This model rule was developed by the Mid-Atlantic Regional Air Management Association (MARAMA) as part of a regional effort to assist states in developing State Implementation Plans for ozone, fine particles, and regional haze.

The MARAMA Technical Oversight Committee chose to use the most stringent limits (either from recent Consent Decrees or rules in other jurisdictions) for illustrative purposes to show how a rule could be structured. MARAMA member States may pursue these model rules as necessary and appropriate during state-specific rulemakings or other implementation methods to establish emission reduction percentages, emission rates, or technologies to meet their particular attainment needs and control strategies.

NOTE: "XXXX" is a place holder for State-specific section numbers, title numbers, or State names.

Model Rule for Petroleum Refinery Flares

PART Env-A xxxx Additional Control Measures for Petroleum Refinery Flares

Env-A xxxx.01 Applicability. This part (subpart) applies on or after January 1, XXXX to all gas flares used at petroleum refineries.

Env-A xxxx.02 Definitions. The following words, terms, and abbreviations used in this part (subchapter) shall have the following meanings:

Note: Each state's policies and rules regarding regulatory definitions vary. Listed here are critical definitions with suggested, broadly defined language that will need to be changed to be consistent with an individual state's rules.

(a) *Flare Event* is any intentional or unintentional release of vent gas to a gas flare. For a flare event that continues for more than 24 hours, each day of venting of gases shall constitute a flare event.

(b) *Flare Gas Recovery System* is a system comprised of compressors, pumps, heat exchangers, knock-out pots and water seals, installed to prevent or minimize the combustion of vent gas in a flare.

(c) *Flare Monitoring System* is the monitoring and recording equipment used for the determination of gas flare operating parameters, including, but not limited to, standard volumetric flow rate, and/or on/off flow indication.

(f) *Representative Sample* is a sample of vent gas collected from the location as approved in the Flare monitoring and Recording Plan and analyzed utilizing test methods specified in subdivision xxxx.07. If sampling of vent gas is exempt due to a catastrophic event as specified in paragraph xxxx.08(a) of this rule or not required due to flare events shorter than 30 minutes, the estimated higher (gross) heating value and total sulfur concentration shall be considered as a representative sample.

(k) *Recordable Flare Event* is any flare event for a specific flare during which the flow rate of vent gases to that flare exceeds 330 standard cubic feet per minute continuously for a period greater than 15 minutes, or any other flare event, as approved in writing by the [Department].

(m) *Vent Gas* is any gas disposed in a gas flare excluding assisting air or steam, flare pilot gas, and any continuous purge gases.

Env-A xxxx.03 Requirements.

(a) The owner or operator of a petroleum refinery subject to this rule shall:

(1) Maintain a pilot flame present at all times a flare is operational.

(2) Operate all flares in a smokeless manner with no visible emissions except for periods not to exceed a total of five minutes during two consecutive hours.

(3) Operate all flares in such a manner that minimizes all flaring and that no vent gas is combusted except during emergencies, shutdowns, startups, turnarounds or essential operational needs.

(4) Prevent the combustion in any flare of vent gas with a hydrogen sulfide concentration in excess of 160 ppm, averaged over three hours, excluding any vent gas resulting from an emergency, shutdown, startup, process upset or relief valve leakage.

(5) Meet the above requirements by using one or any combination of the following methods:

(i) operating and maintaining a flare gas recovery system to prevent continuous or routine combustion.
(ii) Eliminating the routes of continuous or intermittent, routinely-generated refinery fuel gases to a flarind device and operating the flaring flaring device such that it only receives non-routinely generated gases, process upsets, fuel gas released as a result of relief valve leakage or gases released to other emergency malfunctions.

(6) Submit an evaluation of options to reduce flaring during planned shutdowns, startups and turnarounds, including, but not limited to slower vessel depressurization and storing vent gases.

Env-A xxxx.04 Flare Monitoring and Recording Plan Requirements.

(a) The owner or operator of a petroleum refinery which is in operation as of XXX xx, XXXX shall, on or before YYY yy, YYYY, submit a Flare Monitoring and Recording Plan, complete with an application and appropriate fees, for each facility to the [Department] for approval. Each Flare Monitoring and Recording Plan shall contain the information described in paragraph xxxx.04(c) of this rule.

(b) The owner or operator of a new or an existing non-operating petroleum refinery starting or restarting operations on or after XXX xx, XXXX shall:
(1) Provide the [Department] a written notice of the date of startup no later than seven (7) days prior to starting or commencing operations.

(2) Submit a Flare Monitoring and Recording Plan, complete with an application and appropriate fees, to the [Department] for approval. Each Flare Monitoring and Recording Plan shall contain the information described in paragraph xxxx.04(c) of this rule.

