San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

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DATE: December 17, 2020

TO: SJVUAPCD Governing Board

FROM: Samir Sheikh, Executive Director/APCO
Project Coordinator: Jonathan Klassen

RE: **<u>ITEM NUMBER 12: ADOPT PROPOSED AMENDMENTS TO RULE 4311 (FLARES)</u>**

RECOMMENDATIONS:

1. Adopt proposed amendments to Rule 4311 (Flares).

2. Authorize the Chair to sign the attached Resolution.

BACKGROUND:

The *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards (2018 PM2.5 Plan)* was adopted by your Board on November 15, 2018. The development of the *2018 PM2.5 Plan* utilized extensive science and research, state of the art air quality modeling, and the best available information in developing a strategy for bringing the Valley into attainment with the federal health-based 1997, 2006, and 2012 PM2.5 standards as expeditiously as practicable by the respective federal deadlines of 2020, 2024, and 2025. The attainment strategy includes a combination of innovative regulatory and non-regulatory measures for both stationary and mobile sources that built upon stringent air quality measures already in place from earlier District attainment plans and measures adopted by your Board. The *2018 PM2.5 Plan* was developed through an extensive public process, with wide-ranging input and support from involved parties representing environmental, business, and city interests. Among these measures is a commitment from the District to seek additional emission reductions from flares through amendments to District Rule 4311 (Flares).

The *2016 Plan for the 2008 8-Hour Ozone Standard* (*2016 Ozone Plan*) which was adopted by your Board on June 16, 2016 also includes a commitment to further evaluate emission reductions from flaring in the Valley. The comprehensive strategy in the plan was designed to bring the San Joaquin Valley into attainment of EPA's 2008 8-hour ozone standard of 75 ppm as expeditiously as practicable, and no later than December 31, 2031. The District is currently on-track for attainment of this standard, and continued emission reductions of nitrogen oxides (NOx) through the implementation of control measures, including the proposed amendments to Rule 4311, will ensure that the Valley continues to make progress towards attainment of both the 2008 ozone standard, as well as the recently strengthened 2015 federal 8-hour ozone standard of 70 ppm.

As included in the District's *2018 PM2.5 Plan* as well as the *2016 Ozone Plan*, District staff has evaluated the potential for requirement of ultra-low NOx (ULN) flares at facilities in the Valley, as well as enhancements to flare minimization practices. Based on a comprehensive technical analysis, in-depth review of local, state, and federal regulations, and a robust public process, District staff are proposing several modifications to Rule 4311 to reduce emissions from flaring in the San Joaquin Valley. The proposed amendment to District Rule 4311 will remove the exemptions for flares operating at non-major source facilities as well as at landfills, and will establish low-NOx emissions limits for multiple categories of facilities with flares used over specified annual flaring throughput thresholds. The amendments have been designed to reduce emissions from flaring in the Valley by requiring operators to install the cleanest ultra-low NOx flaring technology, and encouraging operators to seek beneficial uses for waste gas, rather than flaring in the most cost-effective manner.

Today's recommendations satisfy the District's control measure commitments in the *2018 PM2.5 Plan* and the *2016 Ozone Plan*. The proposed amendments to Rule 4311 are estimated to reduce NOx emissions from flaring in the Valley by 37.2%, PM2.5 by 19.4% and VOC by 30.4%. Based on the emissions inventory used for the *2018 PM2.5 Plan*, the proposed amendments will achieve an estimated 0.19 tons per day (tpd) of NOx emission reductions in 2024, to be applied towards the District's aggregate commitment included in the *2018 PM2.5 Plan*, as well as an estimated 0.03 tpd of PM2.5 and 0.39 tpd of VOCs.

The District's Citizens Advisory Committee made up of members representing environmental, industry/ag, and city interests provided consensus support for the proposed regulatory measures. The purpose of this item is to seek approval from your Board to adopt the proposed amendments to District Rule 4311.

DISCUSSION:

The primary use of a flare is that of a safety device to reduce the potential for fires and explosions due to unburned gaseous hydrocarbon releases. A flare is a combustion device designed to destroy VOCs in a high-temperature flame. Major industries in the Valley utilizing flares impacted by this rule amendment are Oil and Gas Production, and the Sanitation, Sewerage & Refuse Industries. Flares are used to burn purged and waste gas from refineries, gases from oil wells, landfills, sewage digesters, ammonia fertilizer plants, and gaseous wastes from chemical industries. As with any type of combustion equipment, flares generate air pollutants such as nitrogen oxides, sulfur dioxide, carbon monoxide, and particulate matter, in addition to the release of hydrocarbons that have not been completely combusted. Flaring activities in the Valley emit 0.53 tpd of NOx emissions, representing 0.26% of the annual average NOx emissions in the Valley.

Originally adopted June 20, 2002, District Rule 4311 was developed to implement RACT requirements for “major sources” of Volatile Organic Compounds (VOCs) and NOx. District Rule 4311 was then amended June 15, 2006 to change the major source applicability cutoff from 25 tons per year to 10 tons per year. Most recently, on June 18, 2009, District Rule 4311 was amended to add monitoring, reporting requirements and flare minimization requirements as well as introduce performance targets for emissions of sulfur from flares at petroleum refineries.

The District has continued to evaluate technologically and economically feasible options for reducing emissions from this sector in support of the District’s attainment plan commitments and ongoing work to reduce air pollution and improve public health. This includes studies on opportunities for further emission reductions from flaring in the Valley, as well as regular working group meetings and ongoing technical evaluations.

Ultra-low NOx Flare Technology

Commercially available ULN flares guarantee NOx limits of 15-20 ppmv corrected to 3% O_2. All ULN flares incorporate the “enclosed” flare design involving a tall, large diameter exhaust stack/housing, which allows for lower NOx emissions and more complete combustion of flared gases than conventional open flares. The large exhaust stack of the enclosed flare also allows stack ports for the insertion of probes to measure exhaust emissions, and conceals the visible flame from view to allow less public objection compared to the intrusive glow and noise of an open flame elevated flare.

Ultra-low NOx, low CO emissions, and ≥ 99% VOC destruction efficiency is accomplished with pre-mix combustion air technology and either a conventional flame burner or a mesh stainless steel surface burner head. These advanced burners, combined with the longer retention time in the enclosure stack than is possible with an open flare, result in the ultra-low NOx emissions and reduced CO emissions along with more complete combustion that yields higher VOC destruction efficiency. Pre-mix combustion with a closely monitored and maintained air-to-fuel ratio requires supplemental air provided by a sizeable auxiliary air blower, computer control of combustion parameters, and in some instances, supplemental gas fuel and gas sulfur removal systems.

Summary of Proposed Amendments to Rule 4311

Based on the comprehensive technology assessment that District staff have conducted for this source category, as well as a thorough review of state, federal, and other air district regulations, District staff are proposing several modifications to Rule 4311. District staff are proposing to remove the non-major source exemption, remove the existing landfill exemption, and add performance standards that require ULN technology for flares in order to reduce emissions from flaring in the Valley.

The proposed amendments to Rule 4311 are designed to encourage flare operators to find beneficial alternative uses of gas combusted, or to deploy the cleanest flaring technologies to achieve additional NOx emission reductions from this sector. Specific limits are proposed depending on the applicability of the ultra-low NOx technology to different flaring processes with industry specific considerations. The installation of ULN flare technology would be required for flares that combust the majority of gas in the Valley. This would require installation of ULN flares associated with 65% of total gas flared from all categories. The new ULN requirements would be in addition to current requirements, including flare minimization plans.

Operators of flares subject to proposed Rule 4311 will be required to either demonstrate flare use below annual throughput thresholds specific to the type of facility or meet flare emissions limits appropriate to the facility type.

Table 2 in the rule, displayed below, would establish the following annual throughput thresholds:

Table 2 - Flare Annual Throughput Thresholds (MMBtu/calendar year)	
Flare Category	MMBtu/yr.
A. Flares used at Oil and Gas Operations	25,000
B. Flares used at Landfill Operations	90,000
C. Flares used at Digester Operations	100,000
D. Flares used at Organic Liquid Loading Operations	25,000

District staff evaluated various approaches to determining thresholds to require flare operators to take action to reduce emissions. The only other rule in the nation requiring ULN flares is South Coast Air Quality Management District (SCAQMD) Rule 1118.1. SCAQMD Rule 1118.1 sets thresholds for action based on a percentage of capacity used annually. Applying a percentage-based approach would have excluded some of the most highly utilized flares in the Valley. As an alternative to this approach, District staff evaluated a set of annual throughput thresholds by flare type, with the goal of achieving emissions reductions in greater quantity and more cost-effectively than those achievable under the approach included in SCAQMD Rule 1118.1. The approach included in the District’s proposed rule achieves greater emissions reductions than the approached included in SCAQMD Rule 1118.1 at approximately half the cost, by focusing on flares with the highest usage, resulting in a more effective proposed rule.

Table 3 in the District's proposed Rule 4311, below, would establish NOx limits for those flares exceeding the Table 2 annual throughput thresholds:

Table 3 – VOC and NOx Emissions Requirements for Flares		
Flare Category	VOC (lb./MMBtu)	NOx (lb./MMBtu)
A. Flares at Oil and Gas Operations	0.008	0.018
B. Flares at Landfill Operations	0.038	0.025
C. Flares at Digester Operations (Located at a Major Source)	0.038	0.025
D. Flares at Digester Operations (Not located at a Major Source)	N/A	0.060
E. Flares at Organic Liquid Loading Operations	Pounds/1,000 gallons loaded	
	N/A	0.034

The above emission limits were established based on the currently available control technologies that have been proven to be technologically feasible for each specific type of flaring operation, taking into consideration the gas composition and flow.

Operators of flares that exceed the annual throughput thresholds must install an ULN flare that meets the emission limits of Table 3, or implement a beneficial use project to otherwise reduce flaring activity at the facility, by December 31, 2023. For operators that choose to comply with Rule 4311 requirements by updating their Permit to Operate to include a limit below the annual throughput thresholds, an ATC for the updated permit must be received by the District by July 1, 2022, and compliance with the permitted limits must be shown in the 2024 calendar year and annually thereafter. If a flare exceeds the permitted annual throughput thresholds for two consecutive calendar years, then an operator must install an ULN flare by December 31 of the year following the second year of the exceedance. The compliance dates included in the rule ensure that emission reductions will be achieved in the years 2024 and 2025, as committed to in the *2018 PM2.5 Plan*, to support attainment of the health-based federal PM2.5 standards.

The proposed amendments are expected to reduce the flaring emissions in the Valley by an estimated 0.19 tpd of NOx (37.2%), 0.03 tpd PM2.5 (19.4%) and 0.39 tpd VOC (30.4%) in 2024. The District's *2018 PM2.5 Plan* projected that this measure would achieve 0.05 tpd of NOx reductions.

District staff have prepared a conservative cost-effectiveness analysis for proposed amendments to Rule 4311, considering the NOx emission reductions achieved through the implementation of ultra-low NOx flare technology. Taking the rule amendments as a whole, the cost effectiveness is approximately $100,581 per ton NOx emissions reduced. For flares at oil and gas facilities, the cost-effectiveness of this rule project is $157,120 per ton NOx reduced. For flares at landfill facilities, the cost-effectiveness for this rule project is approximately $56,578 per ton NOx reduced. For flares at wastewater treatment facilities, the estimated cost effectiveness for this rule project is approximately $52,492 per ton NOx reduced. While these conservative cost-effectiveness numbers are high, it is likely that operators will be able to develop and implement beneficial use projects for waste gases in lieu of installing costly ultra-low NOx flare technologies, achieving even greater emission reductions at more cost-effective levels.

Health Benefits of Implementing Plan Measures

The health risks of PM2.5 have been linked to a variety of health issues, including aggravated asthma, increased respiratory symptoms (irritation of the airways, coughing, difficulty breathing), decreased lung function in children, development of chronic bronchitis, irregular heartbeat, non-fatal heart attacks, increased respiratory and cardiovascular hospitalizations, lung cancer, and premature death. CARB explains that even short-term exposure of less than 24 hours can cause for premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days. Children, older adults, and individuals with heart or lung diseases are the most likely to be affected by PM2.5.

PM2.5 emissions are characterized by a unique combination of direct and secondarily formed constituents. As NOx emissions are a key precursor to the formation of ammonium nitrate, which is a large portion of total PM2.5 during the peak winter season, continuing to assess the feasibility of achieving additional NOx reductions across the Valley is critical for continuing to improve PM2.5 throughout the region. PM2.5 is a major health risk because it can be inhaled more deeply into the gas exchange tissues of the lungs, where it can be absorbed into the bloodstream and carried to other parts of the body. Exposure to elevated concentrations of ozone also poses significant health risks, and the Valley has long worked to reduce NOx emissions as the primary precursor for the formation of ozone in the Valley.

To address federal health-based standards for ozone and PM2.5 and improve public health, the District develops attainment plans and implements control measures to lower direct and precursor emissions throughout the San Joaquin Valley. The proposed amendments will achieve additional reductions in NOx, PM2.5, and VOC emissions as requirements are implemented by affected sources and new technologies are installed. Additionally, ongoing efforts to reduce the overall amount of flaring will further reduce directly emitted PM2.5 emissions. New regulatory and incentive-based measures proposed by both the District and CARB, combined with existing measures achieving new emissions reductions, are necessary to achieve the emissions reductions required to attain each health-based federal standard as expeditiously as practicable, and will improve public health as emissions reductions and associated health benefits are realized.

COVID-19 Pandemic Considerations

The COVID-19 pandemic is first and foremost a human tragedy, which has sent society into uncharted territory, and the economic impacts to the United States and the world are significant and far-reaching. The Valley and nation are currently facing uncertain economic times that have the potential to be devastating to local Valley businesses and residents. As an essential public health agency and member of the Valley community, the District has a responsibility to continue providing essential public services while keeping our employees and our communities safe. As the COVID-19 situation continues to evolve, the District has remained open, providing essential services to the residents, businesses, and public agencies of the Valley through virtual tools and direct support from our employees working remotely. District staff also understand the major disruption to the Valley and nation's economy caused by the COVID-19 pandemic; and have committed to work closely with those that we regulate to understand the evolving situation and associated impacts, and develop options for meeting air quality obligations.

In response to COVID-19, District has modified public participation process to ensure continued development of measures included in District commitments in the federally approved *2018 PM2.5 Plan*. Beginning in March 2020, the District transitioned public workshop processes for this rule project to virtual online webinars with multiple options for public participation including video, phone, and email, with full translation services provided at public meetings. The District has continued to hold public workshops and to meet directly with stakeholders through virtual meeting tools throughout the pandemic to enable robust remote public participation.

The COVID-19 pandemic has resulted in the third oil price collapse that the oil and gas extraction industry has seen in just the last 12 years. A combination of job losses and remote work means that far fewer people are commuting. Additionally, travel for recreational activities is reduced as well, whether because facilities are closed or have restrictions in place or because people are reluctant to expose themselves to illness. Those who have lost their jobs as a result of the coronavirus are conscious of their expenses, including on travel. Because the COVID-19 pandemic has dramatically altered metrics used to estimate socioeconomic impacts, such as revenue and employment, the socioeconomic impact analysis conducted for this rule uses a "COVID-adjusted baseline" for these metrics, with details presented in Appendix D to the Final Draft Staff Report.

While the pandemic has had far-reaching economic impacts, it is critical that the Valley continue to make progress towards attainment of the health-based federal ambient air quality standards. The health benefits of improved air quality, and the associated economic benefits, have been well documented. District staff have worked to develop proposed amendments to this rule that provides as much flexibility to affected industry as possible, while still ensuring that real emission reductions will be achieved to support increased air quality, and associated benefits to public health, throughout the Valley.

Supporting Regulatory Analyses

Cost Effectiveness Analysis

The California Health and Safety Code (CH&SC) Section 40920.6(a) requires the District to conduct both an absolute cost effectiveness analysis and an incremental cost effectiveness analysis of available emission control options before adopting each BARCT rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements of a rule. Details of the cost effectiveness analysis is contained in Appendix C to the report.

Socioeconomic Impact Analysis

Pursuant to CH&SC 40728.5, "whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent data are available; perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation." The District, through a competitive solicitation process, selected Eastern Research Group, Inc. (ERG) to perform the socioeconomic impact analysis. District staff identified flares subject to proposed Rule 4311, estimated units likely to be affected by new provisions. Compliance cost information was collected from vendors and stakeholders throughout the public process. The information was provided to ERG to perform the analysis and draft the report. ERG's report includes analysis of the impacts of the COVID-19 pandemic. Because the COVID-19 pandemic has dramatically altered metrics used to estimate socioeconomic impacts, such as revenue and employment, the consultant used a "COVID-adjusted baseline" to estimate these metrics. The socioeconomic report is attached as Appendix D to the final draft staff report.

Rule Consistency Analysis

Pursuant to CH&SC 40272.2, District staff prepared a rule consistency analysis that compares the elements of proposed Rule 4311 with the corresponding elements of other District rules, federal regulations, and guidelines that apply to the same source category or type of equipment. District staff found that none of the proposed requirements of this rule would conflict with other District rules, or federal rules, regulations, or policies covering similar stationary sources.

Environmental Impacts

Pursuant to the California Environmental Quality Act (CEQA), staff investigated the possible environmental impacts of the proposed amendments to Rule 4311. Based on the analysis conducted, District staff has concluded that the proposed amendments are exempt from the provisions of CEQA, as identified in the Staff Report referenced herein. Staff recommends filing a Notice of Exemption under the provisions of Public Resource Code 15062.

Public Rule Development Process

As part of the rule development process, District staff conducted a public scoping meeting in August 2017. Three sets of flare operator workgroup meetings were held October 2017, April 2019, and July 2019. Four public workshops were held November 2019, July 2020, September 2020, and October 2020. At the public meetings, District staff presented the objectives of the proposed rulemaking project, explained the District's rule development process, solicited suggestions from affected stakeholders, and informed all interested parties about tentative upcoming workshop dates, comment periods, and project milestones. Additionally, emission reductions from this source category have been a priority for the Community Steering Committees (CSC) as a part of adopted Community Emission Reduction Programs under AB 617, and the District has invited CSC feedback in the rule development process. Updates were also presented throughout the rulemaking process at multiple public meetings of the Citizens Advisory Committee, Environmental Justice Advisory Group, and the District Governing Board.

In accordance with CH&SC Section 40725, the proposed amendment to Rule 4311 was publicly noticed and made available for public review on November 17, 2020. The public was also invited to provide comments during the public hearing for the proposed adoption of this rule.

The comments received throughout this public process have been integral to the development of this rule amendment, and have been incorporated as appropriate into the proposed rule and final draft staff report. A summary of significant comments and District responses is available in Appendix A of the final draft staff report.

FISCAL IMPACT:

District staff expects no fiscal impact to result from this action.

Attachments:

Attachment A: Resolution for Proposed Amendments to Rule 4311 (4 pages)
Attachment B: Proposed Amendments to Rule 4311 (20 pages)
Attachment C: Final Draft Staff Report with Appendices for Proposed Amendments to Rule 4311 (110 pages)

San Joaquin Valley Unified Air Pollution Control District
Meeting of the Governing Board
December 17, 2020

ADOPT PROPOSED AMENDMENTS TO RULE 4311 (FLARES)

Attachment A:

Resolution for Proposed Amendments to Rule 4311
(4 PAGES)

BEFORE THE GOVERNING BOARD OF THE
SAN JOAQUIN VALLEY UNIFIED
AIR POLLUTION CONTROL DISTRICT

IN THE MATTER OF: PROPOSED AMENDMENTS TO RULE 4311 (FLARES)	) **RESOLUTION NO. ___________**

WHEREAS, the San Joaquin Valley Unified Air Pollution Control District (District) is a duly constituted unified air pollution control district, as provided in California Health and Safety Code (CH&SC) Sections 40150 et seq. and 40600 et seq.; and

WHEREAS, said district is authorized by California Health and Safety Code Section 40702 to make and enforce all necessary and proper orders, rules, and regulations to accomplish the purpose of Division 26 of the CH&SC; and

WHEREAS, pursuant to federal Clean Air Act (CAA) §107, the San Joaquin Valley Air Basin (Valley) is designated as nonattainment for the national health-based air quality standards for particulate matter 2.5 microns and smaller (PM2.5) and 8-hour ozone; and

WHEREAS, the District Governing Board adopted the 2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards (*2018 PM2.5 Plan*) on November 15, 2018 pursuant to the federal Clean Air Act; and

WHEREAS, the District Governing Board adopted the 2016 Plan for the 2008 Ozone Standard (*2016 Ozone Plan*) on June 16, 2016 pursuant to the federal Clean Air Act; and

WHEREAS, the District's *2018 PM2.5 Plan* and *2016 Ozone Plan* commits the District to amend Rule 4311 to evaluate further reductions of NOx emissions from this source category; and

WHEREAS, the staff report and other supporting documentation was presented to the District Governing Board and the Board has reviewed and considered the entirety of this information prior to approving the project; and

WHEREAS, District staff conducted public workshops regarding Proposed Rule 4311 on November 13, 2019, July 30, 2020, September 24, 2020, and October 8, 2020; and

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WHEREAS, a public hearing for the adoption of proposed amendments to Rule 4311 was duly noticed for December 17, 2020, in accordance with CH&SC §40725.

