**Bay Area Air Quality Management District**
**939 Ellis Street**
**San Francisco, CA 94109**

# Staff Report

## Proposed Regulation
## Regulation 12, Miscellaneous Standards of Performance
## Rule 12, Flares at Petroleum Refineries

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**Prepared by:**

**Alex Ezersky**
**Principal Air Quality Specialist**
**Planning and Research Division**

**Reviewed by:**

**Dan Belik**
**Rule Development Manager**
**and**
**Kathleen Walsh**
**Assistant Counsel**

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# I. EXECUTIVE SUMMARY

Emissions from flaring at petroleum refineries have been an ongoing concern to the Bay Area Air Quality Management District and residents of the communities in the neighborhoods surrounding the refineries. Because flares are first and foremost a safety device that must be available for use in emergencies to prevent accident, hazard or release of refinery gas directly to the atmosphere, development of an appropriate regulatory mechanism to address flaring emissions has been a challenge. Through a broad participatory process involving District staff, refinery representatives, community representatives, representatives of local, state and federal public agencies, and other members of the interested public, however, the District has formulated a regulation that will reduce flaring emissions while providing refineries with flexibility to address their unique flare systems without compromising the safety of workers and the public, or the refineries.

Refinery flares are necessary for the safe disposal of gases generated during the refining process. These gases are collected by the refinery blowdown system, which gathers relief flow from process units throughout the refinery, separates liquid from vapors, recovers any condensable oil and water, and recovers gases for use in the refinery fuel system. When the heating value of the gas stream is insufficient for use as refinery fuel, when the stream is intermittent or when it exceeds the refinery's capacity to recover and use the gas for use as a fuel, the blowdown system directs the vapors to the flare, which combusts the gases and prevents their direct uncontrolled release to the atmosphere.

The Bay Area Air Quality Management District (District) discussed the need to study the feasibility of implementing controls on refinery flaring as part of the San Francisco Bay Area 2001 Ozone Attainment Plan for the 1-Hour National Ozone Standard. Analysis of Further Study Measure 8 (FSM-8) for flares, blowdown systems and pressure relief devices was initiated in January of 2002. A draft Technical Assessment Document (TAD) for flares was released in December 2002. The TAD presented information on refinery flares and emission estimates, and was the foundation for the flare monitoring rule. The District's flare monitoring rule, Regulation 12, Rule 11, was adopted by the District Board of Directors on June 4, 2003. Information obtained from the required monitoring was used to develop the proposed control strategies. The result is a proposed new rule, Regulation 12, Rule 12: Flares at Petroleum Refineries.

Emissions from flare operations at each Bay Area refinery have decreased since the District began work on development of the flare monitoring rule in 2002. Reports from refiners and analysis by staff have shown a reduction of total organics of approximately 85% since the time period covered by the TAD. These reductions are primarily due to adding flare gas compressor capacity and better management practices.

Emissions from refinery flares are currently estimated at 2 tons per day of total organic compounds (TOC) and 4 tons per day of sulfur dioxide ($SO_2$). These emission levels reflect the reductions realized as a result of actions taken by Bay Area refiners in recent years. The proposed regulation will capture these reductions to ensure no backsliding to flaring practices of the past. These emissions levels are expressed as daily averages, however; actual emissions on any given day range from 0 to 12 tons TOC and 0 to 61 tons of $SO_2$. The proposed rule calls for refiners to develop flare minimization plans to further reduce these emissions.

Staff investigated a variety of options for addressing emissions from refinery flares. The proposed regulation uses an approach that requires each refinery to develop a comprehensive plan to minimize flare use. Significant differences in refinery configurations and capacities to process and use gas in other processes require the rule to provide flexibility to implement the most appropriate flaring prevention measures for each refinery. The minimization plans will be developed in active consultation with District staff and will require annual updates to ensure that new technologies and practices will be identified and implemented in a process of continuous improvement. The plans will be made available for public review and written comment. A plan will only be approved if the APCO determines that all feasible flaring prevention measures have been considered and incorporated.

An Environmental Impact Report (EIR) was prepared to investigate and discuss elements of the proposed regulation that could result in environmental impacts. The EIR concludes that the proposed regulation would have no adverse environmental impact. A socioeconomic analysis mandated by Section 40728.5 of the Health and Safety Code was prepared by Applied Economic Development, Berkeley, California. The analysis concludes that the affected refineries should be able to absorb the costs of compliance with the rule without significant economic dislocation or loss of jobs.

As part of the technical assessment and rule development process a working group was formed that included representatives from the Bay Area petroleum refineries, the Western States Petroleum Association (WSPA), Communities for a Better Environment (CBE), the California Air Resources Board, and District staff. The workgroup met routinely to discuss technical issues including legal requirements of rule development, emission control strategies, monitoring techniques, standard definitions and investigation procedures. Summaries of these meetings are contained in Section IX of this report.

Additionally, staff hosted two evening public workshops in Martinez on March 24, 2005 and Richmond on, March 16, 2005, to receive input from the public on a proposed draft rule. The core issues raised at these meetings were: due consideration of safety, enforceability of the standards, clarity in definitions, the need for public input into the development of flare minimization plans, adequacy of the breadth of flaring scenarios covered by the rule, and the need for a limit on the hydrogen sulfide content of the vent gas. The proposed rule includes revisions to the rule language presented at the workshops as necessary and appropriate to address these issues.

## II. BACKGROUND

### A. Process Description

Flares are first and foremost devices to ensure the safety of refinery operations and personnel. They also serve as emission control mechanisms for refinery blowdown systems. Blowdown systems collect and separate liquid and gaseous discharges from various process units and equipment throughout the refinery. They also collect gases that are the normal byproducts of a process unit or vessel depressurization, or that may result from an upset in a process unit, or that come from refinery process units during startup and shutdown, or when the balance between gas generation and the combustion of that gas for process heat is disrupted.

Blowdown systems generally recover liquids and send gases to the fuel gas system for use in refinery combustion. However, when the heating value of the gas stream is insufficient, when the stream is intermittent, or when the stream exceeds the refinery's capacity to safely use the gas stream to satisfy refinery combustion needs, and the refinery does not have available storage capacity, the flare is used to combust these gases and prevent their direct uncontrolled release to the atmosphere.

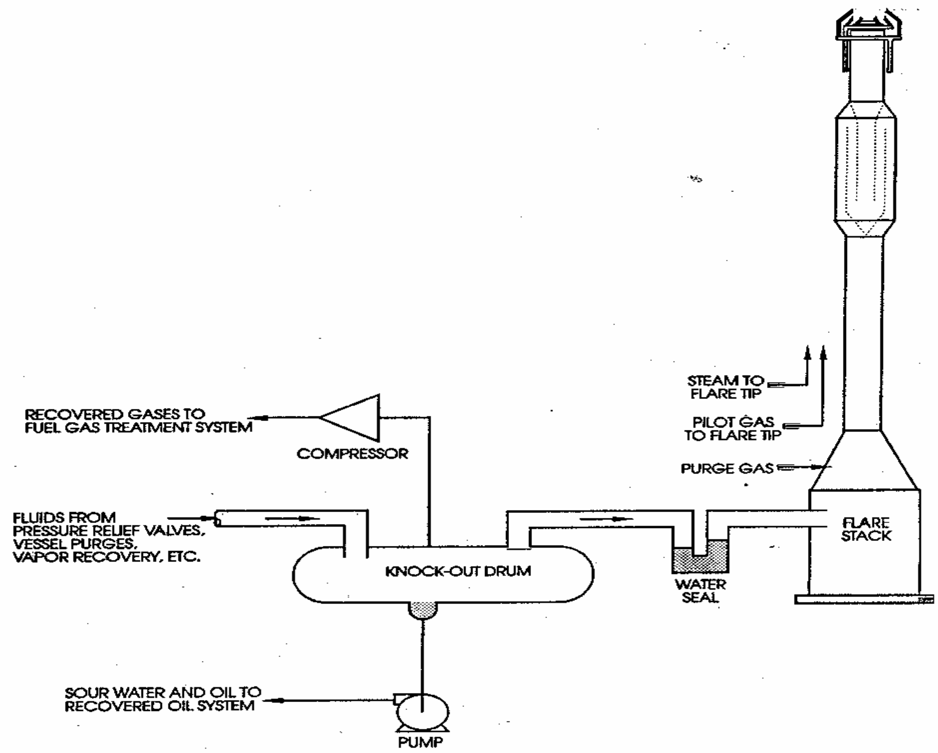


Figure 1. Typical Flare System

The diagram above illustrates a typical flare system. The system is a component of the refinery blowdown system, which delivers gases and liquids to a knockout drum that captures liquids and directs them to the oil recovery stream. The gases are routed to the fuel gas system. The extent to which these gases can be captured depends upon the capacity of the compressors and the energy demand throughout the refinery. A refinery is said to be operating in good balance when gas generation during normal operation is consumed by demand requirements in the refining processes. As a general rule a refinery should be able to capture all of the gases delivered to the blowdown system during normal operations.

