

Quality Assurance Project Plan for the Phillips 66 Rodeo Refinery Fence Line Monitoring Program

Revision 1.0

Phillips 66 Rodeo Refinery

Document Control			
Revision #	Revision Date	Description	Signature
1.0		Original	

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1- Background

1.1 - Introduction

The purpose of this Quality Assurance Project Plan (QAPP) is to prescribe requirements, procedures, and guidelines for the Phillips 66 Rodeo Refinery (the Refinery) Fence Line Air Monitoring Program. It is intended to serve as a reference document for implementing the Quality Assurance/Quality Control program and describes operational procedures for the measurement processes used by Phillips 66 and contractors in the operation and maintenance of the monitoring equipment. The QAPP is a compilation of QA requirements, procedures, and guidelines that are applicable to air pollution and meteorological measurement systems. These systems are designed to achieve a high percentage of valid data readings while maintaining integrity and accuracy within prescribed limits. This QAPP clearly and thoroughly establishes QA protocols and QC criteria required to successfully implement and maintain the Fence Line Monitoring (FLM) Program in accordance with the Air Monitoring Plan submitted to BAAQMD under Rule 12-15.

1.2 - Project Description

The Refinery Fence Line Monitoring Program is composed of a number of ambient air monitoring systems meeting the siting requirements specified in BAAQMD Rule 12-15. Data gathered from the monitoring instrumentation is averaged over a 5-minute period and polled by a data logging system that stores each data point in a local database. The data is also copied to a remote server, which is used for the real-time public access web page. Data validation checks will be performed to meet the data quality objectives outlined in this document. A description of the FLM system is presented in the Air Monitoring Plan submitted to the BAAQMD. Table 1 lists the locations of the monitoring equipment sites and Figure 1 shows these locations on an aerial image.

Table 1 – Monitoring Site Locations

Site Name	Equipment	GPS (Latitude)	GPS (Longitude)	Elevation (feet AGL)	Path-length (m)
North Fence Line Source Tower	FTIR Source, TDL Reflector, and OP-UV Source	38° 2'51.3"N	122°15'7.4"W	Approx. 15	920
North Fence line Receivers	FTIR, TDL and UV workstations.	38° 2'32.4"N	122°14'37.6"W	<10	920
Organic Gas Detector #1	Organic Gas Detector	38° 2'17.5"N	122°14'24.0"W	<10	NA
Organic Gas Detector #2	Organic Gas Detector	38° 2'18.5"N	122°14'37.0"W	<10	NA

Figure 1 - Map of Monitoring Equipment



2 - Program Organization

The facility may opt to utilize a contractor to maintain and operate the FLM system equipment. While this arrangement may be changed in the future as appropriate, the FLM program is currently organized between Phillips 66 and a contractor tasked with operating and maintaining the systems.

A project manager at Phillips 66 will be responsible for managing the work performed by the contractor operating and maintaining the fence line system. In addition, the project manager will act as the primary interface between all stakeholders including the refinery management, the BAAQMD, and the public. Field technicians and the operations manager will be responsible for the day-to-day operation of the fence line monitoring system.

Key Personnel

In general, the following organizational roles associated with the fence line monitoring program are outlined below. These roles may change in the future as needed.

