

ENGINEERING EVALUATION REPORT

FLARE MONITORING AND RECORDING PLAN

COMPANY NAME, MAILING AND LOCATION ADDRESS:

Name: Tesoro Refining and Marketing Company
Los Angeles Refinery
ID# 800436
Title V: Yes
RECLAIM: NOX, SOX
Zone: Coastal
Cycle: 1

Mailing: P.O. Box 817
Wilmington, CA 90748-0817

Location: 2101 E. Pacific Coast Highway
Wilmington, CA 90744

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BACKGROUND:

The Los Angeles Refinery of Tesoro Refining & Marketing Company in Wilmington, California (herein referenced as LAR) operates two (2) general service flares that are subjected to the provisions of Rule 1118. The two flares, identified as the 'East' (Flare No. 1) and 'West' (Flare No. 2) flares, operate as an integrated flare system that services all the major process units in the refinery. The process units consist of the FCCU, DCU, HCU, Alkylation, HTU (4), CRU (2), Bensat, HGU, Isomerization, Depentanizer, Cogen (2), Crude Unit, and the Gas Compression Plant.

Rule 1118 was amended on November 4, 2005 to enhance flare monitoring requirements and reduce flare related emissions. Stricter requirements for monitoring, record keeping, and reporting of flare activities were imposed so that flare emissions can be better quantified. Reliable and accurate flare emissions data are crucial in ensuring petroleum refineries do not exceed the performance targets for SOx emissions pursuant to paragraph (d) of Rule 1118. The flare emissions for LAR and the Sulfur Recovery Plant (SRP) of Tesoro (ID 151798), located in the adjacent city of Carson, are combined for determination of compliance with the SOx performance target of Rule 1118(d).

Due to technical challenges and the complexity of technologies feasible to continuously monitor total sulfur concentrations (TSC) and higher heating values (HHV) of flare vent gases, all South Coast refineries, including the LAR, were unable to comply with the monitoring requirements in Table 1 of Rule 1118(g)(3) by the compliance deadline of July 1, 2007. The AQMD Governing Board foresaw this difficulty and adopted a resolution with the November 4, 2005 amendment of Rule 1118 that directed District staff to work closely with the Western States Petroleum Association (WSPA) and its members to develop the technologies. Two test trials were conducted at two separate South Coast refineries to demonstrate the feasibilities of commercially available analyzers. BP volunteered to conduct a pilot test for a total sulfur analyzer while Chevron agreed to conduct a

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demonstration project for a HHV analyzer. Completion of these pilot projects and obtaining District approvals for the technologies did not happen until March 2008 for the HHV analyzer and May 2008 for the total sulfur concentration analyzer.

The LAR, along with other South Coast refineries, filed a regular variance petition for relief from Rule 1118 requirements on March 9, 2007. The Hearing Board held a common hearing for all the refineries on April 24 through April 26, 2007 and LAR's variance petition, case no. 4982-77, was granted. The LAR was ordered to comply with an Increment of Progress for the variance that specified a schedule for installing and testing of the analyzers on their flares. Final compliance with the variance order was achieved on September 29, 2009 and final certification of the flare analyzers was recently attained on March 20, 2013 from the District .

The LAR is an affected facility subjected to the provisions of paragraph (f) of Rule 1118. As such, a Revised Flare Monitoring and Recording Plan was required to be submitted to the District for approval by 6/30/06 pursuant to Rule 1118(f)(1)(A). The revised plan was initially submitted by the previous owner (Equilon LLC) under A/N 458544 on 7/6/06. As the new facility owner, Tesoro Refining & Marketing Company resubmitted the flare plan to the District on 10/2/07 under A/N 474150 because plans are not transferable. Subsequently, a revised flare plan was submitted on 6/13/08 to incorporate the latest changes to the plan and were subsumed under A/N 474150. This plan, as approved, will supersede the previously approved flare plan under A/N 348198 on 11/30/05. The Equilon plan application (A/N 458544) has been cancelled.

The following information was provided by Tesoro LAR:

Table 1 - Flare Information

Flare ID	Type of Service	Pilot Gas	Purge Gas ¹	Flare Gas Vapor Recovery
East (No. 1)	General	NG	Nitrogen	Yes
West (No. 2)	General	NG	Nitrogen	Yes

¹NG will be used as backup

The following methods are used to monitor and record the operating parameters of the flares:

Table 2 - Vent Gas Monitoring¹ Methods

Flare ID	Gas Flow Meter	Gas Higher Heating Value (HHV) Analyzer	Total Sulfur (TS) Concentration Analyzer
East	Type: Ultrasonic Make: Panametrics Model: GF868 Range: 0.1 – 250 fps	Type: GC Make: Siemens Model: Maxum Edition II Range: 0 – 3500 BTU/ft3	Type: PUVF Make: Thermo Model: SOLA II Dual 10 – 2500 ppm Range: 2000 – 150,000 ppm
West			

¹Monitoring and recording are continuous. Additional analyzer specifications and requirements are contained in Section K of the proposed plan.