(c) Each Flare Monitoring and Recording Plan shall include, at a minimum, the following:

(1) A facility plot plan showing the location of each gas flare in relation to the general plant layout.

(2) Type of flare service, as defined in subdivision xxxx.02, and information regarding design capacity, operation and maintenance for each flare.

(3) The following information regarding pilot and purge gas for each flare:

(i) Type(s) of gas used;

(ii) Actual set operating flow rate in standard cubic feet per minute;

(iii) Maximum total sulfur concentration expected for each type of gas used; and

(iv) Average higher (gross) heating value expected for each type of gas used.

(4) Drawing(s), preferably to scale with dimensions, and an as built process flow diagram of the gas flare(s) identifying major components, such as flare header, flare stack, flare tip(s) or burner(s), purge gas system, pilot gas system, ignition system, assist system, water seal, knockout drum and molecular seal.

(5) A representative flow diagram showing the interconnections of the gas flare system(s) with vapor recovery system(s), process units and other equipment as applicable.

(6) A complete description of the assist system process control, flame detection system and pilot ignition system.

(7) A complete description of the gas flaring process for an integrated gas flaring system which describes the method of operation of the gas flares (e.g. sequential, etc.).

(8) A complete description of the vapor recovery system(s) which have interconnection to a gas flare, such as compressor description(s), design capacities of each compressor and the vapor recovery system, and the method currently used to determine and record the amount of vapors recovered.

(9) Drawing(s) with dimensions, preferably to scale, showing the following information for proposed vent gas:

(i) sampling locations; and,

(ii) flow meter device, on/off flow indicators, higher heating value analyzer and total sulfur analyzer locations and the method used to determine the location.

(10) A detailed description of manufacturer's specifications, including but not limited to, make, model, type, range, precision, accuracy, calibration, maintenance, a quality assurance procedure and any other specifications and information referenced in Attachment A for all existing and proposed flow metering devices, on/off flow indicating devices, higher heating value and total sulfur analyzers for vent gas.

(11) A complete description and the data used to determine and to set the actuating and deactuating and the method to be used for verification of each setting for each on/off flow indicator.

(12) A complete description of proposed analytical and sampling methods or estimation methods, if applicable, for determining higher (gross) heating value and total sulfur concentration of the flare vent gas.

(13) A complete description of the proposed data recording, collection and management and any other specifications and information referenced in Attachment A for each flare monitoring system.

(14) A complete description of proposed method to determine, monitor and record total volume, higher heating value and total sulfur concentration of gases vented to a flare for each flare event.

(15) A detailed description of proposed method to calculate criteria pollutant emissions for flares using Attachment B Guidelines for Calculating Flare Emissions and proposed emission factors with supporting data.

(16) A schedule for the installation and operation of each flare monitoring system.

(17) A complete description of the proposed method to alert personnel designated to collect samples that a recordable flare event has started.

(18) A complete description of any proposed alternative criteria to determine a recordable flare event for each specific flare, if any, and detailed information used for the basis of establishing such criteria.

(19) A request to use the alternative sampling program pursuant to subparagraph xxxx.05(c)(3), if applicable, with a complete description of proposed Quality Assurance/Quality Control procedures to be used in a test program to determine the correlation between the results from the alternative sampling program and the testing and monitoring methods specified in subdivision xxxx.08

(20) A complete description of the method to determine emissions associated with recordable events during periods when the flare monitoring system is out of service pursuant to subparagraph xxxx.05(d)(1).

Env-A xxxx.05 Operation Monitoring and Recording Requirements. The owner or operator of a gas flare subject to this rule shall comply with the following:

(a) On or before six (6) months after approval of the Flare Monitoring and Recording Plan, or other date as specified by the [Department], start monitoring and recording in accordance with subdivision xxxx.05 and, where the plan is approved, in accordance with the Flare Monitoring and Recording Plan.

(b) Perform monitoring and recording of the operating parameters, as applicable, according to the monitoring and recording requirements and frequency shown in Table 1 (including footnotes) below except as specified in paragraphs xxxx.05(c) and xxxx.05(d).

