Rule 4311 (Flares)
Further Study

2014

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San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

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I. EXECUTIVE SUMMARY

The San Joaquin Valley air basin (Valley) faces unique and unprecedented air quality challenges in attaining the federal air quality standards (also called National Ambient Air Quality Standards, or NAAQS). This further study report, analyzing District Rule 4311 (Flares), is a continuation of the San Joaquin Valley Unified Air Pollution Control District's (District) mission to improve the Valley's air quality through proactive efforts to identify and enforce feasible emission reduction opportunities.

Flares are employed to serve two basic functions: as an emission control device for VOC emissions, and/or as a safety device used in emergency situations, which include any situation or condition arising from a sudden and reasonably unforeseeable and unpreventable event beyond the control of the operator and requiring immediate corrective action to restore safe operation at the facility or site.

District Rule 4311 was adopted in June 2002 to reduce emissions from flaring activities. Subsequent amendments to Rule 4311 have made it one of the most stringent rules in the nation for flaring activities. The most recent amendments, in June 2009, incorporated new requirements for operators to submit annual reports of reportable flaring events and annual gas flow from each flare subject to rule requirements, submit flare minimization plans (FMP) to the District, obtain approval of those FMPs, and operate under the conditions specified in the approved FMPs. The purpose of this report is to summarize results of a District analysis of FMPs and annual reports submitted to the District as a result of the 2009 rule amendments and to make a recommendation for future rule actions, if any, as a result of the study.

Through this further study action, the District reviewed data from FMPs, annual monitoring reports, and reportable flaring events submitted to the District in July 2012 accounting for the fiscal year of 2011/2012, and reviewed New Source Performance Standards (NSPS) promulgated by EPA in 2012. In addition to the flare information review committed to in the plans, the District also reviewed the flare emission inventory in the Valley and analogous rules in other air districts in California. As a result of this extensive effort, the District made the following findings.

1. **Flare Emissions Contribute a Small Percentage to the Overall NOx Emissions Inventory**

   A review of the flare emission inventory indicates that emissions from all flares operating in the Valley, regardless of permit status and requirements, contributed to 0.14% of the total annual NOx emitted from all Valley stationary and area sources in 2012. This is in part because these control devices are primarily engineered for emergency operation during process upsets and emergency situations and achieve 98% destruction efficiency when operated properly[1].

2. **Rule 4311 is as Stringent as Other Air Districts' Rules**

   District analysis also confirmed that Rule 4311 is as stringent as similar rules in South Coast Air Quality Management District (SCAQMD), Bay Area Air Quality Management District (BAAQMD), Ventura County Air Pollution Control District (VCAPCD), and Santa Barbara County Air Pollution Control District (SBCAPCD). Those analogous rules have some minor differences in requirements, due to the differences in types of facilities and sizes of flares, which would not result in additional emission reductions if implemented in the Valley. Furthermore, Rule 4311 has been confirmed by EPA in its most recent approval of amendments to the rule as satisfying Reasonable Available Control Technology (RACT) requirements.

3. **Flare Minimization Plans Contain Feasible Measures to Reduce Flaring**

   In the Valley, 95 flares are either operated at petroleum refineries or have large enough flaring capacities to trigger the FMP requirements of Rule 4311. These flares are operated in multiple industries, including the oil and gas industry, wastewater treatment, and wine and cheese production. Operators with FMPs are including feasible measures in the FMPs and actively taking steps to reduce flaring at their facilities.

4. **Annual Monitoring Reports Assist with Enforceability**

   Flares are subject to annual monitoring report requirements if the flare is subject to flare minimization plan requirements and can produce a reportable flaring event. Many Valley operators of flares are proactive in reducing flaring emissions by including Specific Limiting Conditions (SLCs) to their permits that limit the amount of flaring possible by their flare; consequently many of the 95 flares subject to FMP requirements are not required to submit annual monitoring reports. For the 2011-2012 reporting period, 55 reports were submitted to the District and analyzed for this further study report. These

[1] U.S. EPA Office of Air Quality Planning and Standards, "Parameters for Properly Designed and Operated Flares". 2012. Retrieved from http://www.epa.gov/ttn/atw/flare/2012flaretechreport.pdf.

reports were submitted from a variety of industries including, but not limited to, oil and gas production, wastewater treatment, and wine and cheese making. Operators of each of these flares are taking actions to reduce flaring at their facilities pursuant to their District approved FMPs. The annual monitoring reports add an important layer of enforceability to Rule 4311 by providing inspectors with verifiable data to ensure that larger sources of flaring are compliant.

5. Reportable Flaring Events are Non-repeating

A flaring event is considered a reportable flaring event if, during a 24-hour period, more than 500,000 standard cubic feet (scf) of vent gas is flared or sulfur oxide emissions are greater than 500 pounds. Of the 235 flares in the Valley, 21 experienced reportable flaring events in the 2011-2012 reporting period. Most of these reportable flaring events were planned flaring events and were due to new equipment installations—some of which were new air pollution control devices—and repair or maintenance at the facilities. Since most of the events were due to equipment installation or repair, they are not likely to occur again in the near future. Of the gas flared, only 20% was salable quality.

6. Flared Gas Occurs Under Abnormal Conditions

To provide a more in-depth look at different flaring scenarios in the Valley the District performed case studies of flaring events at a light-oil production facility and a wastewater treatment plant (WWTP). Both facilities experienced abnormally high flaring activities over periods of several months.

The by-product of light-oil production, generally referred to as off-gas, is a high quality gas; therefore, these facilities normally sell as much of the off-gas as possible. However, in this aberrant instance, the light-oil production facility discussed in the case study was unable to sell the gas during the 2012-2013 reporting period because the sales transmission pipeline was offline for repairs. The facility had no other feasible options to flaring (see discussion later in report).

Wastewater treatment plants produce waste gas that has a far lower heating value than the off-gas from oil production facilities and requires more extensive treatment prior to use; it is therefore not considered to be salable. In the WWTP case study, the flare gas produced by the facility is normally sent as a supplemental fuel to onsite equipment used to produce electricity and generate heat for some of the treatment processes. However, during the 2011-2012 reporting period, the waste gases could not be sent to the equipment because additional air pollution control devices were being installed.

As seen from the case studies, gas is typically flared only under abnormal conditions. Most facilities actively avoid flaring because these control devices only operate during process upsets and emergency situations.

7. **Rule 4311 Requirements are more stringent than the new 2012 Federal NSPS Requirements**
   The 2012 promulgated NSPS requirements in 40 CFR 60 subparts Ja and OOOO do not implement requirements that are more stringent than those already implemented in District Rule 4311. Therefore, Rule 4311 satisfies the requirements of these NSPS requirements.

This thorough and comprehensive further study evaluation has resulted in the District's conclusion that operators of flares in the Valley are subject to the most stringent emission requirements and are proactively taking measures necessary to minimize emissions from flaring in the Valley by implementing feasible alternatives to flaring and committing to perform activities to reduce flaring.

In light of these findings, the District recommends no rulemaking action for Rule 4311 at this time.

II. BACKGROUND

The development of the District's *2012 PM2.5 Plan* involved extensive research and analyses of technologies for potential opportunities to further reduce emissions of particulate matter (PM) and oxides of nitrogen (NOx), which is a predominant pollutant in the formation of fine particulate matter (particulate matter that is 2.5 microns or less in diameter, or PM2.5) and ozone. Although the results of the analyses for this plan did not indicate that regulatory action to further reduce flaring emissions would accelerate PM2.5 attainment, the District committed to continue evaluating flares through this further study measure. The 2009 rule amendments to Rule 4311, subjected facilities to new reporting requirements that require the submittal of annual flaring reports to the District every July beginning in 2012. While this did not provide adequate time for analysis and incorporation into the *2012 PM2.5 Plan*, the District committed to perform a further study of these reports. Additionally, in 2012, EPA promulgated amendments to an existing New Source Performance Standard (NSPS) and promulgated a new NSPS. The District's *2013 Plan for the Revoked 1-Hour Ozone Standard* also committed to further analyze these opportunities as a part of this Further Study effort. Specifically, the two state implementation plans commit the District to evaluate submitted Flare Minimization Plans, Annual Monitoring Report data, Reportable Flaring Event data, and new NSPS requirements to identify and evaluate potential opportunities to further reduce emissions from these sources. This further study analysis satisfies requirements in both the *2012 PM2.5 Plan* and the *2013 Plan for the Revoked 1-Hour Ozone Standard* by presenting results of the aforementioned review and evaluations.

III. WHAT IS FLARING?

Flares serve two basic functions: as an emission control device for VOC emissions, and as a safety device during unforeseeable and unpreventable emergency situations. Any unreasonable restrictions on flaring could potentially result in catastrophic consequences which may lead to explosions resulting in loss of property, injury and potentially loss of human life.

Flaring is a high temperature oxidation process used to burn mostly hydrocarbons of waste gases from industrial operations, with a destruction efficiency of 98 percent or greater. During combustion, gaseous hydrocarbons react with atmospheric oxygen to form carbon dioxide (CO2) and water. Flares used for emergency situations generally have large flaring capacities to enable them to handle large volumes of gas. Emergency situations, as defined in District Rule 4311, include any situation or condition arising from a sudden and reasonably unforeseeable and unpreventable event beyond the control of the operator and requiring immediate corrective action to restore safe operation at the facility or site. Examples of emergency events include, but are not limited to, equipment failure, natural disasters, external power curtailment, and acts of terrorism. Operators consider feasible alternatives to flaring because it is generally costly, and therefore avoided when possible.

A. General Equipment Description

There are two general types of flares: elevated and ground flares. Flares are further categorized by the height of the flare tip, and by the method of enhancing combustion by mixing at the flare tip (i.e., steam-assisted, air-assisted, pressure-assisted, or non-assisted).

Elevated flares are more common in the Valley and have larger capacities than ground flares. In an elevated flare, a waste gas stream is fed through a stack and is combusted near the tip of the stack. An elevated flare consists of five components: a gas collection header (to collect gases from various process units); a proprietary seal; a water seal, or purge gas supply (to prevent flash back); a single or multiple-burner unit in the flare stack; and gas pilots and an igniter. Figure 1, below, depicts a typical configuration for a steam-assisted elevated flare.

Ground flares, which are not typically found in the Valley, vary in complexity and can consist of either conventional flare burners discharging horizontally with no enclosures or multiple burners in refractory-lined steel enclosures.