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Table 3 - Pilot, Purge Gas and Visible Emissions Monitoring Methods

Flare ID	Pilot Gas (type)	Pilot Gas Flow, Scfm	Purge Gas (type)	Purge Gas Flow (typical), Scfm	Pilot Flame Detection	Visible Emissions Detection
East	NG	10	N ₂	295	Thermocouple	Color video
West	NG	10	N ₂	295	Thermocouple	Color video

FLARE GAS RECOVERY (FGR) SYSTEM AND FLARING OPERATIONS

A new FGR system was installed by January 1, 2009 at the LAR to comply with Rule 1118(c)(4) so that no vent gas is combusted except during emergencies, shutdowns, startups turnarounds or essential operating needs. The new FGR system consist of five new 60 MSCFH flare gas compressors with a total compression capacity of 300 MSCFH. The normal rate for the FGR unit at the LAR is 240 MSCFH. The design is based on the expectation that two compressors are needed for most refinery base load scenarios, two additional compressors are needed for peak capacity and the fifth is a maintenance spare.

Each flare has a dedicated knock out drum located near the base of the flare stack. Water seals in these drums maintain a slight backpressure in the flare header which permits gas to be recovered from the flare header by the FGR compressors. Flare gas will flow to the compressor to the extent of the compressor capacity. When flare gas flow exceeds compressor capacity, pressure upstream of the water seal will increase until one of the water seals is broken and gas is then discharged to the flare stack. The water seal in one drum is maintained at a higher level than the other, resulting in higher backpressure at one of the two flares. Thus, gas exceeding the capacity of the flare gas recovery compressor is flared preferentially through a single flare stack. During a major upset, when the total flare load exceeds 10% design flow (or 17,800 scfm @ 60F), the release gas is flared through both flare stacks.

The recovered flare gas is routed through a trim cooler to an existing amine contactor column (V-598) where H₂S is removed from the gas by contact with lean DEA. Rich DEA is sent to the SRP where H₂S is removed and the DEA is regenerated and re-used. The treated recovered flare gas is sent to the fuel gas mix drum for use in the refinery fuel gas system.

The Rule 1118 flow meter shown in Table 2 is installed upstream of flare knock out/water seal drums V-847 and V-848 for the West and East flare, respectively. Additionally, each flare is equipped with an individual thermal dispersion flow meter FR-5224 and FR-5225 located downstream of V-847 and V-848, respectively. Tesoro proposed to use the secondary flow meters as indicators whether or not vent gas actually flow to the flare (flare event). However, due to the inherent inaccuracies of thermal anemometers at low flow rates and their reliance on relatively stable gas composition, this proposal was not universally approved by the District but should be reviewed for approval on a case by case basis. The HHV/TS analyzers are installed downstream of the knock out/water seal drums. The monitoring and recording equipment in Table 2 are certified by the AQMD to meet or exceed the requirements of Rule 1118, Attachment A.

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PLAN EVALUATION

PLAN COMPLETENESS

A Revised Flare Monitoring and Recording Plan shall contain, at minimum, all of the information specified by paragraphs (f)(3)(A) through (f)(3)(Q) of Rule 1118. As shown in Table 1, LAR's proposed plan has the required information specified by paragraph (f)(3) of the rule.

TABLE 1: Checklist for a Revised Flare Monitoring and Recording Plan

Requirements	Rule 1118 (f)(3)	Yes	Comment
A facility plot plan showing locations of flares	(A)	√	See Appendix A of the revised plan dated 6/13/08.
Flare information: (1) type of service (2) design capacity (3) operation and maintenance	(B)	√ √ √	See Section 2, pages 1-3 of the revised plan dated 6/13/08.
Pilot and purge gas information: (1) type of gas used (2) actual set operating flow rate (3) Expected maximum total sulfur content (4) Expected average higher heating value	(C)	√ √ √ √	See Section 2, pages 3-4 and Appendix C of the revised plan dated 6/13/08.
As built process flow diagrams and drawings identifying flare header, flare stack, flare tip/ burners, purge gas system, pilot gas system, ignition system, assist system, knockout drum, water and molecular seal, etc...	(D)	√	See Appendix B and D of the revised plan dated 6/13/08.
Flow diagrams showing the interconnections of the flares to vapor recovery system and process unit	(E)	√	See Section 2, pages 4 and 6, Appendix B, D and E of the revised plan dated 6/13/08.
Descriptions of the assist system process control, flame detection system and pilot ignition system.	(F)	√	See Section 2, page 5 of the revised plan dated 6/13/08.
Description of the gas flaring process if an integrated gas flaring system is being operated.	(G)	√	See Section 2, page 5 of the revised plan dated 6/13/08.