TABLE 1

TYPE OF FLARE	OPERATING PARAMETER	MONITORING AND RECORDING
Clean Service	Gas Flow[1]	Measured and Recorded[2] Continuously with Flow Meter(s) and/or On/Off Flow Indicator(s)
	Gas Higher heating Value[3]	Calculated or Representative Sample for Each Flare Event[4]
	Total Sulfur Concentration[4] and gas composition[5]	Calculated or Representative Sample for Each Flare Event[4]
Emergency Service	Gas Flow[1]	Measured and Recorded[2] Continuously with Flow Meter(s) and/or On/Off Flow Indicator(s)
	Gas Higher Heating Value[3]	Representative Sample for Each Recordable Flare Event[4]
	Total Sulfur Concentration[4] and gas composition[5]	Representative Sample for Each Recordable Flare Event[4]
General Service	Gas Flow[1]	Measured and Recorded[2] Continuously with Flow Meter(s) with or without on/off flow indicator(s)
	Gas Higher Heating Value[3]	Representative Sample for Each Recordable Flare Event[4]
	Total Sulfur Concentration[4] and gas composition[5]	Representative Sample for Each Recordable Flare Event[4]

1. Standard Cubic Feet Per Minute.
2. All flow meters, flow indicators and recorders shall meet or exceed the minimum specifications in Attachment A.
3. Higher (Gross) Heating Value in British Thermal Units per Standard Cubic Foot.
4. Total Sulfur as SO2, ppm
5. Using methods as determined by the Department

(c) Alternative Flare Vent Gas Sampling

(1) In cases where sampling of vent gas is not performed pursuant to paragraph xxxx.09(a), the owner or operator of a gas flare shall identify for each flare event, the cause of event, the process system(s) involved, date and time event started and duration and any other information related to the type of vent gas (e.g. total sulfur concentration, higher heating value) which is necessary to calculate flare emissions.

(2) The owner or operator of a gas flare may comply with the vent gas sampling requirements of paragraph xxxx.05(b) based on alternative criteria for determining a recordable flare event for each specific flare, provided that such alternative criteria are submitted as part of the Flare Monitoring and Recording Plan in subparagraph xxxx.04(c)(18), and are approved in writing by the [Department].

(3) During the initial six months interim period of monitoring and recording or other interim period not to exceed nine months from the start of monitoring and recording, as approved in writing by the [Department], an alternative sampling program for recordable flare events for each gas flare may be used provided the following requirements are met:

(iii) A request to use an alternative sampling program has been submitted by the flare owner or operator as part of the Flare Monitoring and Recording Plan pursuant to subparagraph xxxx.04(c)(19).

(iv) The vent gas(es) to each flare shall be sampled and analyzed for total sulfur and higher (gross) heating value in accordance with methods specified in subdivision xxxx.08, once

a week. If there is a recordable flare event in any week, the sampling and analysis shall be conducted during such event.

(iii) The vent gas(es) to each flare shall be sampled and analyzed in accordance with Table 1, once a week during a recordable flare event other than the flare event specified in clause xxxx.05(c)(3)(ii), if such a recordable event occurs during that week.

(iv) The vent gas(es) to each flare shall be sampled and analyzed in accordance with Table 1 for all recordable flare events that are the result of any process unit shutdowns.

(v) The vent gas(es) to each flare shall be sampled and analyzed for all other recordable flare events to measure hydrogen sulfide concentrations in the vent gas using a colorimetric method or other methods as specified in the Flare Monitoring and Recording Plan pursuant to subparagraph xxxx.04(c)(19) and as approved in writing by the [Department].

(4) After the initial six months period of monitoring and recording, the owner or operator of a gas flare may, based on the monitoring data, request a change in the vent gas sampling requirement of paragraph xxxx.05(b) and/or propose an alternative criteria for determining a recordable flare event for each specific flare, provided that the owner or operator of the gas flare submits an application for the modification to the Flare Monitoring and Recording Plan and can demonstrate, and obtain written approval of the [Department] that an alternative vent gas sampling and/or an alternative criteria for determining a recordable flare event for each specific flare is adequate to determine the quality of vent gas(es) and to calculate emissions from all such flare events.

(5) After the initial six months period of monitoring and recording, the [Department] may revise any alternative criteria for determining a recordable event for each specific flare or any alternative vent gas sampling which have been previously proposed by the owner or operator of a gas flare and approved by the [Department], if the [Department] determines that the alternative(s) is not adequate based on the monitoring data or other information to determine the quality of vent gas(es) and to calculate emissions from all such flare events. The owner or operator of the gas flare shall use the revised criteria for determining a recordable event or vent gas sampling to monitor and record flare events no later than 30 days after written notification by the [Department].

(e) Flare Monitoring System

(1) Any continuous flare monitoring system, used to ensure compliance with paragraph xxxx.05(c)(3) of this rule, shall be maintained in good operating condition at all times when the gas flare that it serves is operational, except when out of service due to:

(i) Breakdowns and unplanned system maintenance, which shall not exceed 48 hours, cumulatively, per quarter for each reporting period; or,

(ii) Planned maintenance, which shall not exceed 14 days, per 18 month period commencing the start of flare monitoring and recording, provided that a written notification detailing the reason for maintenance and methods that will be used during the maintenance period to determine emissions associated with recordable flare events is provided to the [Department] prior to, or within 24 hours of, removal of the continuous monitoring system from service.