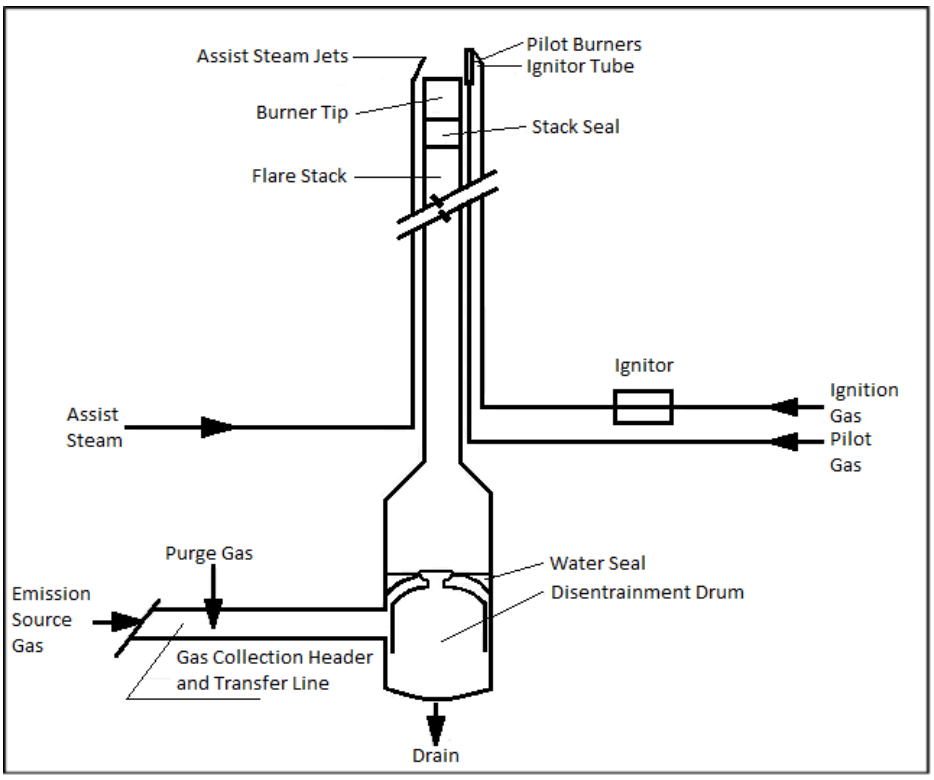

Figure 1 Flare Diagram[2]

B. General Process Description

Complete combustion requires proper mixing of air and gas. Smoking may result from incomplete combustion, depending upon the flare gas components and the quantity and distribution of combustion air. Gases containing methane, hydrogen, CO, and ammonia usually burn without smoke, while gases containing heavy hydrocarbons may cause smoke.

The tendency of a fuel to smoke or make soot is influenced by fuel characteristics and by the amount and distribution of oxygen in the combustion zone. Fuel characteristics include the carbon-to-hydrogen ratio and the molecular structure of the gases to be burned. Soot is eliminated by adding steam or air; hence, most industrial flares are steam-assisted and some are air-assisted. Flare gas composition is a critical factor in determining the amount of steam necessary.

Air is supplied to the flame as primary and secondary air. Primary air is mixed with the gas before combustion. If the amount of primary air is insufficient, the gases entering the base

[2] EPA, "13.5 Industrial Flares". 1995. http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s05.pdf

of the flare are preheated by the combustion zone, and larger hydrocarbon molecules crack to form hydrogen, unsaturated hydrocarbons, and carbon. The carbon particles may escape further combustion and cool down to form soot or smoke.

An external momentum force, such as steam injection, is used for turbulence and efficient mixing of air and waste gas, which promotes smokeless flaring of heavy hydrocarbon waste. Other external forces may also be used, including water spray, high velocity vortex action, or natural gas. External momentum force is rarely required in ground flares.

Combustion efficiency depends on flame temperature, residence time in the combustion zone, vent gas flammability, auto ignition temperature, heating value measured in British thermal units per standard cubic feet (Btu/scf), and turbulent mixing. Through combinations of these factors, flares have a destruction efficiency of 98 percent or greater. Complete combustion converts all volatile organic compounds (VOCs) to CO_2 and water.

Flare gases must have a fuel value of at least 200 to 250 Btu/ft^3 for complete combustion, otherwise another fuel must be added to achieve the required value. Flares for which supplemental fuel must be supplied are known as fired, or endothermic flares. In some cases, even flaring gases with the necessary heat content will require supplemental heat to ensure complete combustion.

Figure 2 A visual example of complete versus incomplete combustion[3]

Flares are normally used to dispose of low volume continuous streams of gases but are designed to handle large quantities of gases associated with potential plant emergencies. As safety devices, it is necessary for flares to have high volume capacities so that they may prevent injury and loss of property during unforeseeable and unpreventable emergency situations. Emergency flaring occurs when necessary, to prevent an accident, hazard, or release of vent gas directly into the atmosphere. Emergency events may occur because of process malfunctions, relief valve leakage, power outages, and equipment breakdown.

[3] Image retrieved February 2012 from: http://www2.epa.gov/sites/production/files/2013-09/nei-air-toxics-flare-250.jpg

Consequently, flare gas volumes can vary from a few cubic feet per hour during regular operations up to several thousand cubic feet per hour under emergency conditions.

IV. VALLEY FLARES

The flare source category subject to Rule 4311 requirements in the Valley is unique from other air districts in California because it incorporates such a diverse group of industries while other air districts generally limit the applicability of their analogous rules to petroleum refineries. There are approximately 235 flares in the Valley. Of those 235 flares, 126 are exempt from District Rule 4311 because they are subject to the requirements of District Rule 4642 (Solid Waste Disposal Sites), subject to the requirements of 40 CFR 60 Subpart WWW (Standards of Performance for Municipal Waste Landfills), subject to the requirements of 40 CFR 60 Subpart Cc (Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills), or are not operated at a major source facility. Stationary sources that emit a total of less than ten tons per year of VOC and NOx emissions from all operations at the facility (including any flares) are not considered major sources, and are exempt from prohibitory requirements of the rule. However, all new or modified flares are subject to New Source Review (NSR) requirements including Best Available Control Technology (BACT) requirements, meaning they may be required to implement even more stringent controls regardless of whether or not they are subject to the requirements of Rule 4311.

The 109 flares in the Valley subject to the requirements in Rule 4311 are used by the following industries:

- Gas plants
- Heavy oil production / Thermally enhanced oil recovery
- Light oil production
- Refinery operations
- Wastewater treatment plants
- Cheese production
- Wine
- Dairy operations
- Flat glass production
- Correctional facility

While much of flaring in the Valley occurs in the Southern region (Tulare and Kern counties) of the Valley, flaring activity also occurs in the Northern (San Joaquin, Stanislaus, and Merced counties) and Central (Madera, Fresno, and Kings counties) Valley. Of the 109 flares subject to Rule 4311 requirements, 7 operate in the Northern region, 5 in the Central region, and 97 in the Southern region.

The emissions from all 235 flares operating in the Valley contributed 0.14% of the total annual NOx emitted from all stationary and area sources in 2012. Flares are a small contributor to overall Valley emissions throughout the year in part because properly operated flares achieve at least 98 percent combustion efficiency[4]. The emissions represented in the table below represent emissions from all flaring activity in the Valley regardless of exemption status.

Table 1 Annual Average Flare Emission Inventory (tons per day) [5]

Pollutant	2012	2014	2015	2016	2017	2018	2019
PM2.5	0.13	0.13	0.13	0.14	0.14	0.14	0.14
NOx	0.38	0.39	0.39	0.39	0.39	0.39	0.39
SOx	0.25	0.26	0.26	0.26	0.26	0.26	0.27

District staff used reported volumes of gas flared to calculate an estimated emission inventory from Valley flaring and compared the calculations to the emission inventory for 2012 in Table 1 above. The data comparison verified that the emissions inventory is representative of the actual flaring activity.

V. METHODOLOGY

This report is a culmination of the efforts of an interdepartmental team consisting of staff from Rule Development, Compliance, and Permits Services spanning a four-year implementation period since the June 2009 amendment of Rule 4311. Some of the actions performed during this implementation period include:

- Working with facilities that operate flares to determine which units are subject to Rule 4311;
- Collecting Flare Minimization Plans (FMP), Annual Monitoring Reports (AMR), and Reportable Flaring Event (RFE) reports; and
- Review and determination of compliance with Rule 4311 requirements for FMPs, AMRs, and RFE reports.

This further study report continues to build on previous efforts to examine this source category and identify and evaluate potential opportunities to reduce emissions by analyzing information collected during the previously described implementation period.

[4] U.S. EPA Office of Air Quality Planning and Standards, "Parameters for Properly Designed and Operated Flares". 2012. Retrieved from http://www.epa.gov/ttn/atw/flare/2012flaretechreport.pdf.
[5] Retrieved from the District's *2012 PM2.5 Plan* (*http://www.valleyair.org/Air_Quality_Plans/PM25Plans2012.htm*)

To begin, District staff analyzed the 235 flare permits to determine which flares are subject to Rule 4311 requirements and how the facility operators are complying with applicable requirements. Based on information gathered, staff compiled all relevant data into the following categories:

- Facility name
- Facility description
- Major source of NOx emissions (true or false)
- Major source of VOC emissions (true or false)
- Region (South, Central, or North)
- Facility ID
- Permit Number
- Facility City
- District inspection area
- Equipment description
- Subject to Rule 4311 requirements, other than recordkeeping (yes or no)
- Flare rating (capacity)
- Permit conditions that limit flaring (yes or now; if yes, description)
- Flare type (emergency, standby, primary disposal
- Greater than 5 MMBtu/hr (yes or no)
- Summary of stated flare uses in FMP
- Actions identified in FMP to minimize flaring
- 2012 Annual Monitoring Report received (yes or no)
- 2012 Reportable Flaring Events report received (yes or no)
- 2012 Reportable Flaring Event analysis (number of events, number planned, and number unplanned)
- Reportable Flaring Event link for more information
- 2010 emissions inventory (MMscf)
- 2010 annual gas flared from inspection reports
- 2011 emissions inventory (MMscf)
- Annual gas flared from AMR (7/11 – 6/12)
- 2012 emissions inventory (MMscf)
- Annual gas flared from annual monitoring report (7/12 – 6/13)

Organizing, sorting, and consolidating the vast collection of data presented a significant challenge throughout this study, and a significant amount of staff resources were expended to thoroughly evaluate this information. As patterns and outlying data points were identified, staff began to sort the information into smaller, more manageable compilations that were used to answer specific questions about various Rule 4311 requirements and search for more patterns and outliers, all with the intent to identify additional opportunities to reduce emissions.

The District began with the determination that out of the 235 flares being evaluated, 126 flares are exempt from Rule 4311 requirements other than basic recordkeeping requirements due to one of the following reasons: non-major source, subject to other rules regulating landfills, or are not stationary. The remaining 109 flares in the Valley were determined to be subject to Rule 4311 requirements. Facilities subject to Rule 4311 requirements were further categorized by whether or not they are subject to Flare Minimization Plans (FMP), Annual Monitoring Reports (AMR), or Reportable Flaring Event (RFE) submission requirements

District staff determined that 95 facilities are subject to Flare Minimization Plan requirements and every flare permit was examined to determine whether an FMP had been submitted and approved by the District. If a facility did not submit an FMP for approval, staff investigated whether or not they were required to. When this study began, all facilities were in compliance with FMP requirements.

The submitted FMPs were analyzed for patterns or irregularities, and evaluated whether:

- FMPs account for all rule-required elements
- Operators are identifying and evaluating opportunities to reduce flaring activities
- Operators are incorporating identified opportunities that are determined to be feasible
- Operators are not missing opportunities to further reduce flaring

FMP review also focused on determining if there were common actions or best management practices identified in the FMPs that could be required for all facilities. As discussed further in the FMP section of this report (Section VI), actions identified in the FMPs are typically dependent on the facility and operation type, as well as the quality of gas being flared. Due to the variability of each facility's needs, staff found no additional feasible actions/practices that could be added to Rule 4311 requirements.

The next major analysis determined that 40 facilities were not subject to the requirements to submit Annual Monitoring Reports. Certain facilities were too small or had not utilized their flares, while the majority had accepted specific limiting conditions on their permits to operate (PTOs) which limited the amount of flaring the facility could conduct. This analysis also determined that 55 facilities are subject to AMR submittal requirements. Similar to the FMP analysis, staff began evaluating if the facility had submitted an AMR for the reporting period and, for the facilities that had not, District staff contacted the facilities to explain deficiencies and collect the missing information.