### B. Bay Area Air Quality Management District Regulations Applicable to Flares

Several District rules apply to Bay Area refinery flare emissions, varying from the general to source specific requirements. The most recent is Regulation 12, Rule 11: Flare Monitoring at Petroleum Refineries, which was adopted on June 4,

2003. This rule requires refineries to accurately monitor the flow and composition of vent gases combusted in a flare, to calculate total organic (methane and non-methane organic compounds) and sulfur dioxide emissions, to identify reasons for and corrective actions taken to prevent major flaring events, to continuously video record flares subject to the rule, and to report this information to the District in a timely manner.

There are several other District regulations applicable to flare emissions. Regulation 1, Section 301: Public Nuisance, is derived from California Health and Safety Code Section 41700. It prohibits discharges that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property. Regulation 6: Particulate Matter and Visible Emissions, limits the quantity of particulate matter in the atmosphere through limitations on emission rates, concentration, visible emissions and opacity. Regulation 7: Odorous Compounds, places general limitations on odorous substances and specific emission limitations on certain odorous compounds. Regulation 9, Rule 1 and Rule 2: Inorganic Gaseous Pollutants for Sulfur Dioxide and Hydrogen Sulfide, limit ground level concentrations of these pollutants. Regulation 10 - Standards of Performance for New Stationary Sources, incorporates Federal standards for petroleum refineries adopted by reference.

Regulation 8, Rule 2 contains controls for organic compounds from miscellaneous operations. Although this regulation was not intended to apply to refinery flares and has not been enforced against these sources by the District, some confusion regarding the scope of this regulation exists. Staff proposes an amendment to Regulation 8, Rule 2, to clarify that this standard does not apply to refinery flares. This modification will resolve the existing confusion and will avoid any overlap or duplication of requirements applicable to refinery flares once Regulation 12-12 takes effect.

## C. Applicable Federal Regulations

Federal New Source Performance Standards (NSPS) in 40 CFR Part 60, Subpart A, Section 60.18 applies to flares that are used as general control devices. Subpart A specifies design and operational criteria for new and modified flares. The requirements include monitoring to ensure that flares are operated and maintained in conformance with their designs. Flares are required to be monitored for the presence of a pilot flame using a thermocouple or equivalent device, to meet visible emissions standards, to maintain a minimum exit velocity and to meet a net heat content of the gas being combusted by the flare.

In addition, the NSPS limits sulfur oxides from combustion devices installed after June 11, 1973 (40 CFR Part 60, Subpart J, Section 60.104). Flaring of gases released due to upset conditions or as a result of relief valve leakage, startup/shutdown, or other emergency malfunctions is exempt from this standard.

Since 1998, EPA has pursued a coordinated, integrated compliance and enforcement strategy to address Clean Air Act compliance issues at the nation's petroleum refineries.

The National Petroleum Refinery Initiative[1] addresses four compliance and enforcement issues under the federal Clean Air Act based on EPA's determination that these concerns affect the petroleum refining industry nationwide:

- Prevention of Significant Deterioration/New Source Review (NSR);
- New Source Performance Standards (NSPS) for fuel gas combustion devices, including sulfur recovery plants, flares, heaters and boilers;
- Leak Detection and Repair requirements (LDAR); and
- Benzene National Emissions Standards for Hazardous Air Pollutants (BWON).

EPA has embarked on a series of multi-issue/multi-facility settlement negotiations with major petroleum refining companies. The settlements for the Bay Area refineries are specific to each refinery. In general, they include elements specific to catalytic cracking units, sulfur recovery plants and flares. One facility has entered into a settlement agreement that locks in the current status of flare operations. Other settlements seek to improve upon the current operating practices and require implementation schedules for application of the NSPS to all their flares. The details of these settlements are available on EPA's website.

## III. POTENTIAL CONTROL STRATEGIES

Staff considered a variety of strategies to control emissions from flares. The traditional method of controlling emissions generally involves add-on devices that capture or reduce emissions, such as baghouses, scrubbers and low NOx burners. These devices are usually designed for a specific pollutant and emission source. They are not well suited for flares where combustion takes place in open air at the flare tip. Also, these control devices are designed for steady state operation making them inappropriate for a source like a flare that must go from burning only pilot gas to burning thousands of cubic feet of gas per second. Consequently, staff concluded that mandating the use of such devices to control emissions from flares generally is not a workable approach.

[1] EPA Website: http://www.epa.gov/compliance/civil/programs/caa/oil/index.html. October 6th, 2004

Equipment control strategies applicable to refinery flare systems include those that require the installation of new equipment or devices, or physical changes to the flare system. Strategies that might be applied to these systems include:

- additional flare gas compressors to collect gases and prevent flaring;
- addition of gas storage capacity to hold flare gas;
- increasing gas treatment capacities;
- installation of redundant equipment;
- improvement of the reliability of the existing flare gas compressors;
- improvement of flare tip designs.

Pollution prevention strategies are designed to reduce emissions through changes to the operation of the refinery, as opposed to controlling the emissions with add-on equipment. These include:

- balancing the use of combustion devices, flare gas and natural gas consumption;
- developing management practices to minimize vent gases directed to the flare.

Since the beginning of the District's technical assessment efforts in 2002, each refinery has implemented one or more of the strategies described above. The most significant of these involve installation of new flare gas recovery compressors at one refinery. Installation of additional compressor capacity and improvement of the reliability of the existing flare gas compressors at other refineries have also significantly reduced emissions. During the rule development process, refiners have presented trend charts to the District that show up to 60% reduction in emissions since 2002. Bay Area refiners and other participants in the work group meetings convened to assist in rule development generally concur with this assessment, but District staff as well as some members of the public have expressed concern over possible backsliding or failure to maintain those reductions. Staff concluded that the most workable strategy for reducing emissions from flaring is to require refiners to develop individual flare minimization plans. This strategy provides flexibility to maximize emission reductions among significantly different refinery process designs and has been crafted to maintain emission reductions from the practices already instituted by the refiners.

## IV. REGULATORY PROPOSAL

### PROPOSED NEW REGULATION 12, MISCELLANEOUS STANDARDS OF PERFORMANCE, RULE 12: FLARES AT PETROLEUM REFINERIES

### A. THE STANDARD

The proposed regulation is to reduce emissions from flares at petroleum refineries by minimizing the frequency and magnitude of flaring. The proposal includes a standard that prohibits the use of a refinery flare unless the use is consistent with an approved flare minimization plan (“FMP” or “Plan”). The rule includes a requirement to conduct a causal analysis to evaluate a reportable flaring event, i.e., flaring more than 500,000 standard cubic feet per calendar day, to identify the cause (or causes) of the flaring and the means to avoid flaring from that cause in the future if possible. In addition, each facility is required to submit an annual report to the District that includes an evaluation of flaring at volumes less than 500,000 where the calculated sulfur dioxide emissions are greater than 500 pounds. This formal evaluation process will ensure that each refinery makes continuous improvement and progress toward the goal to minimize use of refinery flares.

The standard recognizes that flares are safety devices and includes a provision to allow flaring in an emergency if necessary to prevent an accident, hazard or release of vent gas directly to the atmosphere. To ensure that this exemption is properly applied, the proposed rule relies on the causal analysis to confirm that only flaring necessary for the safe operation of the refinery due to an emergency is allowed under this provision.

While the proposal will not eliminate all non-emergency flaring immediately, it will maintain reductions achieved by Bay Area refiners over the past few years and help identify areas where additional reductions are possible. Refiners will be required to update the plan annually to incorporate newly identified preventive measures to ensure continuous improvement over time and progress toward the goal to minimize use of refinery flares.

Certain flares are exempt from the requirements of the proposed rule. These exemptions apply to any flare that functions as an abatement device used exclusively for the following sources: organic liquid storage and distribution, marine vessel loading terminals, wastewater treatment plants, and pumps. Standards for these sources are specified in other District regulations. They include, but are not limited to abatement efficiency, use of good engineering practices, and emission limits depending on the source operation. Emission data from these source-specific applications are submitted annually to the District. Monitoring and control of these systems are well managed within this existing structure.