NOW, THEREFORE, BE IT RESOLVED AS FOLLOWS:

1. The Governing Board hereby adopts Proposed Amendments to Rule 4311 (Flares). Said rule shall become effective on December 17, 2020.

2. The Governing Board hereby finds, based on the evidence and information presented at the hearing upon which its decision is based, that all notices required to be given by law have been duly given in accordance with CH&SC §40725, and the Governing Board has allowed public testimony in accordance with CH&SC §40726.

3. In connection with said rulemaking, the Governing Board makes the following findings as required by CH&SC §40727:

a. **NECESSITY.** The Governing Board finds, based on the staff report, public testimony, and the record for this rulemaking proceeding, that a need exists for said rule amendments. Adopting said rule is necessary to meet the commitments of the SIP and requirements of the federal CAA and the California CAA. Said rule satisfies the commitments in the District's *2018 PM2.5 Plan* and *2016 Ozone Plan*.

b. **AUTHORITY.** The Governing Board finds that it has the legal authority for said rulemaking under CH&SC §40000 and 40001.

c. **CLARITY.** The Governing Board finds that said rule is written or displayed so that the meaning can be easily understood by those persons or industries directly affected by said rule.

d. **CONSISTENCY.** The Governing Board finds that said rule is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.

e. **NONDUPLICATION.** The Governing Board finds that said rule does not impose the same requirements as any existing state or federal regulation.

f. **REFERENCE.** The Governing Board finds that said rulemaking implements federal CAA §172(c)(1) and CH&SC §40920.

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4. The Governing Board hereby finds that the requirements of CH&SC §40728.5 and 40920.6 have been satisfied to the greatest extent possible, and that the Governing Board has actively considered and made a good faith effort to minimize any adverse socioeconomic impacts associated with the proposed rulemaking.

5. The Governing Board finds that, because this rulemaking will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, the proposed actions do not constitute a project under the provisions of the California Environmental Quality Act (CEQA) Guidelines §15378. Furthermore, the proposed actions are exempt for actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment (CEQA Guidelines §15308) (Actions by Regulatory Agencies for Protection of the Environment) and exempt from CEQA per the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment (CEQA Guidelines §15061 (b)(3)).

6. Pursuant to Section 15062 of the CEQA guidelines, the Executive Director/Air Pollution Control Officer is directed to file a Notice of Exemption with the County Clerks of each of the counties in the District.

7. The Executive Director/Air Pollution Control Officer is directed to file with all appropriate agencies certified copies of this resolution and the rule adopted herein and is directed to maintain a record of this rulemaking proceeding in accordance with CH&SC §40728.

8. The Executive Director/Air Pollution Control Officer is directed to transmit said rule to the California Air Resources Board for incorporation into the SIP.

9. The Governing Board authorizes the Executive Director/Air Pollution Control Officer to include in the submittal or subsequent documentation any technical corrections, clarifications, or additions that may be needed to secure EPA approval, provided such changes do not alter the substantive requirements of the approved rule.

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THE FOREGOING was passed and adopted by the following vote of the Governing Board of the San Joaquin Valley Unified Air Pollution Control District this 17th day of December 2020, to wit:

AYES:

NOES:

ABSENT:

SAN JOAQUIN VALLEY UNIFIED
AIR POLLUTION CONTROL DISTRICT

By ______________________________
Craig Pederson, Chair
Governing Board

ATTEST:
Clerk to the Governing Board

By ____________________
Michelle Franco
Clerk to the Board

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San Joaquin Valley Unified Air Pollution Control District
Meeting of the Governing Board
October 15, 2020

ADOPT PROPOSED AMENDMENTS TO RULE 4311 (FLARES)

Attachment B:

Proposed Amendments to Rule 4311

(20 PAGES)

RULE 4311 FLARES (Adopted June 20, 2002; Amended June 15, 2006; Amended June 18, 2009; Amended [rule adoption date])

1.0 Purpose

To limit the emissions of volatile organic compounds (VOC), oxides of nitrogen (NOx), and sulfur oxides (SOx) from the operation of flares.

2.0 Applicability

This rule is applicable to operations involving the use of flares.

3.0 Definitions

3.1 Air-Assisted Flare: a combustion device where forced air is injected to promote turbulence for mixing and to provide combustion air.

3.2 Air Pollution Control Officer (APCO): as defined in Rule 1020 (Definitions).

3.3 Air Resources Board (ARB): as defined in Rule 1020 (Definitions).

3.4 Annual Throughput: the volume of vent gas, converted to heat input in million Btu (MMBtu), that is combusted in a flare in one calendar year.

3.~~4~~5 British Thermal Unit (Btu): the amount of heat required to raise the temperature of one pound of water from 59°F to 60°F at one atmosphere.

3.~~5~~6 Calendar Day: any day starting at twelve o'clock AM and ending at 11:59 PM.

3.7 Chemical Operations: facilities engaged in chemical production or distribution including fuel production.

3.~~6~~8 Coanda Effect Flare: A flare in which the high pressure flare gas flows along a curved surface inspirating air into the gas to promote combustion.

3.9 Digester Operation: a facility that produces gas consisting of methane, carbon dioxide, and traces of other contaminant gases, from either mesophilic or thermophilic digestion of biodegradable waste.

3.~~7~~10 Emergency: any situation or a condition arising from a sudden and reasonably unforeseeable and unpreventable event beyond the control of the operator. Examples include, but are not limited to, not preventable equipment failure, natural disaster, act of war or terrorism, or external power curtailment, excluding a power curtailment due to an interruptible power service agreement from a utility. A flaring event due to improperly designed equipment, lack of preventative maintenance, careless or improper operation, operator error or willful misconduct does not quali~~t~~fy as an emergency. An emergency situation requires immediate corrective action to restore safe operation. A planned flaring event shall not be considered as an emergency.

3.~~8~~11 Enclosed Flare: a flare composed of multiple gas burners that are grouped in an enclosure, and are staged to operate at a wide range of flow rates.

3.~~9~~12 EPA: United States Environmental Protection Agency.

3.1~~0~~3 Feasible: Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

3.1~~1~~4 Flare: a combustion device that oxidizes combustible gases or vapors, where the combustible gases or vapors being destroyed are routed into the burner without heat recovery.~~a direct combustion device in which air and all combustible gases react at the burner with the objective of complete and instantaneous oxidation of the combustible gases. Flares are used either continuously or intermittently and are not equipped with devices for fuel-air mix control or for temperature control.~~

3.1~~2~~5 Flare Event: any intentional or unintentional combustion of vent gas in a flare. The flare event ends when the flow velocity drops below 0.12 feet per second or when the operator can demonstrate that no more vent gas was combusted based upon the monitoring records of the flare water seal level and/or other parameters as approved by the APCO in the Flare Monitoring and Recording Plan. For a flare event that continues for more than one calendar day, each calendar day or venting of gases shall constitute a separate flare event.

3.1~~3~~6 Flare Gas: gas burned in a flare.

3.1~~4~~7 Flare Minimization Plan (FMP): a document intended to meet the requirements of Section 6.5 of this Rule.

3.1~~5~~8 Flare Monitoring System: all flare monitoring and recording equipment used for the determination of flare operating parameters. Flare monitoring and recording equipment includes, but is not limited to, sample systems, transducers, transmitters, data acquisition equipment, data recording equipment, and video monitoring equipment and video recording equipment.

~~3.16 Flexigas: a low BTU fuel gas produced by gasifying coke produced in a fluid-bed Coker. Due to the air used in the gasifying process, Flexigas is approximately 50% nitrogen.~~

3.1~~7~~9 Gaseous Fuel: any gases used as combustion fuel which include, but are not limited to, any natural, process, synthetic, landfill, sewage digester, or waste gases. Gaseous fuels include produced gas, pilot gas and, when burned, purge gas.

3.20 Landfill Operation: facilities engaged in operating landfills as defined in the North American Industry Classification System 562211 (Hazardous Waste Treatment and Disposal) or 562212 (Solid Waste Landfill).

3.21 Major Source: as defined in Rule 2201 (New and Modified Stationary Source Review Rule).

3.~~18~~22 MMBtu: million British thermal units.

3.23 MMscf: million standard cubic feet

3.~~19~~24 Non-Assisted Flare: a combustion device without any auxiliary provision for enhancing the mixing of air into its flame. This definition does not include those flares that by design provide excess air at the flare tip.

3.2~~0~~5 NOx: any nitrogen oxide compounds.

3.26 Oil and Gas Operation: facilities engaged in crude oil or gas production, gas processing, or refining.

3.2~~1~~7 Open Flare: a vertically or horizontally oriented open pipe flare from which gases are released into the air before combustion is commenced.

3.2~~2~~8 Operator: includes, but not limited to, any person who owns, leases, supervises, or operates a facility.

3.29 Organic Liquid Loading Operation: as defined in Rule 4624 (Transfer of Organic Liquid).

3.~~23~~30 Petroleum Refinery: a facility that processes petroleum, as defined in the Standard Industrial Classification Manual as Industry No. 2911, Petroleum Refining. For the purpose of this rule, all portions of the petroleum refining operation, including those at non-contiguous locations operating flares, shall be considered as one petroleum refinery.

3.~~24~~31 Pilot: an auxiliary burner used to ignite the vent gas routed to a flare.

3.~~25~~32 Pilot Gas: the gas used to maintain the presence of a flame for ignition of vent gases.

3.~~26~~33 Planned Flaring: a flaring operation that constitutes a designed and planned process at a source, and which would have been reasonably foreseen ahead of its actual occurrence, or is scheduled to occur. Planned flaring includes, but is not limited to, the following flaring activities:

3.~~26~~33.1 Oil or gas well tests, well related work, tests ordered by a regulatory agency.

3.~~26~~33.2 Equipment depressurization for maintenance purposes.

3.~~26~~33.3 Equipment start-up or shutdown.

3.~~26~~33.4 Flaring of gas at production sources where no gas handling, gas injection or gas transmission facilities exists.

3.~~26~~33.5 Flaring of off-specification gas (i.e. non-PUC quality gas), unless the operator can demonstrate that the gas must be flared for engineering or safety reasons, e.g., under emergency.

3.~~26~~33.6 The operation of a flare for the purpose of performing equipment maintenance.

3.~~27~~34 Prevention Measure: a component, system, procedure, or program that will minimize or eliminate flaring.

3.~~28~~35 Public Utilities Commission (PUC) Quality Gas: any gaseous fuel, gas containing fuel where the sulfur content is no more than one-fourth (0.25) grain of hydrogen sulfide per one hundred (100) standard cubic feet and no more than five grains of total sulfur per one hundred (100) standard cubic feet. PUC quality gas shall also mean high methane (at least 80% by volume) gas as specified in PUC's General Order 58-A.

3.36 Publicly-Owned Facility: A wastewater treatment facility or landfill facility owned and operated by a public agency.

3.~~29~~37 Purge Gas: Nitrogen, carbon dioxide, liquefied petroleum gas, refinery fuel gas, or natural gas, any of which can be used to maintain a non-explosive mixture of gases in the flare header or provide sufficient exit velocity to prevent any regressive flame travel back into the flare header.

3.3~~0~~8 Refinery Fuel Gas: a combustible gas, which is a by-product of the refinery process.

3.39 Regeneration Gas: Purge gas from a system consisting of several media trains that is used to remove impurities from combustible gas vapors that is regenerated by purging with gas.

3.~~31~~40 Reportable Flaring Event: any flaring where more than 500,000 standard cubic feet 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 by monitoring required in Section 6.8 that the integrity of the water seal has been maintained sufficiently to prevent vent gas to the flare tip. For flares without water seals or water seal monitors as required by Section 6.8, a reportable flaring event ends when the rate of flow of vent gas falls below 0.12 feet per second.

3.~~32~~41 Representative Sample: a sample of vent gas collected from the location as approved for flare monitoring and analyzed utilizing test methods specified in Section 6.3.4.

3.3~~3~~42 Shutdown: the procedure by which the operation of a process unit or piece of equipment is stopped due to the end of a production run, or for the purpose of performing maintenance, repair and replacement of equipment. Stoppage caused by frequent breakdown due to poor maintenance or operator error shall not be deemed a shutdown.

3.~~34~~43 Startup: the procedure by which a process unit or piece of equipment achieves normal operational status, as indicated by such parameters as temperature, pressure, feed rate and product quality.

3.~~35~~44 Steam-Assisted Flare: a combustion device where steam is injected into the combustion zone to promote turbulence for the mixing of the combustion air before it is introduced to the flame.

~~3.36 Thermal oxidizer: an enclosed or partially enclosed combustion device, other than a flare, that is used to oxidize combustible gases.~~

3.~~37~~45 Total Organic Gases (TOG): all hydrocarbon compounds containing hydrogen and carbon with or without other chemical elements.

3.~~38~~46 Turnaround: a planned activity involving shutdown and startup of one or several process units for the purpose of performing periodic maintenance, repair, replacement of equipment or installation of new equipment.

3.~~39~~47 Vent Gas: any gas directed into a flare, excluding assisting air or steam, flare pilot gas, and any continuous purge gases.

3.~~40~~48 Volatile Organic Compound (VOC): as defined in Rule 1020 (Definitions).

3.~~41~~49 Water Seal: a liquid barrier, or seal, to prevent the passage of gas. Water seals provide a positive means of flash-back prevention in addition to enabling the upstream flare system header to operate at a slight positive pressure at all times.

4.0 Exemptions

~~4.1 Flares operated in municipal solid waste landfills subject to the requirements of Rule 4642 (Solid Waste Disposal Sites) are exempt from this rule.~~

~~4.2 Flares that are subject to the requirements of 40 CFR 60 Subpart WWW (Standards of Performance for Municipal Waste Landfills), or Subpart Cc (Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills) are exempt from this rule.~~

~~4.3 Except for the recordkeeping requirements in Section 6.1.4 the requirements of this rule shall not apply to any stationary source that has the potential to emit, for all processes, less than ten (10.0) tons per year of VOC and less than ten (10.0) tons per year of NOx.~~

4.1 Flares operated at municipal solid waste landfills that combust less than 2,000 MMscf of landfill gas per calendar year and that have ceased accepting waste.

4.2 Flares that combust only propane or butane or a combination of propane and butane.

4.3 Flares used for well testing, tank degassing, and pipeline degassing operations.

4.4 Flares that combust regeneration gas.

5.0 Requirements

The operator of any source subject to this rule shall comply with the following requirements:

5.1 Flares that are permitted to operate only during an emergency are not subject to the requirements of Sections ~~5.6 and~~ 5.7, 5.8, 5.9 and 5.10.

5.2 Flares that are operated 200 hours or less per calendar year as specified in the Permit to Operate, or with an annual throughput limit equivalent to 200 hours per year at flare rating (MMBtu/hr) as specified in the Permit to Operate, are exempt from the requirements of Sections 5.9 and 5.10.

5.2.1 For the 200 hours per year validation, the operator shall use a calibrated non-resettable totalizing time meter or equivalent method approved in writing by the APCO; or

5.2.2 For the annual throughput limit equivalent to 200 hours per year validation, the operator shall use a calibrated fuel meter or equivalent method approved in writing by the APCO.

5.~~2~~3 The flame shall be present at all times when combustible gases are vented through the flare.

5.~~3~~4 The outlet shall be equipped with an automatic ignition system, or, shall operate with a pilot flame present at all times when combustible gases are vented through the flare, except during purge periods for automatic-ignition equipped flares.

5.~~4~~5 Except for flares equipped with a flow-sensing ignition system, a heat sensing device such as a thermocouple, ultraviolet beam sensor, infrared sensor, or an alternative equivalent device, capable of continuously detecting at least one pilot flame or the flare flame is present shall be installed and operated.

5.~~5~~6 Flares that use flow-sensing automatic ignition systems and which do not use a continuous flame pilot shall use purge gas for purging.

5.~~6~~7 Open flares ~~(air-assisted, steam-assisted, or non-assisted)~~ in which the flare gas pressure is less than 5 psig shall be operated in such a manner that meets the provisions of 40 CFR 60.18. The requirements of this section shall not apply to Coanda effect flares.

5.~~7~~8 Ground-level enclosed flares shall meet the ~~following~~ emission standards~~:~~ in Table 1, except as specified in Section 5.9 and 5.10.

Table 1 – Ground Level Enclosed Flare Emissions Limits

Type of Flare and Heat Release Rate in MMBtu/hr	VOC (lb/MMBtu)	NOx (lb/MMBtu)
Without Steam-assist		
<10 MMBtu	0.0051	0.0952
10-100 MMBtu	0.0027	0.1330
>100 MMBtu	0.0013	0.5240
With Steam-assist		
All	0.14 as TOG	0.068

5.9 Except for flares that meet the emission limits specified in Table 3, operators of flares located at operations specified in Table 2 shall complete one of the following options:

5.9.1 Submit an ATC application to limit flaring annual throughput through an enforceable Permit to Operate limit, to levels not to exceed those specified in Table 2 for two consecutive calendar years, per the compliance schedule in Section 7.2; or

5.9.2 Replace or modify the existing flare to meet Table 3 emission limits per the compliance schedule in Section 7.3.

Table 2 – Flare Annual Throughput Thresholds (MMBtu/calendar year)

Flare Category	MMBtu/yr
A. Flares used at Oil and Gas Operations, and Chemical Operations	25,000
B. Flares used at Landfill Operations	90,000
C. Flares used at Digester Operations	100,000
D. Flares used at Organic Liquid Loading Operations	25,000

Table 3 – VOC and NOx Emissions Requirements for Flares		
Flare Category	VOC (lb/MMBtu)	NOx (lb/MMBtu)
A. Flares at Oil and Gas Operations or Chemical Operations	0.008	0.018
B. Flares at Landfill Operations	0.038	0.025
C. Flares at Digester Operations (Located at a Major Source)	0.038	0.025
D. Flares at Digester Operations (Not located at a Major Source)	N/A	0.060
E. Flares at Organic Liquid Loading Operations	Pounds/1,000 gallons loaded	
	N/A	0.034

5.10 For operators of flares that opt to comply with Section 5.9.1, any operator with a flare that exceeds the annual throughput thresholds specified in Table 2 for two consecutive calendar years shall notify the APCO in writing of the exceedance within 30 days following the end of the second calendar year and shall replace or modify the flare to meet Table 3 emission limits per the compliance schedule in Section 7.4.

5.~~8~~11 Flare Minimization Plan

Effective on and after July 1, 2011, flaring is prohibited at petroleum refineries and major sources, except landfill operations, unless it is consistent with an approved flare minimization plan (FMP), pursuant to Section 6.5, and all commitments listed in that plan have been met. This standard shall not apply if the APCO determines that the flaring is caused by an emergency as defined by Section 3.~~7~~10 and is necessary to prevent an accident, hazard or release of vent gas directly to the atmosphere.