The submitted AMRs were examined for the following information:

- Percentages of total gas flared from each facility
- Patterns of high or irregular flaring

- Flaring in excess of limits committed to
- Reasons for flaring

Information gathered from the Annual Monitoring Reports allowed staff to gain a better understanding of how each facility was utilizing their flares, the measures taken to reduce flaring, and the amounts of gases being flared. Additionally, staff was able to use reported flaring volumes from the AMR to estimate emissions from reported flaring and compare those calculations to verify the accuracy of the emissions inventories.

The final portion of the analysis evaluated data from facilities that experienced Reportable Flaring Events (RFEs) during this reporting period. District staff used the same comprehensive methods as were used for FMPs and AMRs to analyze the RFE reports for the following data:

- Percentage of total volume flared from reportable events for each facility
- Salable gas flared
    - Total volume
    - Total value
    - Average value
- Total volume and percentage of non-salable gas flared
- Causes of events (planned, unplanned, maintenance, new equipment installation, etc.)
- Percentage of events due to each main type of cause

District staff conducted case studies of two facilities during the RFE analysis to gain a deeper understanding of how specific operations and events at those facilities affected their flaring activity. The two facilities were selected because they both experienced periods of abnormally high reportable flaring, and because one was representative of oil field flares, which include the majority of Valley flares. Staff analyzed the following information:

- Type of facility
- Operations performed at the facility
- Reasons for flaring in general
- Causes of reportable flaring events
- Amount of flaring during the periods in question
- Possible prevention measures
- Additional opportunities to reduce flaring at the facility

District staff also performed a regulatory evaluation that compared the requirements of Rule 4311 to those of NSPS and flare rules in other air districts. To understand the differences and similarities between Rule 4311 and NSPS, staff looked at fact sheets, guidance documents, and the actual NSPS text. Similarly, because the different rules for other air district have minor language and administrative differences, staff created a table

(see Attachment) to organize and compare the main requirements of each district's flare rules. Additionally, staff compared total numbers of flares, flare types, and flare capacities between the District and other major air districts in California.

The following sections provide more details and explain the results of the further study as committed to in the *2012 PM2.5 Plan*.

VI. FLARE MINIMIZATION PLANS

A. Rule 4311 Flare Minimization Plan (FMP) Requirements

Sections 5.8 and 6.5 of District Rule 4311 require an FMP be submitted to and approved by the District for any petroleum refinery with a flare or any flare with a flaring capacity greater than or equal to 5.0 MMBtu/hr. The rule prohibits facilities subject to FMP requirements from flaring unless it is consistent with a District-approved FMP and all commitments in that FMP have been met. To ensure FMPs are up-to-date without undue redundancy in paperwork requirements from stakeholders, FMPs are to be updated every five years. Updates to the FMP are also required to address any new or modified equipment that requires an Authority to Construct permit and impacts emissions from the flare.

An FMP submitted to the District pursuant to Section 6.5 of Rule 4311 shall include at least the following information:

- Description and technical specifications for each flare and associated knock-out pots, surge drums, water seals and flare gas recovery systems
- Process flow diagrams of upstream equipment and process units venting to each flare (with identification of type and location of control equipment)
- Description of equipment, processes, or procedures the operator plans to install or implement to eliminate or minimize flaring, and planned date of installation or implementation
- Evaluation of prevention measures to reduce flaring that has occurred or may be expected to occur during planned major maintenance activities, including startup and shutdown
- Evaluation of preventative measures to reduce flaring that may be expected to occur due to issues of gas quantity and quality. This includes an audit of vent gas recovery capacity of each flare system, storage capacity for excess vent gas, and scrubbing capacity available for vent gas for use as a fuel; and shall determine the feasibility of reducing flaring through the recovery, treatment and use of the gas.
- Evaluation of preventative measures to reduce flaring caused by the recurrent failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. Evaluation shall determine adequacy of

existing maintenance schedules and protocols for such equipment. (A failure is recurrent if it occurs more than twice during any five year period as a result of the same cause)

Further Study Commitment:
Evaluate Flare Minimization Plans

B. Summary of Facilities Required to Submit FMPs

Of the 109 flares in the Valley subject to Rule 4311 requirements, 95 are subject to FMP requirements, all of which have been submitted by the time of this further study report. The remaining 14 flares are not required to submit FMPs to the District because they have a flaring capacity less than 5.0 MMBtu/hr and are operated at facilities other than petroleum refineries.

To further illustrate the wide applicability of Rule 4311, a summary of the 95 submitted FMPs is presented in table 2 and is organized by industry type.

Table 2 Submitted FMPs Summarized by Industry

Industry Summary	Qty
Cheese production	1
Wine	2
Correctional Facility	1
Crude oil and natural gas production	14
Crude oil production	1
Crude petroleum and natural gas production	2
Gas plant	2
Light oil production	5
Natural gas processing	4
Natural gas production	2
Natural gas transmission	2
Oil and gas production	13
Oil and natural gas production	29
Petroleum and natural gas production	1
Petroleum production	1
Petroleum refinery	7
Dairy	1
Flat glass	1
Wastewater	6
Total	95

Pursuant to Section 6.5.1 of rule requirements, operators are required to evaluate preventative measures to reduce flaring during planned major maintenance activities, flaring due to issues of gas quantity or quality, and flaring caused by recurrent failure of equipment.

Each operator of the facilities described above performed such evaluations and presented findings in the FMPs they submitted to the District. Table 3 includes a summary of actions identified in FMPs to minimize flaring, along with the facility types that committed to the actions. The actions identified are a sampling from multiple facilities within each category, and not every facility in the category committed to all of the FMP actions shown.

Table 3 Summary of FMP Measures

FACILITY CATEGORY	ACTIONS IDENTIFIED IN FMP TO MINIMIZE FLARING*
Oil and Gas Production and Transmission	Include permit limit on gas flared daily and annually Streamline startup, shutdown, and maintenance procedures to minimize equipment downtime, thereby minimizing flaring Hydrogen sulfide scrubbing of flare gases to condition for sale[6] Inject flare gas in DOGGR-approved wells Use other combustion devices such as glycol re-boiler/thermal oxidizer
Wastewater Treatment/ Reclamation	Install new equipment to combust digester gas in internal combustion engines, fuel cells, and process heaters Install equipment to allow digester gas storage and conditioning for greater use in turbines (additional storage is minimal and only capable of handling excess gas during minor process upsets)
Wine Production	Burn flare gas in steam generation boilers; coordinate plant operations that generate the flare gas with production operations requiring steam
Cheese Production	Modify boiler to combust a natural gas/digester gas blend
Flat Glass Manufacturing	Reduce idle time during calibration and purge test to reduce necessary flaring
Dairy Farming	Install additional gensets (electricity generation equipment located near the end user) to combust more produced biogas

Depending on the facility type, and the quality of flare gas produced, some of the above measures may not be feasible for all facilities.

For oil and gas production, the flare gas produced is often in excess of what could be used onsite to power equipment. For these facilities, flares are generally used only under abnormal conditions, as the flare gas is usually high enough quality to sell for use at other facilities.

For facilities other than oil and gas production, the gas produced is usually a much lower heating value and requires conditioning if combusted for electrical generation or process

[6] BioPath, LLC. (2013). *Hydrogen Sulfide H2S Scrubber*. Retrieved from http://biopathfps.com/hydrogen-sulfide-h2s-scrubber/

heating. Expensive modifications or new equipment is often required to allow said combustion activities, and the flare gas is sometimes of too low quality or quantity to make these installations cost effective. Additionally, depending on the combustion equipment used, there is no guarantee that emissions will be lower because flares are already effective control devices.

The majority of the operators are already performing all activities possible to reduce flaring at their facilities, as confirmed in the FMP submittals. As such, most operators were not able to identify additional actions above and beyond those already implemented at their facilities to further minimize flaring, and those that did identify feasible alternatives committed to them in the FMPs submitted to the District.

C. What was learned from collected FMPs

The majority of the 95 Valley flares with FMPs are standby flares, which means they are only utilized when needed such as during maintenance or to dispose of excess flare gas, and are not used as a method of primary disposal for waste gases. Twelve of the 95 flares are permitted specifically for emergency use only and another three serve a primary purpose as both an emergency flare and a standby flare. See figure 3 for a summary of the primary uses of flares with FMPs in the Valley.

Only three flares in the Valley are permitted to be used as primary disposal devices. Two of the three flares are used at an oil and natural gas production facility as a VOC control device for vapors displaced from trucks during load-out operations pursuant to requirements in District Rule 2201 (New and Modified Stationary Source Review Rule). The facility minimizes flaring by limiting use of the flares to comply with Rule 2201 and not using them for planned major maintenance, start up or shut down activities, or for control of emissions caused by equipment failure or process malfunctions. The third flare is used at a cheese making facility for primary disposal of methane gas generated by the wastewater anaerobic digester at the facility. However, the cheese making facility committed to modify an on-site boiler to combust a natural gas/digester gas blend to reduce flaring in the facility's FMP.

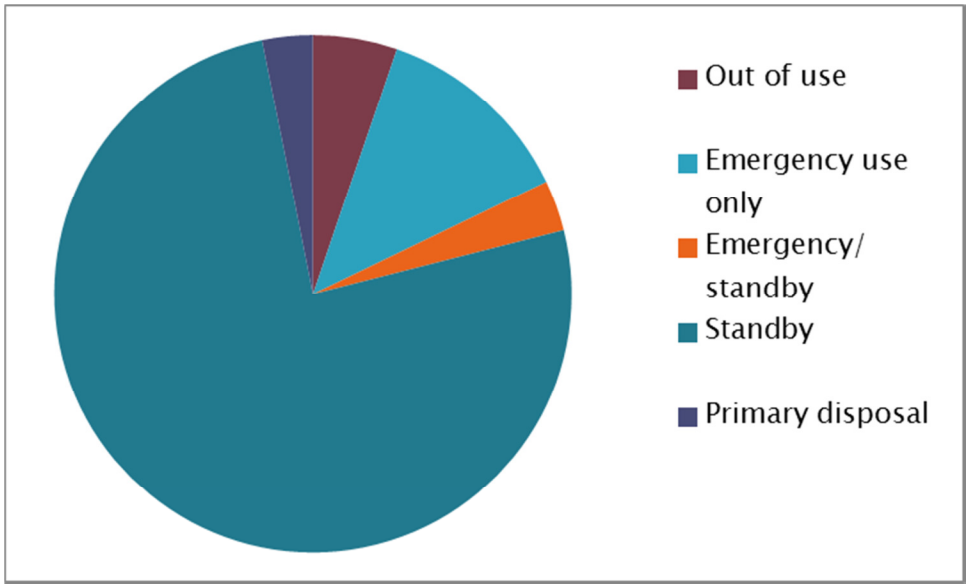

Figure 3 Primary Purpose of Valley Flares

Review of the information in the FMPs verified that operators are performing actions to reduce flaring at their facilities including not using the flares, permitting them for emergency use only, not using them for major maintenance as a standard practice, burning gases in alternative devices when possible, and limiting gas flow to the flares.

VII. ANNUAL MONITORING REPORTS

A. Rule 4311 Annual Monitoring Report Requirements

The operator of a petroleum refinery flare or any flare with a flaring capacity equal to or greater than 50 MMBtu/hr (§5.10, 6.6, 6.7, 6.8, 6.9, 6.10), as appropriate, is required to submit an annual monitoring report to the District no later than July 31st of each calendar year (§6.2.3).

