

**REVISED FLARE MONITORING AND RECORDING PLAN**

**Facility Information**

**AIR PRODUCTS & CHEMICAL, INC.  
ID# 003417  
TITLE V: YES  
RECLAIM: NOX  
ZONE: COASTAL  
CYCLE: 1**

**Mailing Address**

**23300 S. ALAMEDA ST.  
CARSON, CA 90810**

**Equipment Address**

**23300 S. ALAMEDA ST.  
CARSON, CA 90810**

**Contact Information**

**CHRIS MC WILLIAMS (PLANT MANAGER)  
(310) 952-9928**

**BACKGROUND**

Air Products & Chemical, Inc. operates a Hydrogen (H<sub>2</sub>) production facility in Carson, California that produces 99.9% pure H<sub>2</sub> for dedicated 'over the fence' sales (via pipeline) to several neighboring refineries. The facility, known as the 'Carson Hydrogen Plant' (herein referenced as 'the plant'), began operations in late 1999 and has the capacity to produce up to 96 MMSCFD of 'pure' H<sub>2</sub> gas for use in refinery operations.

The plant operates one (1) elevated flare that is subjected to the provisions and requirements of District Rule 1118. This flare (C33) is classified as a 'Clean Service' flare. It is designed and operated to combust only natural gas, hydrogen gas and other gas(es) with a fixed composition vented from specific equipment as defined in Rule 1118(b)(1). As described later in the Process Description section of this evaluation, C33 burns vent gases that are typically predictable in gas composition and has very little or no sulfur content (of commercial natural gas at worst).

The District amended Rule 1118 on November 4, 2005 in an effort to further control and minimize flare emissions. Stricter requirements in monitoring, recordkeeping, and reporting of flare activities were imposed in this latest rule amendment to better quantify flare emissions. Reliable and accurate flare emissions data are crucial in ensuring petroleum refineries do not exceed the performance targets for SO<sub>x</sub> emissions pursuant to section (d) of Rule 1118. Note that Air Products is not an affected facility (petroleum refinery) subjected to the provisions of section (d). Nevertheless, a revised Flare Monitoring and Recording Plan was required to be submitted to the District by 6-30-06 pursuant to Rule 1118(f)(1)(A) for approval.

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The plant submitted their revised Flare Monitoring and Recording Plan on 6-30-06 under A/N 458528. The approved plan under this application will supersede A/N 364657, which was submitted on 1-18-00 for the plant's initial Flare Monitoring and Recording Plan approval.

**FLARE OVERVIEW**

The plant provides the following information on C33:

Table 1 - Flare Information

Flare Device ID	Manufacturer/Model	Type of Service	Pilot Gas	Purge Gas	Vent Gases	Vent Gas Recovery
C33	John Zink/EEF-LHTS-150/70	Clean	Nat. Gas	N <sub>2</sub>	N <sub>2</sub> , H <sub>2</sub> , CO, CO <sub>2</sub> , CH <sub>4</sub> , C <sub>2</sub> - C <sub>5</sub> , trace H <sub>2</sub> S	None

The flare system uses inert Nitrogen as the purge gas to prevent combustible mixtures caused from air infiltration and is maintained at 1700 SCFH to meet accuracy requirements of the vent gas flow meter discussed in Table 3. Continuous purging of the flare header (20") and burner system takes place during normal flare operations. There are no emissions associated with this inert N<sub>2</sub> gas.

Three (3) pilots, using commercial pipeline natural gas from the local utility company, are used to burn the gases vented to C33. There is no flow meter currently installed to measure the actual gas flow to the pilots. The pilot gas usage, for emissions calculation, will be based on the maximum design flow capacity of 75 SCFH per pilot (225 SCFH total). Rule 1118(g)(8)(C) exempts Clean Service flares from measuring and recording actual gas flow to the flare pilots.