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Requirements	Rule 1118 (f)(3)	Yes	Comment
Description of the vapor recovery system: (1) type of compressor (2) design capacity of each compressor (3) design capacity of vapor recovery system (4) method to record amount of vapors recovered	(H)	√ √ √ √	See Section 2, page 6 of the revised plan dated 6/13/08. Note that a new Flare Gas Recovery (FGR) system was installed in 2009 under A/N 501291 to comply with R1118(c)(4) and the DCU compressor C-137 (and spare C-105) described in Section 2 provide additional capacity for recovering vent gas. See discussion in FGR section of evaluation.
Drawings with dimension showing: (1) location of sampling equipment (2) locations of HHV, TS analyzers (3) location of flow meter (4) location of on/off indicator	(I)	√ √ √ √	See Section 2, page 7 and Appendix D of revised plan dated 6/13/08.
Manufacturer's specifications for existing and proposed flow meters and on/off flow indicator, HHV and TS analyzers: (1) make, model and type (2) range, precision and accuracy (3) calibration, maintenance and quality assurance procedures	(J)	√ √ √	See Section 2, pages 8-10, Appendices F and K of revised plan dated 6/13/08. Also see AI response from Tesoro dated 10/8/09.
Description and data used to determine actuating and de-actuating settings for on/off flow indicator, and method to verify these settings.	(K)	√	See Section 2, page 11 of revised plan dated 6/13/08 and AI response from Tesoro dated 10/8/09.
Description of analytical and sampling methods or estimation method, if applicable, to determine high heating value and total sulfur content of vent gases.	(L)	√	See Section 2, page 12-13 of the revised plan dated 6/13/08.
Description of data recording, collection and management system.	(M)	√	See Section 2, page 14 of revised plan dated 6/13/08.
Description of proposed method to determine, monitor and record total gas volume, HHV and total sulfur concentrations of vent gases.	(N)	√	See Section 2, page 15 of revised plan dated 6/13/08.

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Requirements	Rule 1118 (f)(3)	Yes	Comment
Schedule for installation and operation of flare monitoring system..	(O)	√	Flares were placed on modified schedule in accordance with District Variance, Case No. 4892-77. Final compliance was achieved on 9/29/09.
Description of any proposed alternative criteria to determine a sampling event for each specific flare.	(P)	√	'Sampling flare event' was an intermediate definition effective prior to the installation of continuous monitors for HHV and total sulfur concentration. Defining sampling event is not relevant in approving of the proposed plan.
A request to use an alternative sampling program pursuant to paragraph (g)(4)(C)	(Q)	√	See Section 2, page 18 of revised plan dated 6/13/08.

RECOMMENDATIONS

The Tesoro LAR's revised Flare Monitoring and Recording Plan contains all of the requirements pursuant to Rule 1118 (f)(3). Therefore, the plan is recommended for approval with the following conditions:

1. The owner/operator shall perform monitoring and recording of the operating parameters for the following flares in accordance with this approved compliance plan and other applicable requirements of Rule 1118(g). The monitoring and recording shall be performed at all times except when the flare monitoring system is out of service for reasons described in Rule 1118(g)(5)(A).

Flare ID	East (No. 1)	West (No. 2)
Flare Type	General Service	General Service

2. A flare event occurs when the flow velocity of vent gas in a flare equals to 0.10 feet per second (2,542 SCFH) or greater. The flare event ends when the flow velocity drops below 0.12 feet per second (3,050 SCFH). Until the Panametrics flow meter(s) referenced in Condition No. 4 is relocated or additional Panametrics flow meters are installed downstream of flare KO/H2O seal drums, V-847 and V-848, the owner/operator can provide verifiable monitoring records, approved by the AQMD, to demonstrate that vent gas was combusted in the flare for the purpose of determining the onset of a flare event and that no more vent gas

was combusted in the flare to determine when a flare event ends. The Panametrics flow meter(s) relocation or addition shall be completed no later than April 1, 2014.