### B. ADMINISTRATIVE REQUIREMENTS

The proposal specifies the required elements of a flare minimization plan; lays out the process that the APCO will use to evaluate and approve the FMP and updates; identifies the criteria for submission of the initial FMP and FMP updates; requires investigation into the cause of flaring and timely notification to the APCO; and specifies the procedures for submittal and designation of confidential information.

The FMP is not intended to serve as a permit for a flare or to be included as part of the refinery permit; thus the plan is not subject to provisions of the Health and Safety Code or District rules related to permits. If the plan includes a commitment to install new equipment or to modify existing equipment or to take any other action that would trigger the requirement to obtain a permit from the District, the owner or operator must obtain the required permit in a separate process in accordance with applicable District permitting rules.

Refiners will be required to include all feasible prevention measures in the FMP with a schedule for expeditious implementation of those measures. The elements of a FMP include:

1) A description of and technical information for the refinery flare system and the upstream equipment and processes that send gas to the flare, including all associated monitoring and control equipment;
2) A description of the equipment, processes and procedures previously installed or implemented by the owner or operator within the last five years to reduce the flaring;
3) A description of any equipment, process or procedure to reduce flaring that is planned, but not yet installed or implemented and the schedule for completion;
4) A description and evaluation of prevention measures, including a schedule to expeditiously implement the following:
   - flaring during planned major maintenance activities including startup and shutdown;
   - flaring that may occur due to issues of gas quantity or quality;
   - flaring caused by the recurrent breakdown of equipment;
5) Any other information requested by the Air Pollution Control Officer as necessary to enable determination of compliance with applicable provisions of this rule.

The schedule for submitting a flare minimization plan requires the owner or operator of a flare subject to the rule to submit a complete plan within a year of rule adoption. The proposed rule also requires the refiner to demonstrate that it is making progress toward development and timely submission of a complete plan beginning three months after adoption of the rule and every three months thereafter. Ongoing consultation with the APCO will ensure that any problems are identified and addressed early in the process.

The review and approval process allows time for the APCO to make an administrative determination that the FMP is complete and for facilities to make any corrections to address any deficiencies identified by the APCO before the substantive review of the plan is initiated. Once the APCO determines that the plan addresses all the required elements, it will be made available for 60 days for public review and comment. In addition to the complete plans, the quarterly status reports are public records and will be available for review upon request. In providing a lengthy public review and comment period at the earliest stage of the substantive review of the plans, the process ensures meaningful public participation at the point in time when it will be most informed and most effective.

The District's substantive review process will involve an analysis of the prevention measures considered in the plan, including the completeness of the universe of measures identified, the feasibility determination for those measures, and the reasonableness of implementation schedule for the feasible measures. Following this review, including consideration of written public comment, the APCO will approve the FMP if he determines that it complies with the procedural and substantive requirements of the rule.

The proposed regulation includes language allowing a refiner to use a flare consistent with a complete FMP pending final action by the APCO on the plan. This prohibition is necessary because the prohibition on flaring takes effect November 1, 2006. In the event that the APCO has not taken final action on a refiner's initial FMP submission, rather than further delay implementation of the standard, the rule allows a refiner that has submitted a complete plan to flare in accordance with that plan until the APCO takes final action to approve or disapprove the plan. This provision does not signify that the plan is or will be approved.

Updates of FMPs are required annually to incorporate any significant changes in process equipment or operational procedures related to flares. In addition, an update is required prior to installing or modifying any equipment associated with flare systems that would require a District Authority to Construct. This provision requires refineries to consider the impact on flaring when installing or modifying equipment. After the initial implementation phase of the flare control rule, experience may indicate that the frequency of updates may need adjustment. At that point, District staff will reassess this requirement and may recommend to the Board in a future rulemaking that the frequency of updates could be adjusted to enhance the regulation.

Refiners will also be required to submit an annual report covering less significant flaring with sulfur emissions of concern (greater than 500 pounds per day). This report must identify the reason for flaring and describe any prevention measures considered or implemented. Any prevention measure implemented must be included in the annual update of the FMP. Having refiners examine smaller flaring events serves the continuous improvement goal of the proposed rule.

The proposed rule includes a requirement to notify the District of flaring of gas in excess of 500,000 standard cubic feet per calendar day. This will provide the District and the public with timely information about flare operations. Under current regulations, refiners do not have to notify the District of a flaring event unless there is an indicated excess on a ground level monitor (within 96 hours) or they are seeking breakdown relief under Regulation 1 (immediately, with due regard for safety), which is available for equipment failures but not operator error.

The new proposal would ensure that the District receives information regarding flaring in a timely manner (as soon as possible consistent with safe operation of the refinery) in all cases where the trigger level is exceeded.

The proposed rule requires the flare owner or operator to determine and report the cause of a reportable flaring event. The investigation must be sufficient to determine the primary cause and contributing factors that resulted in flaring. This level of investigation is necessary to ensure that sufficient information is available to develop prevention measures to eliminate the recurrence of avoidable flaring. Currently the flare monitoring rule, Regulation 12, Rule 11, requires reporting of the cause of flaring more than 1 million standard cubic feet of vent gas. Over the past two years, the District has worked closely with refinery personnel preparing those reports to ensure that the investigations conducted are sufficient to provide the information necessary to identify measures to reduce or eliminate such flaring, and that reporting of the results of those investigations is complete. The language of the proposed rule is intended to require that the same level of investigation and reporting is provided for flaring of 500,000 scf under the proposed rule.

## C. MONITORING AND RECORDS

The proposed rule requires continuous monitoring of the water seal. The "knockout water seal drum" performs three functions. First, the drum provides final vapor-liquid disengaging ("knockout") to reduce the potential for liquid carryover up the flare stack. Second, the drum provides a positive barrier or "water seal" between the flare gas header and flare stack. This prevents air in the flare stack from back flowing into the flare gas header and potentially forming an explosive mixture with the hydrocarbon vapors. An inert gas purge (such as nitrogen) may also be added at the base of the flare stack as "sweep gas" to prevent air from back flowing from the flare tip into the flare gas header. Third, the drum provides backpressure on the flare gas header to operate a flare gas recovery compressor. The recovery compressor collects vapors in the flare gas header that would otherwise be combusted in the flare, and returns those vapors to the refinery fuel gas system.[2] The flare owner or operator must record and archive the monitoring data to verify the integrity, or proper operational status, of the flare's water seal. These data are indicators of actual flow to the flare and are measured by flow of makeup water, the water seal height or system pressure. Records of these measurements will assist in verification of calculated emissions and investigations into the cause of flaring.

## D. PROPOSED AMENDMENT TO REGULATION 8, ORGANIC COMPOUNDS, RULE 2: MISCELLANEOUS OPERATIONS

Staff is also proposing to amend Regulation 8, Rule 2, to clarify that flares are not subject to that rule.

[2] Excerpt from Flare Control Workgroup meeting by Clark Hopper, Valero Refinery

## V. EMISSIONS AND EMISSION REDUCTIONS

### A. Emissions

Flares produce air pollutants through two primary mechanisms. The first mechanism is incomplete combustion of a gas stream. Like all combustion devices, flares do not combust all of the fuel directed to them. Combustion efficiency reflects the extent to which the oxidation reactions that occur in combustion are complete reactions converting the gases entering the flare into fully oxidized combustion products. Combustion efficiency may be stated in terms of the extent to which all gases entering the flare are combusted, typically called "overall combustion efficiency" or simply "combustion efficiency", or it may be stated as the efficiency of combustion for some constituent of the flare gas as, for example, "hydrocarbon destruction efficiency."

The second mechanism of pollutant generation is the oxidation of flare gases to form other pollutants. As an example, the gases that are burned in flares typically contain sulfur in varying amounts. Combustion oxidizes these sulfur compounds to form sulfur dioxide, a criteria pollutant. In addition, combustion also produces relatively minor amounts of nitrogen oxides through oxidation of the nitrogen in flare gas or atmospheric nitrogen in combustion air.

Unlike internal combustion devices like engines and turbines, flares combust fuel in the open air. Because combustion products are not contained and emitted through a stack, a duct, or an exhaust pipe, emission measurement is very problematic. Studies can be conducted on scale-model flares under a hood or in a wind tunnel where all combustion products can be captured. Any results for these small flares must be adjusted with scaling factors if they are to be applied to full-size flares. For full-size operating industrial flares, which can have a diameter of four feet or more and a stack height of 100 feet or more, all combustion products cannot be captured and measured. To study emissions from these flares, emissions can be sampled with test probes attached to the stack, a tower, or a crane. Emissions can also be studied using remote sensing technologies like open-path Fourier transform infrared (FTIR) or differential absorption lidar (DIAL). In applying the results of any particular study to a specific flare or flare type, it is important to note any differences in flare design and construction. For example, some flares are simply open pipes, while others, like most refinery flares, have flare tips that are engineered to promote flare vent gas mixing to maximize combustion efficiency. In addition, studies suggest that composition and BTU content of gas burned, gas flow rates, flare operating conditions, and environmental factors like wind speed can affect, to varying extents, the efficiency of flare combustion.