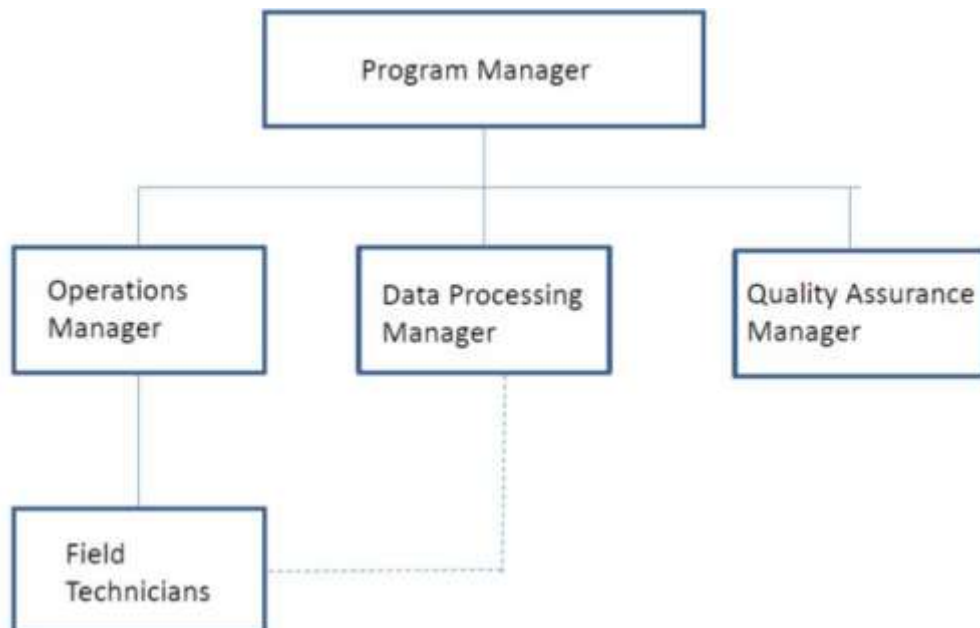
Program Manager - The Program Manager is responsible for overall management of the fence line system.

Operations Manager - The Operations Manager is responsible for day-to-day activities associated with the fence line system.

Quality Assurance Manager – The Quality Assurance Manager is responsible for ensuring all Standard Operating Procedures are updated and maintained. Additional responsibilities include maintaining all real-time monitoring databases as well as summarizing and storing all data quality records associated with the fence line monitoring program.

Data Processing Manager – The Data Processing Manager is responsible for report generation and ensuring all measurement quality objectives are met for the fence line monitoring program.

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



3 - Data Quality Objectives

3.1 - Instrument Types

Equipment included in this QAPP includes the north fence line source tower and receivers specified in Table 1 which includes FTIR, UV, and TDL devices. There are also 2 organic gas detectors covered as described in Table 1.

Please see the approved Phillips 66 Regulation 12, Rule 15 Air Monitoring Plan (AMP) for further details about this equipment. The AMP was approved in a letter dated July 9, 2018 from BAAQMD to Phillips 66.

3.2 - Operating Schedules - Sampling Frequency and Data Completeness Requirements

All air monitoring equipment specified for the Refinery fence line system are set to collect data on five-minute averages and will meet a minimum of 75% completeness on an hourly basis 90% of the time based on annual quarters. Atmospheric conditions beyond the control of the refinery that affect accurate measurements, such as dense fog, shall not be counted against data completeness requirements as long as appropriate measurements document times when these conditions exist. After accounting for these instances, the resultant data completeness metric is referred to as on-stream efficiency in this document.

3.3 - Weather Related Exclusions/Downtime

Atmospheric conditions beyond the control of the Refinery that affect accurate measurements are typically rain and fog. When these occur, the open-path measurement of light signal can drop below a level required to reliably quantify data. The reason for this is the light beams produced by the open-path air monitoring systems are scattered as they interact with the water vapor in the air. Once scattered, the light can no longer be received and used by the

instruments. Each instrument manufacturer establishes the minimum light signal threshold needed to accurately quantify data. Manufacturer's specifications are listed in the Operations Guidance Document (OGD). If an open-path instrument's light signal drops below the manufacturer's minimum threshold, the data is flagged for review. If another instrument is also observed to experience a 10% or greater drop in signal during the same measurement period, the data will be identified and flagged for review as potentially meeting the criteria of atmospheric conditions beyond the control of the Refinery.

In addition to rain and fog, other types of atmospheric conditions beyond the control of the refinery can occur. These include environmental factors such as strong winds, dust, and earthquakes, all of which can affect the ability of an open-path instrument to provide accurate measurements. In the event an instrument indicates a low signal, the data may be flagged as being caused by other environmental factors.