(2) A flare monitoring system may be used to measure and record the operating parameters required in paragraph xxxx.05(c) of this rule for more than one gas flare provided that:

(i) All the gases being measured and recorded are delivered to the flare(s) for combustion; and,

(ii) If the flare monitoring system is used to measure and record the operating parameters for emergency service flares, as well as general service flares, the flare monitoring system shall consist of a continuous vent gas flow meter and recorder that meets the requirements specified in Attachment A.

(f) Monitor the presence of a pilot flame using a thermocouple or any other equivalent device approved by the Department to detect the presence of a flame.

(g) Monitor all flares for visible emissions using color video monitors with date and time stamp, capable of recording a digital image of the flare and flame at a rate of no less than one frame per minute.

(h) for all emergency and general service flares:
(1) Install each flow meter in a manner and at a location that would allow for accurate measurements of the total volume of vent gas to each flare. If the flow meter cannot be placed in the location that would allow for accurate measurement due to physical constraints, the operator shall retrofit or equip the existing flow meters with totalizing capability to indicate the true net volume of gas flow to each flare.
(2) Install an automated sample collection system at each flare, capable to alert personnel that a sample is being collected following the start of a sampling flare event, unless total sulfur is monitored with a certified analyzer approved by the Department.
(3) Monitor and record the pilot gas and purge gas flow to each flare using a flow meter or equivalent device approved by the Department.

Env-A xxxx.06 Recordkeeping Requirements. The owner or operator of a gas flare shall maintain records in a manner approved by the [Department] for all the information required to be monitored under paragraphs xxxx.05(b), xxxx.05(c) and xxxx.05(d) of this rule, as applicable, for a period of five (5) years and make such records available to the [Department] upon request.

Env-A xxxx.07 Reporting Requirements. The owner or operator of a gas flare shall submit a quarterly report to the [Department] on or before 30 days after the end of each quarter. Each quarterly report shall include the following:

(a) The information required to be monitored under paragraphs xxxx.05(b), xxxx.05(c) and xxxx.05(d)of this rule.

(b) The daily and quarterly emissions of criteria pollutants from each flare along with all information used to calculate each flare's emissions, such as volumes, heating values, and sulfur contents of the representative samples of vent gases, etc.

(c) A complete description of the assumptions used to determine the heating value and sulfur content for each representative sample that is estimated as allowed by the rule or when a representative sample is not available.

(d) Flare monitoring system downtime periods, including dates and times and explanation for each period.

(e) A copy of written notices for all reportable air releases related to any flare event, as required by 40 CFR, Part 302 - Designation, Reportable Quantities, and Notification and 40 CFR, Part 355 - Emergency Planning and Notification, if applicable.

Env-A xxxx.08 Testing and Monitoring Methods.

(a) For the purpose of this rule, the test methods listed below shall be used. Alternative test methods may be used if it is determined to be equivalent and approved in writing by the [Department], and, if applicable by the U.S. Environmental Protection Agency.

(1) The higher (gross) heating value of vent gases shall be determined by ASTM Method D 2382-88, ASTM Method D 3588-91 or ASTM Method D 4891-89.

(2) The total sulfur concentration shall be determined by ASTM Method D 5504-94.

(3) The gas flow shall be determined by a flow measuring device that meets or exceeds the specifications described in Attachment A, as applicable.

(b) Analysis for higher (gross) heating value and total sulfur concentration shall be:
(A) Conducted by an approved lab; or,

(B) Conducted by the owner or operator of a gas flare if the Department has provided prior written approval of QA/QC and standard operating procedures. All analytical reports shall be signed by the facility official responsible for analytical equipment to certify the accuracy of the reports.

(c) Notwithstanding paragraphs xxxx.08(a) and xxxx.08(b), continuous monitoring systems certified under [Rule xxxx - Requirements for Monitoring, Reporting and Recordkeeping of Oxides of Sulfur (SOx) Emissions] and [Rule xxxx - Requirements for Monitoring, Reporting and Recordkeeping of Oxides of Nitrogen (NOx) Emissions] may be used for the monitoring of vent gases.

Env-A xxxx.09 Exemptions. Sampling and analyses of representative samples for heating values and sulfur contents pursuant to paragraph xxxx.05(b) may not be required for any flare event that:

(a) is a result of a catastrophic event including a major fire or an explosion at the facility, or

(b) constitutes a safety hazard to the sampling personnel at the sampling location approved in the Flare Monitoring and Recording Plan during the entire flare event, provided that a sample is collected at an alternative location where it is safe. The owner or operator shall demonstrate to the [Department] that the sample collected at an alternative location is representative of the flare event.