5.~~9~~12 Petroleum Refinery SO_2 Performance Targets

~~5.9.1 Effective on and after January 1, 2011, the operator of a petroleum refinery shall minimize sulfur dioxide flare emissions to less than 1.50 tons per million barrels of crude processing capacity, calculated as an average over one calendar year.~~

~~5.9.2 Effective on and after January 1, 2017, t~~The operator of a petroleum refinery shall minimize sulfur dioxide flare emissions to less than 0.50 tons per million barrels of crude processing capacity, calculated as an average over one calendar year.

5.1~~0~~3 Effective on and after July 1, 2011, the operator of a flare at a petroleum refinery or major source, except landfill operations, subject to flare minimization requirements pursuant to Section 5.~~8~~11 shall monitor the vent gas flow to the flare with a flow measuring device or other parameters as specified in the Permit to Operate. The operator shall maintain records pursuant to Section 6.1.7. Flares that the operator can verify, based on permit conditions, are not capable of producing reportable flare events pursuant to Section 6.2.2 shall not be required to monitor vent gas flow to the flare.

5.14 Effective on and after January 1, 2024, the operator of a flare subject to the annual throughput thresholds in Table 2 shall monitor the vent gas flow to the flare with a flow measuring device or other parameters as specified in the Permit to Operate. The operator shall determine the heating value (Btu per cubic foot) of the vent gas annually in accordance with Section 6.3.6. The operator shall maintain records pursuant to Section 6.1.7. Flares that the operator can verify, based on permit conditions, are not capable of exceeding the annual throughput thresholds in Table 2 shall not be required to monitor vent gas flow to the flare.

5.115 Effective on and after July 1, 2011, the operator of a petroleum refinery or a flare at a major source, except landfill operations, with a flaring capacity equal to or greater than 50 MMBtu/hrper hour shall monitor the flare pursuant to Sections 6.6, 6.7, 6.8, 6.9, and 6.10. Effective on and after January 1, 2024, the operator of any flare with a flaring capacity equal to or greater than 50 MMBtu per hour shall monitor the flare pursuant to Sections 6.6, 6.7, 6.8, 6.9, and 6.10.

6.0 Administrative Requirements

6.1 Recordkeeping

The following records shall be maintained, retained on-site for a minimum of five years, and made available to the APCO, ARB, and EPA upon request:

6.1.1 Copy of the compliance determination conducted pursuant to Section 6.4.1.

6.1.2 Copy of the source testing result conducted pursuant to Section 6.4.2.

6.1.3 For flares used during an emergency, record of the duration of flare operation, amount of gas burned, and the nature of the emergency situation.

6.1.4 Operators claiming an exemption pursuant to Section 4.35.2 shall record annual hours of operation or annual throughput, material usage, or other information necessary to demonstrate an exemption under that section.

6.1.5 Effective on and after July 1, 2011, aA copy of the approved flare minimization plan pursuant to Section 6.5.

6.1.6 Effective on and after July 1, 2012, where applicable, aA copy of annual reports submitted to the APCO pursuant to Section 6.2.

6.1.7 Effective on and after July 1, 2011, where applicable, mMonitoring data collected pursuant to Sections 5.103, 5.14, 6.6, 6.7, 6.8, 6.9, and 6.10.

6.2 Flare Reporting

6.2.1 Unplanned Flaring Event

~~Effective on and after July 1, 2011, t~~The operator of a flare subject to flare minimization plans pursuant to Section 5.~~8~~11 of this rule shall notify the APCO of an unplanned flaring event within 24 hours after the start of the next business day or within 24 hours of their discovery, which–ever occurs first. The notification shall include the flare source identification, the start date and time, and the end date and time.

6.2.2 Reportable Flaring Event

Effective on and after July 1, 2012, and annually thereafter, except for flares meeting the emission limits in Table 3, the operator of a flare subject to flare minimization plans pursuant to Section 5.~~8~~11 shall submit an annual report to the APCO that summarizes all Reportable Flaring Events as defined in Section 3.0 that occurred during the previous 12 month period. Beginning January 1, 2024, t~~T~~he report shall be submitted within 30 days following the end of the previous calendar year.~~twelve month period of the previous year.~~ The report shall include, but is not limited to all of the following:

6.2.2.1 The results of an investigation to determine the primary cause and contributing factors of the flaring event;

6.2.2.2 Any prevention measures considered or implemented to prevent recurrence together with a justification for rejecting any measures that were considered but not implemented;

6.2.2.3 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 gas at the facility; and

6.2.2.4 The date, time, and duration of the flaring event.

6.2.3 Annual Monitoring Report

~~Effective on and after July 1, 2012, and annually thereafter,~~Until January 1, 2024, the operator of a flare at a petroleum refinery or major source, except landfill operations, subject to flare monitoring requirements pursuant to Sections 5.1~~0~~3, 5.14, 6.6, 6.7, 6.8, 6.9, and 6.10, as appropriate, shall submit an annual report to the APCO within 30 days following the end of each 12 month period.

Effective on and after January 1, 2024, and annually thereafter, the operator of a any flare subject to flare monitoring requirements pursuant to Sections 5.13, 5.14, 6.6, 6.7, 6.8, 6.9, and 6.10, as appropriate, shall submit an annual report in an electronic format approved by the District to the APCO within 30 days following the end of each calendar year for all required monitoring under those sections.

The report shall include the following:

6.2.3.1 The total volumetric flow of vent gas in standard cubic feet for each day for the previous calendar year.

6.2.3.2 Hydrogen sulfide content, methane content, and hydrocarbon content of vent gas composition, where applicable pursuant to Section 6.6.

6.2.3.3 If vent gas composition is monitored by a continuous analyzer or analyzers pursuant to Section 5.114, average total hydrocarbon content by volume, average methane content by volume, and depending upon the analytical method used pursuant to Section 6.3.4, total reduced sulfur content by volume or hydrogen sulfide content by volume of vent gas flared for each hour of the month.

6.2.3.4 If the flow monitor used pursuant to Section 5.103 measures molecular weight, the average molecular weight for each hour of each month.

6.2.3.5 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, as applicable pursuant to Section 6.7.

6.2.3.6 Flare monitoring system downtime periods, including dates and times, as applicable pursuant to Section 6.9.

6.2.3.7 For each day and for each month provide calculated sulfur dioxide emissions, as applicable.

6.2.3.8 A flow verification report for each flare subject to this rule. The flow verification report shall include flow verification testing pursuant to Section 6.3.5.

6.2.3.9 For flares subject to the annual throughput thresholds specified in Table 2, include the annual throughput in MMBtu for the previous calendar year.

6.3 Test Methods

The test methods listed below shall be used to demonstrate compliance with this rule. Alternate equivalent test methods may be used provided the test methods have been approved by the APCO and EPA.

6.3.1 VOC, measured and calculated as carbon, shall be determined by EPA Method 25, except when the outlet concentration must be below 50 ppm in order to meet the standard, in which case Method 25a may be used, and analysis of halogenated exempt compounds shall be analyzed by EPA Method 18 or ARB Method 422 "Determination of Volatile organic Compounds in Emission from Stationary Sources". The VOC concentration in ppmv shall be converted to pounds per million Btu (lb/MMBtu) by using the following equation:

$$\text{VOC in lb/MMBtu} = \frac{(ppmv\ dry)\ x\ (F, dscf\ /\ MMBtu)}{(1.135\ x 10^{6})\ x\ (20.9 - \%O_2)}$$

Where: F = As determined by EPA Method 19

6.3.2 NOx emissions in pounds per million BTU shall be determined by using EPA Method 19.

6.3.3 NOx and O_2 concentrations shall be determined by using EPA Method 3A, EPA Method 7E, or ARB 100.

6.3.4 Testing and Sampling Methods for Flare Monitoring

Effective on and after July 1, 2011 operators subject to vent gas composition monitoring requirements pursuant to Section 6.6 shall use the following test methods as appropriate, or by an alternative method approved by the APCO, ARB and EPA:

6.3.4.1 Total hydrocarbon content and methane content of vent gas shall be determined using ASTM Method D 1945-96, ASTM Method UOP 539-97, EPA Method 18, or EPA Method 25A or 25B,

6.3.4.2 Hydrogen sulfide content of vent gas shall be determined using ASTM Method D 1945-96, ASTM Method UOP 539-97, ASTM Method D 4084-94, or ASTM Method D 4810-88.

6.3.4.3 If vent gas composition is monitored with a continuous analyzer employing gas chromatography the minimum sampling frequency shall be one sample every 30 minutes.

6.3.4.4 If vent gas composition is monitored using continuous analyzers not employing gas chromatography, the total reduced sulfur content of vent gas shall be determined by using EPA Method D4468-85.

6.3.5 Flow Verification Test Methods

For purposes of the flow verification report required by Section 6.2.3.8, vent gas flow shall be determined using one or more of the following methods, or by any alternative method approved by the APCO, ARB, and EPA:

6.3.5.1 EPA Methods 1 and 2;

6.3.5.2 A verification method recommended by the manufacturer of the flow monitoring equipment installed pursuant to Section 5.1~~0~~3.

6.3.5.3 Tracer gas dilution or velocity.

6.3.5.4 Other flow monitors or process monitors that can provide comparison data on a vent stream that is being directed past the ultrasonic flow meter.

6.3.6 The heating value of flare gas shall be determined by ASTM D 1826-88 or ASTM D 1945-81 in conjunction with ASTM D 3588-89; alternately, an operator may elect to use a default heating value from Table 4.

Table 4 – Default Flare Gas Heating Values

Flare Category	Heating Value (Btu/scf)
Flares at Oil and Gas Operations or Chemical Operations	1,000
Flares at Landfill Operations	500
Flares at Digester Operations	600

6.4 Compliance Determination

6.4.1 Upon request, the operator of flares that are subject to Section 5.~~6~~7 shall make available, to the APCO, the compliance determination records that demonstrate compliance with the provisions of 40 CFR 60.18, (c)(3) through (c)(5).

6.4.2 The operator of ~~ground-level enclosed~~ flares subject to emission limits in Table 1 and Table 3, Categories A, B, and C shall conduct source testing at least once every 12 months to demonstrate compliance with Section 5.~~7~~8. The operator shall submit a copy of the testing protocol to the APCO at least 30 days in advance of the scheduled testing. The operator shall submit the source test results not later than ~~45~~ 60 days after completion of the source testing.

6.5 Flare Minimization Plan

6.5.1 By July 1, 2010, the operator of a petroleum refinery flare or any flare at a major source, except landfill operations, that has a flaring capacity of greater than or equal to 5.0 MMBtu per hour shall submit a flare minimization plan (FMP) to the APCO for approval.

The FMP shall include, but not be limited to:

6.5.1.1 A description and technical specifications for each flare and associated knock-out pots, surge drums, water seals and flare gas recovery systems.

6.5.1.2 Detailed process flow diagrams of all upstream equipment and process units venting to each flare, identifying the type and location of all control equipment.

6.5.1.3 A 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.

6.5.1.4 An 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.

6.5.1.5 An evaluation of preventative measures to reduce flaring that may be expected to occur due to issues of gas quantity and quality. The evaluation shall include an audit of the vent gas recovery capacity of each flare system, the storage capacity available for excess vent gases, and the scrubbing capacity available for vent gases including any limitations associated with scrubbing vent gases for use as a fuel; and shall determine the feasibility of reducing flaring though the recovery, treatment and use of the gas or other means.

6.5.1.6 An 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. The evaluation shall determine the adequacy of existing maintenance schedules and protocols for such equipment. For purposes of this section, a failure is recurrent if it occurs more than twice during any five year period as a result of the same cause as identified in accordance with Section 6.2.2.

6.5.1.7 Any other information requested by the APCO as necessary for determination of compliance with applicable provisions of this rule.

6.5.2 Every five years after the initial FMP submittal, the operator shall submit an updated FMP for each flare to the APCO for approval. The current FMP shall remain in effect until the updated FMP is approved by the APCO. If the operator fails to submit an updated FMP as required by this section, the existing FMP shall no longer be considered an approved plan.

6.5.3 An updated FMP shall be submitted by the operator pursuant to Section 6.5 addressing new or modified equipment, prior to installing the equipment. Updated FMP submittals are only required if:

6.5.3.1 The equipment change would require an authority to construct (ATC) and would impact the emissions from the flare, and

~~6.5.3.2 The ATC is deemed complete after June 18, 2009, and~~

6.5.3.~~3~~2 The modification is not solely the removal or decommissioning of equipment that is listed in the FMP, and has no associated increase in flare emissions.

6.5.4 When submitting the initial FMP, or updated FMP, the operator shall designate as confidential any information claimed to be exempt from public disclosure under the California Public Records Act, Government Code Section 6250 et seq. If a document is submitted that contains information designated confidential, the operator shall provide a justification for this designation and shall submit a separate copy of the document with the information designated confidential redacted.

6.6 Vent Gas Composition Monitoring

Effective on and after July 1, 2011, the operator of a petroleum refinery flare or any flare at a major source, except landfill operations, that has a flaring capacity equal to or greater than 50 MMBtu per hour shall monitor vent gas composition using one of the five methods pursuant to Section 6.6.1 through Section 6.6.5, as appropriate.

Effective on and after January 1, 2024, the operator of any flare with a flaring capacity equal to or greater than 50 MMBtu per hour, except landfill operations, shall monitor vent gas composition using one of the five methods pursuant to Section 6.6.1 through Section 6.6.5, as appropriate.

6.6.1 Sampling that meets the following requirements:

6.6.1.1 If the flow rate of vent gas flared in any consecutive 15-minute period continuously exceeds 330 standard cubic feet per minute (SCFM), a sample shall be taken within 15 minutes. The sampling frequency thereafter shall be one sample every three hours and shall continue until the flow rate of vent gas flared in any consecutive 15-minute period is continuously 330 SCFM or less. In no case shall a sample be required more frequently than once every 3 hours.

6.6.1.2 Samples shall be analyzed pursuant to Section 6.3.4.

6.6.2 Integrated sampling that meets the following requirements:

6.6.2.1 If the flow rate of vent gas flared in any consecutive 15 minute period continuously exceeds 330 SCFM, integrated sampling shall begin within 15 minutes and shall continue until the flow rate of vent gas flared in any consecutive 15 minute period is continuously 330 SCFM or less.

6.6.2.2 Integrated sampling shall consist of a minimum of one aliquot for each 15-minute period until the sample container is full. If sampling is still required pursuant to Section 6.6.2.1, a new sample container shall be placed in service within one hour after the previous sample was filled. A sample container shall not be used for a sampling period that exceeds 24 hours.

6.6.2.3 Samples shall be analyzed pursuant to Section 6.3.4.

6.6.3 Continuous analyzers that meet the following requirements:

6.6.3.1 The analyzers shall continuously monitor for total hydrocarbon methane, and depending upon the analytical method used pursuant to Section 6.3.4, hydrogen sulfide or total reduced sulfur.

6.6.3.2 The hydrocarbon analyzer shall have a full-scale range of 100% total hydrocarbon.

6.6.3.3 Each analyzer shall be maintained to be accurate to within 20% when compared to any field accuracy tests or to within 5% of full scale.

6.6.4 Continuous analyzers employing gas chromatography that meet the following requirements:

6.6.4.1 The gas chromatography system shall monitor for total hydrocarbon, methane, and hydrogen sulfide.

6.6.4.2 The gas chromatography system shall be maintained to be accurate within 5% of full scale.

6.6.5 Monitor sulfur content using a colorimetric tube system on a daily basis, and monitor vent gas hydrocarbon on a weekly basis by collecting samples and having them tested pursuant to a method in Section 6.3.4.

6.6.6 If flares share a common header, a sample from the header will be deemed representative of vent gas composition for all flares served by the header.

6.6.7 The operator shall provide the APCO with access to the monitoring system to collect vent gas samples to verify the analysis required by Section 5.1~~1~~4.

6.7 Pilot and Purge Gas Monitoring

Effective on and after July 1, 2011, the operator of a petroleum refinery flare or any flare at a major source, except landfill operations, that has a flaring capacity equal to or greater than 50 MMBtu per hour shall monitor the volumetric flows of purge and pilot gases with flow measuring devices or other parameters as specified on the Permit to Operate so that volumetric flows of pilot and purge gas may be calculated based on pilot design and the parameters monitored.

Effective on and after January 1, 2024, the operator of any flare that has a flaring capacity equal to or greater than 50 MMBtu per hour shall monitor the volumetric flows of purge and pilot gases with flow measuring devices or other parameters as specified on the Permit to Operate so that volumetric flows of pilot and purge gas may be calculated based on pilot design and the parameters monitored.

6.8 Water Seal Monitoring

Effective on and after July 1, 2011, the operator of a petroleum refinery flare or any flare at a major source, except landfill operations, that has a flaring capacity equal to or greater than 50 MMBtu per hour with a water seal shall monitor and record the water level and pressure of the water seal that services each flare daily or as specified on the Permit to Operate.

Effective on and after January 1, 2024, the operator of any flare that has a flaring capacity equal to or greater than 50 MMBtu per hour with a water seal shall monitor and record the water level and pressure of the water seal that services each flare daily or as specified on the Permit to Operate.

6.9 General Monitoring

Effective on and after July 1, 2011, the operator of a petroleum refinery flare or any flare at a major source, except landfill operations, that has a flaring capacity equal to or greater than 50 MMBtu per hour shall comply with the~~ following~~ below sections, as applicable~~:~~.

Effective on and after January 1, 2024, the operator of any flare with a flaring capacity equal to or greater than 50 MMBtu per hour shall also comply with the below sections, as applicable.

6.9.1 Periods of flare monitoring system inoperation greater than 24 continuous hours shall be reported by the following working day, followed by notification of resumption of monitoring. Periods of inoperation of monitoring equipment shall not exceed 14 days per any 18-consecutive-month period. Periods of flare monitoring system inoperation do not include the periods when the system feeding the flare is not operating.

6.9.2 During periods of inoperation of continuous analyzers or auto-samplers installed pursuant to Section 6.6, operators responsible for monitoring shall take one sample within 30 minutes of the commencement of flaring, from the flare header or from an alternate location at which samples are representative of vent gas composition and have samples analyzed pursuant to Section 6.3.4. During periods of inoperation of flow monitors required by Section 5.1~~0~~3, flow shall be calculated using good engineering practices.

6.9.3 Maintain and calibrate all required monitors and recording devices in accordance with the applicable manufacturer's specifications. In order to claim that a manufacturer's specification is not applicable, the person responsible for emissions must have, and follow, a written maintenance policy that was developed for the device in question. The written policy must explain and justify the difference between the written procedure and the manufacturer's procedure.

6.9.4 All in-line continuous analyzer and flow monitoring data must be continuously recorded by an electronic data acquisition system capable of one-minute averages. Flow monitoring data shall be recorded as one-minute averages.

6.10 Video Monitoring

~~Effective on and after July 1, 2011, t~~The operator of a petroleum refinery flare shall install and maintain equipment that records a real-time digital image of the flare and flame at a frame rate of no less than one frame per minute. The recorded image of the flare shall be of sufficient size, contrast, and resolution to be readily apparent in the overall image or frame. The image shall include an embedded date and time stamp. The equipment shall archive the images for each 24-hour period. In lieu of video monitoring the operator may use an alternative monitoring method that provides data to verify date, time, vent gas flow, and duration of flaring events.

7.0 Compliance Schedule

7.1 Operators of flares, that are exempt under Section 4.0 and that lose exemption status, shall not operate flares until in full compliance with all applicable requirements of this rule effective on the date the exemption status is lost.

7.2 Operators of flares opting to limit flaring annual throughput per Section 5.9.1 shall meet the compliance schedule in Table 5.

Table 5 – Flaring Throughput Permit to Operate Limit Timeline	
Requirement	Deadline
A. Submit ATC application to limit annual throughput to levels below those specified in Table 2	July 1, 2022
B. Compliance with flaring annual throughput limits	On and after January 1, 2024

7.3 Operators of flares opting to replace or modify a flare to meet the emission limits in Table 3 per Section 5.9.2 shall meet the compliance schedule in Table 6.