### B. Emission Reductions

While the District staff was studying flare emissions during the TAD period, the Tesoro Refinery was in the process of installing a fuel gas compressor capital improvement project to recover hydrocarbons previously sent to the flare.

Tesoro added an additional 8 million standard cubic feet of recovery capacity to the flare system. This project significantly reduced the volume of gases flared and emissions from flaring. Additionally, all the refineries instituted programs to reduce flaring. Measures implemented include improvements in flare gas compressor reliability, prolonging the interval between major maintenance activities, better process controls during startup and shutdown, source reduction efforts and increased scrutiny of flare gas systems.

### Characterizing Flare Emissions

When the District staff examines the emissions from an air pollution source category, the air pollution emission estimates are typically expressed on an annual average basis (usually tons per day) determined from reported annual process throughput or reported emissions. For large, intermittent emission sources such as refinery flares, this air pollution emission estimation process can be quite challenging. First, there is the cyclic nature of refinery process unit startups and shutdowns. Major refining units at a petroleum refinery typically go five years between turnaround events. Until recently, the District's inventory excluded episodic emissions and Bay Area refineries were not required to measure the quantities of vent gases sent to their flare systems. Therefore, engineering assumptions had to be made to estimate air pollution emissions with limited information. While daily emissions based on annual averages are consistent with standard emission inventory practices, on any given day, actual refinery flare emissions can vary significantly. The day-to-day variation for the period of June 1, 2001 through September 1, 2002, is shown in Figure 2.

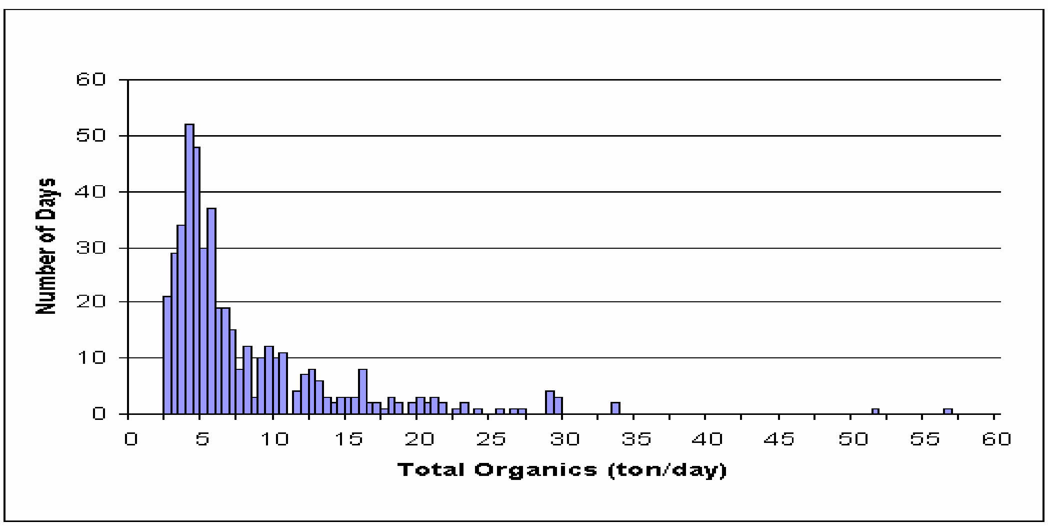


Figure 2. Distribution of Total Organics (tons per day) for the period of June 1, 2001 through September 1, 2002

### Estimating Minimum Flow in Calculating Flare Emissions

In the past, there was a wide variation in the quality of flare monitoring instrumentation. The limit of detection of the instrumentation, the lower limit where vent gas flows could be detected, was not state-of-the-art. Under typical operating situations, water seals prevent refinery gases from venting to a flare until a certain positive pressure is achieved. Once that positive pressure is exceeded, the refinery gases pass through the water seal and then are combusted in the flare.

The potential exists for refinery gases to travel through the water seal at some nominal flow less than the limit of detection for the monitoring instrumentation that was in place during the TAD period.[3] Pressure surging, percolation, inadequate or fluctuating water levels, or water seal design may allow refinery gases to reach the flare. To address concerns about minimum flows that could not be easily detected by the instrumentation, District staff investigated several methods to quantify these emissions. One method was to examine correlations between pressure and level indications at the water seal and the flow meter readings. This method presented limitations for some flare systems. In some instances the pressure measuring devices were located in different locations or at long distances from the water seal, possibly providing measurements that may not represent the actual water seal pressure. Where District staff identified proper installations of the water seal instrumentation, the readings were used to adjust minimum flow data.

Where the District staff identified issues with using water seal data, an alternative method was used. Staff considered the variation in flow meter technologies used during the TAD period, the limits of detection and reliability of the meters, refinery design and operational status that could generate flow to the flare, and then estimated minimum flow emissions at a value equal to 50% of the minimum limit of detection. The total contribution of this minimum flow emission estimate is approximately 1 ton per day of total organic emissions during the flare TAD study period.

**The TAD Emission Estimates**

The emission inventory for refinery flares prior to the Flare Monitoring Rule was included in the Draft December 2002 Technical Assessment Document (TAD). In order to develop emission information for the TAD, the District asked the refineries to submit flow and composition data on their flare systems for the period of January 1, 2001 to August 31, 2002. Some refineries had no monitoring, some used fairly new ultrasonic monitoring systems. To compensate for the wide-variation in the quality of information provided, staff used engineering assumptions and estimated from the information submitted that emissions from flares were approximately 22 tons/day[4] of total organic

[3] Uncertainties regarding minimum flows have been greatly reduced due to improved instrumentation requirements that specify much lower limits of detection. These requirements of Regulation 12, Rule 11 became effective in December 2003.

[4] Assumptions used for that estimate are: 1) emissions are averaged per day of flare use, 2) a flare gas composition of 75% hydrocarbon, and 3) a hydrocarbon molecular weight of 44.

compounds. As described below, subsequent efforts indicate that the TAD significantly overestimated flare emissions.

### Updated TAD Emission Estimates

The initial emission estimate in the flare TAD caused the refineries to question District staff's analysis and the data submittals themselves. District staff spent considerable time working with each refinery to review the available data and replace the overall averages used in the TAD with refinery-specific information that is more representative of each refinery's flare emissions. Since the publishing of the TAD, the refineries have submitted several modifications to their original data submittals and have met with District staff on numerous occasions to clarify their data re-submittals. After evaluating the data re-submittals and developing refinery-specific gas composition and hydrocarbon molecular weight estimates, staff have revised the emission estimate from flares, on an annual average basis, to approximately 8 tons/day of total organic compounds (5 tons/day of non-methane organic compounds) during the TAD period. Additionally, staff now estimates flare emissions for the period of time covered by the TAD to include approximately 20 tons/day of $SO_X$ for the time period June 1, 2001 through September 1, 2002. The daily emissions ranged from 2.5 to 55 tons/day of total organic compounds, and from 6 to 55 tons/day $SO_X$ during the TAD data period.

### Current Flare Emission Estimates

The data from the refineries that have been submitted since adoption of the monitoring rule indicates that flare flows have been reduced compared to flows during the TAD data period. Much of the reduction is due to the installation of additional compressors at the Tesoro refinery and better management practices at all of the refineries. Figure 3 illustrates the trend since implementation of the flow measuring requirement in the flare monitoring rule.