3.4 - Instrument Operation Verification

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 12-15 fence line monitoring program is to ensure the data obtained from the fence line system meets the quality standards needed for presenting data to the public. Measurement Quality Objectives (MQOs) are evaluations of certain parameters needed to assure the validity of data generated by the monitors. MQOs are designed to evaluate the measurement process to ensure the total measurement confidence needed to meet the DQO. Each MQO includes a data quality indicator which identifies specific criteria used to evaluate whether the instrument performance is satisfactory for that objective. This is referred to as the acceptance criteria below. If an analyzer fails an MQO, corrective action will be initiated to address the issue and the Phillips 66 Rodeo Fenceline website will be updated as applicable. Corrective actions associated with MQOs will be reported in the monthly report that is made available to the BAAQMD and the public. The FLM system MQOs and associated acceptance criteria are discussed in the following sections. Please note MQOs may be done more frequently than noted below.

3.4.1 - FLM System MQO #1 - Open Path FTIR - Detection Limit for Alkanes

Frequency: Monthly

Description: MQO #1 is to determine the detection limit using the method outlined in the Environmental Protection Agency's Environmental Technology Verification (ETV) Test Protocol for open-path air monitoring systems and to compare this result to the required lower detection limit for alkane gas specified in in the Air Monitoring Plan approved July 9, 2018.

Measurement Quality Objective: The minimum detection limit (MDL) is calculated by collecting a series of 26 single-beam spectra taken using the appropriate averaging time (5 min). The

single-beam spectra are used to create absorption spectra, using each single beam spectrum as the background for the next spectrum. The absorption spectra are created by using the first and second single-beam spectra, the second and third, the third and fourth, etc. The resulting 25 absorption spectra are analyzed for the target gas. For this MQO, the MDL is defined as two times the standard deviation of the calculated concentrations.

Acceptance Criteria: MQO #1 will be considered to have been met if the calculated minimum detection limit is less than or equal to the required lower detection limit specified in the Air Monitoring Plan approved July 9, 2018.

Corrective Action: If the system does not meet the acceptance criteria, the electronic records saved during the test will be sent to the equipment manufacturer or their representative to troubleshoot the issue. Corrective actions will be included in the monthly report summarizing the activities associated with the fence-line monitoring system.

3.4.2 – FLM System MQO #2 – Open Path FTIR - Concentration Limits for Methane

Frequency: Continuous

Description: MQO #2 is to check that as the FTIR air monitoring system records data, it is capable of detecting methane in the ambient air above concentrations of 1.7 ppm. This is the approximate natural concentration of methane in the ambient air. The FTIR includes internal status flags that record whether the quantified methane concentration is above this level. If the system fails this QA/QC check, a data flag is generated.

Measurement Quality Objective: Instrument quantified detection of methane is reviewed for each 5-minute period.

Acceptance Criteria: MQO #2 will be considered to have been met if the real-time measured value of methane gas is greater than or equal to 1.7 ppm.

Corrective Action: If the system does not meet the acceptance criteria, appropriate personnel will be notified via email that the system may not be operating correctly and troubleshooting will occur, as needed. Corrective actions will be included in the monthly report summarizing the activities associated with the fence-line monitoring system.

3.4.3 - FLM System MQO #3 - Open Path FTIR - Signal Strength Validation

Frequency: Monthly

Description: MQO #3 is to check the light signal from the FTIR system and compare it to a known signal strength needed to meet the detection limits listed specified in the Air Monitoring Plan approved July 9, 2018 for the FTIR system.

Measurement Quality Objective: At the end of each month's maintenance activities, the signal strength of the IR Beam will be measured at three different spectral areas as specified in

Table 2. The measured value of the light signal must be greater than or equal to the percent of full scale at each wave number.

Table 2 – Infrared Light Wavelength Checks

Wavenumber (cm ⁻¹)	Percent of Full Scale
950	18.75
2750	2.5
4100	0.625

Acceptance Criteria: MQO #3 will be considered to have been met if the measured light signal is greater than or equal to the percentage of full scale of the light signal as noted in Table 2.

Corrective Action: If the system does not meet the acceptance criteria, the following tasks will be performed to improve the signal strength.

- A realignment of the source and receiver unit will be performed.
- If necessary, all optical components of the system will be cleaned.
- If necessary, the IR source will be replaced.