Table 6 – Flare Modification or Replacement Timeline	
Requirement	Deadline
A. Submit ATC application to modify or replace the flare to meet Table 3 emission limits	July 1, 2022
B. Demonstrate Compliance with Table 3 emission limits	December 31, 2023

7.4 Operators of flares subject to Section 5.10 shall meet the compliance schedule in Table 7.

Table 7 – Flare Modification or Replacement Timeline	
Requirement	Deadline
A. Submit ATC application to modify or replace the flare to meet Table 3 emission limits	By April 15 of the year after the end of the second consecutive calendar year in which an exceedance of the Annual Throughput Threshold occurred
B. Demonstrate Compliance with Table 3 emission limits	By December 31 of the year after the end of the second consecutive calendar year in which an exceedance of the Annual Throughput Threshold occurred

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San Joaquin Valley Unified Air Pollution Control District
Meeting of the Governing Board
December 17, 2020

ADOPT PROPOSED AMENDMENTS TO RULE 4311 (FLARES)

Attachment C:

Final Draft Staff Report with Appendices for Proposed Amendments to Rule 4311
(110 PAGES)

SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

FINAL DRAFT STAFF REPORT

Proposed Amendments to Rule 4311 (Flares)

December 17, 2020

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San Joaquin Valley
UNIFIED AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

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I. SUMMARY

A. Reasons for Rule Development and Implementation

The U.S. Environmental Protection Agency (EPA) periodically reviews and establishes health-based air quality standards for ozone, particulates, and other pollutants. Although the San Joaquin Valley's (Valley) air quality is steadily improving, the Valley experiences unique and significant difficulties in achieving these increasingly stringent standards. The Valley's challenges in meeting national ambient air quality standards are unmatched in the nation due to the region's unique geography, meteorology and topography. In response to the latest federal mandates and to improve quality of life for Valley residents, the District has developed and implemented multiple generations of rules on various sources of air pollution. Valley businesses are currently subject to the most stringent air quality regulations in the nation. Since 1992, the District has adopted nearly 650 rules to implement an aggressive on-going control strategy to reduce emissions in the Valley, resulting in air quality benefits throughout the Valley. Similarly, the California Air Resources Board (CARB) has adopted stringent regulations for mobile sources. Together, these efforts represent the nation's toughest air pollution emissions controls and have greatly contributed to reduced ozone and particulate matter concentrations in the Valley.

Due to the significant investments made by Valley businesses and residents and stringent regulatory programs established by the District and CARB, the Valley's ozone and PM2.5 (particulate matter that is 2.5 microns or less in diameter) emissions are at historically low levels, and air quality over the past few years has continued to set new clean air records. Despite the significant progress under these regulations, greatly aided by the efforts of Valley businesses and residents, many air quality challenges remain, including attainment of the federal air quality standards for PM2.5 that are addressed in the District's recently adopted *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards* (*2018 PM2.5 Plan*).

The *2018 PM2.5 Plan* contains a comprehensive set of local and state measures that build on existing measures to further reduce air pollution from stationary, area, and mobile sources throughout the Valley. These measures include a suite of innovative regulatory and incentive-based measures, supported by robust public education and outreach efforts to reduce emissions of PM2.5 in the Valley. Attaining the multiple federal PM2.5 standards by the mandated deadlines is not possible without significant additional reductions in oxides of nitrogen (NOx), an important precursor to the formation of atmospheric PM2.5.

One of the measures included in the plan is to amend District Rule 4311 (Flares) as a necessary measure for further reducing NOx and bringing the Valley into attainment with federal PM2.5 standards within the mandated federal deadlines. Flaring, in the Valley, accounts for 0.26% of all NOx emissions but it contributes 2% of NOx emissions from stationary sources under the regulatory control of the District.

Based on a comprehensive technical analysis, in-depth review of local, state, and federal regulations, and a robust public process, District staff are proposing several modifications to Rules 4306 and 4320 to reduce emissions from boilers, process heaters, and steam generators in the San Joaquin Valley. The proposed Rule 4306 and Rule 4320 go above and beyond federal standards of Reasonably Available Control Technology (RACT), Best Available Retrofit Control Technology (BARCT), and Most Stringent Measures (MSM). This rule amendment project is proposed to satisfy the commitments in the District's *2016 Ozone Plan for the 2008 8-hour Ozone Standard* and the *2018 PM2.5 Plan*. The proposed amendments to Rule 4311 will seek to obtain as much NOx emission reductions from the source category as expeditiously practicable, technologically feasible, and economically reasonable.

B. Health Benefits of Implementing Plan Measures

The health risks of PM2.5 have been linked to a variety of health issues, including aggravated asthma, increased respiratory symptoms (irritation of the airways, coughing, difficulty breathing), decreased lung function in children, development of chronic bronchitis, irregular heartbeat, non-fatal heart attacks, increased respiratory and cardiovascular hospitalizations, lung cancer, and premature death. CARB explains that even short-term exposure of less than 24 hours can cause for premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days.[1] Children, older adults, and individuals with heart or lung diseases are the most likely to be affected by PM2.5.

PM2.5 emissions are characterized by a unique combination of direct and secondarily formed constituents. As NOx emissions are a key precursor to the formation of ammonium nitrate, which is a large portion of total PM2.5 during the peak winter season, continuing to assess the feasibility of achieving additional NOx reductions across the Valley is critical for continuing to improve PM2.5 throughout the region. PM2.5 is a major health risk because it can be inhaled more deeply into the gas exchange tissues of the lungs, where it can be absorbed into the bloodstream and carried to other parts of the body. Exposure to elevated concentrations of ozone also poses significant health risks, and the Valley has long worked to reduce NOx emissions as the primary precursor for the formation of ozone in the Valley.

To address federal health-based standards for ozone and PM2.5 and improve public health, the District develops attainment plans and implements control measures to lower direct and precursor emissions throughout the San Joaquin Valley. The proposed amendments will achieve additional reductions in NOx, PM2.5, and VOC emissions as requirements are implemented by affected sources and new technologies are installed. Additionally, ongoing efforts to reduce the overall amount of flaring will further reduce

[1] "Inhalable Particulate Matter and Health (PM2.5 and PM10)." *California Air Resources Board*, 2020, ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health.

directly emitted PM2.5 emissions. New regulatory and incentive-based measures proposed by both the District and CARB, combined with existing measures achieving new emissions reductions, are necessary to achieve the emissions reductions required to attain each health-based federal standard as expeditiously as practicable, and will improve public health as emissions reductions and associated health benefits are realized.

C. Description of Project

Rule 4311 controls emissions from flares used in the Valley at facilities such as, but not limited to, oil and gas production facilities, sewage treatment plants, waste incineration and petroleum refining operations. Under Rule 4311, flare operators are required to submit flare minimization plans, perform extensive monitoring and record keeping, submit reports of planned and unplanned flaring activities to the District, and meet petroleum refinery SO2 performance targets.

Flaring activities in the Valley emit 0.53 tpd of NOx emissions, representing 0.26% of the annual average NOx emissions in the Valley. Despite this relatively small amount of emissions, the District committed in the *2018 PM2.5 Plan* to evaluate this source category to support the attainment of the health-based federal ambient air quality standards.

Originally adopted June 20, 2002, District Rule 4311 was developed to implement RACT requirements for "major sources" of volatile organic compounds (VOCs) and NOx. District Rule 4311 was then amended June 15, 2006 to change the major source applicability cutoff from 25 tons per year to 10 tons per year. Finally, on June 18, 2009 District Rule 4311 was amended to add monitoring, reporting requirements and flare minimization requirements as well as introduce performance targets for emissions of sulfur from flares at petroleum refineries.

The *2016 Plan for the 2008 8-Hour Ozone Standard* was adopted by the District Governing Board on June 16, 2016. The comprehensive strategy in the plan was designed to bring the San Joaquin Valley into attainment of EPA's 2008 8-hour ozone standard of 75 ppm as expeditiously as practicable, and no later than December 31, 2031. This plan included commitments to further evaluate emission reductions from flaring in the Valley. The District is currently on-track for attainment of this standard, and continued emission reductions of NOx and VOCs through the implementation of control measures, including the proposed amendments to Rule 4311, will ensure that the Valley attains both the 2008 ozone standard, as well as the recently strengthened 2015 federal 8-hour ozone standard of 70 ppm.

On November 15, 2018 the District's Governing Board adopted the *2018 PM2.5 Plan*. The plan demonstrated that Rule 4311 had the most stringent measures feasible to implement in the valley and committed to go beyond the Most Stringent Measures and pursue additional opportunities for emission reductions from this source category. The plan projected to achieve 0.05 tons per day of NOx reductions from this rule amendment.

The proposed amendments would amend Rule 4311 to satisfy commitments in the *2016 Ozone Plan* and *2018 PM2.5 Plan*. The proposed amendments to Rule 4311 include lowering NOx emissions limits for multiple categories of facilities with flares subject to the rule used over specified annual flaring throughput thresholds, clarifying definitions, and updating test methods. The NOx emissions limits proposed require the installation of ultra-low NOx flares. Operators may also choose to reduce flare use, such as by implementing alternative flare gas utilization options. The proposed Rule 4311 amendments are estimated to achieve reductions from current emissions levels of 37.2% NOx, 30.4% VOC, and 19.4% PM2.5 in 2024. Based on the emissions inventory used for the *2018 PM2.5 Plan*, this will result in estimated emissions reductions of 0.19 tons per day (tpd) of NOx, 0.39 tpd VOC, and 0.03 tpd PM2.5 emissions reductions in 2024. It is expected that the implementation of alternative flare gas utilization options will result in additional NOx emission reductions from this source category, however District staff are not quantifying or proposing these reductions for SIP-credit at this time.

D. Rule Development Process

As part of the rule development process, District staff conducted a public scoping meeting in August 2017. Three sets of flare operator workgroup meetings were held October 2017, April 2019, and July 2019. Four public workshops were held November 2019, July 2020, September 2020, and October 2020. At the public meetings, District staff presented the objectives of the proposed rulemaking project, explained the District’s rule development process, solicited suggestions from affected stakeholders, and informed all interested parties about tentative upcoming workshop dates, comment periods, and project milestones.

The knowledge gathered during the scoping meeting and public workshops was used to inform the process of drafting the amended draft rule and draft staff report. The final draft rule, draft staff report, and socioeconomic analysis report will be published prior to the public hearing to consider the adoption of the amendments to the rule by the District's Governing Board.

II. DISCUSSION

A flare is a combustion device designed to destroy VOCs in a high-temperature flame. Flares are used to burn purged and waste gas from refineries, gases from oil wells, landfills, sewage digesters, ammonia fertilizer plants, and gaseous wastes from chemical industries. Flares can be used to control most VOC streams, and can accommodate fluctuations in VOC concentration, flow rate, heating value, and inert species content.

The primary use of a flare is that of a safety device to reduce the potential for fires and explosions due to unburned gaseous hydrocarbon releases. Major industries in the Valley utilizing flares impacted by this rule amendment are Oil and Gas Production, and the Sanitation, Sewerage & Refuse Industries. As with any type of combustion equipment, flares generate air pollutants such as nitrogen oxides, sulfur dioxide, carbon monoxide, and particulate matter, in addition to the release of hydrocarbons, which have not been completely combusted.

There are two types of flares, elevated and enclosed ground flares. Flares are categorized by the height of the flare tip, and by the method of enhancing combustion by mixing excess air at the flare tip (i.e., steam-assisted, air-assisted, pressure-assisted, or non-assisted). Elevated flares are more common and have larger capacities than ground flares. The typical flare components include gas vent collection piping, knockout drum, liquid seal, flare stack, gas seal, burner tip, pilot burners, steam injection or forced air, ignition system, and controls. Combustion efficiency depends on flame temperature, residence time in the combustion zone, vent gas flammability, auto-ignition temperature, heating value (Btu/scf), and turbulent mixing. These factors promote a VOC destruction efficiency of 98 percent or greater.

A. Ultra-Low NOx Flare Technology

Ultra-low NOx (ULN) flares are a growing technology. Commercially available ULN flares guarantee NO_x limits of 15-20 ppmv corrected to 3% O_2. All ULN flares incorporate the “enclosed” flare design involving a tall, large diameter exhaust stack/housing which allows for lower NOx emissions and more complete combustion of flared gases than conventional open flares. The large exhaust stack of the enclosed flare also allows stack ports for the insertion of probes to measure exhaust emissions, and conceals the visible flame from view to allow less public objection compared to the intrusive glow and noise of an open flame elevated flare.

Ultra-low NO_x, low CO emissions, and ≥ 99% VOC destruction efficiency is accomplished with pre-mix combustion air technology and either a conventional flame burner or a mesh stainless steel surface burner head. These advanced burners, combined with the longer retention time in the enclosure stack than is possible with an open flare, result in the ultra-low NO_x emissions and reduced CO emissions along with more complete combustion that yields higher VOC destruction efficiency. Pre-mix combustion with a closely monitored and maintained air-to-fuel ratio requires supplemental air provided by a sizeable auxiliary air blower, computer control of combustion parameters, and in some instances, supplemental gas fuel and gas sulfur removal systems.

The minimum BTU content of waste gas able to be successfully flared is reported to be in the 150-250 Btu/dscf range, depending on vendor. Additionally, most ULN manufacturers state that sulfur compounds in the waste gas do not pose a problem for the stainless steel burner components, although some other components of the system which are not constructed of stainless steel, such as the blowers, may be susceptible to sulfur based corrosion. One manufacturer has stated that preferred sulfur content is not to exceed 400 ppmv. Manufacturer statements concerning startup/warmup periods of the flare to receive waste gas and achieve ULN combustion range from 30 to 60 minutes. It should be noted that all the ULN manufacturers agree that the closely monitored combustion parameters and steady state waste gas flowrate feeding a ULN renders it unfeasible for use as an emergency release flare, as is commonly found in the Oil and Gas Industry and refineries.

Some of the ULN flares commercially available include:

- Aereon CEB® Series: 0.34 MMBtu/hr – 41 MMBtu/hr; Guaranteed NO_x ≤ 15 ppmv @ 3% O_2, equivalent to 0.018 lb-NO_x/MMBtu
- John Zink Hamworthy ZULE®: Custom sizing; Guaranteed NO_x ≤ 20 ppmv @ 3% O_2, equivalent to 0.025 lb-NO_x/MMBtu
- Perennial Energy: Custom sizing; Guaranteed NO_x ≤ 20 ppmv @ 3% O_2, equivalent to 0.025 lb-NO_x/MMBtu
- LFG Technologies: Custom sizing; Guaranteed NO_x ≤ 15 ppmv @ 3% O_2, equivalent to 0.018 lb-NO_x/MMBtu

Limitations of ultra-low NOx technology

ULN flares utilize fuel air premixing, air/fuel ratio control, and advanced burner designs to achieve ultra-low NOx emissions and higher VOC destruction efficiencies as compared to traditional open and enclosed flares that do not utilize these techniques. Use of ultra-low NOx technology results in limitations of their suitability in various settings as compared to traditional open and enclosed flares as discussed below.

- ULN flares require a start period of 30 to 60 minutes prior to introducing gas to be flared. This start up period makes the use of ULN flares infeasible in settings where flaring of gas is needed immediately or for short periods of time, such as during unforeseen events, power outages, process upsets, etc.

- ULN flares utilize pre-mixing of flare gas and combustion air prior to directing the air/fuel mixture to the burner. The air-fuel ratio must be carefully calibrated for the parameters specific to each individual site. This process relies on the flare gas flow rate and flare gas heating value (Btu/scf) to be relatively constant. As such, ULN flares are not suitable in situations when the flare gas flow rate or heating value are highly variable.

- Electricity is required to power ULN flares, including the computerized controls and the blower system. Electricity adds costs to the flare operation, and, additionally, some remote sites may not have electricity available. Further, electrical power outages that can cause the need to dispose of waste gas by flaring due to the primary disposal devices being shut down would also render a ULN flare inoperable.

B. Flaring in the San Joaquin Valley

A search of the District's permits database identifies 266 flares operating in the Valley. In 2020, these flares emit 0.53 tons per day of NOx, and 0.16 tons per day of PM2.5. This represent 0.26% of the annual average NOx emissions, and 0.27% of the annual average PM2.5 emissions from all sources. For stationary sources under the regulatory control of the District that represents 2% of both the NOx and PM2.5 emissions.

A wide variety of industries rely on flares as safety devices and as essential emissions control devices. The 266 flares operating in the valley are located at facilities from 25 different SIC codes. The diversity of industries that must comply with Rule 4311 is illustrated in Table 1.

Table 1 — *SIC Codes and Corresponding Industries*

SIC	SIC Industry
241	Dairy Farms
1311	Crude Petroleum and Natural Gas
1321	Natural Gas Liquids
1389	Oil and Gas Field Services, Not Elsewhere Classified
2022	Natural, Processed, and Imitation Cheese
2037	Frozen Fruits, Fruit Juices, and Vegetables
2084	Wines, Brandy, and Brandy Spirits
2099	Food Preparations, Not Elsewhere Classified
2869	Industrial Organic Chemicals, Not Elsewhere Classified
2873	Nitrogenous Fertilizers
2879	Pesticides and Agricultural Chemicals, Not Elsewhere Classified
2911	Petroleum Refining
3211	Flat Glass
4911	Electric Services
4922	Natural Gas Transmission
4932	Gas and Other Services Combined
4952	Sewerage Systems
4953	Refuse Systems
4959	Sanitary Services, Not Elsewhere Classified
5169	Chemicals and Allied Products, Not Elsewhere Classified
5171	Petroleum Bulk stations and Terminals
5172	Petroleum and Petroleum Products Wholesalers, Except Bulk Stations and Terminals
5984	Liquefied Petroleum Gas (Bottled Gas) Dealers

SIC	SIC Industry
723	Crop Preparation Services for Market, Except Cotton Ginning
7359	Equipment Rental and Leasing, Not Elsewhere Classified
8062	General Medical and Surgical Hospitals
9199	General Government, Not Elsewhere Classified
9223	Correctional Institutions

Of the flare gas combusted in those 266 flares, 92% is combusted in flares at landfills, oil and gas operations, or wastewater treatment plants; SIC codes 4953, 4952, and 1311.

Gasses produced by this variety of industries differ in content, as well as gas production rates and consistency. Given the balance of fuel to air mix and other parameters necessary to maintain NOx emissions as low as required, while still maintaining appropriate VOC destruction efficiencies, ULN technologies are analyzed in the context of the industries they would likely be deployed in, as further discussed below.

Municipal and Privately Held Landfills

Landfill operators are sometimes required to collect landfill gas (LFG) as necessary to protect water quality (if LFG were allowed to remain under ground, it would contaminate groundwater) and to comply with state and federal air pollution requirements. A LFG collection system consisting of a series of wells connected to a blower is used to remove the LFG from the landfill. At landfills, flares exist as a primary method of destruction for gas collected to destroy methane, VOCs, and other contaminants; or as a backup to LFG to energy projects.

Some landfills have installed LFG fired internal combustion engines, operated by third parties, to combust collected LFG and produce electricity for use at the facility or sale to the electrical grid as a beneficial use method of LFG disposal with the existing flare as backup. Unfortunately, many of these projects are short lived because of problems with the engines operating on the LFG or budgetary issues. To this end, landfills are shown to be the largest single source for constant flaring of gases. The SJV does not currently have any ULN flares installed at any of the multiple landfills, only elevated open flares and enclosed flares with NO_X limits ranging from 0.050 lb/MMBtu to 0.068 lb/MMBtu. However, the District has recently received an application to install an ULN flare at a landfill.

LFG typically contain manageable sulfur content and enough methane content to yield a heating value of 450-550 Btu/scf. Because of the properties of the gas and the controllable gas flowrate to the flare, a ULN flare is suitable for use at these facilities.

Oil and Gas Industry

The oil and gas industry uses flares primarily to handle emergency upsets from over-pressured vessels, failure of the vapor control system serving production wells and production storage tanks, the unexpected shutdown of combustion equipment disposing of produced gas, or as a method to dispose of produced gas where there is no other use for the gas. Additionally, gas sales pipelines occasionally are shut-down resulting in the need to flare the gas until the sales line is back online or wells can be "shut-in". Flaring sales gas is a loss of revenue and used as a last resort.