A flow meter, meeting the requirements of Attachment A of Rule 1118, is installed on the flare header to monitor and record the total volume of vent gases combusted during flaring. The specifics on this flow meter are summarized in Table 3.

**FLARE PROCESS DESCRIPTION**

Four categories of vent gases are combusted by C33 and are summarized in Table 2. The composition of each stream is fairly consistent. They are summarized in Section 3.4.2 of the Revised Flare Monitoring and Recording Plan. Plant performance tests have been conducted to verify the gas composition and heat content (HHV) of these vent gas streams. The report, showing the gas composition, HHV, and total sulfur content of each vent gas stream, is shown in Appendix A of the revised plan. This information is recorded in the plant's Distributed Control System (DCS) for data retrieval to calculate emissions.

Table 2 - Vent Gases to C33

Vent Gas Stream	% Of Total Flow to C33	Source	Gas Composition	HHV, Btu/Scf
Syngas		Automatic Vent Valve PV-150. Reformer outlet to PSA Unit inlet.	H <sub>2</sub> , CO <sub>2</sub> , CO, CH <sub>4</sub> , trace N <sub>2</sub> & H <sub>2</sub> O, Sulfur free	312

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PSA Purge Gas	>95	Automatic Vent Valve PV-183. PSA outlet stream (used as primary fuel to reformer burners).	CO <sub>2</sub> , H <sub>2</sub> , CH <sub>4</sub> , CO, trace N <sub>2</sub> & H <sub>2</sub> O, Sulfur free	292
H <sub>2</sub> Product		Automatic Vent Valve PV- 165C. PSA outlet stream (to product compressors).	99.9% pure H <sub>2</sub> , trace N <sub>2</sub> & CO, Sulfur free	324
Natural Gas, Syngas, PSA Purge Gas or H <sub>2</sub> Product	<5	Miscellaneous (Compressor blowdowns, manual and safety relief valves)	CH <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> - C <sub>5</sub> H <sub>12</sub> , CO <sub>2</sub> , H <sub>2</sub> , trace H <sub>2</sub> S & N <sub>2</sub>	Use worst case gas composition of Natural Gas (1020)

Three of the four vent sources are vented to the flare via 'automatic vent valves' which operate like pressure relief valves that regulate pressure in the process stream it serves. As shown above, these three vent streams account for over 95% of the vent gases combusted in the flare. The miscellaneous gas stream portion is insignificant relative to any of these three vent streams and the worst case gas composition of natural gas is used for emissions calculations whenever all three vent valves are fully closed and the flare gas flow meter is registering flow  $\geq 0.10$  feet/sec. The operations of the automatic vent valves are monitored by the plant's DCS. Knowing what stream is venting to the flare header, the gas composition, HHV, sulfur content, and total vent gas flow (measured by the flare header flow meter) to C33, flare emissions are calculated and recorded. Table 3 summarizes the vent gas monitoring method used by the plant.

Table 3 – Vent Gas Monitoring/Recording Method

Flare ID	Gas Flow	Gas Higher Heating Value, Btu/Scf	Total Sulfur Concentration
C33	Measured and recorded continuously by a common flare header flow meter:  <b>Type:</b> Ultrasonic <b>Make:</b> GE Sensing <b>Model:</b> Panametric GF868 (dual channel, 2 path, 1 transverse,	Calculated based on composition measured during plant performance test.  See Table 2 for HHV when single stream is venting to flare. When multiple or unknown streams are venting at the same time, use worst case HHV.	Sulfur free if vent gas source is Syngas, PSA Purge Gas, or H <sub>2</sub> Product.  If vent gas source is Miscellaneous or unknown, use worst case emission factor of 0.83 lb/mmscf for Natural Gas.

The pilot, purge gas, and visible emissions monitoring methods are summarized in Table 4 below.