Pursuant to Rule 4311 Section 6.2.3, the annual monitoring report submitted to the District shall contain the following information:

- Total volumetric flow of vent gas (§6.2.3.1)
- Hydrogen sulfide content, methane content, and hydrocarbon content of vent gas (§6.2.3.2)
- If vent gas composition is monitored by a continuous analyzer(s): average total hydrocarbon content by volume, average methane content by volume, and depending upon the analytical method used, total reduced sulfur content by volume or hydrogen sulfide content by volume of vent gas flared for each hour of the month (§6.2.3.3)

- If the flow monitor measures molecular weight, the average molecular weight for each hour of each month (§6.2.3.4)
- For any pilot and purge gas used, the type of gas used, the volumetric flow for each day and for each month, and the means used to determine flow (§6.2.3.5)
- Flare monitoring system downtime periods, including dates and times (§6.2.3.6)
- For each day and each month provide calculated sulfur dioxide emissions (§6.2.3.7)
- A flow verification report for each flare (§6.2.3.8)

Further Study Commitment:
Evaluate Annual Monitoring Report Data

B. Submitted 2012 Annual Monitoring Reports

Flares are subject to the annual monitoring report requirements if the flare is subject to flare minimization plan requirements and can produce a reportable flare event; however, many Valley operators of flares are proactive in reducing flaring by having specific limiting conditions added to their District permits that limit the amount of flaring. As a result, many of the 95 flares subject to FMP requirements do not produce reportable flare events and are not required to submit annual monitoring reports. At the time of this further study effort, 55 annual monitoring reports have been submitted to the District. The following table is a summary of annual monitoring reports sorted by industry type.

Table 4 Submitted Annual Monitoring Reports Summarized by Industry

Industry Summary	Qty
Correctional Facility	1
Cheese Production	1
Winery	1
Oil and Gas Production	6
Crude Petroleum and Natural Gas	1
Crude Oil and Natural Gas Production	7
Oil and Natural Gas Production	15
Natural Gas Transmission	2
Waste Water Reclamation	1
Gas Plant	2
Petroleum and Natural Gas production	1
Petroleum refining	7
Natural Gas Production or Processing	6
Light Oil Production	4
Total	55

C. What was learned from submitted Annual Monitoring Reports

As committed to, the District collected and analyzed Annual Monitoring Reports. Information from these AMRs allowed the District to evaluate the total amount of vent gases combusted and their compositions from each of the 55 flares. This information allowed the District to calculate the amount of emissions from the reported flaring and compare those values to verify the accuracy of the emissions inventory for flares.

As can be seen above, the annual monitoring reports represent a variety of industries in the Valley. Of the flares summarized in the 55 annual monitoring reports, only one is used as a primary disposal device, one is dormant, and eleven are designated for emergency use only. The remaining flares are standby flares. Many facilities have specific limiting conditions in their permits that limit the amount of flaring allowed to less than the threshold for reportable flaring events; another example of operators committing to keep flaring at their operations reduced. Operators of all of the flares with annual monitoring reports are also actively taking measures pursuant to their FMPs to reduce flaring at their facilities; a few examples include having the flares permitted for emergency use only, rendering flares dormant, and coordinating efforts at the facility to reduce flaring. Annual monitoring reports are a valuable resource for understanding the activities of Valley flares.

The information in these reports offers additional evidence that flaring is generally a last resort for facilities. The District will continue to collect and analyze these reports annually.

VIII. REPORTABLE FLARING EVENT

A. Rule 4311 Reportable Flaring Event Requirements

What is a Reportable Flaring Event?

A flaring event is considered a "Reportable Flaring Event" if more than 500,000 standard cubic feet (scf) of vent gas is flared per calendar day, or where sulfur oxide emissions are greater than 500 pounds per calendar day. A reportable flaring event ends when it can be demonstrated that the integrity of the water seal has been maintained sufficiently to prevent vent gas to the flare tip, or when the rate of flow of vent gas falls below 0.12 feet per second (§3.31). Assuming an estimated heating value for flare gas of 1,000 Btu/scf, a flare must have a capacity greater than or equal to 20.8 MMBtu/hr to achieve a reportable flaring event, although most flares commonly operate at a small fraction of maximum capacity. Additionally, some low quality waste gases can have heating values of 200-300 Btu/scf, which would lower the minimum capacity for reportable flaring events. Reportable Flaring Event requirements are applicable to the operator of a flare subject to FMP requirements with the exception of flares that the operator can verify are not capable of producing reportable flare events (§5.10). Annual reports summarizing all Reportable Flaring Events shall be submitted to the District no later than July 31st of each year (§6.2.2).

What data are required to be reported to the District in the Reportable Flaring Event report?

The report shall summarize all Reportable Flaring Events that occurred during the previous 12 month period (§6.2.2). The report shall include, but is not limited to the following:

- The results of an investigation to determine the primary cause and contributing factors of the flaring event (§6.2.2.1)
- Any prevention measures considered or implemented to prevent recurrence together with a justification for rejecting any measures that were considered but not implemented (§6.2.2.2)
- If appropriate, an explanation of why the flaring was an emergency and necessary to prevent accident, hazard or release of vent gas to the atmosphere, or where, due to a regulatory mandate to vent a flare, it cannot be recovered, treated and used as a fuel at the facility (§6.2.2.3)
- The date, time, and duration of the flaring event (§6.2.2.4)

Further Study Commitment:
Evaluate Reportable Flare Event Data

B. Reportable Flaring Events

The reportable flaring events data presented in this report are from the 2011-2012 fiscal year. While 2012-2013 reportable flare event reports and data have been submitted to the District at the time of this further study, a complete analysis of these more recent reports has not been incorporated into this further study because doing so would require an additional year of District analysis. However, the District analyzed 2012-2013 reportable flaring events data for the two case studies presented below.

Of the 109 flares subject to Rule 4311, 21 flares generated 395 reportable flaring events. The following table summarizes the amount of gas flared during reportable flaring events. This information is organized by industry type.

Table 5 Summary of Total Reportable Flare Events (MSCF)

Industry Summary	Qty of Flares	Reportable Flare Events – Total (MMscf)
Crude Oil and natural gas production	3	27.8
Gas plant	2	12.0
Light oil production	3	7.7
Natural gas processing and production	5	42.8
Oil and natural gas production	4	52.5
Petroleum and NG production	1	20.9
Petroleum refining	2	59.4
Wastewater reclamation facility	1	124.2
Total	21	347.4

C. Case Studies

Two case studies were performed to provide a more in-depth evaluation of flaring activities in the Valley. As the oil and gas related industries represent a majority of the operations in the Valley performing flaring activities, the first case study focuses on an oil field flare. The second case study is of flaring activities at a wastewater treatment plant; this facility was selected because it had an unusual amount of flaring during the reporting period.

LIGHT OIL PRODUCTION

Vintage Production California LLC operates as a subsidiary for Occidental Petroleum Corporation at several facilities in California. One facility located in North Shafter (VPC North Shafter) was selected for a case study because it is representative of oil field flares in the Valley and because it experienced a period of abnormally high flaring activity during the reporting period.

Flare gas at oil production facilities is mostly composed of high quality, high energy content compounds like methane, ethane, propane, and butane, and typically transmitted either to a sales gas line or to a gas plant pipeline where it is treated prior to use or sale. With an estimated heating value of 1000 Btu/scf for this gas, it is a valuable commodity. The facilities producing this gas generally try to use or sell as much as possible, but must sometimes flare for various reasons, most commonly for safety during emergency and process upset situations. Other reasons for flaring include gas produced in excess of commercial demand or in excess to what can be burned as process gas, vapors collected from the tops of tanks as they are filled, process upsets, equipment changeover or maintenance, well tests, production shut-down, gas of insufficient volume to financially warrant treatment prior to sending to a pipeline, or when there is not a gas plant pipeline available.

VPC North Shafter operates a 41.7 MMBtu/hr Coanda tip flare with liquid knockout and sulfur knockout vessels. It is permitted at a gas rate of no more than 4.0 MMscf/day and 438 MMscf per year. The emission rates (lb/MMscf) are not to exceed 20 for PM10, 68 for NOx, 33 for VOC, or 38 for CO.

Of the 395 reportable flaring events in 2011-2012 in the Valley, nine were at VPC North Shafter, all of which were planned maintenance. In contrast, the facility performed 157 reportable flaring events in 2012-2013; all of which were for planned shutdown for repair and maintenance because Chevron, which normally pipes the flare gas to its Kern River oil field after purchasing it from VPC North Shafter, was repairing a pipeline.[7] The total volume flared during reportable events at VPC North Shafter in 2011-2012 was 13.1 MMscf, compared to 283.3 MMscf in 2012-2013.

During the 2012-2013 reporting period, there were four months of nearly constant flaring. Despite the abnormally high flaring activity, NOx emissions from these reportable flaring events were 9.6 tons for the entire reporting period, an average of 0.06 tons per day. The total value flared during the 2012-2013 reportable events was an estimated $1.4M. The

[7]The Bakersfield Californian, "The Sound and the Fury". 2012 http://www.bakersfieldcalifornian.com/business/x871558971/The-sound-and-the-fury-Gas-flare-wears-on-Shafter-area-residents

sales transmission line was closed due to conditions beyond the control of the facility. Therefore, flaring activities conducted in 2012-2013 at VPC North Shafter were extremely abnormal and unlikely to occur in the future.

Internal combustion engines (IC engines) can combust low-sulfur well vapors typical of light oil production sources such as the VPC North Shafter facility. Increased use of IC engines, where available and feasible, can reduce flaring activities; however, it would not decrease emissions beyond what would be reduced by the flare. Flares are emission control devices that operate at 98% control efficiency. The use of IC engines in the Valley is regulated through District Rule 4702 (Internal Combustion Engines). Depending on the size, type, and total hours of usage of the engine, using IC engines in place of flaring could actually increase emissions. Furthermore, the addition of IC engines to a facility requires additional controls (Best Available Control Technology), monitoring, and reporting thus increasing the cost of using the waste gas in this type of equipment.

Measures listed in the VPC North Shafter FMP include:

- Flaring frequency and gas volume flared is insufficient to economically justify installation of redundant equipment
- In the event of a planned shut down by end user, and/or major maintenance activities to the sales gas compressor, gas production will be curtailed to the extent possible without hampering oil production
- The gas process equipment is operated in a manner to minimize disruptions from repair and/or maintenance
- Sales gas compressor has a thorough, regular maintenance schedule to prevent major malfunctions that result in longer periods of flaring
- VPC cooperates with end user to minimize down time and flaring

The VPC case study offers evidence that oil production facilities take actions to minimize flaring and instead attempt to transmit the gas for sale or use in other locations. Occasional installation, maintenance, or repair of critical items such as transmission lines can cause abnormally high flaring activity, but these are typically one-time events. Because light oil production facilities already sell or utilize as much flare gas as possible, no feasible alternatives are available.

WASTE WATER TREATMENT PLANT—Fresno/Clovis Regional Wastewater Treatment Plant, South Fresno

The Fresno/Clovis Regional Wastewater Treatment Plant (WWTP), located in south Fresno, was selected for this case study because it experienced an abnormally high amount of flaring and is not a part of the petroleum and natural gas industry.