3.4.4 - FLM System MQO #4 - Open Path FTIR - Challenge of System with Gas

Frequency: Monthly

Description: MQO #4 is to perform a Quality Control check to ensure the FTIR is correctly quantifying alkane gases. Alkane gas will be introduced into the beam path of the FTIR air monitoring system. The values generated by the analyzer will be compared to an independent quantification of the gas concentration in the data spectrum that is within the concentration range of alkane gases expected to be seen at the refinery during normal operating conditions. The gas concentration range for the test will be in the range of 200 ppb.

Measurement Quality Objective: The real-time concentration results of the FTIR software will be compared to a validation check using an independent method of quantifying the gas.

Acceptance Criteria: MQO #4 will be considered to have been met if the real-time quantified result is within 20% of the expected value (i.e., the independently quantified value).

Corrective Action: If the system does not meet the acceptance criteria, the electronic records saved during the test will be sent to the equipment manufacturer or their representative to troubleshoot the issue. An explanation of the corrective actions will be presented in the monthly report summarizing fence-line activities.

3.4.5 - FLM System MQO #5 - Open Path UV – Challenge of System with Gas

Frequency: Monthly

Description: MQO #5 is a Quality Control check to ensure the UV air monitoring system is correctly quantifying target gases. A gas cell with a known concentration of Benzene and SO₂ gas will be introduced into the beam path of the UV air monitoring system. The values generated by the analyzer will be compared to the known value of the gas cell. Benzene and SO₂ are used for this check as they have spectral absorption features that span the spectral range of the spectrometer.

Measurement Quality Objective: Gas calibration cells that contain a mixture of benzene and SO₂ gas will be inserted into the beam path. The system will collect data with the calibration cells in the beam path and quantify concentrations of each gas.

Acceptance Criteria: MQO #5 will be considered to have been met if the quantified result is within 20% of the expected value (i.e., the gas concentration in the cell).

Corrective Action: If the system does not meet the acceptance criteria, the electronic records saved during the test will be sent to the equipment manufacturer or their representative to troubleshoot the issue. An explanation of the corrective actions will be presented in the monthly report summarizing fence-line activities.

3.4.6 - FLM System MQO #6 – Open Path UV- Signal Strength Validation

Frequency: Monthly

Description: MQO #6 is to check the light signal from the UV system and compare it to a known signal strength needed to meet the detection limits listed in the Air Monitoring Plan approved July 9, 2018 for the UV system.

Measurement Quality Objective: At the end of each month's maintenance activities, the signal strength of the UV beam will be measured and recorded.

Acceptance Criteria: MQO #6 will be considered to have been met if the system achieves a signal strength of 75% of full scale at a sample integration time of 750 milliseconds or less.

Corrective Action: If the system does not meet the acceptance criteria, the following tasks will be performed:

- A realignment of the source and receiver unit will be performed.
- If necessary, all optical components of the system will be cleaned.
- If necessary, the UV light source will be replaced.

An explanation of the corrective actions will be presented in the monthly report summarizing fence-line activities.

3.4.7 - FLM System MQO #7 – Open Path UV - Signal-to-Noise Check

Frequency: Monthly

Description: MQO #7 is to determine the signal-to-noise ratio of the UV air monitoring system.

Measurement Quality Objective: The MQO is defined by using the following process to measure the system noise:

- Two back-to-back spectra will be subtracted from each other to create an absorbance spectrum.
- The peak-to-peak noise absorbance spectrum will be examined in the region of 252.00 to 255.00 nanometers.

Acceptance Criteria: MQO #7 will be considered to have been met if the peak-to-peak noise is less than 0.003 absorbance units in the measurement region. The peak-to-peak noise of 0.003 is three times the magnitude of the benzene absorbance feature located in the portion of the UV spectra for a gas concentration equivalent to 4 ppm-m which is the detection limit for the system.

Corrective Action: If the system does not meet the acceptance criteria, system troubleshooting will occur. Additional actions such as aligning the source optics, cleaning system optical equipment, and replacing the light sources may be conducted as necessary. If the system fails this MQO upon system recheck, the manufacturer will be contacted for further assistance. An explanation of the corrective actions will be presented in the monthly report summarizing fence-line activities.

3.4.8 - FLM System MQO #8 - Organic Gas Detector – Calibration and Gas Challenge

Frequency: Quarterly

Description: MQO #8 is to check the response of the OGDs by introducing a calibration gas and noting the instrument response.