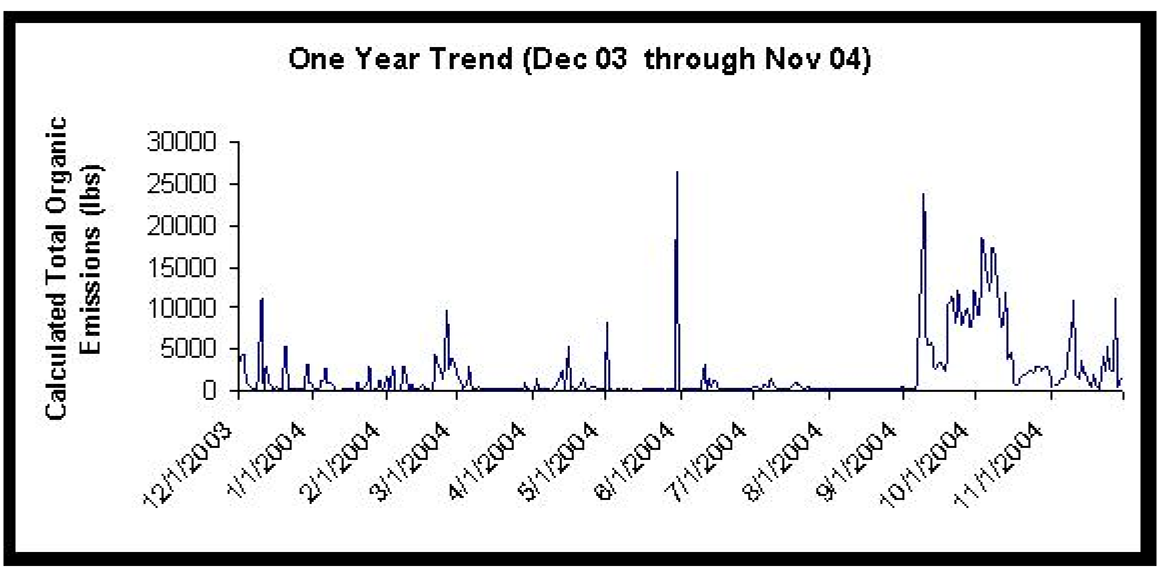


Figure 3. Total Organic Emission Trend

The graph illustrates four characteristics of refinery operations relative to flaring: 1) general operations through May 2004, 2) episodic emissions around June 2004, 3) general operations with emphasis on reductions during July 2004 to September 2004, and 4) major maintenance activities at several refineries from September through November 2004. The values represented in this figure are based on the assumption that no flow occurs when the water seal remains intact or the flow rate is less than 0.5 feet per second (lower limit of accuracy for ultrasonic flow meters).

Staff evaluated the reported data and characterized emissions using the assumption that any positive reading represents flow to the flare tip. Figure 3 illustrates the breakdown per facility for total organic emissions from vent, pilot and purge gas on an average daily basis for 2004.

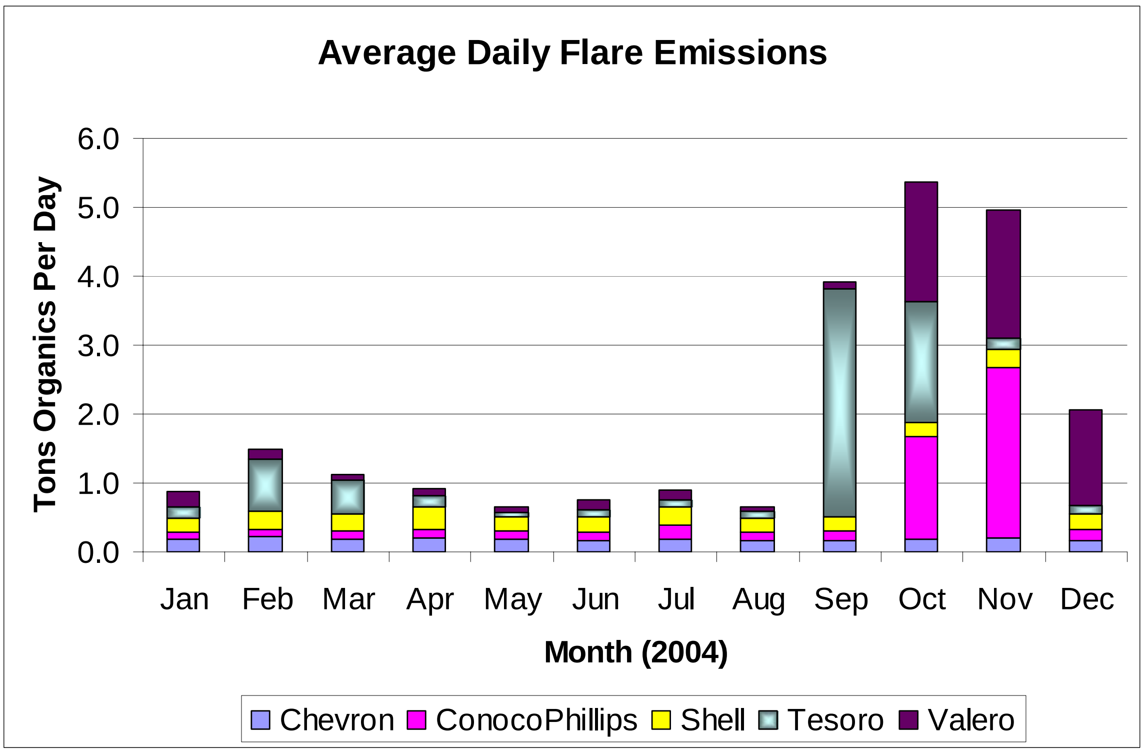


Figure 4. Average Daily Total Organic Emissions

The emission estimate from flares, on an average daily basis for all facilities in 2004, was approximately 2 tons/day of total organic compounds (approximately 1.5 tons/day of non-methane organic compounds). A monthly distribution for each facility is illustrated in Figure 4. The daily emissions ranged from 0 to 12 tons/day of total organic compounds. For sulfur dioxide, the average daily basis was approximately 4 tons/day and ranged from 0 to 61 tons/day.

## VI. ECONOMIC IMPACTS

### A. Introduction

This section discusses the estimated costs associated with the proposed rule. The California Health & Safety Code states, in part, that districts shall endeavor to achieve and maintain state ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide by the earliest practicable date. In developing regulations to achieve this objective, districts shall consider the cost-effectiveness of their air quality programs, rules, regulations, and enforcement practices in addition to other relevant factors, and shall strive to achieve the most efficient methods of air pollution control. However, priority shall be placed upon expeditious progress toward the goal of healthful air.[5]

A number of unique factors come into play in the analysis of the cost of the proposed flare control rule. First, many of the benefits of the flare control rule, at least those expected in the early years of implementation, have already been achieved and the associated costs have been incurred by the refineries. Second, a number of the controls refineries will implement to reduce flaring will provide additional operational or economic benefits to the refinery operations, thus offsetting costs. For this reason, the costs of compliance presented below provide a very conservative picture.

Non-typical factors affect the cost-effectiveness analysis as well. For example, because emissions from flares are episodic, the use of annualized emissions provides a much less meaningful picture of cost effectiveness for the proposed flare control rule than for a standard control measure to control emissions from more stable sources or operations. In fact, the reduction or elimination of flaring will have far more significant benefits during a day when flaring would have occurred – particularly a day when the amount of gas flared is at the high end of the events that have occurred historically and can be expected to occur in the future – than during an hypothetical day with annualized flaring emissions.

Moreover, because the proposed rule requires refineries to develop the prevention measures they will implement to reduce flaring, the regulation ensures that the most cost effective means for achieving this goal will be implemented. That is, it is reasonable to expect that each refinery, given the flexibility provided by the structure of the rule, will include the most cost-effective prevention measures available for each iteration of the flare minimization plan, thus insuring the continuous improvement at the least cost.

### B. Discussion of Elements

#### Development of a Flare Minimization Plan

Staff estimated the cost of developing the FMP document based on the workload

[5] California Health and Safety Code Section 40910

encountered during development of materials mandated by the Contra Costa County Safety Ordinance. The safety ordinance requires a hazard analysis for each process unit. This structure is nearly identical to the FMP, although the level of detail in the analysis would be substantially less under the proposed rule. The difference is due to the narrower focus of the FMP; it targets flare minimization while the hazard analysis required consideration of the "entire universe" of potential impacts. The approximate cost of a hazard analysis was $12,000 per process unit. This assumes 3.5 refinery staff at $35 per hour, a professional facilitator to assist in developing the analysis at $150 per hour, and 32 days[6] to develop the report. [7] Applying these values to a medium sized refinery, the cost for developing a FMP is approximately $100,000.

**Implementation of Prevention Measures**

The costs associated with implementing a flare minimization plan will vary depending on the status of the individual flare systems. Some systems may need only minor adjustments to existing operating procedures while others may need substantial modifications to incorporate design changes.

The precise costs for implementing a plan are difficult to determine prior to evaluating the specific elements of the plan. Refiners did not provide this level of detail during the workgroup process due to concerns over liability and trade secret information. Discussions with refiners regarding prevention measures already implemented or planned for study have lead to a general consensus that $20,000,000 represents a fair estimate of the high end of the range of costs.

To demonstrate the range of cost, staff considered alternatives to the high end, for example where a facility has already achieved the most feasible level of emission reductions. Staff estimated the range to be from $100,000 for minor modifications to potentially well over $20,000,000 for systems needing additional recovery and scrubbing capacities.