The 80 million gallon per day (MGD) facility treats wastewater through primary treatment, secondary treatment, and anaerobic digestion. Digester gas from the WWTP is produced during anaerobic digestion, a process that exploits a variety of bacteria in an oxygen-free environment to reduce organic matter in bio-solids[8]. Anaerobic digesters are capable of producing high-quality, high energy content methane that can be used for electricity generation or to supply heat needed to complete the digestion process. However, digester gas requires treatment to remove hydrogen sulfide (H_2S) and sometimes requires dehydration, filtering, or CO_2 removal. Digester gas, which usually has a methane content of greater than 60%, can be a suitable natural gas fuel substitute for use in boilers, hot water heaters, reciprocating engines, turbines, and fuel cells.[9]

According to the District-approved FMP for this facility, digester gas is consumed to create electricity and provide heat for the digesters. The WWTP uses two 3.4 Megawatt (MW) turbine engines and one 16.7 MMBtu/hr process boiler that are almost completely fueled by digester gas. Because there is no significant gas storage capacity, any excess digester gas or gas produced during interruptions to the turbines or boiler must be flared.

Flaring at the WWTP is performed by a 36.3 MMBtu/hr John Zink waste gas flare that was installed to replace three older, less efficient flares. The fully automated, enclosed ground flare is designed to burn digester gas without auxiliary fuel at a maximum flow rate of 1,100 cubic feet per minute (CFM). NOx emissions are less than 0.06 lb/MMBtu, and SOx is controlled by reducing H_2S concentrations in the digester gas. To fulfill commitments in the FMP, the facility installed a small digester gas storage tank, installed additional digester gas conditioning, and increased the allowable digester gas fuel for the turbines from 50% to 100%. The storage tank is capable of holding gas for small periods, such as during switchover between turbines, and the gas conditioning allows the use of selective catalytic reduction (SCR) on the turbines.

The WWTP has reduced the volume of gas flared from 174.7 MMscf in 2004 to 50.4 MMscf in 2013; however, the 2011-2012 reporting period included abnormally high flaring activity. During this period, the turbines were out of service to allow installation of selective catalytic reduction (SCR) control devices for compliance with District Rule 4703 (Stationary Gas Turbines). As a result, a large portion of the digester gas was flared. Out of 395 total reportable flaring events in the Valley during the 2011-2012 reporting period, 164 occurred at the WWTP. Those events accounted for 36 percent of the total volume of gas flared during reportable events, more than three times the next highest volume at any

[8]City of Fresno Wastewater Management Division. Retrieved from http://www.fresno.gov/Government/DepartmentDirectory/PublicUtilities/Wastewater/default.htm on 1/26/14.
[9] DOE, "Wastewater Digester Gas can Produce High Quality Methane Fuel for Federal Facilities." 2005. http://www1.eere.energy.gov/femp/news/news_detail.html?news_id=8961

facility. The graph below shows the percent of total volume flared from each source that experienced reportable flaring events during the reporting period.

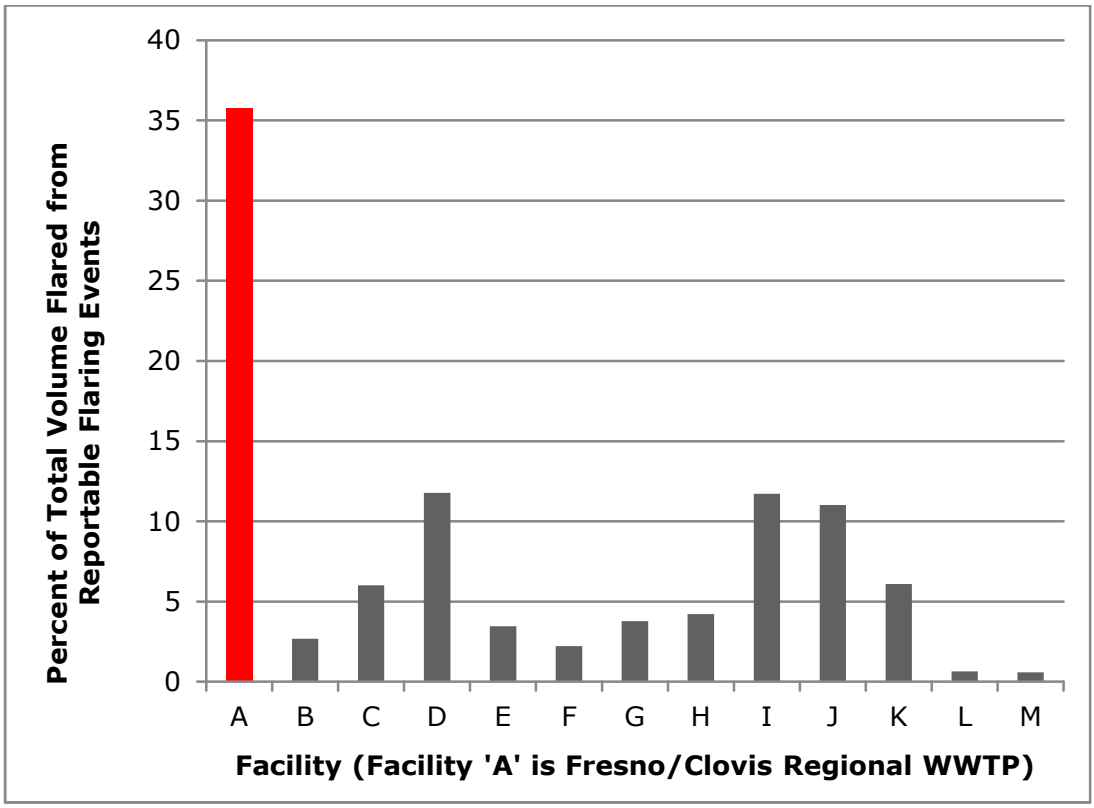

Figure 4 Percent of Reportable Flaring from All Sources

All of the events were planned, and the majority (127 events) was for the installation of the SCR units. The remaining 37 events were due to maintenance or excess digester gas production. By contrast, the 2012-2013 reporting period showed only 46 reportable flaring events, all of which were for regular activities except one due to failure of a turbine. Because the majority of flaring events during the 2011-2012 reporting period were due to installations and are therefore one-time events, they are not part of normal facility operations.

The WWTP case study offers further evidence that facilities in the Valley are already implementing feasible measures to reduce flaring. The digester biogas is a valuable resource that the WWTP uses to provide a significant portion of its electricity demands and process heating input. The facility implemented measures identified in the FMP to increase digester gas usage onsite, install a gas storage tank, and further condition the gas to allow for additional air pollution control equipment to be operated.

D. What was learned from collected Reportable Flaring Event reports

The majority of reportable flaring events during the 2011-2012 reporting period were planned (82.5%) and only 20% involved salable flare gas. This shows that measures have already been implemented to reduce the number of emergency events. Over half of the reportable flaring events were due to new installations, and as such are unlikely to be repeated. The figure below shows the percent of events due to the different reasons for reportable flaring events.

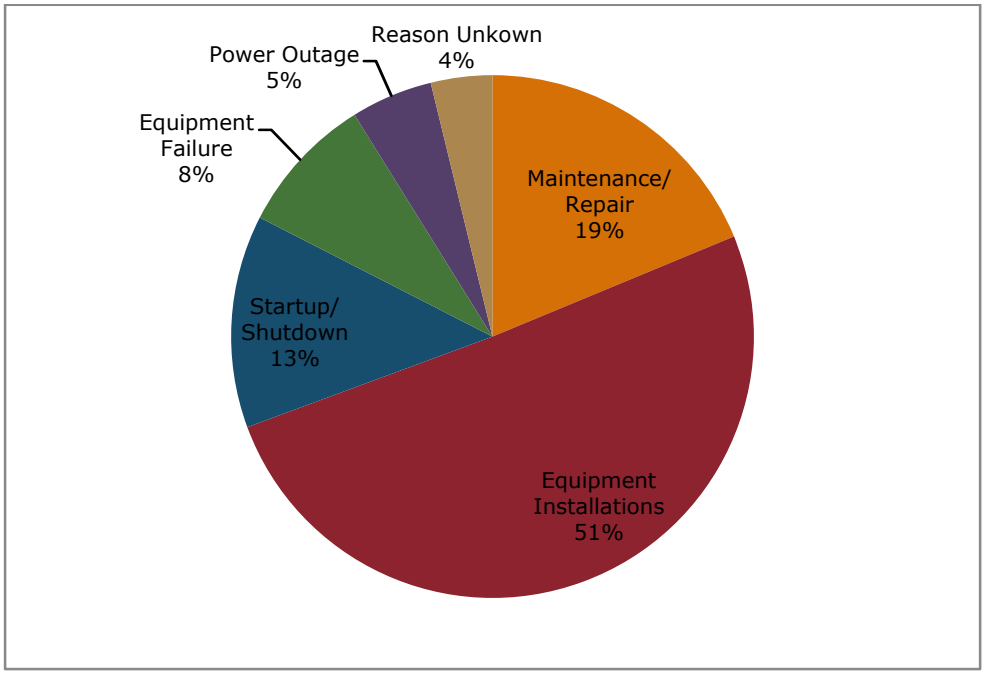

Figure 5 Reasons for Reportable Flaring Events

The total value of all reportable flaring events was estimated at $560,000, of which only $190,000 occurred due to planned events. Facilities in the Valley are already implementing feasible alternatives to flaring because flare gas is a valuable commodity for sale or use onsite.

The two case studies of typical Valley facilities show that most facilities attempt to sell or use as much flare gas as possible. The greatest flaring during the 2011-2012 period was from a wastewater treatment plant, where the option to curtail operations does not exist, due to the necessary nature of the facility. The excessive flaring at that facility was required to install more air pollution control equipment, and was therefore a one-time event that will benefit Valley air in the long term.

IX. REGULATORY EVALUATION

In evaluating District Rule 4311, the U.S. Environmental Protection Agency (EPA) identified three core requirements needed to satisfy RACT for flares:

- Flare minimization plans
- Monitoring and reporting flare events
- Causal analysis for large flare events[10]

Upon comparing District Rule 4311 to analogous rules for these criteria, EPA deemed the District rule as being at least as stringent as RACT and finalized approval of the District's 2009 amendments to Rule 4311 on November 3, 2011.[11] Additionally, EPA finalized a partial approval of the 2009 RACT demonstration report on January 10, 2012 and confirmed this rule as still being at least as stringent as established RACT requirements.[12] For purposes of this further study, the regulatory evaluation will consist of actions occurring after January 2012.

A. Federal Requirements

Rule 4311 is as stringent as, or more stringent than the applicable federal NSPS (40 Code of federal Regulations (CFR) 60.18 – General Control Device Requirements)[13] and the flares section of the Consolidated Federal Air Rule (40 CFR 65.147 – Flares)[14], and the applicable federal National Emission Standards for Hazardous Air Pollutants (40 CFR 63, Subpart SS – National Emission Standards for Closed Vent Systems, Control Devices, Recovery Devices and Routing to a Fuel Gas System or a Process)[15]. There are no applicable Control Techniques Guidelines, Alternative Control Techniques, or Maximum Achievable Control Technology requirements for flares.