ATTACHMENT A

FLARE MONITORING SYSTEM REQUIREMENTS

The components of each flare monitoring system must meet or exceed the minimum specifications listed below. Components with other specifications may be used provided the owner or operator of a gas flare can demonstrate that the specifications are equivalent and has been approved by the Department.

1. Continuous Flow Measuring Device

The monitor must be sensitive to rapid flow changes, and have the capability of reporting both instantaneous velocity and totalized flow. Materials exposed to the flare gas shall be corrosion resistant. If required by the petroleum refinery or the hydrogen production plant, the manufacturer must provide an enclosure with an area classification rating of Class 1, Division 2, Groups A, B, C, D, and is FM and CSA approved. The monitor shall (i) feature automated daily calibrations at low and high ranges, and (ii) shall signal alarms if the calibration error or drift is exceeded, provided that the monitor is equipped with such capability. The volumetric flow measuring device may consist of one or more flow meters, and, as combined, shall meet the following specifications.

Velocity Range: 0.1-250 ft/sec

Repeatability: ± 1% of reading over the velocity range

Accuracy: + 20% of reading over the velocity range of 0.1-1 ft/s and ± 5% of reading over the velocity range of 1-250 ft/s

Installation: Applicable AGA, ANSI, API, or equivalent standard; hot tap capability. If applicable, the manufacturer must specify the straight-run pipe requirements in terms of the minimum upstream and downstream distances from the nearest flow disturbances to the device

Flow Rate Determination: Must be corrected to one atmosphere pressure and 680 F and recorded as one-minute averages

Data Records: Measured continuously and recorded over one minute averages. The instrument shall be capable of storing or transferring all data for later retrieval

QA/QC: An annual verification of accuracy is required, and shall be specified by the manufacturer.

2. On/Off Flow Indicator

The on/off flow indicator is a device which is used to demonstrate the flow of vent gas during a flare event, and shall meet or exceed specifications as approved by the Department. The on/off flow indicator setting shall be verifiable.

3. Data Recording System

All data as generated by the above flow meters and the on/off flow indicators must be continuously recorded by strip chart recorders or computers. The strip chart must have a minimum chart width of 10 inches, a readability of 0.5% of the span, and a minimum of 100 chart divisions. The computer must have the capability to generate one-minute average data from that which is continuously generated by the flow meters and the on/off limit switch.

4. Continuous and Semi-continuous Gaseous Stream Higher Heating Value (HHV) Flare Monitoring Systems

The following is intended to ensure that verifiable, meaningful, and representative data are collected from continuous and semi-continuous gaseous stream HHV flare measurement monitoring devices systems. All procedures are subject to Department review and approval.

General Requirements:

a. The monitoring system must be capable of measuring HHV within the requirements of the rule.

b. The monitoring system must be capable of adjusting to rapid changes in HHV within a reasonable time meeting the definition of a continuous or semi-continuous monitoring system as defined in the applicable rule and as approved by the Department.

c. Monitoring system sampling interfaces and analyzers in contact with sample gas must be compatible with sample gases and able to resist flow temperatures and pressures.

d. The sampling inlet system interface must be heated as necessary so as to prevent condensation.

e. Sample gas must be conditioned such that the sample is free of particulate or liquid matter.

f. The sample must flow without impediment through the instrument sampling system sampling interface and analyzer.

g. Use an enclosure with an area classification rating of Class 1, Division 2, Groups A, B, C, D, and is FM or CSA approved. The enclosure must be able to maintain a stable analyzer temperature as required for analyzer performance.

h. The monitoring system must feature automated daily calibrations calibration checks, minimally at mid-range, and preferably at both applicable Federal minimum BTU requirements (low end) and 95% of full scale (high end) ranges at low and high ranges

i. The monitoring system system analyzer must include an output compatible with a Data Acquisition System (DAS) or similar system that can process data generated by the analyzer and record the results. A data recorder compatible with analyzer output and capable of recording analyzer output must be supplied with the instrument.

j. Each monitoring system must have a written quality assurance/quality control (QA/QC) plan approved by the Department and available for inspection.

k. Maintain a maintenance log for each monitoring system.

l. Perform routine maintenance and repair as recommended by the manufacturer or according to a standard operating procedure submitted and approved by the Department.

m. The placement and installation of monitoring systems is critical for collecting representative information on HHV gas content. Factors that should be considered in placement of a sampling interface include but are not limited to safety, ensuring the sample is representative of the source, ease of placement and access. Sampling interfaces, conditioning systems and enclosures may be shared with other instrumentation, if appropriate.