**Notification of Flaring**

The trigger level for this requirement is 500,000 standard cubic feet in any calendar day. The cost is dependant on the number of flaring days exceeding the volume trigger. The data from the flare monitoring monthly reports shows 243 occurrences where the volume of vent gas flared was greater than 500,000 standard cubic feet per day in 2004 for all facilities[8]. Based on this information and assuming 15 minutes per call at a rate of $30.00 per person hour, staff estimated the total cost for all facilities of notifying the District and providing the necessary information would be approximately $1,800 for all facilities per year. The cost for an individual refinery is expected to be much less, and in some cases zero cost.[9]

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[6] Excludes administrative review and approval.
[7] Based on phone conversations with affected refineries.
[8] The majority, 88 occurrences, are from one flare with the same reported cause of flaring.
[9] Maintaining levels indicated in the 2004 Flare Monitoring Reports

**Determination and Reporting of Cause**

The cost for this requirement is dependant on the number of reportable flaring events and the complexity of the event. The data from the flare monitoring monthly reports shows 243 occurrences where the volume of vent gas flared was greater than 500,000 standard cubic feet per day (MMSCFD) in 2004 for all facilities. Regulation 12, Rule 11: Flare Monitoring at Petroleum Refineries requires investigation into and reporting of flaring events. The new requirement expands the scope of events requiring investigation because the trigger drops from 1,000,000 to 500,000, and it requires greater detail for all reportable events, including a thorough investigation into the cause and contributing factors, a description of prevention measures considered and justification for those not implemented, and identification of issues that require the use of a flare including safety considerations and regulatory mandates. To adjust for these differences, staff assumed an increase in the hourly rate to $50.00 per hour for 12 hours per event. The result was an estimate of approximately $145,800 for all facilities per year. Again the cost for an individual refinery will be much less. Moreover, staff expects this value to drop in time as facilities minimize the number of events and become more proficient in investigations.

**Annual Reports and Updates**

The proposed rule requires an annual report that summarizes flare usage when the flow rate is less than 500,000 standard cubic feet per day where the sulfur dioxide emissions are greater than 500 pounds. Flare monitoring data for 2004 indicates an additional 20 events for all facilities meeting the reporting criteria will occur. Additionally, the proposed rule requires the FMP to be updated annually to incorporate any new prevention measures identified as a result of the causal analysis and annual updates. Staff expects the complexity of these reports to be far less than the FMPs. Based on these factors staff estimates the annual reports and updates will cost less than one third of the cost of the FMP, or $30,000 for each.

**Water Seal Integrity**

The costs associated with this provision are dependant on the need to upgrade current monitoring systems on water seals. Several refineries have systems that are already configured for continuous monitoring and recording. Other systems would need upgrades, including water level and drum pressure measuring devices, hardwiring to data recording systems, and administrative procedures. For those systems that require upgrades, about half, the primary cost is hard-wiring to the control room and is a function of the distance. The cost might be reduced by choosing an alternative such as wireless, however, confidence in this technology is not known. Staff considered a system that would require only minor upgrades and arrived at an estimate of $100,000 for the first year. Annual costs thereafter include periodic maintenance and data handling. This cost was estimated at $3,000 per year.

## C. Cost Analysis

The proposed rule is intended to reduce emissions from flares by minimizing the frequency and magnitude of flaring. This is accomplished by requiring each refinery to develop a flare minimization plan (FMP). The primary function of the plan is to set a schedule for implementing feasible flaring prevention measures. Refiners will be required to investigate the cause of all significant flaring and to update the FMP annually to incorporate the means identified to prevent recurrence. The initial FMP will prevent backsliding from those emission reductions that have already occurred by codifying those efforts as part of the plan.

Table 1 shows the costs associated with the proposed rule. Costs for individual refineries will vary significantly depending on the number and complexity of flares and flare systems and the amount of reduction already achieved. Following the table is a discussion of each provision. The provisions listed in the table include both one-time and recurring costs. The non-recurring costs are those associated with development of the FMP and the upgrades for water seal monitoring. About half of the monitoring systems would need an upgrade. The recurring costs in Table 1 are based on the scenario where significant flaring has occurred. These costs are likely to decrease in time as the level of flaring is minimized.

**Table 1. Estimated Costs, First Year**

| Provision | Estimated Cost | Assumptions |
|---|---|---|
| FMP Development[a] | 100,000 | 1/3 of an average hazard analysis[b] for a medium size facility |
| Prevention Measure (High End) | 1,900,000 | $20,000,000 project amortized over 20 year lifespan at 7% |
| FMP Updates | 30,000 | Approximately 1/3 of a full FMP |
| Notification of Flaring | 500 | 67 notifications[c] |
| Causal Analysis | 40,200 | $50/hr for 12 hours per event for 67 events[d] |
| Annual Reports | 30,000 | Approximately1/3 of a full FMP |
| Water Seal Monitoring | 9,000[e] | Partial upgrade; amortized over 20 year lifespan at 7% |

[a] One time cost
[b] Hazop for the Contra Costa County Safety Ordinance
[c] Data from monthly reporting pursuant to the District's Flare Monitoring Rule
[d] Time based on pilot program during technical assessment, 2001
[e] Includes $3,000 for direct annual or recurring cost, and $6,000 non-recurring upgrade costs

Based on the example given in Table 1, the cost for a hypothetical refinery that must undertake a significant capital improvement project, such as the addition of compressor capacity, is approximately $2,100,000 for the first year. The total cost for the proposed rule would not be this calculated cost times the number of flare systems. Each flare system is unique and would have a unique set of feasible prevention measures at a variety of costs. However, this hypothetical provides an example approaching the upper bound of the cost range. Costs for a typical Bay Area flare is expected to be less.

As an alternative scenario staff considered a refinery that only implements an enhanced I&M program or other type of operational control, or is able to demonstrate no flare usage and therefore only needs to memorialize existing practices. Using Table 1 provisions for FMP updates, annual reports and recurring costs for monitoring, the recurring cost is approximately $63,000. This hypothetical provides the lower bound of the cost range.

## COST EFFECTIVENESS ESTIMATE

Even though a traditional cost-effectiveness analysis is expected to be conservative due to various factors as discussed above, i.e., the use of average daily emissions, which tend to underestimate expected emission reductions from preventing a period of flaring, and the flexibility built into the proposed rule, which is expected to result in refiners selecting the most cost-effective means of reducing emissions from flaring, the following analysis – based on the traditional model – still supports a finding that the proposed rule is cost effective.

### Case Studies

To demonstrate the cost effectiveness of equipment modifications, staff considered two scenarios that have already been implemented. Both involve modifications to the vent gas recovery compressors. The first involved a reliability study and implementation of measures used to improve performance of existing compressors. The second involved an increase in the recovery capacity of the compressors. Although the cost of implementation is similar – approximately $20,000,000 – the reductions achieved differ significantly. Table 2 shows the estimated emissions over the time period for these projects.

**Table 2. Estimated Annualized Average Emissions[a]**

| Facility | Year | Organics[b] (tons/day) | SOx[c] (tons/day) | CO[d] (tons/day) | NOx[d] (tons/day) | PM[e] (tons/day) | Total |
|---|---|---|---|---|---|---|---|
| **Case 1** | 2002 | 0.73 | 0.95 | 0.11 | 0.06 | 0.01 | 1.86 |
| | 2003 | 0.18 | 0.41 | 0.04 | 0.02 | 0.01 | 0.66 |
| **Case 2** | 2002 | 3.93 | 13.6 | 0.59 | 0.59 | 0.09 | 18.8 |
| | 2003 | 0.32 | 2.21 | 0.05 | 0.03 | 0.01 | 2.61 |

[a] Until the flare monitoring rule was adopted (June 2003) Bay Area refineries were not required to measure the quantities of vent gases sent to their flare systems. Therefore, engineering assumptions had to be made to estimate air pollution emissions with limited information.

[b] Total organics including vent, pilot and purge gas. Methane varies significantly; average content

is ~ 30%
[c] Assumes all sulfur as hydrogen sulfide oxidized to sulfur dioxide
[d] Calculated using AP42 emission factors
[e] Calculated using AP42 emission factors assuming no visible emissions

For the first case, the total emissions as indicated in Table 2 decreased from a total of 1.86 tons per day prior to the reliability study, to a total of 0.66 tons per day, after implementing the reliability improvements. This represents a 65% reduction. For the second case, the total emissions decreased from 18.8 tpd to 2.61 tpd after the equipment upgrade. This represents approximately an 86% reduction.