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TABLE 4: Pilot, Purge Gas and Visible Emissions Monitoring Methods

Flare ID	Pilot Gas Flow	Purge Gas Flow	Pilot Flame	Visible Emissions
C33	Actual usage of Natural Gas not measured. Usage based on maximum design flow rate of 75 scfh per pilot continuously.	Nitrogen Gas not measured. No emissions since gas is inert	Thermo-Couple w/ Auto Ignite	Color Video

The pilots (3) use commercial pipeline quality natural gas as pilot fuel and meet the requirements of Rule 1118(g)(6). The operations of the pilot and purge gas system was previously discussed in 'Flare Overview' section of this evaluation.

**PLAN EVALUATION**

A revised Flare Monitoring and Recording Plan shall contain, at minimum, all of the information specified by Subsections (f)(3)(A) through (f)(3)(Q) of Rule 1118. As shown in Table 5, Air Product's proposed plan meets the requirement specified in Section (f)(3) of the rule.

TABLE 5: 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 Figure 1 of the proposed plan
Flare information: (1) type of service (2) design capacity (3) operation and maintenance	(B)	√ √ √	See Section 3 of the proposed plan
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 3.3 of the proposed plan.
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 of the proposed plan
Flow diagrams showing the interconnections of the flares to vapor recovery system and process unit.	(E)	√	No vapor recovery system. See Appendix B for interconnections to process units.

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Requirements	Rule 1118 (f)(3)	Yes	Comment
Descriptions of the assist system process control, flame detection system and pilot ignition system.	(F)	√	See Section 3.1 of the proposed plan
Description of the gas flaring process if an integrated gas flaring system is being operated.	(G)	--	Not an integrated flare system
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)	-- -- --	Not equipped with vapor recovery system.
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)	-- -- √ --	Flow meter located at main flare heater to measure total flow. HHV calculated from plant performance test for dedicated vent streams or use worst case natural gas HHV & TS if vent stream is not known.
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)	√ √ √	No HHV or total sulfur analyzers used. Calculated values used based on plant performance test and Natural Gas SOx emission factor. See Section 4.1.1 and Appendix C of the proposed plan for vent gases.
Description and data used to determine actuating and de-actuating settings for on/off flow indicator, and method to verify these settings.	(K)	--	Not equipped with on/off flow indicator.
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 Sections 3.4.2 and 4.1 of the proposed plan
Description of data recording, collection and management system.	(M)	√	See Section 4.0 of the proposed plan

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Requirements	Rule 1118 (f)(3)	Yes	Comment
Description of proposed method to determine, monitor and record total gas volume, HHV and total sulfur concentrations of vent gases.	(N)	√	See Section 4.1 of the proposed plan
Schedule for installation and operation of flare monitoring system	(O)	√	See Section 4.1.1 of the proposed plan. New GE Panametric flow meter installed in Feb '07 and in operations as of July 1 '07.
Description of any proposed alternative criteria to determine a sampling event for each specific flare.	(P)	--	None proposed. HHV and TS currently calculated based on plant performance test
A request to use an alternative sampling program pursuant to paragraph (g)(4)(C)	(Q)	--	No request made

**RECOMMENDATION:**

The revised Flare Monitoring and Recording Plan, along with the supplemental information, submitted by Air Products Carson contain all 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 flare in accordance with this approved compliance plan and other applicable requirements of Rule 1118(g). Monitoring and recording of the below flare pursuant to this approved plan shall be performed at all times, except when out of service for reasons described in Rule 1118(g)(5)(A).

Flare Device ID	Type of Service
C33	Clean

2. A flare event occurs when the flow velocity of vent gas in the flare equals to 0.10 feet per second or greater. The flare event ends when the flow velocity drops below 0.12 feet per second. The owner/operator may use monitoring records of the flare water seal level and closures of control valves to demonstrate that no more vent gas was combusted in the flare for the purpose of determining when the flare event ends.
3. A flare event lasting 24 hours or less shall be considered a single flare event even when the vent occurs in two consecutive days. When a flare event continues for more than 24 hours, each calendar day shall be a separate flare event.