n. Perform at monitoring system start-up and on an annual basis a relative accuracy test audit (RATA) which is the ratio of the sum of the absolute mean difference between the monitoring system generated data and the value determined using ASTM D1945-03 and ASTM D3588-91, ASTM D 4891-89, or other ASTM standard as approved by the Department.

o. Periodically perform a calibration curve or linearity verification error test according to permitting conditions and or on a schedule approved by the Department. Typically, this calibration curve will be prepared from standards representing a:

i. 10-30 percent of the measurement range
ii. 40-60 percent of the measurement range
iii. 80-100 percent of the measurement range

p. Analyzers with auto calibration check capability should be checked daily unless a different calibration frequency is approved by the Department. For analyzers without auto calibration check capability, submit a calibration check frequency request including supporting documentation to the Department for comment and approval.

q. Periodically perform a zero drift test. Allowed zero drift should be consistent with a properly operating system.
.
r. Retain records on the valid data return percentage.

s. Retain records on the availability or up-time of the monitoring system.

t. Retain records on the breakdown frequency and duration of the breakdown.

u. Retain records on excursions beyond quality control limits stated in the QA plan.

5. Continuous and Semi-continuous Gaseous Stream Total Sulfur Monitoring Systems

The following is intended to ensure that verifiable, meaningful, and representative data are collected from continuous and semi-continuous gaseous stream sulfur monitoring systems. All procedures are subject to Department review and approval.

General Requirements

a. The monitoring system must be capable of measuring total sulfur concentration within the requirements of the rule.

b. The monitoring system must be capable of adjusting to rapid changes in sulfur concentration within a reasonable time as defined in the applicable rule and as approved by the Department.

c. Monitoring system in contact with sample gas must be inert to sulfur gases and resistant to corrosion.

d. The sampling inlet system interface system must be heated as necessary so as to prevent condensation.

e. Sample gas must be conditioned such that the sample is free of particulate or liquid matter.

f. The sample must flow without impediment through the instrument sampling system sampling interface and analyzer.

g. Use an enclosure with an area classification rating of Class 1, Division 2, Groups A, B, C, D, and is FM or CSA approved. The enclosure must be able to maintain a stable analyzer temperature as required for analyzer performance.

h. The monitoring system must feature automated daily calibrations at low and high ranges, and shall signal alarms if the calibration error or drift is exceeded.

i. The monitoring system must include a Data Acquisition System (DAS) or similar system that can process data generated by the analyzer and record the results.

j. Each monitoring system must have a written quality assurance/quality control (QA/QC) plan approved by the Department and available for District inspection.

k. Maintain a maintenance log for each monitoring system.

l. Perform routine maintenance as recommended by the manufacturer or according to a standard operating procedure submitted and approved by the Department.

m. The placement and installation of monitoring systems is critical for collecting representative information on total sulfur gas concentration. Factors that should be considered in placement of a sampling interface include but are not limited to safety, ensuring the sample is representative of the source, ease of placement and access. Sampling interfaces, conditioning systems and enclosures may be shared with other instrumentation, if appropriate.

n. Perform at monitoring system start-up and on an annual basis a relative accuracy test audit (RATA) which is the ratio of the sum of the absolute mean difference between the monitoring system generated data and the value determined using SCAQMD Laboratory Method 307-91, ASTM D5504-01 or other ASTM standard as approved by the Department.

o. Facilities are strongly encouraged to use calibration gases prepared using a NIST hydrogen sulfide SRM, Nederlands Meetinstituut NMi or a NTRM standard as the primary reference.

p. Periodically perform a calibration curve or linearity verification performed according to permitting conditions and/or on a schedule approved by the Department. Typically, this calibration curve will be prepared from standards representing:

i. 10 to 30 percent of the measurement range
ii. 40 to 60 percent of the measurement range
iii. 80 to 100 percent of the measurement range

q. Analyzers with auto calibration capability shall be calibrated daily unless a different calibration frequency is approved by the Department. For analyzers without auto calibration capability, submit a calibration frequency request, including supporting documentation to the Department for comment and approval.

r. Seven Day Calibration Error Test shall be performed by evaluating the analyzer performance over seven consecutive days as necessary. The calibration drift should not exceed five percent of the full-scale range.

s. Analyze daily a control or drift test sample or standard. Adequate system analyzer performance is demonstrated by recoveries of 90 to 110 percent of the theoretical amounts for total reduced sulfur species in the test gas.

t. Periodically perform an analyzer blank test to evaluate the presence of analyzer leaks or wear on sample valves and related components. Replace components as necessary to restore the analyzer to nominal function. A blank should yield results below the monitoring plan approved lower measurement range.

u. Periodically perform a zero drift test. Allowed zero drift should be consistent with a properly operating system analyzer.

v. Retain records on the valid data return percentage.

w. Retain records on the availability or up-time of the monitoring system.

x. Retain records on the breakdown frequency and duration of the breakdown.

y. Retain records on excursions beyond quality control limits stated in the QA plan.