At a twenty year amortized cost of 7%, equipment costs for each of the two case studies is $1,921,592 per year. The cost effectiveness for Case 1 is about $40,000 per ton for total organics, $9600 per ton for SOx, and $4,300 per ton for all pollutants combined. The cost effectiveness for Case 2 is about $1,580 per ton for total organics, $443 per ton for SOx, and $341 per ton for all pollutants combined. Despite the many factors that indicate these estimates are conservative, this analysis demonstrates that the proposed rule is cost effective for all pollutants and exceeds the range for hydrocarbon only in comparison to Best Available Control Technology guidelines.

Tables 3 and 4 include the cost of the administrative requirements of the rule with the equipment costs. Table 3 shows the estimated costs using as an example a facility that has performed a hazard analysis for Contra Costa County and has upgraded the flare gas recovery system. It is intended to represent a more costly prevention measure. Table 4 gives an example of a less costly measure in which startup and shutdown schedule adjustments result in a reduction of flaring and add lost production.

**Table 3. Estimated Costs for High Cost Prevention Measure**

| Provision | Estimated Cost ($/Year) | Assumptions |
|---|---|---|
| FMP Development | 100,000 | 1/3 of an average hazard analysis for a medium size facility |
| Prevention Measure | 1,921,592 | Flare gas recovery compressor project; amortized over 20 years at 7% |
| FMP Updates | 30,000 | 1/3 of a full FMP |
| Notification of Flaring | 500 | 67 notifications |
| Causal Analysis | 40,200 | $50/hr for 12 hours per event for 67 events |
| Annual Reports | 10,950 | Enhanced daily log:1 hr/day at $30/hour for 365 days |
| Monitoring | 9,000 | Partial upgrade; amortized over 20 years at 7% |

It is important to note that all items except the FMP development and the prevention measure are recurring costs that will decrease in time. The estimated cost of the prevention measure listed in Table 3 is for a specific system and would be substantially reduced after implementation. The cost could vary significantly for different systems and should not be assumed to be the same for any other system. However, recovery upgrade projects at other facilities were cited in this general price range.

**Table 4. Estimated Costs for a Low Cost Prevention Measure**

| Provision | Estimated Cost ($/Year) | Assumptions |
|---|---|---|
| FMP Development | 100,000 | 1/3 of an average hazard analysis for a medium size facility |
| Prevention Measure | 121,945 | Startup/Shutdown schedule adjustments including lost production costs; 5 year lifespan |
| FMP Updates | 30,000 | Approximately 1/3 of a full FMP |
| Notification of Flaring | 50 | 7 notifications |
| Causal Analysis | 4,200 | $50/hr for 12 hours per event for 7 events |
| Annual Reports | 10,950 | Enhanced daily log:1 hr/day at $30/hour for 365 days |
| Monitoring | 3,000 | No upgrades |

The cost effectiveness for the high cost prevention measure would be $1,603 per ton for the first year for all pollutants, $1,527 per ton thereafter. For the low cost prevention measure the cost effectiveness would be $1,298 per ton for all pollutants, and $818 per ton thereafter.

### D. Socioeconomic Impacts

Section 40728.5 of the Health and Safety Code requires an air district to assess the socioeconomic impacts of the adoption, amendment, or repeal of a rule if the rule is one that "will significantly affect air quality or emissions limitations." Applied Economic Development, Berkeley, California, has prepared a socioeconomic analysis. The analysis concludes that the affected refineries should be able to absorb the costs of compliance with the proposed rule without significant economic dislocation or loss of jobs. The socioeconomic analysis is attached as Appendix A.

### E. Incremental Costs

Under California Health and Safety Code Section 40920.6, the District is required to perform an incremental cost analysis for a proposed rule under certain circumstances. To perform this analysis, the District must (1) identify one or more control options achieving the emission reduction objectives for the proposed rule, (2) determine the cost effectiveness for each option, and (3) calculate the incremental cost effectiveness for each option. To determine incremental costs, the District must "calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option."

To determine the incremental cost, staff used a case study (Case 2, Table 2) that considers reductions achieved since installation of capital equipment, and future implementation of a potential control option with a corresponding emission reduction based on historical reductions. The capital equipment installed was two new compressors rated at 4 MMSCFD each and was operational in the first quarter of 2003. The estimated cost was $20,000,000.[10] The emission inventory for NMHC[11] in tons per day, based on flare monitoring data received during the technical assessment and in accordance with the flare monitoring rule, indicated 3.07, 0.25 and 0.45 for 2002, 2003 and 2004, respectively.

The NMHC reduction in 2003 was 2.82 tons per day, or 92%. Assuming comparable reductions[12] and a potential control option with a cost of $40,000,000, the incremental cost is calculated at approximately $8,300,000. This is an example of a "most costly" scenario. For comparison, assuming the same reductions at a lower cost, for example $500,000[13], the incremental cost is calculated at approximately $207,500.

The proposed concept is to evaluate each flare system to identify where reductions may be available for that particular system, develop a plan most suited for that system, then operate in a manner consistent with the plan. It is dissimilar to traditional regulatory mandates due to the variation of the flare systems and the emission reduction potential for each of those systems. The incremental cost is specific to the individual system rather than applicable to the entire source category. This approach adds greater certainty to the selection of the most feasible measure.

### F. District Staff Impacts

Implementing this rule will require a total of 1.5 FTE at an average staff level of a Senior Engineer. The actual personnel involved will likely include Senior and Supervising Inspectors assigned to refineries, a Principal Specialist and a Principal Engineer to coordinate review of flare minimization plans, and Source Test Engineers and Technicians to review water seal monitoring systems.

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[10] This figure represents an estimate of the total project costs. A breakdown of costs was not provided, is likely to be less and is not applicable to any other project.
[11] Methane was approximately 22% of the total organic emissions.
[12] This assumption recognizes that flaring will not be eliminated.
[13] This value was stated during workgroup meetings and is an estimate for one day of loss in production, for example to extend a startup.

Causal analysis review should take no more than an hour for 90% of the flaring events, however, for the 10% of the events (24, based on 2004 flaring events) that are large, emergency events, a week of an inspector's time and several days of an engineer's time may be needed. A Senior Engineer level (top step) costs $149,000 at 1.5 FTE. In addition, management review, particularly for first year plans and major event analyses, will add to the costs. Management staff involvement would include personnel from the Enforcement, Engineering and Technical Divisions, with some oversight by the Deputy APCOs and the APCO. The total cost will exceed $250,000.

On June 15, the Board adopted a schedule of fees that shifted refinery flares from Schedule G1 to Schedule 3, which will result in approximately an additional $178,000 in revenue from these sources. The calculations above are only for the increase in costs for this proposal. Significant additional costs have been incurred over the last several years from investigation of complaints and implementation of the flare monitoring rule (Reg. 12, Rule 11). One Air Quality Specialist currently allocates 40% of his time to quality assurance of the monitoring reports and coordinating refinery work groups in the Enforcement Division, at a cost of $34,000.

## VII. ENVIRONMENTAL IMPACTS

Pursuant to the California Environmental Quality Act, the District's environmental consultant, Environmental Audit, Inc., has prepared an Environmental Impact Report (EIR) for the proposed rule to determine whether it would result in any significant environmental impacts. The EIR concludes that the proposed rule would not have any adverse impacts. The EIR including comments and responses is attached as Appendix B.

## VIII. REGULATORY IMPACTS

Section 40727.2 of the Health and Safety Code requires an air district, in adopting, amending, or repealing an air district regulation, to identify existing federal and district air pollution control requirements for the equipment or source type affected by the proposed change in district rules. The district must then note any differences between these existing requirements and the requirements imposed by the proposed change. Table 5 is a matrix of the proposed rule, existing Bay Area regulations, and federal requirements for flares.

**Table 5. Regulatory Matrix**

| Agency | Regulation | Control/Performance Requirements | Monitoring Requirements | Emission Limitations |
|---|---|---|---|---|
| BAAQMD | Reg. 2, Rule 6 (Title V permit) | Specific to facility and source | Specific to facility and source | Throughput (lbs/hr vent gas), Visible emissions |
| BAAQMD | Proposed Reg. 12, Rule 12 | Prohibits flaring without or not in accordance with a flare minimization plan. | Water seal pressure and level. | Minimize Flaring |
| EPA | 40 CFR 60.18 (applies to flares subject to NSPS) | Pilot flame present at all times, heat content, maximum tip velocity, composition | Presence of flame, heating value | Smokeless capacity |
| EPA | Subpart J | Limits on gases other than those due to malfunction, relief valve leakage and emergencies. | Hydrogen sulfide in fuel gas | Hydrogen sulfide in fuel gas |

**Federal Requirements**

Federal New Source Performance Standards (NSPS) in 40 CFR Part 60, Subpart A, Section 60.18 apply to flares that are used as general control devices. They specify design and operational criteria for new and modified flares. The requirements include monitoring to ensure that flares are operated and maintained in conformance with their designs. Flares are required to be monitored for the presence of a pilot flame using a thermocouple or equivalent device. Other parameters to be monitored include visible emissions, exit velocity and net heat content of the gas being combusted by the flare.