Most of the large oil producers in the valley have various methods to dispose of waste gases in a "beneficial use" manner. Only in the instance of what is described as "stranded gas" at an oil lease, where there is not an available pipeline for sales or field gas, combustion equipment suitable for disposal of waste gas, or re-injection wells, would the produced gas be routinely flared. Some of the thermally enhanced oil recovery (TEOR) waste gas is of such a low quality, e.g. very low heat content and high sulfur content, that further processing to enhance the combustibility or salability of the gas is not feasible, and flaring is the only reliable disposal option.

Besides crude oil and natural gas production, there are other facility types in the oil and gas industry, such as natural gas processing plants and refineries, which incorporate emergency flares for safety measures during interruptions and maintenance activities that require vessels to be purged where re-routing purged gases is not possible. Petroleum transfer "racks" and loading/unloading terminals incorporate vapor recovery systems with a standby flare onsite for the occasional breakdown of the vapor control system.

Produced gases from the Oil and Gas Industry vary widely in respect to BTU/scf and sulfur content. Heavy oil production yields gases ranging from 200 BTU/scf (due to high levels of CO2 and inert gases) to ≤ 1,000 BTU/scf. Sulfur content coming out of TEOR wells can vary from negligible to over 20,000 ppmv as H2S. Produced gases from light oil production tend to be very low sulfur and high BTU content, sometimes higher than 1,000 BTU/scf. Any of the facilities that flare at a steady rate, or periodically flare for a reasonable amount of time per episode, can be a candidate for utilizing a ULN flare, with attention paid to managing sulfur in the waste gas. Manufacturers of ULN flares have confirmed that these flares are not suitable for use as an emergency release flare.

Municipal and Privately Held Sewage and Wastewater Treatment Plants

Wastewater treatment plants include anaerobic digesters that are a critical component of the wastewater treatment process to break down organic waste. After primary treatment of influent streams, which consists of physically separating the solid and liquid components of the waste stream, a secondary biological treatment of the wastewater occurs in digester tanks. Anaerobic digester operations generate a mixture of primarily

CO_2 and methane. Depending on the material entering the digester, gasses may contain a number of other contaminants such as sulfur compounds or siloxanes.

Waste gas from the digesters are frequently directed to onsite combustion equipment such as small boilers to heat the digesters or internal combustion engines that can produce electricity to supplement the facility needs and heat transfer to heat the digesters. When all the gas produced cannot be utilized by the combustion equipment, the flares are used to burn off excess gas. Frequently, the boilers that provide heat to the digester tanks are not needed because of sufficient ambient air temperature. Additionally, internal combustion engine based cogeneration systems are taken offline for repairs and complete overhaul, leaving the flare to dispose of the produced digester gas. At smaller facilities without the above combustion equipment to process digester gas, flaring is used exclusively.

Digester gas at these facilities typically contain manageable sulfur content and enough methane to yield a heating value of 500-750 Btu/scf, typically 600 Btu/scf. Because of the properties of the gas and the controllable steady release to the flare, a ULN is suitable for use at such a facility, even if the buildup and required release of excess digester gas requires the flare to be cycled on and off during the day.

III. PROPOSED AMENDMENTS TO RULE 4311

Based on the comprehensive technology assessment that District staff have conducted for this source category, as well as a thorough review of state, federal, and other air district regulations, District staff are proposing several amendments to Rule 4311. District staff are proposing to remove the non-major source exemption, remove landfill exemption, add performance standards to require ultra-low NOx technology for new and existing flares to the current flare rule in order to reduce flare emissions in the District.

The proposed amendments to Rule 4311 are designed to encourage flare operators to reduce flaring by finding beneficial alternative uses of gas that would otherwise be flared or deploy the cleanest flaring technologies to achieve additional NOx emission reductions. Specific limits are proposed depending on the applicability of the ultra-low NOx technology to different flaring processes with industry specific considerations. The installation of ULN flare technology would be required for flares that combust the majority of gas in the Valley. This would require installation of ULN flares associated with 65% of total gas flared from all categories. The new ULN requirements would be in addition to current requirements, including flare minimization plans.

The following is a summary of the major proposed draft amendments to Rule 4311.

Section 1.0 Purpose
No changes are proposed for Section 1.0 at this time.

Section 2.0 Applicability
No changes are proposed for Section 2.0 at this time.

Section 3.0 Definitions
Definitions would be added or amended to provide clarity and to reflect the additions of the proposed amendments to rule language. Definitions not used in the rule would be removed.

Section 4.0 Exemptions
Existing exemptions for landfills and non-major sources would be removed (Sections 4.1 through 4.3). New exemptions effective on and after December 17, 2020 would be added to rule language.

Section 4.1 Closed Landfills
Closed landfills experience decreasing quality and quantity of landfill gas over time. Eventually, declining landfill gas makes flaring not feasible. In some cases when this occurs, activated carbon may be used to replace flares. The declining gas output makes long term investments in alternative uses of landfill gas at closed landfills, or the expense of ultra-low NOx flares not cost-effective. Closed landfills with sufficient gas production would produce enough gas to justify such upgrades so the proposed exemption is for closed landfills producing less than 2,000 MMscf of landfill gas per year.

Section 4.2 Propane and/or Butane Flares
Flares where only butane or propane, or a combination of propane and butane, is combusted in the flare are exempt from Rule 4311. Most of the flares in this category are located at non-major source facilities that were previously exempt from Rule 4311 requirements. The two flares at major sources in this category are used to ensure propane backup systems (used during emergency natural gas curtailments) are functioning properly. These flares are rarely used, with one flare having been dormant for the last five years, and the other flare having a maximum usage of 12 hours per year. Due to these flares being used only for testing of emergency backup systems, and having such a limited usage, the flares are not suitable for the installation of ULN flare technology or for flare minimization. Including this exemption will not result in any increases in emissions in the Valley.

Section 4.3 Well testing, tank degassing, and pipeline degassing operations
Flares used for well testing, tank degassing, and pipeline degassing operations are generally permitted with various location permits, and are not directly associated with any specific site. The variable nature of their use make them unsuitable for ULN technology. The flares currently permitted in the Valley that will be eligible for this exemption are at facilities that are not major sources, and as a result were previously exempt from Rule 4311.

Section 4.4 Flares that combust regeneration gas

Regeneration gas is produced when impurities are being removed from landfill or digester gas. The gas clean up system usually employs two catalyst beds to clean the gas, one catalyst bed is actively cleaning the biogas while the other catalyst bed is being regenerated. The gas used to clean/regenerate the catalyst cannot be used beneficially and is directed to a small flare. These flares only exist at facilities engaging in a beneficial use project such as pipeline injection. This exemption is essential to ensure the proposed rule does not discourage beneficial use of landfill or digester gas. The two existing flares in the District that fall under this exemption are located at landfill energy projects, and therefore were previously exempt from Rule 4311.

Section 5.0 Requirements

Section 5.1 Emergency Flares

Added sections 5.8, 5.9, and 5.10 to the list of sections to which emergency flares are exempt. These sections represent the new sections requiring ULN flares and annual throughput limitations, as ULN flares are not suitable for emergency uses, emergency flares are exempt from these requirements.

Section 5.2 Low-use Flares

Flares operated under 200 hours per year, or equivalent to under 200 hours per year as specified in the Permit to Operate are exempt from the requirements in Section 5.9 and 5.10, the rule sections setting thresholds and establishing requirements for ULN flares. Flares with such low use are cost-prohibitive to require expensive ULN technologies.

Section 5.7 Open Flares

Removed references to air assisted, steam assisted, or non-assisted to improve rule clarity as they were unnecessary.

Section 5.8 Ground Level Enclosed Flare Emissions Limits

Updated to be compatible with the enhanced ULN emissions limits in Sections 5.9 and 5.10.

Section 5.9 Flare Annual Throughput Thresholds

A new requirement that would establish annual throughput thresholds that flares must either not exceed or emissions limits that flares must meet if they exceed the thresholds. Annual throughput thresholds will be based on not exceeding the applicable threshold in any two consecutive calendar years. Flare operators will have the option of modifying their permit to meet the throughput threshold limits per the compliance schedule in Section 7.2, or replace or modify their flare to meet applicable emissions limits per the compliance schedule in section 7.3.

Table 2 in the rule, displayed below, would establish the following annual throughput thresholds:

Table 2 – Flare Annual Throughput Thresholds (MMBtu/calendar year)	
Flare Category	MMBtu/yr
A. Flares used at Oil and Gas Operations	25,000
B. Flares used at Landfill Operations	90,000
C. Flares used at Digester Operations	100,000
D. Flares used at Organic Liquid Loading Operations	25,000

District staff evaluated various approaches to determining thresholds to require flare operators to take action to reduce emissions. The only other rule in the nation requiring ULN flares is South Coast Air Quality Management District (SCAQMD) Rule 1118.1. Rule 1118.1 sets thresholds for action based on a percentage of capacity that a flare is used on an annual basis. Applying a percentage-based approach would have excluded some of the most highly utilized flares in the Valley. As an alternative to this approach, District staff evaluated a set of annual throughput thresholds by flare type, with the goal of achieving emissions reductions in greater quantity and more cost-effectively than those achievable under the approach included in SCAQMD Rule 1118.1. The approach included in the District's proposed rule achieves greater emissions reductions than the approached included in SCAQMD Rule 1118.1 at approximately half the cost by focusing on flares with the highest usage, resulting in a more effective proposed rule.

Table 3 in the rule, below, would establish NOx limits for those flares exceeding Table 2 thresholds:

Table 3 – VOC and NOx Emissions Requirements for Flares		
Flare Category	VOC (lb/MMBtu)	NOx (lb/MMBtu)
A. Flares at Oil and Gas Operations	0.008	0.018
B. Flares at Landfill Operations	0.038	0.025
C. Flares at Digester Operations (Located at a Major Source)	0.038	0.025
D. Flares at Digester Operations (Not located at a Major Source)	N/A	0.060
E. Flares at Organic Liquid Loading Operations	Pounds/1,000 gallons loaded	
	N/A	0.034

The above emission limits were established based on the currently available control technologies that have been proven to be technologically feasible for each specific type of flaring operation, taking into consideration the gas composition and flow. Existing District Rule 4624 establishes VOC limits at Organic Liquid Loading operations, so no

VOC limit is proposed for flares at these facilities to ensure consistency with Rule 4624 requirements.

Section 5.10 Throughput threshold exceedance procedure
This new section would establish timelines and requirements for flares that exceed annual throughput thresholds for two consecutive calendar years, as proposed in Table 2. For operators of flares triggering this provision, replacement or modification of flares to meet Table 3 emissions limits must be completed per the schedule in section 7.4.

Section 5.11 Flare Minimization Plan
Flares currently subject to the flare minimization plan requirements will continue to be subject to this section and flares brought into the requirements of this rule based on new loss of exemptions would not be required to submit a plan based on the few to no options available to minimize flaring. For example, landfills are required to flare for safety and environmental reasons and generally have no other options for the flared gas.

Section 5.12 Petroleum SO2 Performance Targets
Updates in this section would remove requirements with implementation dates between 2011 and 2017 that have already passed.

Section 5.13 Vent Gas Flow
New language would maintain current vent gas flow monitoring requirements for facilities currently subject to this requirement, while vent gas flow monitoring requirements for newly subject operations is addressed in the following section.

Section 5.14 Vent Gas Flow for Operations Subject to Table 2 Throughput Thresholds
This new section establishes vent gas flow monitoring requirements for flares at operation types specified in Table 2, which are subject to the annual flare throughput thresholds of this rule. Operators of these specified flares are required to monitor the vent gas flow to the flare, keep records of the vent gas flow, and annually determine the heat content of the flare gas.

Section 5.15 Flare Monitoring Requirements
This section would maintain flare monitoring requirements for flares which are already subject to the monitoring requirements in the current version of Rule 4311. New language would also require newly subject flares to begin monitoring per specified sections by January 1, 2024.

Section 6.0 Administrative Requirements

Section 6.1 Recordkeeping
Proposed modifications to various subsections would remove effective dates that occurred in the past, and will require record keeping for flares claiming the low-use exemption under Section 5.2.

Section 6.2 Flare Reporting

Section 6.2.1 Unplanned Flaring Event
Proposed modifications remove effective dates that occurred in the past.

Section 6.2.2 Reportable Flaring Event
This section would maintain reportable flaring event requirements, except for those flares that meet the ultra-low NOx emissions limits included in Table 3. Modifications would also update the submittal timeline for required reporting to be on a calendar-year basis, consistent with other reporting required in the rule (such as reporting of the annual throughput thresholds).

Section 6.2.3 Annual Monitoring Report
This section will maintain the annual monitoring reporting requirements, while updating the requirement to occur on a calendar year basis, and will modernizes the submittal requirement to require an electronic format approved by the District. Additional language maintains report requirements for flares currently subject to requirements, and phases in reporting requirements for flares newly subject to Rule 4311.

Section 6.3 Test Methods

Section 6.3.6 Heating Value Determination
This new section specifies methods for determining heating value of flare gas for computation in annual throughput reporting.

Section 6.4 Compliance Determination
Proposed modification updates the requirements for source testing to ensure flares demonstrate compliance with Section 5.8 limits. Additionally, a minor correction on timeline for submittal of source test results to align with District Rule 1081 (Source Sampling) correcting a discrepancy identified during rule consistency analysis.

Section 6.5 Flare Minimization Plan (FMP)
The Flare Minimization Plan requirements for flares already subject to those requirements will be maintained, and language has been added to clarify the applicability of this requirement.

Section 6.5.3 New or modified equipment
Proposed changes to this section will remove an outdated clause with dates that have already passed.

Section 6.6 Vent Gas Composition Monitoring
Proposed modified language maintains existing requirements for major source non-landfill operations, and sets an effective date for non-major non-landfill source operations previously exempt from requirements in this section.

Section 6.7 Pilot and Purge Gas Monitoring
Proposed modified language maintains existing requirements for major source non-landfill operations, and sets an effective date for non-major source and landfill operations previously exempt from requirements in this section.

Section 6.8 Water Seal Monitoring
Proposed modified language maintains existing requirements for major source non-landfill operations, and sets an effective date for non-major source and landfill operations previously exempt from requirements in this section.

Section 6.9 General Monitoring
Proposed modified language maintains existing requirements for major source non-landfill operations, and sets an effective date for non-major source and landfill operations previously exempt from requirements in this section.

Section 6.10 Video Monitoring
Proposed modifications remove effective dates that occurred in the past.

Section 7.0 Compliance Schedule
Proposed new language would set schedules for compliance with Section 5.8 requirements.

Section 7.2 Compliance Schedule for Annual Throughput Threshold Limits
Proposed language would set the schedule for flare operators electing to meet Table 2 annual throughput threshold limits. Flare operators electing this option shall submit an ATC application to limit annual throughput by July 1, 2022. The section would further set a requirement that the implementation of measures to limit throughput be completed and compliance with annual throughput limits must be met no later than the 2024 calendar year.

Section 7.3 Compliance Schedule for Ultra-Low NOx Flare Replacement
Proposed language would set the schedule for flare operators electing to meet Table 3 flare emissions limits. Flare operators electing this option shall submit an ATC application to limit annual throughput by July 1, 2022. The section would further set a requirement that the installation and switch to the replacement unit be completed and in compliance with emissions limits no later than the December 31, 2023.

Section 7.4 Compliance Schedule for Annual Throughput Threshold Exceedance
Proposed language would set the schedule for flare operators who previously elected to meet Table 2 annual throughput threshold limits then exceeded those limits in two

consecutive calendar years. Flare operators triggering this schedule must complete the installation or modification of a flare meeting Table 3 limits by December 31 of the year following the second consecutive threshold exceedance. In response to a stakeholder comment which stated that the draft ATC submittal timeline was unrealistic given the complexity that must go into engineering and design, District staff modified the deadline to submit an ATC application from March 1 to April 15 from the proposed draft rule published November 17, 2020. This small technical clarification will not change the deadline to meet the proposed emissions limits, only allowing additional time for the permit application process.

A. Affected Flares

District staff queried the District Permit Services Database for all flares, and identified 266 flares in total. Most flare operators are required to submit annual throughputs of gas for emissions inventory purposes. Staff consolidated this information to perform an analysis averaging flare use over the past three calendar years to estimate future flare throughputs. The flares were then sorted into categories based on the types of operations, and using permitted NOx limits to estimate emissions as shown in Table 2.

Table 2 – *Flare Annual Average Throughputs and NOx Emissions*

Facility Type	**Number**	**Throughput (MMbtu/yr)**	**NOx (tpy)**	**VOC (tpy)**	**PM10 (tpy)**
Agriculture Related Digester - Major	4	73,512	2.3	0.2	0.6
Agriculture Related Digester - Non-major	12	48,125	1.4	1.5	0.5
Chemical Production and/or Distribution	5	18,182	0.6	0.2	0.1
Gas Plants	11	169,323	5.8	5.3	0.7
Landfill	17	2,750,093	72.6	33.2	21.9
Landfill – Closed	11	532,272	15.8	3.0	14.1
Oil and Gas Production	161	2,178,620	69.6	56.0	16.8
Other	6	68,430	1.5	4.7	6.6
Propane Backup System	6	409	0.0	0.0	0.0
Refinery	7	96,663	3.3	3.0	1.3
Wastewater Treatment – Major	6	434,537	13.7	6.9	2.0
Wastewater Treatment – Non-Major	16	264,604	8.6	5.9	3.3
Organic Liquid Handling	4	58,215	2.9	1.8	0.1
Total	**266**	**6,692,984**	**198.0**	**121.7**	**67.9**

Based on this information, 31 flares are estimated to exceed proposed rule threshold limits and would be required to be replaced or modified to meet proposed emissions limits. This includes 19 flares at oil and gas producers, 2 flares at digester operators, and 10 flares at landfill operations.

B. Rule Comparisons

District staff compared emission limits, optional control requirements, and work practices in District Rule 4311 to comparable requirements in rules from the following air districts:

- Bay Area AQMD - Regulation 12, Rule 11 (Adopted June 4, 2003)
- Bay Area AQMD - Regulation 12, Rule 12 (Adopted July 20, 2005)
- Santa Barbara APCD - Rule 359 (Amended June 28, 1994)
- South Coast AQMD - Rule 1118 (Amended July 7, 2017)
- South Coast AQMD - Rule 1118.1 (Adopted January 4, 2019)

Sacramento Metropolitan AQMD and Ventura County APCD do not have an analogous rule for this source category.

Bay Area Air Quality Management District (BAAQMD)
On June 4, 2003, BAAQMD adopted Rule 12-11 (Flare Monitoring at Petroleum Refineries) requiring monitoring and recording of emissions data for flares at petroleum refineries. This rule enabled BAAQMD to collect emissions data from refineries, which BAAQMD used to determine the causes of specific flaring events, as well as estimate the quantity of emissions released during those events. As a result of findings obtained under Rule 12-11, Rule 12-12 (Flares at Petroleum Refineries) was adopted July 20, 2005.

Rule 12-12 reduces emissions from flares by minimizing the frequency and magnitude of flaring. Rule 12-12 also prohibits 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 releases more than 500,000 standard cubic feet of gas per calendar day (scf/day). The flaring report must identify the actions that will be taken to avoid flaring from that cause in the future, if possible. 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 that evaluate flaring events that released less than 500,000 scf/day, but SO_2 emitted was more than 500 lbs.

Santa Barbara County Air Pollution Control District (SBCAPCD)
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, natural gas services and transportation sources and wholesale trade in petroleum/petroleum products. 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.

South Coast Air Quality Management District (SCAQMD)
SCAQMD adopted Rule 1118 (Emissions from Refinery Flares) on February 13, 1998 and last amended the rule on July 7, 2017. Facilities subject to Rule 1118 are required to minimize or eliminate routine flaring from refining operations with flares and by establishing facility specific sulfur dioxide annual emission performance targets. SCAQMD adopted Rule 1118.1 (Non-Refinery Flares) on January 4, 2019. This rule sets NOx emissions limits for all new flares as well as annual thresholds based on percentages of installed flare capacity. Thresholds are established by facility type, 70% of capacity for digester gas flares, 20% of capacity for landfill gas flares, and 5% of capacity for produced gas flares or any gas combusted in an open flare. Flares exceeding the established thresholds are required to either reduce their flaring below the applicable threshold or replace the flare with a ULN flare. The rule establishes various timelines for compliance with replacement or reduction requirements, as well as monitoring and reporting standards.