In 2012, EPA modified an existing NSPS for flares (40 CFR 60 Subpart Ja)[16] and added a new NSPS (40 CFR 60 Subpart OOOO)[17], both of which are applicable to this source

[10] EPA TSD (Analysis of SJVUAPCD's Rule 4311), http://www.regulations.gov/#!documentDetail;D=EPA-R09-OAR-2011-0601-0022
[11] 76 FR 68106, http://www.gpo.gov/fdsys/pkg/FR-2011-11-03/pdf/2011-28391.pdf
EPA Proposed approval 76 FR 52623, http://www.gpo.gov/fdsys/pkg/FR-2011-08-23/pdf/2011-21368.pdf
TSD: http://www.regulations.gov/#!documentDetail;D=EPA-R09-OAR-2011-0601-0022
[12] 77 FR 1417, http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf
[13] 40 CFR 60.18. http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol6/pdf/CFR-2010-title40-vol6-sec60-18.pdf
[14] 40 CFR 65.147. http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol15/pdf/CFR-2010-title40-vol15-sec65-147.pdf
[15] 40 CFR 63, subpart SS. http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=1a65b68f3f3a44dbf44870e8aec64884&r=SUBPART&n=40y11.0.1.1.1.18
[16] 40 CFR 60, subpart Ja http://www.law.cornell.edu/cfr/text/40/part-60/subpart-Ja

category. The District's Permit Services Department already evaluates NSPSs on a case-by-case basis to ensure the relevant flares comply with all federal requirements as they are promulgated, therefore, adding any requirements from subparts Ja and OOOO would not achieve additional emission reductions from this source category.

40 CFR 60 Subpart J

The NSPS for refinery flares constructed or modified after June 11, 1973 are regulated in 40 CFR Part 60, Subparts A and J. Subpart A applies to flares as general control devices, specifying design and operational criteria for new and modified flares. Requirements include operating the flare with no visible emissions, monitoring the presence of the pilot flame with a thermocouple or equivalent device, and meeting heat content and maximum tip exit velocity specifications. Rule 4311 is as stringent as Subpart A.

40 CFR 60, subpart J - NSPS for petroleum refineries applies to the affected facilities at a refinery including flares that commence construction, reconstruction or modification after June 11, 1973, but on or before May 14, 2007. Subpart J applies to flares at petroleum refineries, where flares are defined as fuel gas combustion devices, and are limited to burning fuel gas for maintenance of the pilot flame if the fuel gas contains hydrogen sulfide (H_2S) in excess of 0.10 gr/dscf. This limitation does not apply during process upsets, relief valve leakage, or other emergency malfunctions, where vent gases or fuel gas are released to the flare. This subpart also requires that a continuous monitoring and recording device be installed to track emissions of SO_2 or H_2S from the flare, in addition to the installation of an oxygen monitor for correcting the emissions data for excess air.

Amendments to Subpart J add a new paragraph to 40 CFR 60.100 to allow sources affected by 40 CFR part 60, subpart J to comply by following the requirements in 40 CFR part 60, subpart Ja. Other amendments were administrative in nature and provided additional clarity to existing standards.

[17] 40 CFR 60, subpart OOOO http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=5c050fac63d930ea5bc5c11716888545&r=SUBPART&n=40y7.0.1.1.1.102

Further Study Commitment:
Evaluate New NSPS Requirements for Flares

40 CFR 60 Subpart Ja

NSPS for petroleum refineries (40 CFR 60, subpart Ja) apply to flares that commence construction, reconstruction or modification after June 24, 2008, and other affected facilities at petroleum refineries that commence construction, reconstruction, or modification after May 14, 2007. Subpart Ja contains requirements for monitoring systems for certain flares, but does not specify any emission limits or technology requirements.

EPA amended 40 CFR 60 Subpart Ja on September 12, 2012[18]. Amendments clarified existing requirements and applicability including what is considered and what is not considered a flare modification, clarification of secondary flares, and of the records that must be maintained by the operator.

The September 2012 amendments to Subpart Ja included new requirements for flare-related unit and process descriptions, assessments and evaluations, analyses of causes and corrective actions for reportable flaring events, and sulfur limits for petroleum refineries. The NSPS subpart Ja does not implement more stringent requirements than Rule 4311. While there may be some minor differences in terminology or requirements, making direct comparisons is not possible. The same level of controls and emission reductions are achieved through District regulations as through this NSPS. Additionally, as previously stated, the District's Permit Services Department continuously evaluates NSPSs on a case-by-case basis to ensure the relevant flares comply with all federal requirements as they are promulgated.

Subpart Ja has one new exemption for continuous monitoring which allows for fewer requirements, than previously required in the NSPS, and therefore, is not more stringent than current rule language.

40 CFR 60 Subpart OOOO

EPA finalized approval of a new NSPS requirement 40 CFR 60 Subpart OOOO on August 16, 2012[19]. This NSPS may indirectly affect some Valley flares since there is a possibility that a flare is exempt from the majority of Rule 4311 and is used as a control device for a vapor controlled tank that is subject to Subpart OOOO.

Affected facilities under this subpart that may use flares as an approved control device include centrifugal compressors, storage vessels, and onshore natural gas processing

[18] 77 FR 56422, http://www.gpo.gov/fdsys/pkg/FR-2012-09-12/pdf/2012-20866.pdf
[19] 77 FR 49490, http://www.gpo.gov/fdsys/pkg/FR-2012-08-16/pdf/2012-16806.pdf

plants. If the facility chooses to meet the control requirements, then the flare must be designed and operated in accordance with §60.18(b) and must conduct the compliance determination using Method 22 at 40 CFR part 60, appendix A-7, to determine visible emissions. §60.18(b) was last amended Dec. 22, 2008, which is after the last amendment for District Rule 4311 (June 18, 2009). Therefore, Subpart OOOO has no new requirements for flares after Rule 4311 rule adoption.

B. State Requirements

There are no California state Air Resources Board (ARB) requirements specific to flaring activities in California because flares are located at stationary sources, and the emissions are therefore under the jurisdiction of California's local air districts.

C. Local Requirements at Other Air Districts

As mentioned above, flares are under the jurisdiction of local regulatory agencies because they are located at stationary sources. In California, local regulatory agencies include air pollution control districts (APCD) and air quality management districts (AQMD). District Rule 4311 is unique from all other air districts' flare rules in California in that it has a broader applicability. The Rule 4311 source category currently includes flares associated with oil and gas production, combustion, sewage treatment, incinerators, petroleum refining, and VOC control. Flare rules in other air districts in California are generally limited in applicability to flares at petroleum refining operations, or the use of flares at oil and gas or natural gas sources. As previously stated, EPA analysis of Rule 4311 resulted in the 2012 determination that Rule 4311 is as stringent as requirements in other air districts in California (76 FR 68106).

The following is a brief summary of the regulatory comparisons, for the complete review of rule requirement comparisons, refer to the attachment (Rule Requirement Comparisons) at the end of this report.

SCAQMD Rule 1118 (Emissions from Refinery Flares)[20]

SCAQMD adopted Rule 1118 (Emissions from Refinery Flares) in February of 1998. The emissions data collected as a product of Rule 1118, between 1999 and 2003, was analyzed and resulted in recommendations to further strengthen emissions monitoring and reporting procedures, which led to the adoption of amendments on November 4, 2005.

The 2005 amendments prohibit the flaring of vent gases except in emergency situations, or during operational needs, including activities such as startups, shutdowns, and turnarounds. The 2005 amendments also established annual SO_2 performance targets, the

[20] SCAQMD Rule 1118. Retrieved from https://www.aqmd.gov/rules/reg/reg11/r1118.pdf on 12/15/13.

requirement that flares operate in a smokeless manner, and the requirement for annual inspections of pressure relief devices directly connected to flares. Any refinery that does not meet SO_2 performance targets is required to have a FMP. The rule also contains provisions for refineries to give 24-hour advance notice for each large planned flaring activity, to notify SCAQMD within 1-hour of unexpected flaring events, and to submit quarterly reports detailing flow, emissions, and cause of each flaring event.

EPA analysis of District Rule 4311 resulted in the 2012 determination that Rule 4311 is as stringent as requirements in SCAQMD Rule 1118, in terms of core RACT requirements[21]. Additionally, SCAQMD recently identified the need to evaluate flare emissions from sources other than refineries, sulfur recovery plants, and hydrogen production plants since District Rule 4311 regulates these flares and SCAQMD Rule 1118 does not.[22]

BAAQMD Regulation 12 Rule 11 (Flare Monitoring at Petroleum Refineries)[23] and Regulation 12 Rule 12 (Flares at Petroleum Refineries)[24]

On June 4, 2003, BAAQMD adopted Rule 12-11 (Flare Monitoring at Petroleum Refineries), which requires operators to monitor and record emissions data for flares at petroleum refineries. This rule facilitated the collection of emissions data from refineries and resulted in the adoption of Regulation 12 Rule 12.

Regulation 12 Rule 12 (Rule 12-12) (Flares at Petroleum Refineries) was adopted on July 20, 2005 to prohibit the use of refinery flares without the refinery first creating, following, and annually updating an FMP for each flare. Facilities are required to submit flaring reports when a flare at that facility releases more than 500,000 standard cubic feet of gas per calendar day (scf/day). The flaring report must identify the cause, take actions if possible to avoid future flaring from that cause, and explain actions that will be taken. The rule also requires continuous monitoring of the flare system's knock-out drum water seal for leaks, and the submittal of annual reports to BAAQMD evaluating flaring events that released less than 500,000 scf/day, but emitted more than 500 lbs SO_2.

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[21] EPA TSD (Analysis of SJVUAPCD's Rule 4311), http://www.regulations.gov/#!documentDetail;D=EPA-R09-OAR-2011-0601-0022

[22] SCAQMD (Board Meeting Date June 6, 2014 – Adopt the 2016 AQMP Reasonably Available Control Technology Demonstration). Retrieved from http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2014/2014-jun6-031.pdf?sfvrsn=2 [Page 3 of RACT Demonstration, 13th page of the PDF]

[23] BAAQMD Regulation 12 Rule 11. Retrieved from http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2012/rg1211.ashx?la=en on 12/15/13.

[24] BAAQMD Regulation 12 Rule 12. Retrieved from http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2012/rg1212.ashx?la=en on 12/15/13.

EPA analysis of Rule 4311 resulted in the 2012 determination that Rule 4311 is as stringent as requirements in both BAAQMD flare rules in terms of core RACT requirements.

VCAPCD Rule 54 (Sulfur Compounds)[25]

VCAPCD Rule 54 (Sulfur Compounds) was adopted July 2, 1968, and last amended June 14, 1994. Rule 54 has very limited applicability in that it is specific to sulfur compounds only. Rule 54 prohibits the discharge of sulfur compounds from any source, including flares that would exist as a liquid or gas at standard conditions in excess of the specified concentrations. Rule language also specifies several scenarios that are exempt from rule requirements including unplanned flaring, and planned flaring provided certain circumstances are met. Unplanned flaring is exempt from rule requirements as long as the unplanned burning of gas is for emergency or safety concerns. Planned Flaring Events are exempt from rule requirements provided specific conditions are met. Each operator is required to submit a Flaring Management Plan to the VCAPCD that includes descriptions of measures implemented to decrease flare gas volume and reduce sulfur emissions, planned operational or maintenance procedures that may cause flaring, design features of each flare system, and measures to be implemented to reduce the number of planned flaring events.

EPA analysis of Rule 4311 resulted in the 2012 determination that Rule 4311 is as stringent as requirements in VCAPCD Rule 54 in terms of core RACT requirements.

SBCAPCD Rule 359 (Flares and Thermal Oxidizers)[26]

SBCAPCD adopted Rule 359 (Flares and Thermal Oxidizers) on June 28, 1994. Provisions of this rule apply to the use of flares and thermal oxidizers at oil and gas production sources, petroleum refinery and related sources, and natural gas services.