In addition, the NSPS limit sulfur oxides in vent gases combusted in a flare installed after June 11, 1973 (40 CFR Part 60, Subpart J, Section 60.104). Upset gases or fuel gas that is flared as a result of relief valve leakage or other emergency malfunctions is exempt from the standard. As discussed above, EPA has entered into consent decrees with all Bay Area refineries. These decrees, among other requirements, contain increments of progress for the application of NSPS standards to all flares.

## IX. RULE DEVELOPMENT PROCESS

As part of the development of this regulation staff have undertaken an extensive rule development process in order to receive input from all affected parties. These efforts included the formation of a technical working group, public meetings, workshops and presentations to the District Board Stationary Source Committee. The following is a discussion of these efforts.

### A. Technical Working Group

To assist in the TAD and rule development process a technical working group was formed that included representatives from Industry, Communities for a Better Environment (CBE), California Air Resources Board, and District staff. This workgroup met routinely to discuss technical issues. The issues discussed include the significance of emission levels, potential control strategies, legal requirements for rule development and sharing of confidential information, current flare system monitoring, procedures to determine the cause of flaring, and the most effective means to distribute information to the public. The following is a summary of those meetings:

<u>August 7, December 10, and January 13, 2003</u>
The topics included the Technical Assessment Document (TAD) update, flare use categories and control strategies, and the rule development schedule. The discussion focused on the basis to update the District's initial assessment, how to identify the causes of flaring and how to develop appropriate control strategies.

<u>March 19, 2004</u>
The topics included technical assessment of emissions and flare control proposals. The discussion of the basis for updating the District's initial assessment, how to identify the cause of flaring and develop appropriate control strategies was continued from the previous meeting.

<u>June 11, 2004</u>
The topics included status update and timelines, final TAD revision, flare control proposals, definitions, and web casting. Staff presented a tentative schedule for rule development, an updated assessment of the flare TAD, proposals for controlling emissions from flares, definitions of various terms and text based web casting of flare monitoring data.

<u>November 4, 2004</u>
A professional facilitator was added to the workgroup for this and subsequent meetings. The topics included agenda review, flare control rule status, workgroup discussion ground rules, possible categories of flaring events, and definitions of terms. The discussion focused on meeting process, developing categories for the cause of flaring, and using terms consistently.

December 2, 2004

This meeting consisted of individual presentations by the Western States Petroleum Association, Communities for a Better Environment, and the District. The focus was on the procedure to evaluate the significance of flare events and the appropriate action to establish control strategies.

December 14, 2004

The topics included flaring information for determining cause, verification of low flow regimes, water seal integrity, and characterization of flare gas composition. The discussion focused on root cause analysis as the standard for investigating the reasons for flaring, monitoring devices on water seals, and current sampling protocols.

January 11, 2005

Workgroup members discussed the purpose, approach and essential elements of a flare control rule. A list of findings/issues was developed, with general agreement that a management plan for reducing emissions from flares is appropriate.

February 8, 2005

The meeting focused on two issues that had been developed at the prior meeting; thresholds for the casual analysis and expectations for a management plan.

The group reached consensus on the need to meet individually for future meetings. Subsequently, staff and District management met with representatives of the refineries, the Western States Petroleum Association, Communities for a Better Environment and the Plumbers and Steamfitters Local 342. In addition, numerous phone conversations between District staff and individual refineries occurred to gather information on the specific designs and operating practices for each flare system.

**B. Stationary Source Committee Reports**

At the flare monitoring rule adoption hearing, staff committed to provide an update to the Stationary Source Committee eighteen months after rule adoption. At the November 11, 2004 meeting, staff provided a report on the implementation of Regulation 12, Rule 11: Flare Monitoring at Petroleum Refineries, flare emissions information, and flare control rule development progress. In addition to staff's presentation, WSPA and CBE gave presentations. The minutes of that meeting can be found on the District's web site at (http://www.baaqmd.gov/brd/brddirectors/agendas_minutes_2004.asp).

Three additional presentations were given to the Stationary Source Committee: one on January 24, 2005, one on March 28, 2005, and one on May 23, 2005. The presentations provided progress reports regarding rule development and accomplishments since November 11, 2004, the last Stationary Source meeting.

The reports included background materials, an update on emission characterizations, workgroup progress, reports on the public workshops, response to public comments, and plans for finalizing this rule development process.

**C. Public Meetings and Workshops**

The staff of the Bay Area Air Quality Management District conducted public meetings in four different locations to discuss flare systems at petroleum refineries. The purpose of the meetings was to present information on the flare control measure and to receive input. These evening meetings were held on October 23, 2003 at the Crockett Community Center, October 29, 2003 at the Maple Hall Civic Center in San Pablo, November 5, 2003 at the Benicia City Council Chambers, and November 6, 2003 at the Martinez City Council Chambers. The input provided by the public was used in developing a draft rule.

A draft rule was presented at two public workshops held in Martinez on March 16, 2005 and in Richmond on March 24, 2005. Both meetings were held in the evening and combined were attended by over 200 people. The two core issues raised at the workshops concerned the perceived lack of clearly defined standards and the desire to have the rule provide an opportunity for public comment on the flare minimization plans. Staff made modifications to the proposed rule to address both of these concerns.

Written comments on the draft rule were received from the Western States Petroleum Association, Communities for a Better Environment, the Plumbers and Steamfitters Local 342, American Lung Association, Valero Refinery, EPA, ARB, Global Community Monitor, Clean Water Action and Community Labor Refinery Tracking Committee, Ohio Citizen Action, Louisiana Bucket Brigade, Inform Public Relations, Center for Environmental Health, Pamela Calvert, Bob Craft, Norma Wallace, Molly Boggs, and Peter Hendricks. In addition, one phone message was received from Shirley Butt. All were supportive of the District's effort to develop a flare control rule and made suggestions for improvement. Staff made modifications to the proposed rule to address the comments and suggestions.

This proposed rule was made available for public comment and posted on the District's web site. Staff has continued to meet with workgroup members to discuss the proposed rule. Written comments and staff responses will be contained in an addendum to this Staff Report (Appendix C), which will be prepared following the July 12, 2005 close of the public comment period on the regulatory proposals.

Appendix D contains a matrix of the timeline for the FMP submittal, public comment, and review and approval process.

## X. CONCLUSION

The proposed rule, Regulation 12, Rule 12: Flares at Petroleum Refineries, is intended to limit the amount of emissions released from flares by limiting the frequency and magnitude of flaring events. Pursuant to Health and Safety Code Section 40727, new regulations must meet necessity, authority, clarity, consistency, non-duplicity and reference. The proposed regulation is:

- Necessary to protect public health by reducing ozone precursor emissions. The amendments also reduce exposures to toxic air contaminants, sulfur dioxide and particulate matter.

- Authorized by California Health and Safety Code Section 40702.

- Clear, in that the new regulation specifically delineates the affected industry, compliance options and administrative requirements for industry subject to this rule,

- Consistent with other District rules, and not in conflict with state or federal law,

- Non-duplicative of other statutes, rules or regulations, and

- The proposed regulation properly references the applicable District rules and test methods and does not reference other existing law.

An Environmental Impact Report prepared by Environmental Audit, Inc., concludes that there will be no adverse environmental impacts from adoption of the proposed rule. A socioeconomic analysis prepared by Applied Development Economics concludes that the affected refineries will be able to absorb the costs of compliance with the proposed rule without economic dislocation or loss of jobs.

Staff recommends the adoption of the proposed new Regulation 12: Miscellaneous Standards of Performance, Rule 12: Flares at Petroleum Refineries, the proposed amendment to Regulation 8: Organic Compounds, Rule 2: Miscellaneous Operations, and certification of the Final Environmental Impact Report.

## REFERENCES


1. United States Environmental Protection Agency, “Refinery Initiative”, EPA Website: http://www.epa.gov/compliance/civil/programs/caa/oil/index.html. Last updated on Wednesday, October 6th, 2004

2. Bay Area Air Quality Management District, “Draft Technical Assessment Document-Flares”, December 2002

3. Bay Area Air Quality Management District, “Regulation 12, Rule 11: Flare Monitoring at Petroleum Refineries” Adopted June 4, 2003

4. California Health and Safety Code, CHAPTER 10, “District Plans To Attain State Ambient Air Quality Standards”, Section 40910