Since SCAQMD recently adopted their Rule 1118.1, District staff conducted a comprehensive analysis to understand the potential emission reduction opportunities of applying a similar rule concept to sources located in the San Joaquin Valley. District staff evaluated various approaches to determining thresholds to require flare operators to take action to reduce emissions. Applying a percentage-based approach would have excluded some of the most highly utilized flares in the Valley. As an alternative to this approach, District staff evaluated a set of annual throughput thresholds by flare type, with the goal of achieving emissions reductions in greater quantity and more cost-effectively than those achievable under the approach included in SCAQMD Rule 1118.1. The approach included in the District's proposed rule achieves greater emissions reductions than the approached included in SCAQMD Rule 1118.1 at approximately half the cost by focusing on flares with the highest usage, resulting in a more effective proposed rule.

IV. ANALYSIS

A. Emission Reduction Analysis

In order to determine the emission reductions associated with the proposed changes, District staff queried the District Permit Services Database for all flares, and then sorted the flares into categories based on the types of operations. The District identified 266 flares in total. Based on the three-year average of throughput data reported to the District in annual emissions inventory submissions, 32 flares are estimated to exceed proposed rule threshold limits and would be required to be replaced or modified to meet proposed emissions limits if that average is indicative of future throughput. This includes 19 flares at oil and gas producers, 2 flares at digester operators, and 10 flares at landfill operations. Details for the affected flares, with expected NOx reductions are in Table 3 below.

Table 3 – *Summary of NOx Reductions Based on Average Flare Annual Throughputs*

Facility Category	**Total Permitted Flares**	**Number Replacing Flares**	**Annual Throughput of Affected Flares (MMBtu/yr)**	**Percent NOx Reductions**	**Percent VOC Reductions**	**Percent PM Reductions**
Oil and Gas Facilities	161	19	1,299,587	46.4%	46.9%	17.0%
Landfill Facilities	28	10	2,576,069	47.9%	27.8%	47.1%
Wastewater Treatment	22	2	334,500	47.1%	23.4%	0.0%
Other Facilities	55	0	0	—	—	—
Totals	266	31	4,210,156	37.2%	30.4%	19.4%

Estimated NOx reductions are based on three-year average throughputs, and are used for cost-effectiveness purposes. However, for SIP purposes, a percentage reduction from each pollutant is calculated from three-year average data, and that percentage will be used for the emissions controlled from the rule. For the years 2024 and 2025, the percentage reductions will be applied to the emissions inventory data from CEPAM Version 1.5, which was used as the inventory for the *2018 PM2.5 Plan*. These reductions are shown in Table 4.

Table 4 – *SIP Emissions Reductions*

	NOx	**VOC**	**PM2.5**
Reduction Percentage	37.2%	30.4%	19.4%
2024 Emissions Reductions (tons per day)	0.19	0.39	0.03
2025 Emissions Reductions (tons per day)	0.19	0.38	0.03

Details of the emissions reduction analysis is contained in Appendix B to this staff report.

B. Cost Effectiveness Analysis

The California Health and Safety Code (CH&SC) Section 40920.6(a) requires the District to conduct both an absolute cost effectiveness analysis and an incremental cost effectiveness analysis of available emission control options before adopting each BARCT rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements of a rule. Details of the cost effectiveness analysis is contained in Appendix C to this report.

C. Socioeconomic Analysis

Pursuant to CH&SC 40728.5(a), "Whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent data are available, perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation." The District, through a competitive solicitation process, selected Eastern Research Group, Inc. (ERG) to perform the socioeconomic impacts analysis. District Staff identified flares subject to proposed Rule 4311, estimated units likely to be affected by new provisions. Cost information was collected from vendors and stakeholders throughout the public process. The information was provided to ERG to perform the analysis and draft the report. The report is contained in Appendix D of this staff report.

D. Environmental Impact Analysis

The District is proposing to amend existing District Rule 4311 (Flares) to meet the commitments in the 2016 Ozone Plan and 2018 PM2.5 Plan. The Purpose of this rule amendment project is to add additional low NOx flare emission limitations for existing and new flaring activities and expand applicability of the rule by removing the exemption for non-major.

There are no other actions or rule requirements associated with this project. Based on the District's investigation, substantial evidence supports the District's conclusion that the amendments will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, and as such is not a "project" as that term is defined under the California Environmental Quality Act (CEQA) Guidelines § 15378. In addition, substantial evidence supports the District's conclusion that, if one assumes the amendment is a "project" under CEQA in spite of our conclusion to the contrary, it will not have any significant adverse effects on the environment.

In addition, the amendments to District Rule 4311 is an action taken by a regulatory agency, the San Joaquin Valley Air District, as authorized by state law to assure the maintenance, restoration, enhancement, or protection of air quality in the San Joaquin Valley where the regulatory process involves procedures for protection of air quality.

CEQA Guidelines §15308 (Actions by Regulatory Agencies for Protection of the Environment), provides a categorical exemption for "actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Construction activities and relaxation of standards allowing environmental degradation are not included in this exemption." No construction activities or relaxation of standards are included in this project. Therefore, the rule amendment project is exempt from CEQA.

Finally, according to Section 15061 (b)(3) of the CEQA Guidelines, a project is exempt from CEQA if, "(t)he activity is covered by the common sense exemption that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA." As such, for this additional reason, the District finds that the rule amendment project is exempt from CEQA.

E. Rule Consistency Analysis

Pursuant to CH&SC Section 40727.2, staff has prepared a rule consistency analysis that compares the elements of Rule 4311 with the corresponding elements of other District rules and federal regulations and guidelines that apply to the same type of equipment or source category. The analysis is discussed in Appendix E of this staff report. District staff has concluded that Proposed Rule 4311 is not in conflict with nor inconsistent with other District rules nor is Proposed Rule 4311 in conflict with nor inconsistent with federal policy, rule, or regulations governing the same source category.

APPENDIX A

Summary of Significant Comments and Responses
For Proposed Amendments to Rule 4311 (Flares)

December 17, 2020

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SUMMARY OF SIGNIFICANT COMMENTS
DRAFT AMENDMENTS TO RULE 4311
(FLARES)
November 17, 2020

The District published and noticed the proposed amendments to Rule 4311 on November 17, 2020. Summaries of significant comments received during the associated comment period are summarized below.

Comments were received from the following:
Kern Oil & Refining Co. (Kern)

1. **COMMENT:** Proposed rule Table 2 sets limits on annual throughput for refineries to 25,000 MMBtu/yr. The primary purpose of flares at refineries are as safety devices during emergency situations. Requiring an annual throughput limit will be problematic if an emergency situation occurs and the flare needs to be used in that case. (Kern)

   RESPONSE: The proposed amendments to Rule 4311 are designed to encourage flare operators to find beneficial alternative uses of gas combusted or deploy the cleanest flaring technologies to achieve additional NOx emission reductions from this sector. While Rule 4311 establishes an annual throughput threshold, facilities have the option to either comply with this threshold or install an ultra-low NOx flare that meets the emission limits specified in the rule and not be held to the annual throughput threshold. Each facility will have the option to comply based on what is most reasonable and cost-effective for their operation.

2. **COMMENT:** Releases due to process upsets or other emergencies should be exempt from the 25,000 MMBtu/yr limit. (Kern)

   RESPONSE: Many of the flare minimization practices identified in the District's 2015 Flare Further Study[1] involve reductions to emergency flaring including procedures to prevent or mitigate effects of power outages to reduce flaring, redundant systems, and maintenance and testing procedures. Exclusion of emergency flare gas throughput from threshold calculations would be an inappropriate disincentive to ensuring the best minimization practices are implemented by flare operators.

3. **COMMENT:** ULN flares will not have the capacity to maintain the desired emissions limits of proposed rule Table 3 due to varying composition of gases

[1] 2015 Flare Minimization Plan Further Study. http://www.valleyair.org/notices/Docs/2017/08-22-17_(FMP)/FlaresFurtherStudy.pdf

that are directed to a flare by a petroleum refinery, and vendors will not guarantee NOx emissions under all conditions at the flares. (Kern)

RESPONSE: District staff understand that flares at petroleum refineries are primarily used as safety devices, and control devices designed to reduce emissions from waste gas. However, flares routinely used for flaring waste gas can be controlled to reduce emissions of NOx. Technical evaluations conducted by District staff indicate that the emissions limits specified for Oil and Gas Operations, including refining operations, can be met by existing flare control technologies. ULN flare technology is continuing to be developed, with additional manufacturers entering the market, and District staff expect options for ULN flares to continue to expand in the coming years, increasing options for operators that choose to install this technology in lieu of implementing an alternative use for waste gases.

4. COMMENT: Will proposed flaring limitations of the rule trigger an update to the Flare Minimization Plan? (Kern)

RESPONSE: Proposed Rule 4311 section 6.5.3 requires an FMP update if there is new or modified equipment being installed. A permit modification to include flare limits to meet annual throughput threshold requirements would not be an installation of new equipment for flares that have been consistently operating under the applicable threshold and would not require an FMP update. If a flare operator needed to install new equipment or modify practices in their existing FMP to reduce their flare throughput to meet annual throughput threshold limits then an FMP update would be necessary to identify those new minimization practices.

5. COMMENT: Proposed rule Table 7 sets a timeline for flare modification requiring an Authority to Construct (ATC) application be completed and submitted two months after triggering the requirement. This timetable is unrealistic given the complexity that must go into engineering and design sufficient to support a permit application. (Kern)

RESPONSE: The District understands that additional time may be needed to submit an ATC permit application and is extending the timeframe for submitting the required ATC application March 1 to April 15 of the applicable year.

SUMMARY OF SIGNIFICANT COMMENTS
DRAFT AMENDMENTS TO RULE 4311
(FLARES)
October 8, 2020

The District held a public workshop to present, discuss, and receive comments on the draft amendments to Rule 4311 on October 8, 2020. Summaries of significant comments received during the public workshop and associated comment period are summarized below.

Comments were received from the following:
Chris Hall, Drilling & Production, Co. (D&P)
Christine, Western Safe Petroleum Association (WSPA)
Daniel Beck, Chevron (Chevron)
Juan Campos, CRC (CRC)
Kim Burns, E&J Gallo Winery (Gallo)
Rock Zierman, California Independent Petroleum Association (CIPA)
Sabrina Lockhart, California Independent Petroleum Association (CIPA)
Matthew Helo, TetraTech (Tetra)
Nicholas Diercks, EnviroTech Consultants, Inc. (EnviroTech)
E&B Natural Resources (E&B)

1. **COMMENT:** For emergency flares, can the flaring of gas during the maintenance and testing of other equipment, or when gas cannot be sent to a sales pipeline, be considered an emergency. (CIPA)

   RESPONSE: The current definition of "emergency" included in Section 3 of the rule does not allow for flaring of gas during maintenance or testing of other equipment. However, emergency flaring would be allowed in emergency events beyond an operator's control (see Section 3.10).

2. **COMMENT:** How does this rule apply to facilities when flaring is required due to a power outage (and an ULN flare would be inoperable) and when a ULN flare is down for required maintenance. (CIPA)

   RESPONSE: If an existing flare is designated as an emergency use-only flare, such a flare could be used during a power outage, as such an event qualifies as an "emergency". Emergency use only flares would not be subject to the proposed new requirements. For existing flares that are not designated as emergency use only, but rather have an annual throughput limit, any flaring, e.g. during emergencies, maintenance of a new ULN flare or other equipment, or any other reason, would count towards the annual throughput threshold limits. Such an existing flare could be used during a power outage (when a ULN flare may be inoperable) and during ULN flare maintenance activities. Additionally, facilities may need to conduct planning to respond to unplanned outages as they relate to flaring activities as is similarly done for other industrial impacts.

Based on conversations with affected stakeholders, if a new ULN is required to be installed, an existing flare can be maintained provided it meets the annual throughput limits in the proposed rule amendments, and could be used during periods when the ULN flare is inoperable due to a power outage, during periods of ULN flare maintenance, or for other reasons. The District will work with affected operations during the permitting process if this type of installation is required.

3. **COMMENT:** If an operator were to exceed the annual throughput threshold committed to with a permit condition, would they just be required to install an Ultra-Low NOx flare or would there also be a risk of an issuance of a notice of violation? (Chevron)

   RESPONSE: Exceedance of annual throughput thresholds in Table 2 would not result in a Notice of Violation for the exceedance. Permit modifications required for operators opting to comply via Section 5.9.1 provisions would include a requirement in the permit condition indicating exceedance in two consecutive calendar years would require replacement or modification of a flare to meet the Table 3 emissions limits within one year of the second calendar year exceedance.

4. **COMMENT:** ULN's are new technology and questions remain about the useful life of these devices. Be sure the life cycle is accounted along with the maintenance. (CRC)

   RESPONSE: ULN flares that have been installed in other parts of the state have been demonstrated to have a useful life between 10-25 years. The District understands that there may be many factors that decrease the useful life of a flare and has taken that into consideration in our analysis. The cost-effectiveness analysis and socioeconomic impact analysis are based on a conservative 10-year useful life for replacement flares.

5. **COMMENT:** The District, CARB, and PUC should support efforts to eliminate flaring through the implementation of alternative use projects, such as generation of electric power exported to the grid. PUC limits prevent this use and I would like support in reopening the effort with CARB on the alternate use of gas. (D&P)

   RESPONSE: The proposed amendments to Rule 4311 are designed to encourage flare operators to find beneficial alternative uses of gas combusted or deploy the cleanest flaring technologies to achieve additional NOx emission reductions from this sector. Through this approach, the District supports alternative uses of flare gas for beneficial purposes and will support opportunities for these types of projects.

6. **COMMENT:** Please exempt emergency flares from administrative plans and reports, the beneficial value is low because their use is already limited. (Gallo)

   RESPONSE: Currently, the rule requires Flare Minimization Plans for emergency flares. The proposed rule will keep these requirements in place to ensure operators take appropriate measures to minimize the occurrence of emergency flare needs.

7. **COMMENT:** The posted draft rule changes reports to be based on calendar year, please have the first report due January 1, 2022 covering the 2021 calendar year. (Gallo)

   RESPONSE: Annual report requirements in Proposed Rule 4311 Section 6.2.2 and 6.2.3 maintain current reporting requirements until 2024, and then changes to a calendar year basis to match the calendar year annual throughput threshold basis. The first report under the calendar year basis will be due 30 days from the end of the 2024 calendar year.

8. **COMMENT:** There is limited availability of ultra-low NOx flares for oil and natural gas operations. Only one current manufacturer. If several operators need to install ultra-low NOx flares within the same timeframe will this one manufacturer be able to fulfill all equipment, installation, and maintenance needs? (CIPA)

   RESPONSE: District staff have identified multiple manufacturers who produce flares suitable for the oil and gas industry including but not limited to Aeron, John Zink, and Zeeco.

9. **COMMENT:** Cost-effectiveness needs to consider stranded gas, where no options exist to send gas to a sales gas pipeline or other disposal method. (CIPA)

   RESPONSE: The cost-effectiveness analysis was based on replacement of flares that exceed annual throughput thresholds, which includes stranded gas. The cost-effectiveness analysis is included in Appendix C.

10. **COMMENT:** For emergency flares, is there a condition that allows throughput to the flare for maintenance/testing? (CIPA)

    RESPONSE: A flare permitted for emergency use is allowed to be used for certain limited testing and maintenance of the flare itself. However, flared gas from equipment that are down for maintenance and testing cannot be sent to the emergency flare.

11. COMMENT: Calculating the flare annual throughput will require a heating value. Heating values could be obtained from source test results or from a default table of heating values as SCAQMD provides in Rule 1118.1 Table 5. What method the San Joaquin Valley APCD will require? (Tetra)

RESPONSE: Proposed rule language includes default flare gas heating values for operators who would prefer to use them in their reporting, see sections 5.14 and 6.3.6 or an option to provide their own heating value by testing as specified in Section 6.3.6 of the rule.

12. COMMENT: Some existing flares have permit conditions requiring source test results to be submitted within 60 days after test completion, but the draft rule requires submission within 45 days after test completion. (Tetra)

RESPONSE: District staff identified this discrepancy in the process of its rule consistency analysis and the proposed rule Section 6.4.2 includes an update to ensure consistency with Rule 1081 (Source Sampling).

13. COMMENT: For operators who exceed the annual throughput thresholds require the operator to propose a compliance plan if they exceed the limit for two of the three proceeding years. Allow the plan to provide a route back to compliance with thresholds. (E&B)

RESPONSE: The District has considered the need for additional flexibility and modified the proposed rule from the draft posted with the October workshop. The proposed rule would trigger replacement after two consecutive years of exceeding the annual throughput threshold. This change will provide flexibility for operators who have unforeseen circumstances necessitating flaring beyond the threshold limitations, provided those circumstances do not extend for to two consecutive calendar years.

14. COMMENT: BACT should not apply to existing flares when meeting rule requirements to lower permitted throughput levels. (E&B)

RESPONSE: The District will work closely with permitted entities to address any requirements associated with modifications to permits associated with complying with the proposed amendments.

15. COMMENT: COVID-19 has had significant impacts on the oil and gas industry, causing a dramatic and sudden shift in demand for crude worldwide, disrupted supply chains and access to capital. The District should delay the rule-making due to COVID-19. (E&B)

RESPONSE: The District appreciates the concerns raised regarding the economic impacts associated with the COVID-19 pandemic. The District has carefully considered comments and suggestions regarding potential options for achieving additional emissions reductions to ensure that impacts are minimized where possible, while achieving the emissions reductions necessary to meet health-based standards. Additionally, in response to the pandemic, the District directed the third party contractor performing the socioeconomic impact analysis to consider COVID-19 related impacts in their analysis. The analysis performed includes consideration of those impacts, and details can be found in Appendix D to this staff report.

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APPENDIX B

Emission Reduction Analysis
For Proposed Amendments to Rule 4311

December 17, 2020

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EMISSION REDUCTION ANALYSIS FOR PROPOSED AMENDMENTS TO RULE 4311 (FLARES)

I. SUMMARY

The purpose of this rule project is to obtain as much reductions of nitrogen oxides (NOx) emissions from the source category as expeditiously practical, technologically feasible, and economically reasonable. The District committed to amending Rule 4311 as part of the District's *2016 Plan for the 2008 8-Hour Ozone Standard* and the *2018 Plan for the 1997, 2006 and 2012 PM2.5 Standards (2018 PM2.5 Plan)*. In the *2018 PM2.5 Plan*, the District estimated an amendment to Rule 4311 would contribute 0.05 tons per day towards the aggregate commitment in the PM2.5 Plan. This appendix details the calculations and assumptions used to estimate the emission reductions associated with the proposed amendments to Rule 4311. The District estimated emission reductions using permit conditions and annually reported throughput of individual flares, and the proposed rule's emission and throughput limits.

In order to determine the emission reductions associated with the changes, District staff queried the District Permit Services Database for all flares, and then sorted the flares into categories based on the types of operations. Categories were oil and gas operations, digester operations, landfill operations, organic liquid loading operations, and other operations. The District further divided digester operations into flares at major source facilities and those at non-major source facilities, and landfill operations into open and closed landfills to be consistent with SCAQMD Rule 1118.1 requirements.

The District identified 266 flares in total. Based on the three-year average of throughput data reported to the District in annual emissions inventory submissions, 31 flares are estimated to exceed the proposed rule threshold limits and would be required to be replaced or modified to meet proposed ULN emissions limits. This includes 19 flares at oil and gas producers, 2 flares at digester operations, and 10 flares at landfill operations.