3. A flare event lasting 24 hours or less which continues into the next calendar day shall be considered a single flare event even when the event occurs in two consecutive days. When a flare event continues for more than 24 hours, each calendar day shall be a separate flare event.
4. The continuous HHV analyzers, total sulfur analyzers and gas flow meter used in this flare plan shall meet or exceed the minimum specifications described in Attachment A of Rule 1118. The flare monitoring system shall also be certified by the SCAQMD. For quality assurance procedures, the owner/operator shall follow the Guidelines for Rule 1118 Flare Monitoring System Quality Assurance and Quality Control Plan published by the SCAQMD.
5. When the maximum range of a flow meter is exceeded, the flow rate shall be assumed to be the maximum design capacity of the flare.
6. Volumetric flow rates of vent gases shall be corrected to standard conditions of 14.7 psia and 68°F.
7. Whenever the continuous flow meter, HHV and/or TSC analyzer(s) is down due to breakdowns or maintenance, the owner/operator shall use the data substitution method referenced in Attachment B of Rule 1118 to calculate and report flare emissions except when an alternative data substitution procedure has been approved in writing by the District. Analyzer(s) downtime shall be limited pursuant to Rule 1118(g)(5)(A).
8. The owner/operator shall calculate emissions of criteria pollutants from each flare and each flare event using the methods described in Attachment B of Rule 1118.
9. The owner/operator shall install and maintain a flow meter to monitor and record the pilot and purge gas flow to the flares.
10. In the event the pilot gas flow meter is out of service, the monitoring/recording system shall default to the maximum design flow rate of 900 SCFH during the outage.
11. In the event the purge gas flow meter is out of service, the monitoring/recording system shall default to the maximum design flow rate of 17,700 SCFH during the outage.
12. The owner/operator shall monitor the flares at all times for presence of a pilot flame using a thermocouple that will alarm the owner or operator in the event of a flame out. In the event of a pilot flame out, the owner or operator shall re-ignite the pilot immediately.
13. The owner/operator shall notify the Executive Officer within one hour of any unplanned flare event with emissions exceeding either 100 pounds of VOC or 500 pounds of sulfur dioxide, or exceeding 500,000 standard cubic feet of flared vent gas. The owner/operator shall also notify the Executive Officer by telephone at least 24 hours prior to the start of a planned flare event with emissions exceeding either 100 pounds of VOC or 500 pounds of sulfur dioxide, or 500,000 standard cubic feet of combusted vent gas.

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14. The owner/operator shall conduct a Specific Cause Analysis for any flare event, excluding planned shutdown, planned startup and turnaround, resulting in any of the followings: (a) 100 pounds of VOC emissions. (b) 500 pounds of sulfur dioxide emissions. (c) 500,000 standard cubic feet of vent gas combusted. The analysis shall identify the cause and duration of the flare event and describe any mitigation and corrective action taken to prevent recurrence of a similar flare event in the future. Unless an extension is granted, the owner/operator shall submit Specific Cause Analysis to the Executive Officer within 30 days of the event.
15. The owner/operator shall conduct an analysis and determine the relative cause for a flare event that results in combustion of more than 5,000 standard cubic feet of vent gas. A Specific Cause Analysis may be submitted to satisfy this condition.
16. For the purpose of Rule 1118(d)(1), flare emissions from this facility and Tesoro SRP (ID 151798) shall be considered as flare emissions from a single petroleum refinery.
17. The owner/operator shall submit a complete Flare Minimization Plan for approval by the Executive Officer no later than 90 days from the end of a calendar year in which flare emissions exceeding the annual performance targets set by Rule 1118(d)(1). The plan shall comply with the requirements of Rule 1118(e).
18. The owner/operator shall maintain records in a manner approved by the Executive Officer for the following.
 - a. Flare event data collected pursuant to paragraph (g)(3), (g)(4), (g)(5), (g)(6) and subparagraph (g)(8)(C) of Rule 1118 as applicable.
 - b. Total daily and quarterly emissions of criteria pollutant from each flare and each flare event along with all information specified by Rule 1118(i)(5)(B).
 - c. Pilot flame failure report.
 - d. Planned and unplanned flare monitoring system downtime report that include date, time and explanation for taking the system out of service and date, time the system returned to normal operations.
 - e. Information to substantiate any exemptions taken under Rule 1118(k).
 - f. Specific Cause Analysis completed pursuant to Condition No. 14.
 - g. Relative Cause Analysis completed pursuant to Condition No. 15.
 - h. Annual acoustical pressure relief device leak survey.
 - i. Combined annual sulfur dioxide emissions for all flares at Tesoro LAR (ID 800436) and Tesoro SRP (ID 151798) normalized over the crude oil processing capacity in calendar year 2004 pursuant to Condition No. 16.
 - j. Video records pursuant to Rule 1118(g)(7).

Within 30 days after the end of each calendar quarter, the owner/operator shall submit a quarterly report to the AQMD Refinery Compliance Team to the below address. Items (a) through (g) shall be submitted quarterly in electronic format. Hard copy of item (h) shall be submitted with the quarterly report for the quarter which the survey was conducted. Hard copy of item (i) shall be submitted with the last quarterly report for the year. Item (j) shall be made available to the Executive Officer upon request.

All records required by this condition shall be certified for accuracy in writing by the responsible facility official and maintained for at least five years.

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Processed by Thomas Lee

Reviewed by

Date 3-15-13

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