Gas Chromatograph (GC) Based System Analyzer Specific Requirements

a. The following performance tests specific to GC based sulfur analyzers are part of an overall QA program. This list is not all inclusive. The specific performance tests that are required under rule compliance will be based upon analyzer configuration, data requirements, practical concerns such as safety and are subject to approval by the Department.

i. Whenever a calibration is performed and whenever a calibration drift test is performed, examine retention times for each calibration component. Compare the retention times against historically observed retention times. Retention time drift should be better than within five percent. Compare the retention times to analyzer and DAS parameters such as time gates to ensure compatibility. These parameters including the analysis time may need to be updated on occasion.

ii. ii. Verify daily that the analyzer response drift for individual sulfur species does not exceed ten percent of the control information.

Total Sulfur Analyzer System Requirements

a. The following performance tests specific to total sulfur based analyzers are part of an overall QA program. This list is not all inclusive. The specific performance tests that are required under rule compliance will be based upon instrument analyzer configuration, data requirements, practical concerns such as safety and are subject to approval by the Department.

i. Verify daily that the analyzer response drift for the concentration of total sulfur, expressed as sulfur dioxide does not exceed ten percent of the control information.

ATTACHMENT B

GUIDELINES FOR CALCULATING FLARE EMISSIONS

The following methods shall be used to calculate flare emissions. An alternative method may be used, provided it has been approved as equivalent in writing by the Department.

1. Emission Calculation Procedures

Petroleum refinery operators shall use the following equations and emission factors to calculate emissions from vent gas, natural gas, propane and butane:

Vent Gas

Air Pollutant	Equation	Emission Factor
VOC	E = V x HHV x EF	0.063 lb/mmBTU
NOx	E = V x HHV x EF	0.068 lb/mmBTU
CO	E = V x HHV x EF	0.37 lb/mmBTU
PM10	E = V x EF	21 lb/mmSCF
SOx	E = V x Cs x 0.1662	Note (1)

Where:
E = Calculate vent gas emissions (lbs)
V= Volume flow of vent gas, as measured in million standard cubic foot at 14.7 psia and 680 Fahrenheit
HHV = Higher Heating Value, as measured in British Thermal Unit per standard cubic foot
EF = Emission Factor
Cs = The concentration of total sulfur in the vent gas, expressed as sulfur dioxide, as measured in part per million by volume using the methods specified in this rule.

Note (1) If an approved total sulfur analyzer is used in accordance with this rule, Cs is the concentration of total sulfur in the vent gas, averaged over 15 minutes or less, if the event duration is shorter than 15 minutes.

Natural Gas

Air Pollutant	Equation	Emission Factor
VOC	E = V x EF	7 lb/mmSCF
NOx	E = V x EF	130 lb/mmSCF
CO	E = V x EF	35 lb/mmSCF
PM10	E = V x EF	7.5 lb/mmSCF
SOx	E = V x EF	0.83 lb/mmSCF

Propane and Butane

Air Pollutant	Equation	Emission Factor
VOC	E = V x 3500 x EF	0.003 (lb/mmBTU)
NOx	E = V x 3500 x EF	0.13 (lb/mmBTU)
CO	E = V x 3500 x EF	0.032 (lb/mmBTU)
PM10	E = V x 3500 x EF	0.0014 (lb/mmBTU)
SOx	E = V x 3500 x EF	0.047 (lb/mmBTU)

Single On/Off Flow Indicator Switch

The flow rate setting of the on/off flow indicator switch if the switch is not actuated or the maximum design capacity of the flare for the flow rate for each flare event.

Multiple On/Off Flow Indicator Switch

a) The flow rate setting of the first stage on/off flow indicator switch if the switch is not actuated.

b) When an on/off switch is actuated assume the flow rate is the flow rate that would actuate the on/off switch set at the next highest flow rate.

c) Use the maximum design capacity of the flare for the flow rate when theon/off switch set for the highest flow rate is actuated.

Flow Meters Only

a) Use the recorded flow meter data until the maximum range is exceeded.

b) When the maximum range of the flow meter is exceeded, assume the flow rate is the maximum design capacity of the flare(s), unless the owner or operator demonstrates and the Department approves a calculated flow based upon operational parameters and process data that represent the flow during the period of time that the flow exceeded the maximum range of the flow meter.

c) When the flow rate is below the valid lower range of the flow meter, assume
the flow rate is at the lower range.