Rule 359 sets specific requirements for the sulfur content in gaseous fuels, technology based standards, flare minimization plans, emergency events, and emission and operational limits.

Section D.3 of Rule 359 requires a FMP be submitted by any source subject to this rule that operates a flare rated at 15 MMBtu/hour or greater. For planned flaring, the FMP for all sources subject to this rule shall list a targeted maximum monthly flared gas volume, which shall not exceed 5% of the average monthly gas handled/produced/treated at the source unless the operator demonstrates such a maximum volume to be infeasible based on safety, engineering or cost constraints and proposes a different percentage. Any flaring that causes an exceedance of the emission limits or standards of Rule 359 shall not be a violation if the operator demonstrates that the exceedance resulted from an emergency event.

[25] VCAPCD Rule 54. Retrieved from http://www.vcapcd.org/Rulebook/Reg4/RULE%2054.pdf on 12/15/13.
[26] SBCAPCD Rule 359. Retrieved from http://www.sbcapcd.org/rules/download/rule359.pdf on 12/15/13.

Rule 359 does not apply to the burning of sulfur compounds in the manufacturing of sulfur compounds. For oil and gas sources that recover sulfur as a by-product of gas treating/sweetening processes, the exemption for manufacturing shall apply to those specific processes (e.g., sulfur recovery plant). Additionally, flares whose flaring operations solely consist of planned, continuous flaring due to the non-availability of a produced gas pipeline outlet are exempt from FMP requirements.

During the development of the District's 2012 PM2.5 Plan and the 2013 Plan for the Revoked 1-Hour Ozone Standard, certain environmental interest groups claimed that District Rule 4311 was not as stringent as the SBCAPCD Rule 359, citing the specific flare minimization target of five percent of the total gas produced/handled/treated. However, the comments failed to point out the second part of the requirement that states that if an operator demonstrates such a maximum volume (5%) is infeasible due to engineering, safety, or cost constraints, the facility could obtain approval of a higher percentage. The District performed a thorough analysis of flare rules in other air districts in California during the development of the two plans, and during the rule amendment project in 2009. The District found that while the SBCAPCD rule appears to include a performance standard restricting the use of flaring, it actually allows flaring under broad conditions, and Rule 4311 is at least as stringent. EPA concurs with this assessment as illustrated by the approval of the rule as a SIP revision in 2011[27]. Therefore, EPA analysis of Rule 4311 resulted in the 2012 determination that Rule 4311 is as stringent as requirements in SBCAPCD Rule 359 in terms of core RACT requirements.

X. VALLEY FLARING COMPARED TO OTHER AIR DISTRICTS

The following discussion compares Valley flares to flares regulated by other air districts in California. Major differences include the types of facilities operating the flares, the capacities of the flares, and the emissions from the flares.

A. Operations and Capacities

One major difference between Valley flares and flares regulated in other air districts is the type of facility that employs them. Rule 4311 regulates flaring from a variety of sources, as discussed in Section IV above (Valley Flares). Facility types include wastewater treatment, oil and natural gas production and processing, cheese and wine production, flat glass manufacturing, dairy operations, and a correctional facility. In contrast, flares regulated by SCAQMD, BAAQMD, VCAPCD, and SBCAPCD are employed only at oil and natural gas production and processing facilities. Because over 88% of flares in the Valley are operated

[27] 76 FR 68106, http://www.gpo.gov/fdsys/pkg/FR-2011-11-03/pdf/2011-28391.pdf

at oil and natural gas production facilities as well, it is useful to compare these facilities between districts.

Flares in the Valley and other air districts are primarily engineered for emergency operation during process upsets and emergency situations. While they can be used during maintenance, new equipment installations, and startup/shut-down, the main concern is safety. In this regard, Valley flares are similar to those in other districts, the difference being that the facilities in SCAQMD, BAAQMD, and SBCAPCD are much larger. The facilities in those districts are mostly operated at massive oil and gas refineries, with significantly higher throughputs than those in the Valley. Temperatures and pressures are higher, cracking regularly occurs, and flares must be engineering to control emergencies and process upsets on a larger scale. Flare gas is typically sent to a flare header, where it is distributed to multiple large flares. The flares at these facilities are much larger in physical size, as well as capacity, as shown in the table below.

Table 6 Flaring Capacity Comparisons (MMBtu/hr)

Air District	Total Flares	Median	Mean	Largest
District	235	33	663	40,000
SCAQMD	29	10,234	14,328	72,751
BAAQMD	23	108	14,442	246,612
VCAPCD	55	34	284	7,100
SBCAPCD	75	17	1,242	18,200

Flaring capacities of the flares in the SCAQMD, BAAQMD, and SBCAPCD are all significantly higher than the flaring capacities of flares in the Valley, while those in VCAPCD are similar size to Valley flares. Flares in BAAQMD have a wide range of capacities, while those in SCAQMD are all greater than 1,000 MMBtu/hr. Figure 6 shows the average capacity of flares in the District, SCAQMD, BAAQMD, VCAPCD, and SBCAPCD.

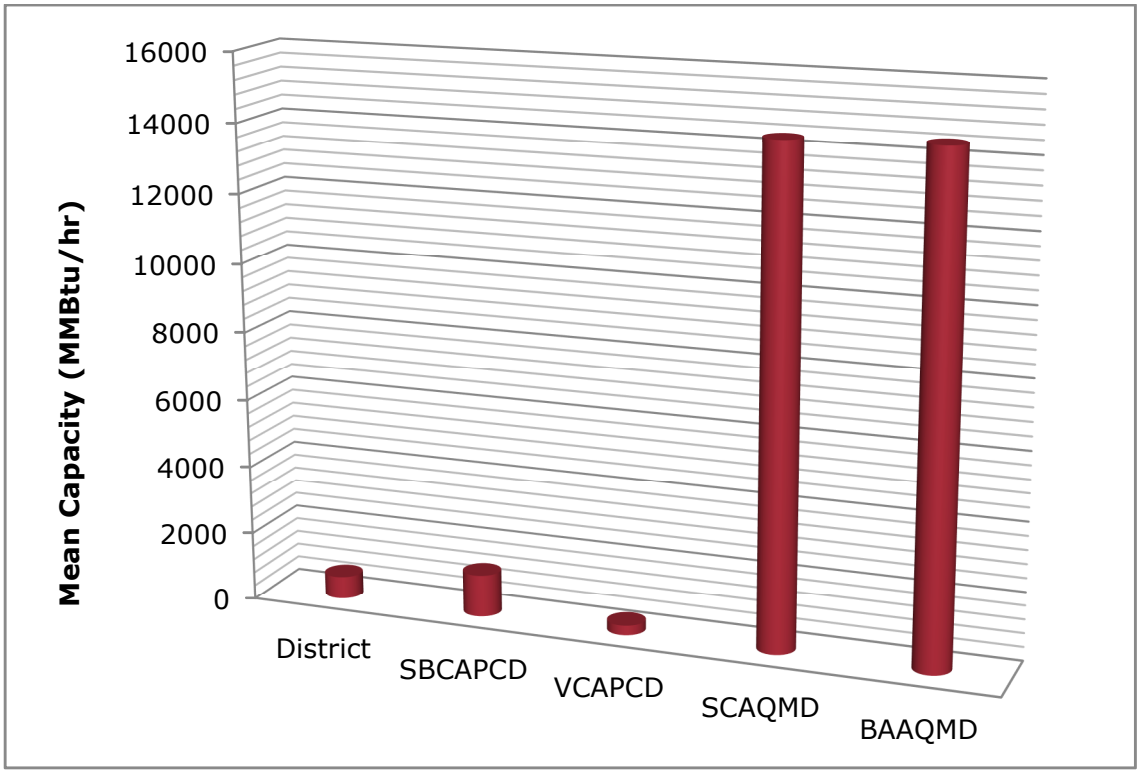

Figure 6 Average Flare Capacities in the Different Air Districts

The size and capacity of flares in other districts explains why the San Joaquin Valley Air District with roughly ten times the number of flares has NOx emissions nearly two times lower than BAAQMD and three times lower than SCAQMD, as illustrated in the emission inventory tables below.

B. Comparison of Emission Inventories

The flaring data in the tables below is from all flaring activities in each air district's jurisdiction and is provided in the ARB-maintained 2012 CEPAM: NORCAL 2012 PM2.5 SIP Baseline Emission Projection Tool.

Table 7 NOx Emission Inventories (tons per day)

Air District	2012	2013	2014	2015	2016	2017	2018	2019
SJVAPCD	0.38	0.39	0.39	0.39	0.39	0.39	0.39	0.39
SCAQMD	1.19	1.20	1.20	1.21	1.22	1.22	1.23	1.23
BAAQMD	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.65
VCAPCD	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13
SBCAPCD	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08

Table 8 VOC Emission Inventories (tons per day)

Air District	2012	2013	2014	2015	2016	2017	2018	2019
SJVAPCD	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
SCAQMD	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41
BAAQMD	1.32	1.33	1.33	1.33	1.33	1.33	1.33	1.33
VCAPCD	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
SBCAPCD	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05

Table 9 SOx Emission Inventories (tons per day)

Air District	2012	2013	2014	2015	2016	2017	2018	2019
SJVAPCD	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.27
SCAQMD	3.27	3.27	3.27	3.27	3.28	3.28	3.28	3.28
BAAQMD	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
VCAPCD	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
SBCAPCD	0.18	0.17	0.17	0.17	0.16	0.16	0.16	0.15

In summary, emissions in SCAQMD, BAAQMD, and SBCAPCD are much higher per flare than in the Valley. Far less volume is flared at Valley facilities, and each facility contributes only a small fraction of emissions. Emissions are effectively controlled at these facilities, and the remaining flaring activity is necessary for safety. Consequently, these facilities cannot reasonably be expected to further reduce flaring.

XI. CONCLUSION

District Rule 4311 limits the emissions from flaring activities while offering flexibility to affected industries by allowing a variety of options to control emissions. Flaring is itself is a highly effective control technology with a 98 percent or greater destruction efficiency.

Additionally, flares are necessary for safety during unforeseeable and unpreventable emergency situations. Any unreasonable restrictions on flaring have the potential to result in catastrophic consequences which may lead to explosions and other dangers.

This further study report was committed to as a part of the District's 2012 and 2013 attainment plans to allow the District sufficient time to review and analyze information submitted to the District by operators of flares in July 2012 pursuant to Rule 4311 requirements. Specifically, the District committed to evaluate FMPs, data from annual monitoring reports, reportable flaring event data, and two new NSPS requirements promulgated by EPA in 2012.

This thorough and comprehensive further study evaluation has resulted in the District's conclusion that operators of flares in the Valley are doing their due diligence to reduce emissions from flaring in the Valley by implementing alternatives to flaring and committing to perform activities to reduce flaring. As such, the District recommends no rulemaking action for Rule 4311.