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4. The flow meter used in this flare plan shall meet the requirements of Rule 1118 Attachment A and shall be certified by the AQMD.
5. When the maximum range of the 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. Except for flare events originating from automatic vent valve PV-165C only (Hydrogen vent gas stream), the owner/operator shall calculate emissions of criteria pollutants for each flare event using the methods described in Attachment B of Rule 1118 and the appropriate HHV and Cs values specified in Section 3.4.2 of the revised FMRP. Whenever two (2) or more automatic vent valves (PV-150, PV-183 and PV-165C) are opened concurrently during a flare event, the owner/operator shall calculate flare emissions using the highest HHV value and sulfur content of these vent streams.
8. The owner/operator shall sample and analyze the Syngas, PSA Purge Gas, and H<sub>2</sub> vent streams to the flare once a year pursuant to the methods listed in Rule 1118(j). The total sulfur content for these streams can be considered 0 and the analysis shall be for gas composition and HHV only. Samples shall be taken within 30 minutes, but no sooner than 15 minutes, of the start of a flare event. In the event the HHV of these vent streams deviate by 10% or more from the values shown in this approved plan, the owner/operator shall submit an application to the Executive Officer to modify the HHV used to calculate emissions pursuant to Attachment B of Rule 1118.
9. The owner/operator shall calculate emissions for a flare event that occurs even when all three (3) automatic vent valves (PV-150, PV-183 and PV-165C) are in the fully closed position by using Natural Gas emission factors in Attachment B of Rule 1118.
10. For flare events originating from PV-165C only, the operator shall use the below equation and emission factor to calculate NO<sub>x</sub> emissions only. All other criteria pollutants are presumed to be zero for this hydrogen vent gas stream.

$$E_v = V_v \times \text{HHV} \times \text{EF}$$

Where;

V<sub>v</sub> = Volume flow of vent gas in MMScf at 14.7 psia and 68°F

HHV = 324 Btu/Scf for H<sub>2</sub>

EF = 0.068 lb/MMBtu

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11. The owner/operator shall calculate emissions of pilot gas based on the maximum design capacity of 225 SCFH using the equation for natural gas in Attachment B of Rule 1118.
12. The owner/operator shall monitor the flare at all times for presence of a pilot flame using a thermocouple that will alarm the owner/operator in the event of a flame out. The owner/operator shall reignite the pilot immediately after a pilot flame out occurs.
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.
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 a 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. The owner/operator shall maintain records of all the information required to be monitored and make such records available to District personnel upon request.
  - a. Flare event data collected pursuant to paragraphs (g)(3), (g)(4), (g)(5), (g)(6) and (g)(8)(C) of Rule 1118 as applicable.
  - b. Total daily and quarterly emissions of criteria pollutant from the flare and each flare event along with all information specified by Rule 1118(i)(5)(B).
  - c. Monitoring record of automatic vent valves on/off positions pursuant to Condition No. 7, 9 and 10.
  - d. Pilot flame failure report.
  - e. Planned and unplanned flare gas flow meter downtime report that includes date, time and explanation for taking the meter out of service.
  - f. Sample results for gas composition and HHV pursuant to Condition No. 8.
  - g. Specific Cause Analysis completed pursuant to Condition No. 14.
  - h. Relative Cause Analysis completed pursuant to Condition No. 15.
  - i. Annual acoustical pressure relief device leak survey.

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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 at the below address. Item (a) through (h) shall be submitted quarterly in electronic format. Hard copy of item (i) shall be submitted with the quarterly report for the quarter which the survey was conducted. 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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REFINERY COMPLIANCE  
1500 WEST CARSON STREET, SUITE 115  
LONG BEACH, CA 90810

17. The operator/operator shall comply with all provisions of this approved Flare Monitoring and Recording Plan unless the plan is suspended, revoked, modified, reissued, or denied. Violation of any of the terms of the plan is a violation of Rule 1118.