Combination of Flow Meters and On/Off Flow Indicator Switches

a) Use the recorded flow meter data until the maximum range is exceeded.

b) When the maximum range of the flow meter is exceeded, assume the flow rate is the flow rate that would actuate the on/off switch set at the next highest flow rate.

c) Use the maximum design capacity of the flare for the flow rate when the on/off switch set for the highest flow rate is actuated.

d) When the flow rate is below the valid lower range of the flow meter, assume the flow rate is at the lower range.

e) When the flow rate is below the valid lower range of the flow meter and the set flow rate of an on/off switch, assume the flow rate is the flow rate that would actuate the on/off switch.

2. Data Substitution Procedures

For any time period for which the vent gas flow, the higher heating value or the total sulfur concentration, expressed as sulfur dioxide, are not measured, analyzed and recorded pursuant to the requirements of this rule, unless the owner or operator of a petroleum refinery demonstrates using verifiable records of flare water seal level and/or other parameters as approved by the Department in the Flare Monitoring and Recording Plan or the Revised Flare Monitoring and Recording Plan that no flare event occurred during the period these parameters were not measured, analyzed or recorded, the operator shall substitute and report the following values:

a) If the flow rate is not measured or recorded for any flare event, the totalized flow shall be calculated from the methodology in section 2(a)(i) below, unless the Department approves the method specified in Section 2(a)(ii).

i) The totalized flow shall be calculated from the product of the flare event duration and the estimated flow rate. The flow rate shall be calculated using the following equation for the period of time the flow meter was out of service:

$$FR = Max.\ FR - 0.5(Max.\ FR - Avg.\ FR)$$

Where:

FR	=	Estimated Flow Rate (standard cubic feet per minute)
Max FR	=	Maximum flow rate that was measured and recorded for that flare during the previous 20 quarters preceding the flare event. This maximum value is based on the average flow rate during an individual flare event, not an instantaneous maximum value.
Avg FR	=	Average flow rate for all measured and recorded flow rates for all sampled flare events for that flare, during the previous 20 quarters preceding the subject flare event.

The duration of a flare event during periods when the flow meter is out of service shall be determined using an alternate method approved by the Department in the Flare Monitoring and Recording Plan or Revised Flare Monitoring and Recording Plan. In the absence of an approved alternate method to determine the duration of the flare event during periods when the flow meter is out of service, the operator shall report the flare to be venting for the entire time the flow meter is out of service.

ii) Alternate methods using recorded and verifiable operational parameters and/or process data, including reference to similar events that have previously occurred, approved by the Department to be representative of the volume of vent gas, may be used to determine the flow rate in lieu of the method specified above.

b) If the higher heating value is not measured or recorded for any flare event pursuant to the requirements of this rule, the higher heating value shall be calculated from the methodology in section 2(b)(i) below, unless the Department approves the method specified in Section 2(b)(ii).

i) The higher heating value shall be calculated using the following equation for the period of time this parameter was not measured or recorded:

$$HHV = Max\ HHV - 0.5(Max\ HHV - Avg\ HHV)$$

Where:

HHV	=	Estimated higher heating value (Btu/scf)
Max HHV	=	Maximum HHV measured and recorded for that flare during the previous 20 quarters preceding the flare event.
Avg HHV	=	Average value of all HHV measured and recorded for that flare for all sampled flare events during the previous 20 quarters preceding the flare event.

ii) Alternate methods using recorded and verifiable operational parameters and/ or process data, including reference to similar events that have previously occurred, approved by the Department to be representative of the HHV of the vent gas, may be used to determine the HHV in lieu of the method specified above.

c) If the total sulfur concentration, expressed as sulfur dioxide, is not measured or recorded for any flare event pursuant to the requirements of this rule, it shall be calculated from the methodology in section 2(c)(i) below, unless the Department approves the method specified in Section 2(c)(ii).

i) The total sulfur concentration expressed as sulfur dioxide shall be calculated using the following equation for the period of time this parameter was not measured or recorded:

$$SFE = Max\ SFE - 0.5(Max\ SFE - Avg\ SFE)$$

Where:

SFE	=	Estimated total sulfur concentration, expressed as sulfur dioxide (ppmv)
Max SFE	=	Maximum total sulfur concentration expressed as sulfur dioxide measured and recorded for that flare during the previous 20 quarters preceding the flare event.
Avg SFE	=	Average value of all total sulfur concentrations measured and recorded for that flare for all sampled flare events during the previous 20 quarters preceding the flare event.

ii) Alternate methods using recorded and verifiable operational parameters and/ or process data, including reference to similar events that have previously occurred, approved by the Department to be representative of the total sulfur concentration of the vent gas expressed as sulfur dioxide, may be used to determine the total sulfur concentration in lieu of the method specified above.