District staff estimates that the proposed changes in the rule limits and new annual throughput thresholds would lead to approximately 0.19 tons per day (tpd) of NOx, 0.39 tpd of VOC, and 0.03 tpd of direct PM2.5 emission reductions in 2024. Flare operators may opt to reduce the use of their flares to comply with Rule 4311 requirements, and such reductions will often result in more than 50% to 75% throughput reductions and in those cases more overall emissions reductions than installing new flares. Although District staff expects proposed Rule 4311 will result in more emissions reductions than what is calculated here, this rule project will not attempt to quantify or take credits for these additional reductions.

A summary of the emission reduction analysis results is shown in Table 1 and details of the calculations are explained later in this appendix.

Table 1 – Summary of Emissions Reductions Based on Average Flare Annual Throughputs

Facility Category	Total Permitted Flares	Number Replacing Flares	Annual Throughput of Affected Flares (MMBtu/yr)	Percent NOx Reductions	Percent VOC Reductions	Percent PM2.5 Reductions
Oil and Gas Facilities	161	19	1,299,587	46.4%	46.9%	17.0%
Landfill Facilities	28	10	2,576,069	47.9%	27.8%	47.1%
Wastewater Treatment	22	2	334,500	47.1%	23.4%	0.0%
Other Facilities	55	0	0	—	—	—
Totals	266	31	4,361,417	37.2%	30.4%	19.4%

II. BACKGROUND

District staff estimates there are 266 flares that are currently under permit with the District and are subject to the proposed Rule 4311. Flares act as a safety device during unforeseeable and unpreventable situations, and as an emission control device for air toxics and VOCs.

Effective technologies to reduce NOx emissions for flares rely on precise combustion controls achieved with careful air/fuel mixing and specially tuned burners to ensure complete combustion with appropriate residence times in the combustion zones. In order to be effective the systems are designed to match the input gas heating values and flow rates, or installed with sensors and controls to accommodate variations on these parameters in real time. These combustion controls also reduce emissions of VOCs and PM in many cases.

III. EMISSION REDUCTION ANALYSIS

District staff used the Permit Database to identify the flares with type of facility, rated capacities, and permitted NOx emissions limits in the District. District staff also queried emissions inventory submittals for facilities with flares required to submit to determine the annual throughputs for most permitted flares. There are approximately 266 permitted flares that may be subject to the proposed Rule 4311.

The proposed amendment to Rule 4311 was designed to encourage flare operators to find beneficial alternative uses of gas combusted in flares. It is expected that some of the flare operators that would otherwise be required to replace flares exceeding proposed annual throughput thresholds will instead install equipment to make beneficial uses of the gas. These alternative uses potentially resulting in cost savings and likely greater reduction of emissions including NOx from flares than would occur if replaced with ultra-low NOx flares. It would be speculative, at best, to determine which flares this might occur at; therefore, the following emission reduction analysis does not include any estimate of emissions reductions for beneficial alternative uses of flare gas.

A. Affected Flares

District staff queried the Permit Services Permits Database for flare and sorted the flares by facility type. Some facility types were further sorted into closed or open landfills and major or non-major sources for facilities for those categories that may have different requirements in the proposed rule. Using collected annual throughput, permitted NOx, VOC, and PM10 emissions factors, and assumptions of gas heat content calculations of estimated future emissions were made for all flares. Gas heat content was assumed to be 500 btu/scf for landfill gas, 650 btu/scf for digester gas, and 1000 btu/scf for other gas sources (equivalent to methane). Propane was taken as 91,000 btu/gallon. As PM2.5 is a subset of PM10, and improving combustion parameters will reduce particulates across the entire range of particle size, the reduction percentage for PM10 calculated is assumed to apply equally to PM2.5.

Table 2 shows the number of each type of flare, the estimated emissions, and throughputs based on a three-year average of annual throughputs for calendar years 2017, 2018, and 2019.

Table 2 – Flare Emissions Based on Annual Average Throughputs

Facility Type	Number	NOx (tpy)	VOC (tpy)	PM10 (tpy)	Throughput (MMbtu/yr)
Agriculture Related Digester - Major	4	2.29	0.18	0.61	73,512
Agriculture Related Digester - Non-major	12	1.36	1.48	0.47	48,125
Chemical Production and/or Distribution	5	0.62	0.16	0.10	18,182
Gas Plants	11	5.76	5.34	0.74	169,323
Landfill	17	72.62	33.20	21.89	2,750,093
Landfill – Closed	11	15.84	3.02	14.09	532,272
Oil and Gas Production	161	69.60	55.95	16.78	2,178,620
Other	6	1.46	4.71	6.63	68,430
Propane Backup System	6	0.01	0.01	0.00	409
Refinery	7	3.29	3.04	1.26	96,663
Wastewater Treatment - Major	6	13.66	6.87	1.98	434,537
Wastewater Treatment - NonMajor	16	8.56	5.90	3.26	264,604

Facility Type	Number	NOx (tpy)	VOC (tpy)	PM10 (tpy)	Throughput (MMbtu/yr)
Organic Liquid Handling	4	2.92	1.83	0.12	58,215
Total	**266**	**197.96**	**121.70**	**67.93**	**6,692,984**

B. Emission Reduction Calculations

District staff reviewed each flare's average annual throughput, as well as eligibility for exemptions, to determine which flares would be expected to exceed annual throughput thresholds and replace existing flares to meet proposed emissions limits. Emissions reductions were calculated for those flares by multiplying the difference in emissions from the current permit limit to the proposed rule limit by the average annual throughput.

$$ER = (EF_{Permit} - EF_{Limit}) \times Throughput_{Average} \quad (1)$$

Where:

ER = Emissions Reduction in lb/yr
EF_{Permit} = Emission Factor from Permit to Operate in lb/MMBtu
EF_{Limit} = Emissions Factor from proposed Rule 4311 in lb/MMBtu
$Throughput_{Average}$ = Annual Throughput averaged over the 2017, 2018, and 2019 calendar years in MMBtu/yr

For PM emissions, the proposed rule language does not include a limit. However, the technology used to reduce NOx in ULN flares will reduce PM emissions compared to many flares in use. PM emission reductions were calculated using a controlled 0.008 lb/MMBtu, 18 of 31 affected flares already met that limit, but the remaining 13 flares would reduce PM emissions once replaced.

Emissions reductions for the 31 flares expected to be replace by the proposed amendments to Rule 4311 were each calculated using Equation 1. The results of the calculations are listed in Table 3 for NOx, Table 4 for VOC and Table 5 for PM10 at the end of this appendix. An example of one such calculation is as follows:

$$ER = (EF_{Permit} - EF_{Limit}) \times Throughput_{Average}$$

$$ER = \left(0.068 \frac{lb}{MMBtu} - 0.018 \frac{lb}{MMBtu}\right) \times 176{,}120 \frac{MMBtu}{yr}$$

$$ER = 8{,}806 \frac{lb}{yr}$$

Where:

EF_{Permit} = 0.068 lb/MMBtu
EF_{Limit} = 0.018 lb/MMBtu
$Throughput_{Average}$ = 176,120 MMBtu/yr

Table 3 – NOx Emission Reductions from Affected Flares

SIC	Annual Throughput (MMBtu/yr)	Permitted NOx Limit (lb/MMBtu)	Proposed NOx Limit (lb/MMBtu)	NOx Reduced (lb/yr)
1311	176,120	0.068	0.018	8,806
1311	172,143	0.068	0.018	8,607
1311	161,873	0.068	0.018	8,094
1311	111,653	0.068	0.018	5,583
1311	86,467	0.068	0.018	4,323
1311	85,267	0.068	0.018	4,263
1311	64,053	0.068	0.018	3,203
1311	52,703	0.068	0.018	2,635
1311	52,514	0.068	0.018	2,626
1311	43,200	0.068	0.018	2,160
1311	37,530	0.068	0.018	1,877
1311	37,514	0.068	0.018	1,876
1311	37,210	0.068	0.018	1,860
1311	36,614	0.068	0.018	1,831
1311	34,801	0.068	0.018	1,740
1311	29,597	0.068	0.018	1,480
1311	27,644	0.068	0.018	1,382
1311	26,450	0.068	0.018	1,322
1311	26,233	0.068	0.018	1,312
4953	617,890	0.05	0.025	15,447
4953	456,837	0.057	0.025	14,619
4953	304,840	0.048	0.025	7,011
4953	290,792	0.05	0.025	7,270
4953	257,278	0.05	0.025	6,432
4953	170,667	0.06	0.025	5,973
4953	142,215	0.05	0.025	3,555
4953	142,149	0.05	0.025	3,554
4953	100,152	0.05	0.025	2,504
4953	93,250	0.06	0.025	3,264
4952	205,822	0.0606	0.025	7,329
4952	128,678	0.068	0.025	5,533
Total	**4,210,156**			**147,470**

Table 4 – VOC Emission Reductions from Affected Flares

SIC	Annual Throughput (MMBtu/yr)	Permitted VOC Limit (lb/MMBtu)	Proposed VOC Limit (lb/MMBtu)	VOC Reduced (lb/yr)
1311	176,120	0.063	0.008	9,687
1311	172,143	0.063	0.008	9,468
1311	161,873	0.021	0.008	2,104
1311	111,653	0.0021	0.008	-
1311	86,467	0.063	0.008	4,756
1311	85,267	0.063	0.008	4,690
1311	64,053	0.0028	0.008	-
1311	52,703	0.063	0.008	2,899
1311	52,514	0.063	0.008	2,888
1311	43,200	0.063	0.008	2,376
1311	37,530	0.063	0.008	2,064
1311	37,514	0.063	0.008	2,063
1311	37,210	0.063	0.008	2,047
1311	36,614	0.063	0.008	2,014
1311	34,801	0.033	0.008	870
1311	29,597	0.063	0.008	1,628
1311	27,644	0.0037	0.008	-
1311	26,450	0.063	0.008	1,455
1311	26,233	0.063	0.008	1,443
4953	617,890	0.0084	0.038	-
4953	456,837	0.0055	0.038	-
4953	304,840	0.063	0.038	7,621
4953	290,792	0.063	0.038	7,270
4953	257,278	0.0055	0.038	-
4953	170,667	0.0084	0.038	-
4953	142,215	0.063	0.038	3,555
4953	142,149	0.03	0.038	-
4953	100,152	0.006	0.038	-
4953	93,250	0.0089	0.038	-
4952	205,822	0.0027	0.038	-
4952	128,678	0.063	0.038	3,217
Total	**4,210,156**			**74,113**

Table 5 – PM10 Emission Reductions from Affected Flares

SIC	Annual Throughput (MMBtu/yr)	Permitted PM10 Limit (lb/MMBtu)	PM10 Emissions with ULN Controls (lb/MMBtu)	PM10 Reduced (lb/yr)
1311	176,120	0.0080	0.008	-
1311	172,143	0.0080	0.008	-
1311	161,873	0.0202	0.008	1,975
1311	111,653	0.0202	0.008	1,362
1311	86,467	0.0080	0.008	-
1311	85,267	0.0080	0.008	-
1311	64,053	0.0140	0.008	384
1311	52,703	0.0080	0.008	-
1311	52,514	0.0080	0.008	-
1311	43,200	0.0080	0.008	-
1311	37,530	0.0260	0.008	676
1311	37,514	0.0080	0.008	-
1311	37,210	0.0080	0.008	-
1311	36,614	0.0260	0.008	659
1311	34,801	0.0200	0.008	418
1311	29,597	0.0080	0.008	-
1311	27,644	0.0160	0.008	221
1311	26,450	0.0080	0.008	-
1311	26,233	0.0080	0.008	-
4953	617,890	0.0080	0.008	-
4953	456,837	0.0080	0.008	-
4953	304,840	0.0170	0.008	2,744
4953	290,792	0.0200	0.008	3,490
4953	257,278	0.0080	0.008	-
4953	170,667	0.0340	0.008	4,437
4953	142,215	0.0080	0.008	-
4953	142,149	0.0340	0.008	3,696
4953	100,152	0.0500	0.008	4,206
4953	93,250	0.0300	0.008	2,051
4952	205,822	0.0080	0.008	-
4952	128,678	0.0020	0.008	-
Total	**4,210,156**			**26,319**

Using this methodology, District staff calculated the total emission reductions expected to be achieved from the replacement of flares that operate above the Rule 4311 Annual Throughput Thresholds. The percent reduction is calculated comparing the total emissions from Table 2 to the emissions reductions from Table 3, Table 4 and Table 5 as shown in Table 6.

Table 6 – Percent Reduction of Emissions

Pollutant	NOx	VOC	PM
Estimated Total (tons/year)	198.0	121.7	67.9
Estimated Reduction (tons/year)	73.7	37.1	13.2
Reduction Percentage	37.2%	30.4%	19.4%

This measure is expected to reduce the flaring emissions inventory in the Valley by 37.2% for NOx, 30.4% for VOC, and 19.4% for PM.

C. State Implementation Plan (SIP) Credit from Proposed Rule

The emissions reductions calculated above are based on average flare throughputs reported in 2017, 2018, and 2019. This ensures the calculation is based on the best and most current information. However, in order to determine the emissions reductions that may be applied to commitments in the SIP the reductions must be normalized to the planning inventory used in the analysis for the plan. The *2018 PM2.5 Plan* inventory for flares is shown in Table 7.

Table 7 – Annual Average Emissions Inventory from Flares[1]

Pollutant	2013	2017	2019	2020	2022	2023	2024	2025	2026	2028
PM2.5	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17
NOx	0.56	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.51
VOC	1.64	1.61	1.48	1.42	1.39	1.39	1.31	1.28	1.26	1.23

To normalize the emissions reduction expected to be achieved by the rule, District staff multiplied the percent reductions in Table 6 of the flaring inventory by the inventory included in CEPAM version 1.05 (the inventory used for the plan).

Table 8 – Emissions Reductions from Proposed Amendment

Pollutant	2024	2025	2026	2028
PM2.5	0.03	0.03	0.03	0.03
NOx	0.19	0.19	0.19	0.19
VOC	0.39	0.38	0.38	0.36

[1] Emissions Inventory data source is CEPAM v. 1.05.

APPENDIX C

Cost Effectiveness Analysis
For Proposed Amendments to Rule 4311

December 17, 2020

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COST EFFECTIVENESS ANALYSIS FOR PROPOSED RULE 4311

I. SUMMARY

The California Health and Safety Code (CH&SC) Section 40920.6(a) requires the District to conduct both an absolute cost effectiveness analysis and an incremental cost effectiveness analysis of available emission control options before adopting each Best Available Retrofit Control Technology (BARCT) rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements of a rule. District staff have prepared a conservative cost-effectiveness analysis for proposed Rule 4311, considering the NOx emission reductions achieved through the implementation of ultra-low NOx flare technology.

Absolute cost effectiveness of a control option is the added annual compliance cost to meet the proposed rule's requirements, in dollars per year, divided by the emission reduction achieved in tons of pollutant reduced per year.

Table 1 shows the costs and the results of the cost effectiveness analysis for flares expected to be replaced as a result of the proposed Rule 4311. District staff estimates that operators will need to replace or modify a total of 31 flares at an annualized cost of approximately $7.4 million. For flares at oil and gas facilities, the estimated cost effectiveness is $157,120 per ton NOx removed. For flares at landfill facilities, the absolute cost effectiveness for this rule project is approximately $56,578 per ton NOx removed. For flares at wastewater treatment facilities, the absolute cost effectiveness for this rule project is approximately $52,492 per ton NOx removed. Taking the rule amendments as a whole, the cost effectiveness is approximately $100,581 per ton NOx removed.

Table 1 *– Absolute Cost-effectiveness of Flare Replacements*

Facility Category	Total Permitted Flares	Number Replacing Flares	Estimated NOx Reductions (tpy)	Estimated Annualized Cost ($/yr)	Cost-Effectiveness ($/ton)
Oil and Gas Facilities	161	19	32.5	$5,106,410	$157,120
Landfill Facilities	28	10	34.8	$1,968,911	$56,578
Wastewater Treatment	22	2	6.43	$337,523	$52,492
Other Facilities	55	0	0	0	—
Totals	266	31	73.7	$7,412,844	$100,581

II. BACKGROUND

Based on the comprehensive technology assessment that District staff have conducted for this source category, as well as a thorough review of state, federal, and other air district regulations, District staff are proposing several modifications to Rule 4311. District staff are proposing to remove the non-major source exemption, remove landfill exemption, add performance standards to require ultra-low NOx technology for new and existing flares to the current flare rule in order to reduce flare emissions in the District.

The proposed amendments to Rule 4311 are designed to encourage flare operators to find beneficial alternative uses of gas combusted or deploy the cleanest flaring technologies to achieve additional NOx emission reductions from this sector. Specific limits are proposed depending on the applicability of the ultra-low NOx technology to different flaring processes with industry specific considerations. The installation of ULN flare technology would be required for flares that combust the majority of gas in the Valley. This would require installation of ULN flares associated with 65% of total gas flared from all categories. The new ULN requirements would be in addition to current requirements, including flare minimization plans.

The emissions reduction analysis in Appendix B to this staff report identified flares that have had an average throughput over the years 2017, 2018, and 2019 exceeding the thresholds as proposed, and are likely to be affected by the more stringent emissions limits.

This analysis identifies 31 of 266 flares likely to be affected by the more stringent limits, located at 26 facilities, representing 63% of the total flared gas. Of the 26 facilities, 14 are oil and gas production, 10 are landfills, and two are wastewater treatment plants. This cost-effectiveness analysis focuses primarily on these three facility types, as the locations of affected flares.

III. ESTIMATED COMPLIANCE COSTS

District staff used cost information provided by control equipment manufacturers and vendors, and from stakeholders to conduct a cost effectiveness analysis of the proposed NOx limits in Draft Rule 4311. Specifically the data used in the analysis came from the following sources:

1. Aereon
2. California Resources Corporation
3. A large oil producer in the Valley
4. SCAQMD Rule 1118.1 Staff Report
5. Foothill landfill (San Joaquin County)
6. Badlands landfill (Riverside County)
7. Monterey Peninsula landfill (Monterey county)
8. Fresno/Clovis wastewater treatment plant

9. Bakersfield City wastewater treatment plant
10. Visalia wastewater treatment plant

In some cases, OAQPS methodologies were used to estimate annual operation and maintenance costs. Cost information submitted to the District is summarized in Table 2.

Table 2 – Flare Costs Analyzed

Category	Capacity (MMbtu/hr)	Installed Cost	Annual Operations & Maintenance Cost
Landfill	60.7	$1,935,000	Not provided
Landfill	54.6	$754,000	$59,275
Landfill	167	$1,386,400	$219,850
Oil and Gas	36	$2,200,000	$40,000
Oil and Gas	27	$3,020,000	Not provided
Oil and Gas	75.7	$492,820	Not provided
Oil and Gas	3.4	$800,000	Not provided
Oil and Gas	25	$950,000	Not provided
Wastewater Treatment	16.5	$361,858	$79,195
Wastewater Treatment	53.2	$2,518,000	$30,000

A. Cost Scaling to Flare Capacity

Cost information was obtained for a certain capacity of flare at certain operation types. In order to determine costs for flares with capacity different from the base cost, District staff used the following equation:

$$Cost_{Flare} = Cost_{Basis} \times \left[\frac{Capacity_{Flare}}{Capacity_{Basis}}\right]^{6/10}$$

Where

$Cost_{Flare}$ = Estimated cost of replacement flare; and
$Cost_{Basis}$ = Cost of flare used as basis of calculation; and
$Capacity_{Flare}$ = Rated capacity of replacement flare; and
$Capacity_{Basis}$ = Rated capacity of flare used as basis of calculation.

B. Baseline Flares for Analysis

Of the various flare estimates and cost data collected in Table 2, the following analysis is based on two costs from actual installations. One provided by Riverside County for a flare installed at the Badlands Landfill, the other was a flare from a large oil and gas producer in Kern County. As actual installed costs, with annual operation and maintenance data to support it, these two flares were deemed the most suitable for scaling. The landfill flare costs was used as the baseline for both wastewater treatment as well as landfill facilities, and the oil and gas flare was used for oil and gas operations.