Measurement Quality Objective: The operation of the OGDs will be validated by challenging them with a known quantity of methane gas and checking the system response. The methane gas has a known concentration equivalent to 50% of the Lower Explosion Level for methane.

Acceptance Criteria: MQO #8 will be considered to have been met if the quantified result is within 20% of the expected value.

Corrective Action: If the system does not meet the acceptance criteria, the manufacturer or their representative will be contacted to troubleshoot the issue. An explanation of the corrective actions will be presented in the monthly report summarizing fence-line activities.

3.4.9 - FLM System MQO #9 - TDL Hydrogen Sulfide - Challenge of System with Gas

Frequency: Monthly

Description: MQO #9 is to perform a manufacturer-recommended test to validate the operation of the TDL unit by exposing it to a quantity of H₂S gas and checking the system response.

Measurement Quality Objective: The operation of the TDL will be validated by challenging it with H₂S gas and checking the system response.

Acceptance Criteria: MQO #9 will be considered to have been met if the quantified result is above the analyzer detection limits.

Corrective Action: If the system does not meet the acceptance criteria, the electronic records saved during the test will be sent to the equipment manufacturer or their representative to troubleshoot the issue. An explanation of the corrective actions will be presented in the monthly report summarizing fence-line activities.

4 - Data Management

4.1 - Real-time Data Management

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. An automated system conducts the Quality Assurance checks before the data is reported to the website.

Data review will be overseen by the Data Processing Manager who will ensure all reported data meets the detection limits listed in in the Air Monitoring Plan approved July 9, 2018. No data will be altered in this process, but rather it will be considered valid or invalid and flagged accordingly. Automated real-time data checks are listed in Table 3.

Table 3 – Summary of Real-time Data Checks

Real-Time Check	System Check	Follow-up Activities ¹
Low Signal	Signal Threshold Test for UV or TDL	If the signal is below the threshold value: 1) The real-time website reports "Low Signal" to analyzer, and 2) an automated email is sent to the Program Manager, Operations Manager, and Field Technician.
Instrument Error Code	Instrument Error Code	The real-time website will report an "off-line" message. An email will be sent to the Program Manager, Operations Manager, and Field Technician notifying them of the situation. If necessary, the website message board will be updated to inform public that analyzer troubleshooting is underway. If necessary, the website message board will be updated when system is back on line.
Analyzer Off-line	Analyzer Communication Check	The real-time website will report an "off-line" message. An email will be sent to the Program Manager, Operations Manager, and Field Technician. If appropriate, the website message board will be updated to inform the public that an analyzer is off-line and troubleshooting is underway. If appropriate the website message board will be updated when system is back on line.
Internet Connection Lost	Backup Connection Enabled	An email is sent to the Field Technician, Program Manager, and Operations Manager. A backup connection is enabled.
High Detection	Data Detection Above Threshold	The real-time website indicates a detection above certain thresholds by a background color change for the gas. A notification is sent to the Operations Manager, Program Manager, Shift Supervisor, and Field Technician. The message board on the website will be updated with notification that Phillips 66 personnel are aware of the situation and are performing an investigation. Raw data will be examined to validate or invalidate the detection. The refinery will perform a site survey to identify possible sources of the detection. The message board on the website will be updated once further information is available.

¹As appropriate, the message board will be updated with standard statements describing the cause of the system failure. Standard statements are referenced in the Operations Guidance Document.

4.2 - Post-Processed Data Management

Data from the fence line system will be reviewed and validated on a monthly basis with the results stored in a separate portion of the monitoring database from the raw data. Data review and validation includes screening the entire data set for the following invalid data:

- Non-field data such as calibration data,
- Spurious data associated with power or mechanical issues, and
- Data with a light signal below predetermined thresholds.

This data review will be overseen by the Data Processing Manager. No data will be altered in this process, but rather it will be considered valid or invalid and flagged accordingly. Only data that has not met an MQO, or specific operational data that demonstrates that the equipment was not operating properly will be removed. Table 4 summarizes the process by which monitoring data is reviewed and post processed.

