and the light source.	✓		
Verify system settings.	✓		
Clean optics on detector, retro reflector or light source.	✓		
Realign system after service.	✓		
Check system performance indicators.	✓		
Check light signal.		✓	
Annual service check			✓

Schedule of Maintenance Activities for the Open-path FTIR

Activity	Monthly	Annually
Visually inspect the system.	✓	
Download data from detector hard drive and, if needed, delete old files to free space.	✓	
Check system performance indicators.	✓	
Annual service check		✓

Schedule of Maintenance Activities for Hydrogen Sulfide Monitors

ITEM	ACTION	FREQUENCY	CAL CHECK	MANUAL SECTION
SO_2 scrubber	Replace	As required	Yes	8.3.3
$H_2S \rightarrow SO_2$ Converter Catalyst	Replace	As required	Yes	8.3.5
[1]Particulate filter	Change particle filter	Weekly	No	8.3.1
Verify test functions	Review and evaluate	Weekly	No	Appendix C
Zero/span check	Evaluate offset and slope	Weekly	--	6.3, 6.6, 6.9
[1]Zero/span calibration	Zero and span calibration	Every 3 months	--	6.2, 6.4, 6.5, 6.7, 6.8
[1]External zero air scrubber (optional)	Exchange chemical	Every 3 months	No	8.3.4
[1]Perform flow check	Check Flow	Every 6 Months	No	9.5.2
[1]Critical flow orifice & sintered filters	Replace	Annually	Yes	8.3.7
Internal IZS Permeation Tube	Replace	As required	YES	8.3.2
Perform pneumatic leak check	Verify Leak Tight	Annually or after repairs involving pneumatics	Yes	9.5.1
[2]Pump diaphragm	Replace	At least Every 2 years or if **PRES** is ≥ 33.00 in-Hg-A	Yes	See instruction in diaphragm kit
PMT sensor hardware calibration	Low-level hardware calibration	On PMT/ preamp changes if 0.7 < **SLOPE** or **SLOPE** >1.3	Yes	9.6.4

Schedule of Maintenance Activities for Black Carbon Monitors

Activity	Monthly	Quarterly	6 Monthly	Annually
Verify total flow rate at the inlet.	✓			
Inspect and clean cyclone inlet	✓			
Inspect and clean the insect screen assembly	✓			
Verify Date / Time, update if necessary.	✓			
Inspect and clean optical chamber			✓	
Calibrate flow	✓			
Leak check			✓	
Clean air test			✓	
Stability test			✓	
ND Filter test				✓
Lubricate optical chamber				✓
Change filter tape roll		✓		
Change bypass filter cartridge				✓
Change active zero filters				✓

Section 6 – Document Control

Document Control will include the following elements:

- Management and Organization
    - Quality Assurance Project Plan for Fence-line Monitoring Program
    - Organizational chart
    - Personnel qualifications and training
    - Support contract

- Site Information
    - Site maps
    - Equipment registers

- Field work
    - SOPs
    - Field notebooks
    - Sample handling check sheets
    - Maintenance check sheets
    - QA check sheets

- Raw data
    - Description of raw data files generated by instruments

- Data Reporting
    - Real-time website
    - Monthly reports

- Data Management
    - Database structure
    - Data management flowchart
    - Database backup plan

- Quality Assurance
    - Site audits
    - Corrective action reports
    - System audits
    - Data quality assessments

Section 7 – Website Management

The real-time website is operated and maintained by the contractor, who will be solely responsible for its content. This section addresses the methods used to provide information to the public, including message board updates, notification of significant events, data reporting, learning center section and a contact page.

Message Board Updates

A message board on the real-time website is used to inform the public whenever an event such as gas detections above a preset level occurs, the Internet connection is lost, or an instrument fails to operate within normal parameters. If one of these or similar events occur, the message board will be updated by the contractor as soon as practical. A listing of the standardized messages and the timeframe in which they will be posted to the website are listed in FLM-QLT-GUI-001 OGD.

Data Reporting

Data from the fence-line monitors will be transmitted to an internet website where the near-real-time results can be viewed by the public. Data generated by the fence-line monitoring equipment undergoes review throughout the measurement and reporting process. Included in this process are automated QA/QC checks that occur before data is reported on the real-time website. Under normal circumstances, a five-minute average measurement will appear on the website within 10 minutes of the end of the measurement period. However, the data uploaded may be impacted by internet traffic. An automated system conducts the automated QA/QC checks before the data is reported to the website. The website will also make available a rolling 24-hour trend of the 5-minute data for each gas reported.

Learning Center

Individuals will be able to access additional information pertaining to the fence-line program. This will include information about each target gas, a site map showing locations of fence-line equipment, Office of Environmental Health Hazard Assessment (OEHHA) health standards for target gases (if applicable), and links to the SCAQMD and the California Air Resources Board (CARB).

Contact Section

Individuals will be able to send feedback to operators of the fence-line system.