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Attachment
Rule Requirement Comparisons

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
DATES OF ADOPTION/ AMENDMENT					
Adopted Jun 20, 2002; Amended Jun 15, 2006; Jun 18, 2009	Adopted Feb 13, 1998; Amended Nov 4, 2005	Adopted Jun 4, 2003	Adopted Jul 20, 2005	Adopted Jul, 1968; Revised Oct 1968; Jun 1969; May 1972; Jul 1983; Jun 1994	Adopted Jun 28, 1994
APPLICABILITY					
All flares	Flares used at: • Petroleum (petro.) refineries • Sulfur recovery plants • Hydrogen production plants	Flares used at petro. refineries	Flares used at petro. refineries	Any person who discharges sulfur compounds from any source	Flares and thermal oxidizers used at: • Oil and gas production • Petro. refinery • Natural gas services and transportation • Wholesale trade in petro./petro. products
EXEMPTIONS					
• Municipal solid waste landfill flares subject to Rule 4642 • Flares subject to 40 CFR 60 WWW or Cc • Stationary sources w/ potential to emit <10 tons VOC and <10 tons NOx per	Exempt from sampling and analyses for higher heating values and sulfur concentration for flare event that: • Results from catastrophic event • Is safety hazard to sampling personnel;	Flares and thermal oxidizers used for: • Emissions from organic liquid storage vessels (subj. to R. 8-5) • Emissions from loading racks (subj. to R. 8-6, 8-33, or 8-39)	Same as Rule 11 (except last exemption on list)	Sulfur emission limit and avg. concentration limit don't apply to: Unplanned flaring for emergency or safety if: • Not result of intentional or negligent act, omission, improper	Burning of sulfur, hydrogen sulfide, acid sludge, or other sulfur compounds in manufacturing of sulfur or sulfur compounds For oil and gas sources that recover sulfur as

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
year (Not exempt from recordkeeping)	Sulfur dioxide (SO_2) emissions (emissions) from flaring events caused by: • External power curtailment beyond operator's control • Natural disasters • Acts of war or terrorism (Not exempt from flare monitoring system requirements)	• Emissions from marine vessel loading terminals (subj. to R. 8-44) Thermal oxidizers used for: • Emissions from wastewater treatment systems (subj. to R. 8-8) • Emissions from pump seals (subj. to R. 8-18) (except when emissions from pump are routed to flare header) Monitoring and reporting total hydrocarbon (HC) or methane composition doesn't apply to flare that burns flexicoker gas if weekly sampling shows methane/non-methane content of vent gas flared is <2%/<1% by volume		maintenance or setting of shut-in sensors • Results from operational problems (emergency blowdowns, process upsets, power outages, equipment breakdown) • Records of event kept • corrective measures immediately taken • Event lasts <24 hr. • Notify <4 hr. after detection and submit report if event >1 hr. Planned flaring if: • Notice submitted >72 hr. in advance, justifying work (reasons and steps to minimize sulfur emissions) • Notice can be submitted <72 hr. if hazardous situation, economic harm, or excess emissions • Submit planned	by-product of gas treating/sweetening, manufacturing exemption applies only to those specific processes (Except technology-based std.) Burning gas w/ net heating value <300 Btu/scf if fuel used to incinerate gas has sulfur compounds: • <15 grain/100 ft3 in Southern Zone • <50 grain/100 ft3 in Northern Zone Flare and thermal oxidizer units rated ≤1.7 MMBtu/hr., unless total cumulative rating of all such units at a source is ≥5 MMBtu/hr. (Not exempt from sulfur content std., technology std., monitoring, recordkeeping, and

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
				flaring mgmt. plan • Records kept 2 yrs. • District notified when work complete • Sulfur emissions are minimized • Excess emissions fee paid to District each year ($5.00/lb. SO2 emitted)	recording.) Flares and thermal oxidizers exempt from FMP: • Rated at <15 MMBtu/hr, unless cumulative rating >50 MMBtu/hr. • Operations of only planned, continuous flaring due to non-availability of a produced gas pipeline outlet
FLARE MINIMIZATION PLAN (FMP) REQUIREMENTS					
FMP requirements don't apply if flaring caused by emergency and necessary to prevent accident, hazard or release of vent gas directly to the atmosphere FMP required for petro. refinery flare or any flare w/ capacity ≥5.0 MMBtu/hr.: • Technical specs for each flare, knock-out	Owner/operator of petro. refinery exceeding performance targets submit FMP: • <90 days from end of year w/ emissions exceeding target • Plan is pursuant to Rule 221 and fees pursuant to Rule 306 • List all actions to be taken to meet targets: ○ Technical specs for flares, knock-out	None	FMP required for flares subject to rule and 3-month status reports required until FMP completed: • Technical information for each flare • Upstream equipment and processes (Same as SJVAPCD and SCAQMD) • Equipment, processes, and procedures	Each operator submits a planned flaring management plan: • Measures to decrease FG volume and reduce sulfur emissions • Description of planned operational or maintenance procedures that may cause flaring • Description of each flare system including design	Sources subject to rule and flares and thermal oxidizers rated at ≥15 MMBtu/hr submit FMP: • Planned flaring: targeted max monthly FG volume ○ <5% avg. monthly gas handled/ produced/ treated at source based on 3 years ○ Higher limit may be granted by APCO if

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
pots, surge drum, water seal, and flare gas (FG) recovery system • Process flow diagrams of upstream equipment and process units venting to each flare • Equipment, processes, or procedures planned to install or implement to minimize flaring and planned date • Evaluations of preventative measures to reduce flaring expected due to planned major maintenance activities, gas quantity and quality issues, and recurrent failure of equipment or processes • Submit updated FMP every 5 years and for new or modified equipment prior to	pots, surge drums, water seals and FG recovery systems ○ Process flow diagrams of upstream equipment and process units venting to flares ○ Policies, procedures, and equipment improvements to minimize flaring and flare emissions ○ FG recovery equipment and treatment systems to be installed • FMPs available for 60-day public review prior to approval • 45 days allowed to correct deficiencies • Facility in violation if FMP denied • Revised FMP submitted 90 days after end of year if performance targets exceeded		implemented in last 5 years to reduce flaring and those planned to be installed or implemented • Prevention measures, including schedule for implementation for flaring: ○ That has or will occur during planned major maintenance ○ Expected to occur due to issues of gas quantity and quality (include audits of capacities), or caused by recurrent failure of equipment or processes	features • Description of any sulfur reduction system • Measures to be implemented to reduce the number of planned flaring events	demonstrated to be infeasible • Submit emissions mitigation plan if: ○ Volume limit >10% of avg. monthly gas ○ Sulfur content of flared gas >239 ppmv/ >796 ppmv in Southern/ Northern Zone • The emissions mitigation plan must achieve 50% reduction of greater of actual or proposed avg. monthly FG volume limit • Owner/operator reimburses for review and approval of plans FMP includes: • Measures to decrease volume of FG and planned flaring events • Measures to prevent emergency flaring and unplanned

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
installing					flaring • Flare system • FG monitoring system • Design and operation features of pilot and purge gas system • Design features of flare to handle nominal and peak gas flows and range of compositions • Plans to reduce planned flaring emissions • Schedules to reduce planned shutdowns • Proposed study of different settings to minimize emissions • Summary of scheduled/typical planned flaring • Review FMP every 5 years
ANNUAL MONITORING REPORTS					
For refinery flare or flare w/ flaring capacity ≥50 MMBtu/hr: Operator submit annual report	Submit quarterly report ≤30 days after end of each quarter including: • Information required	Monthly report: • Total volumetric flow each day and month • If gas composition monitored w/	None	None	Submitted annually, by March 1 of the following calendar year, including: • Monthly volumes of

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
≤30 days after end of each 12 month period including: • Total volumetric flow of vent gas (scf) for each day • Contents of vent gas composition: ○ Hydrogen sulfide ○ Methane ○ HC • If vent gas composition monitored by continuous analyzer or analyzers: the following for each hour of the month: ○ Avg. total HC content by volume ○ Avg. methane content by volume ○ Total reduced sulfur content by volume or hydrogen sulfide content by volume • Avg. molecular weight for each hour of each month (if measured) • For pilot and purge	to be monitored: ○ Table of nine operating parameters, based on flare type (clean service, emergency service, general service) ○ Alternative flare vent gas sampling information necessary to calculate flare emissions ○ Flare monitoring system data ○ Images of visible emissions ○ Presence of pilot flame ○ Pilot gas and purge gas flow to each flare • Total daily and quarterly emissions of criteria pollutants from each flare and each flare event along with information used to calculate emissions	sampling, content by volume for each sample of total HC, methane, and H_2S • If composition monitored w/ continuous analyzer, avg. content by volume of: total HC; methane; total reduced sulfur; H_2S • Avg. molecular weight for each hour of the month (if measured) • For pilot & purge gas ○ Type of gas ○ Volumetric flow for each day and month ○ Means used to determine flow • For any 24-hr period when 1 million scf flared, description: ○ Cause ○ Time and duration ○ Source ○ Measures to reduce or eliminate flaring • Monitoring system downtime periods			gas flared per planned continuous and planned intermittent flaring categories • Summary of total gas volume released during emergencies and weighted-average H2S content for the entire volume • Monthly reporting on any exceedance of the allowable monthly volume of gases planned for flaring

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
gas: ○ Type of gas used ○ Volumetric flow for each day and each month ○ Means used to determine flow • Flare monitoring system downtime • SO_2 emissions for each day and each month • Flow verification report for each flare	• Description of cause and category of each flare event • Records of annual acoustical or temperature leak survey • Flare monitoring system downtime periods • Copy of written notices for all reportable air releases related to any flare event	• Images recorded for the month • Methane, non-methane, and SO_2 emissions for each day and for the month Semi-annual flow verification report, comparing flow measured by monitoring system and flow verification for same period of time			
REPORTABLE FLARING EVENT REPORTS					
• Definition: ○ Flaring event where >500,000 scf gas flared/day or ○ SO2 emissions >500 lb/day ○ Ends when water seal integrity demonstrated or ○ For flares w/o water seal, ends when flow <0.12 ft/s • Submit annual report summarizing all	Requirements: • Notify by telephone ≤1 hr. of unplanned flare event w/ emissions >100 lb. VOC, >500 lb. SO2, or >500,000 scf gas • Submit Specific Cause Analysis w/in 30 days – cause, duration, mitigation/ corrective actions	For any 24-hour period during which >1 million scf of vent gas was flared: • Cause • Time of occurrence and duration • Source or equipment of origin • Measures taken to reduce or eliminate flaring	Notify if volume flared >500,000 scf per day: • Results of cause investigation • Measures to prevent recurrence • Justification for rejecting measures • Explanation why consistent with FMP • Explanation of why emergency and cannot be recovered • Volume flared	For unplanned flaring >1 hr. in duration: • Notify <4hr. after detection • Submit report: ○ Date, time, duration, volume of gas flared ○ Reasons for flaring ○ Settings pressure relief valves and max/min allowed safety settings ○ Corrective measures and actions to prevent	Exceedance not a violation if emergency: • Inform <4 hr. after start of next business day • Document event occurrence and causes • Submit <7days after end of event: ○ Description of event and mitigating and corrective actions implemented ○ Demonstration

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
reportable flaring events: ○ Results of cause investigation ○ Mitigation/ corrective actions to prevent recurrence ○ Justification for rejecting measures ○ Explanation of why emergency and cannot be recovered ○ Date, time, duration			• Methane, non-methane, HC, and SO_2 emissions	recurrence ○ Sulfur emissions ○ Equipment or controls that failed For planned flaring: • Notice submitted >72 hr. prior: ○ Work that requires ○ Date and time ○ Expected gas volume and sulfur emissions ○ Steps or equipment to minimize sulfur emissions	reasonable steps taken to minimize excess emissions ○ Demonstration that emergency not caused by improperly designed equipment; lack of preventative maintenance; careless or improper operation; operator error; willful misconduct ○ Document that source was properly operated at time event occurred