Table 4. Summary of Data Validation Process

Post Process Data Check	System/Data Check	Follow up Activities
Gas Detection	Target Gas Detections	The Data Processing Manager will validate or invalidate all gas detections from the monitoring equipment.
Non-field Data Check	Maintenance logs and QA/QC logs will be checked to see when systems were not in a normal operating mode.	The Data Processing Manager will flag any non-field data such as data obtained during periods of maintenance activities. Such data will be excluded from future reporting.
Spurious Data	Instrument error codes will be reviewed and flagged if instrument error codes are recorded. Data associated with these codes will also be reviewed. As necessary, other spurious data may warrant review on a case by case basis (e.g., event based data, etc.).	The Data Processing Manager will flag any data when instrument error codes are recorded. Such data will be excluded from future reporting. If necessary, the Data Processing Manager will evaluate data of interest on a case by case basis and make a determination regarding the confidence of the data to reach a conclusion regarding data validity.
Low Signal	Data will be reviewed for low signal. If low signal is recorded, data will be flagged and the reason for low signal will be recorded.	The Data Processing Manager will flag any data when low signal flags are recorded. Such data will be excluded from future reporting.

4.3 - Corrective Actions

Phillips 66 will investigate any portion of the fence line system that fails to meet the above measurement quality objectives, or on-stream efficiency requirements under Rule 12-15. The investigation team will include members of the fence line management team and appropriate equipment vendors to assess the problem and to initiate corrective action. In addition, improvement opportunities identified will be considered as possible further action to minimize the chance for similar problems in the future. Phillips 66 can upgrade the system, without prior consultation of other parties, with substantially equivalent equipment or software (i.e., equipment that does not diminish the sensitivity of the equipment or the fence line system) as necessary to maintain system operability. Changes to equipment described in this QAPP may trigger a change in the Quality Assurance/Quality Control requirements associated with the updated equipment. Any substantive changes requiring revisions to the QAPP will be submitted to BAAQMD for review and approval. Messaging and context will be provided on the website to inform the public regarding scheduled downtime and data availability. Any extended downtime will need to be explained and coordinated with BAAQMD.

4.4 - Data Reporting and Availability

4.4.1 Public and BAAQMD Access

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. Automated QA/QC checks that will occur prior to the data being displayed on the public website are discussed in Section 4.1 of this document. Under normal circumstances, a 5-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. The website will also make available a rolling 24-hour trend of the 5-minute data for each gas reported.

Once QA/QC of the final data is completed, within 60 days after the end of each calendar quarter, the refinery will provide one-hour average concentration data, all QA/QC check results, and any supported information in tabular format through a comma separated value data file to the BAAQMD. The BAAQMD may make the one-hour average data available to the public through a BAAQMD website or through a public records request. Upon request prior to the report submittal, the refinery will make the one-hour averaged data available to BAAQMD as well as any data needed to validate a measurement such as raw data spectra and verification of gas concentrations. In addition, all data will be archived for a minimum period of three years and made available to the BAAQMD upon request.

4.4.2 Annual BAAQMD Reporting

Phillips 66 will submit an annual report to the BAAQMD that summarizes overall performance of the fence line monitoring system. The report will include the following performance indicators:

- On-stream efficiency
- Annual averages of gas concentrations
- Any instances of failed MQOs
- A summary of corrective actions undertaken to correct any issues that may have occurred during the reporting period. The corrective action summary will include a summary of actions taken to minimize future issues.

5 - Maintenance

Specific tasks for periodic testing, inspection, and maintenance are required for the air monitoring equipment to provide sufficient quality control to remain within the manufacturer's operating specifications and ensure that the quality goals are met. Initial testing of each piece of equipment is conducted to ensure equipment operation is within the manufacturer's specifications. Operational checks are repeated during installation before initial calibration and use in measuring field conditions. Each monitor has manufacturer-recommended maintenance schedules that are found in the operating manuals. All recommended manufacturer maintenance activities will be performed on each instrument. A complete set of standard operating procedures, maintenance checks, and operational parameters such as message board updates, are included in the Operations Guidance Document. The Operations Guidance Document will be maintained and updated as part of the fence-line system.