Table 3 – Baseline Flare Costs

Category	Capacity (MMbtu/hr)	Installed Cost	Annual Operations & Maintenance Cost
Landfill and Wastewater	54.6	$754,000	$59,275
Oil and Gas	36	$2,200,000	$40,000

C. Replacement Flare Size

The District found that some of the back-up/emergency flares were sized beyond the levels where an ULN replacement flare would be feasible. For the cost analysis, it is assumed that these large flares would likely have to be kept for their role as emergency use flares to prevent significant catastrophes and loss of life. In those cases, this analysis assumes that a smaller ULN flare would have to be installed to manage the more routine gas.

For cost scaling purposes, District staff assumed a flare size for replacements smaller than the flare to be replaced. Table 4 includes a column labeled ULN capacity with the size of flare assumed for this purpose. Where that column is empty, the size of the original flare was used. These capacities, coupled with the baseline flare costs, and the scaling process detailed above were used to estimate the range of costs located in Table 4.

IV. ABSOLUTE AND INCREMENTAL COST EFFECTIVENESS ANALYSIS

Absolute cost effectiveness of a control option is the added annual cost, in dollars per year, of a control technology or technique divided by the emission reductions achieved, in tons reduced per year. The costs can include, but are not limited to, capital equipment costs, engineering design costs, and additional labor or fuel costs. The costs also can include any monetary savings realized by implementation of the pollution controls.

Incremental cost effectiveness is intended to measure the change in costs and the potential additional emission reductions between progressively more effective control options or technologies. Incremental cost effectiveness does not reveal the emission reduction potential of the control options, but merely indicates the additional cost of adding the next most effective control to a given control measure. Although absolute cost effectiveness and incremental cost effectiveness are in the same units, the relative values produced in the incremental cost effectiveness analysis and the absolute cost effectiveness values are not comparable and cannot be evaluated using similar standards.

A. Absolute Cost Effectiveness Analysis

The absolute cost effectiveness is the cost in dollars per year of the expected control technology divided by the estimated annual emission reductions achieved in tons of pollutant reduced per year. Details of the expected emission reductions are in Appendix B of this staff report.

1. Oil and Gas Facilities

Using the costs calculated above and the estimated emission reductions from Appendix B, the cost effectiveness for flares at oil and gas facilities due to the change in NOx limit is $157,120 per ton NOx removed. The cost effectiveness is shown in Table 4.

2. Landfill Facilities

Using the costs calculated above and the estimated emission reductions from Appendix B, the cost effectiveness for flares at landfill facilities due to the change in NOx limit is $56,578 per ton NOx removed. The cost effectiveness is shown in Table 4.

3. Wastewater Treatment Facilities

Using the costs calculated above and the estimated emission reductions from Appendix B, the cost effectiveness for flares at wastewater treatment facilities due to the change in NOx limit is $52,738 per ton NOx removed. The cost effectiveness is shown in Table 4.

B. Incremental Cost Effectiveness Analysis

The incremental cost effectiveness is the difference in cost between successively more effective controls divided by the additional emission reductions achieved. Proposed Rule 4311 requires flares used at an annual throughput exceeding thresholds to meet more stringent emissions limits. The progressively more stringent control option is to require all flares emitting higher than these limits to be replaced if they do not meet any of the proposed exemptions.

The proposed control option would impact 31 flares, cost a total of $10,026,733 per year, and achieve 73.7 tons per year of NOx emissions reductions. The progressively more stringent control option would impact approximately 93 flares, would cost a total of $18,626,556 per year, and achieve 95.6 tons per year of NOx emissions reductions. The incremental cost-effectiveness for replacing all higher emitting flares is $392,686 per ton of NOx reduced as calculated below.

$$Incremental\ Cost\ Effectiveness = \frac{\$18{,}626{,}556 - \$10{,}026{,}733}{95.6 - 73.7} = \$392{,}686/ton$$

Thus, the progressively more stringent control option was not chosen.

ATTACHMENT A – DETAIL TABLE

Table 4 – Cost-Effectiveness Calculation Detail Table

SIC	Flare Capacity (MMBtu/hr)	ULN Capacity (MMBtu/hr)[1]	Annualized Replacement Cost	NOx Reduction (tpy)	Cost-Effectiveness ($/ton)
1311	14.5		$230,657	4.40	$52,386
1311	535.5	40	$424,015	4.30	$98,526
1311	20		$279,745	4.05	$69,127
1311	41.2		$431,602	2.79	$154,622
1311	5		$121,766	2.16	$56,330
1311	15.1		$236,337	2.13	$110,869
1311	21		$288,056	1.60	$179,885
1311	41	12	$205,899	1.32	$156,270
1311	208.3	40	$424,015	1.31	$322,970
1311	58.3	27	$334,937	1.08	$310,127
1311	7.3		$152,805	0.94	$162,862
1311	10.4		$188,958	0.94	$201,482
1311	140	40	$424,015	0.93	$455,811
1311	20		$279,745	0.92	$305,616
1311	41.7	27	$334,937	0.87	$384,974
1311	21.6	12	$205,899	0.74	$278,272
1311	16.38	12	$205,899	0.69	$297,933
1311	6.6		$143,837	0.66	$217,523
1311	10.8		$193,286	0.66	$294,717
4953	162		$349,485	7.72	$45,249
4953	150		$333,714	7.31	$45,656
4953	60		$192,580	3.51	$54,934
4953	78.33		$225,984	3.63	$62,171
4953	63		$198,301	3.22	$61,661
4953	24.4		$112,242	2.99	$37,581
4953	45.5		$163,127	1.78	$91,764
4953	35		$139,367	1.78	$78,434
4953	30		$127,055	1.25	$101,490
4953	30		$127,055	1.63	$77,858
4952	36.3		$142,451	3.66	$38,876
4952	61.3		$195,073	2.77	$70,511

[1]See Replacement Flare Size (Page 6)

APPENDIX D

Socioeconomic Impact Analysis
For Proposed Amendments to Rule 4311

December 17, 2020

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POTENTIAL AMENDMENTS TO RULE 4311—FLARES

SOCIOECONOMIC IMPACT ANALYSIS

Final

December 9, 2020

Submitted to:

San Joaquin Valley Air Pollution Control District
1900 East Gettysburg Avenue
Fresno, CA 93726-0244

Submitted by:

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8950 Cal Center Drive, Suite 230
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District Agreement No. CONT-00656

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1. EXECUTIVE SUMMARY

This report estimates the socioeconomic impacts of potential amendments to the San Joaquin Valley Air Pollution Control District (SJVAPCD or District) Rule 4311 (Flares). This rule amendment would satisfy the commitments included in the *2016 Ozone Plan* and *2018 PM2.5 Plan* to enact additional low NOx flare emission limits, include additional flare minimization requirements, remove the exemption for non-major sources, and evaluate requiring ultra-low NOx flare technology (SJVAPCD, 2020a). Some facilities would incur costs under the potential amendments to install ultra-low NOx flare technology.

After providing an overview of demographic and economic trends in the District as a whole and describing how the COVID-19 pandemic has impacted the District economically, ERG estimates the impacts of the potential amendments on entities that would incur costs under the potential amendments by comparing compliance costs to profits.

As shown in Table 1, no affected sector would experience a significant adverse impact, defined as costs that amount to 10 percent or more of profits (Berck, 1995). The "Oil and Gas Production" sector would incur both the highest average cost per facility and highest impacts. Note that the wastewater treatment facilities impacted by this rule are operated by local government agencies. Because local governments do not seek to maximize profits in the same way that private entities do, profit values are not shown in the following and subsequent tables. Local governments commonly raise fees to cover the compliance costs of regulations, and will likely plan for incurring these additional costs through their annual budgeting processes.

Table 1. Summary of Socioeconomic Impacts due to Potential Amendments to Rule 4311—Flares

Sector	Affected Facilities	Total Annualized Cost [a]	Average Annualized Cost per Facility	Average Profits per Facility	Cost as % Profits
Oil and Gas Production	14	$5,106,410	$364,744	$5,361,445	6.80%
Wastewater Treatment – Major [b]	2	$337,523	$168,762	—	—
Landfill	10	$1,968,911	$196,891	$7,128,137	2.76%
Total/Average	**26**	**$7,412,844**	**$285,109**	**$5,628,523**	**5.07%**

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Notes:

[a] The total annualized cost is calculated by summing annualized one-time costs (annualized over a 10-year period using a 10 percent discount rate) and annual costs.

[b] As government agencies, wastewater treatment facilities do not have profits, so profit values are not shown here.

As a secondary measure of impacts, ERG also used the IMPLAN (2020a) input-output model to assess how facilities with costs under the potential amendments might react by reducing employment, as well as a "ripple effect" felt if affected facilities reduce purchases from their suppliers, and their suppliers in turn reduce their own purchases. These impacts make up less than **0.01 percent** of District-wide revenue and employment.

ERG also conducted sensitivity analyses to assess how varying degrees of recovery from the effects of the COVID-19 pandemic might affect the results of the analysis. Impacts would increase slightly with a full recovery. This is because IMPLAN (2020a) data suggest that some of the affected sectors actually have higher revenues under the main analysis with no recovery from the pandemic.

2. INTRODUCTION AND BACKGROUND

This report contains ERG's analysis of economic data and analysis in support of the San Joaquin Valley Air Pollution Control District (SJVAPCD or District) assessment of the socioeconomic feasibility of potential amendments to its existing rules for flares. This work was performed by ERG under District Agreement No. CONT-00656.

Flaring is a high temperature oxidation process used to burn combustible components, primarily hydrocarbons, of waste gases from industrial operations, primarily for the purpose of controlling emissions and as a safety device. Flares operating in the District are employed by a diverse group of sectors for a wide variety of applications, including oil and gas production, wastewater treatment, and landfills.

The potential amendments would revise existing District Rule 4311 (last revised in 2009), which was designed "to limit the emissions of volatile organic compounds (VOC), oxides of nitrogen (NOx), and sulfur oxides (SOx) from the operation of flares" (SJVAPCD, 2009).

The potential amendments to Rule 4311 will satisfy the commitments included in the *2016 Ozone Plan* and *2018 PM2.5 Plan* to evaluate requiring ultra-low NOx flare technology to lower emission limitations for existing and new flaring activities, and to include additional flare minimization requirements (SJVAPCD, 2020a).

This analysis was prepared by ERG to meet the requirements of California Health and Safety Code §40728.5, which requires an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of air district rules. It begins by providing an overview of demographic and economic trends in the District, and then estimates the economic impacts on specific entities subject to the potential rule amendments (including small entities), and how those economic impacts might affect the surrounding communities, including at-risk populations.

3. REGIONAL DEMOGRAPHIC AND ECONOMIC TRENDS

In this section ERG considers larger demographic and economic trends in the District, which includes eight counties that are home to over 4 million people.[1] These counties have become more populous over the last decade, and the median income (adjusted for inflation) has also increased. Utilities, wholesale and retail trade, and transportation, along with agriculture and oil and gas extraction, are the predominant industries within the District both in terms of establishments and employment.

3.1. REGIONAL DEMOGRAPHIC TRENDS

This section presents the demographic shifts within the District's jurisdiction over the past decade. The District has experienced greater population growth rate than the state as a whole, but the median income has lagged the state. The poverty rate throughout the District, while decreasing over time, is doing so at a slower pace than California as a whole.

The San Joaquin Valley contains almost 11 percent of the state of California's population. Table 2 shows how this population has changed over the last 10 years. Table 2 also shows the compound annual growth rate (CAGR) between 2010 and 2019. The CAGR is the constant rate the population would have changed annually to go from the 2010 level to the 2019 level.

The region has seen small amounts of population growth, an annual average growth rate marginally higher than the state of California. Kings and Madera Counties, the two counties with the smallest population of the counties in the District, saw little growth in their populations from 2010 to 2019, and were the only counties to have population declines in any one year over the last ten years. San Joaquin County saw the most growth, increasing at 1.16 percent annually.

[1] While only part of Kern County falls into the District's boundaries, all of Kern County is included in the data presented in this section, as the data were only available at the county level.

Table 2. Population Trends by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR 2010-2019
Fresno	932,039	939,406	945,045	951,514	960,567	969,488	976,830	985,238	991,950	999,101	0.78%
Kern [a]	840,996	847,970	853,606	862,000	869,176	876,031	880,856	887,356	893,758	900,202	0.76%
Kings	152,370	151,868	150,991	150,337	149,495	150,085	149,382	149,665	151,382	152,940	0.04%
Madera	150,986	151,675	151,527	151,370	153,456	153,576	153,956	155,423	156,882	157,327	0.46%
Merced	256,721	259,297	260,867	262,026	264,419	266,353	267,628	271,096	274,151	277,680	0.88%
San Joaquin	687,127	694,354	699,593	702,046	711,579	722,271	732,809	743,296	752,491	762,148	1.16%
Stanislaus	515,145	517,560	520,424	523,451	528,015	533,211	539,255	544,717	548,126	550,660	0.74%
Tulare	442,969	446,784	449,779	452,460	455,138	457,161	459,235	462,308	464,589	466,195	0.57%
SJVAPCD [a]	**3,978,353**	**4,008,914**	**4,031,832**	**4,055,204**	**4,091,845**	**4,128,176**	**4,159,951**	**4,199,099**	**4,233,329**	**4,266,253**	**0.78%**
California	**37,319,502**	**37,638,369**	**37,948,800**	**38,260,787**	**38,596,972**	**38,918,045**	**39,167,117**	**39,358,497**	**39,461,588**	**39,512,223**	**0.64%**

Source: U.S. Census Bureau, 2020e.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 3 shows the median income by county for 2010 through 2018 U.S. Census Bureau (2019a).[2] Median income growth rates varied across counties from 2010 to 2018, though the counties in the District as a whole had a CAGR of 0.63 percent overall; this is significantly lower than the growth rate of median income for the state of California (1.60 percent). Kern and Tulare Counties experienced declines in median income (-0.17 percent and -0.26 percent respectively) while all other counties experienced some level of growth. Kings and Merced Counties have notably higher growth rates of 2.34 percent and 2.13 percent, respectively. These are the only two counties in the District where median income increased at a rate faster than the state.

[2] 2018 is the most recent data year currently available in the U.S. Census Bureau (2019a) median income data from the American Community Survey.

Table 3. Median Income by County [a]

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	$52,859	$49,014	$46,766	$48,496	$47,071	$50,369	$51,728	$53,987	$53,547	0.16%
Kern [b]	$53,213	$51,781	$51,578	$51,758	$51,647	$55,082	$52,990	$51,959	$52,478	-0.17%
Kings	$52,144	$57,645	$51,606	$50,538	$46,378	$49,078	$56,527	$59,985	$62,738	2.34%
Madera	$56,421	$53,323	$47,229	$43,896	$45,998	$50,585	$54,852	$53,448	$57,287	0.19%
Merced	$49,619	$45,863	$48,979	$44,921	$47,788	$45,056	$50,692	$49,750	$58,752	2.13%
San Joaquin	$58,458	$58,227	$56,984	$56,785	$55,999	$57,617	$63,199	$63,746	$65,237	1.38%
Stanislaus	$56,159	$50,467	$52,134	$52,954	$55,376	$56,177	$57,664	$62,027	$61,373	1.12%
Tulare	$50,727	$47,136	$45,277	$43,525	$46,191	$45,503	$48,719	$48,219	$49,668	-0.26%
SJVAPCD [b][c]	**$53,990**	**$51,459**	**$50,426**	**$50,318**	**$50,550**	**$52,467**	**$54,674**	**$55,614**	**$56,791**	**0.63%**
California	**$67,455**	**$65,594**	**$65,529**	**$66,454**	**$67,136**	**$69,198**	**$71,929**	**$74,837**	**$76,589**	**1.60%**

Source: U.S. Census Bureau, 2019a.

Notes:

[a] Inflated values to 2019$ using the BEA (2020) GDP deflator.

[b] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

[c] Median income for SJVAPCD is a weighted average by population.

Poverty rates by county for the same nine-year period are shown in Table 4. The poverty rate decreased in every county in the District in that time frame. Poverty rates within the District are higher than state average, and declining at a slower rate overall compared to the state of California's rate of -2.60 percent. Fresno and Tulare Counties consistently had the highest poverty rates while Stanislaus and San Joaquin Counties had the two lowest. San Joaquin and Stanislaus Counties were also the only two counties in the District with a lower CAGR lower than the state. Despite Merced County's notable CAGR of median household income, its poverty rate has declined at one of the slowest rates (-0.55 percent) in the District.

Many the District's leading industries, including agriculture, transportation, and manufacturing, typically employ a higher percentage of low income and less educated employees than other industries, and have unstable or seasonal employment needs (Abood, 2014), likely leading to the relatively high rates of poverty.

Table 4. Poverty Rate by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	26.8%	25.8%	28.4%	28.8%	27.7%	25.3%	25.6%	21.1%	21.5%	-2.72%
Kern [a]	21.2%	24.5%	23.8%	22.8%	24.8%	21.9%	22.7%	21.4%	20.6%	-0.36%
Kings	22.2%	20.5%	21.2%	21.4%	26.6%	23.6%	16.0%	18.2%	19.2%	-1.80%
Madera	21.0%	24.3%	23.6%	23.6%	22.2%	23.4%	20.3%	22.6%	20.9%	-0.06%
Merced	23.0%	27.4%	24.3%	25.2%	25.2%	26.7%	20.3%	23.8%	22.0%	-0.55%
San Joaquin	19.2%	18.1%	18.4%	19.9%	20.9%	17.4%	14.4%	15.5%	14.2%	-3.70%
Stanislaus	19.9%	23.8%	20.3%	22.1%	18.0%	19.7%	14.2%	13.5%	15.6%	-3.00%
Tulare	24.5%	25.7%	30.4%	30.1%	28.6%	27.6%	25.2%	24.6%	22.5%	-1.06%
SJVAPCD [a]	**22.5%**	**23.8%**	**24.2%**	**24.6%**	**24.3%**	**22.7%**	**20.6%**	**19.7%**	**19.3%**	**-1.91%**
California	**15.8%**	**16.6%**	**17.0%**	**16.8%**	**16.4%**	**15.3%**	**14.3%**	**13.3%**	**12.8%**	**-2.60%**

Source: U.S. Census Bureau, 2019b.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 5 shows the population below the poverty line from 2010 to 2018. While there was a decline in the number of people below the poverty line from 2010 to 2018, the number fluctuated during this period. The number of people in poverty grew by over 100,000 between 2010 and 2014, but has declined since 2014.

The CAGR of population below the poverty line varies across counties. Fresno County had the largest population below the poverty line as of 2018, which coincides with its large population and relatively higher poverty rate. Conversely, San Joaquin County has a notable decline in CAGR at -2.56 percent, one of three counties to see declines in poverty at a rate faster than the state (along with Fresno and Stanislaus Counties). Kern, Madera, and Merced Counties have positive CAGR and have seen an increase in population below the poverty over the nine-year period.

Table 5. Population Below Poverty Line by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018
Fresno	246,196	238,706	264,738	270,072	263,220	242,083	247,507	205,291	209,799	-1.98%
Kern [a]	171,950	201,230	196,625	189,484	208,388	186,501	193,133	184,619	178,239	0.45%
Kings	30,425	27,101	27,819	28,473	35,623	31,453	21,565	24,935	26,299	-1.81%
Madera	29,936	34,148	33,936	34,242	32,432	34,227	29,736	33,482	31,191	0.51%
Merced	58,360	70,243	62,448	64,552	65,405	70,118	53,314	63,485	59,283	0.20%
San Joaquin	128,748	123,258	126,610	137,663	146,601	123,817	103,399	113,136	104,622	-2.56%
Stanislaus	101,335	122,212	104,559	114,628	94,586	104,801	76,191	73,254	85,073	-2.16%
Tulare	107,660	113,515	135,194	135,066	129,485	125,728	114,290	112,524	103,711	-0.47%
SJVAPCD [a]	**874,610**	**930,413**	**951,929**	**974,180**	**975,740**	**918,728**	**839,135**	**810,726**	**798,217**	**-1.14%**
California	**5,783,043**	**6,118,803**	**6,325,319**	**6,328,824**	**6,259,098**	**5,891,678**	**5,525,524**	**5,160,208**	**4,969,326**	**-1.88%**

Source: U.S. Census Bureau, 2019b.

Notes:

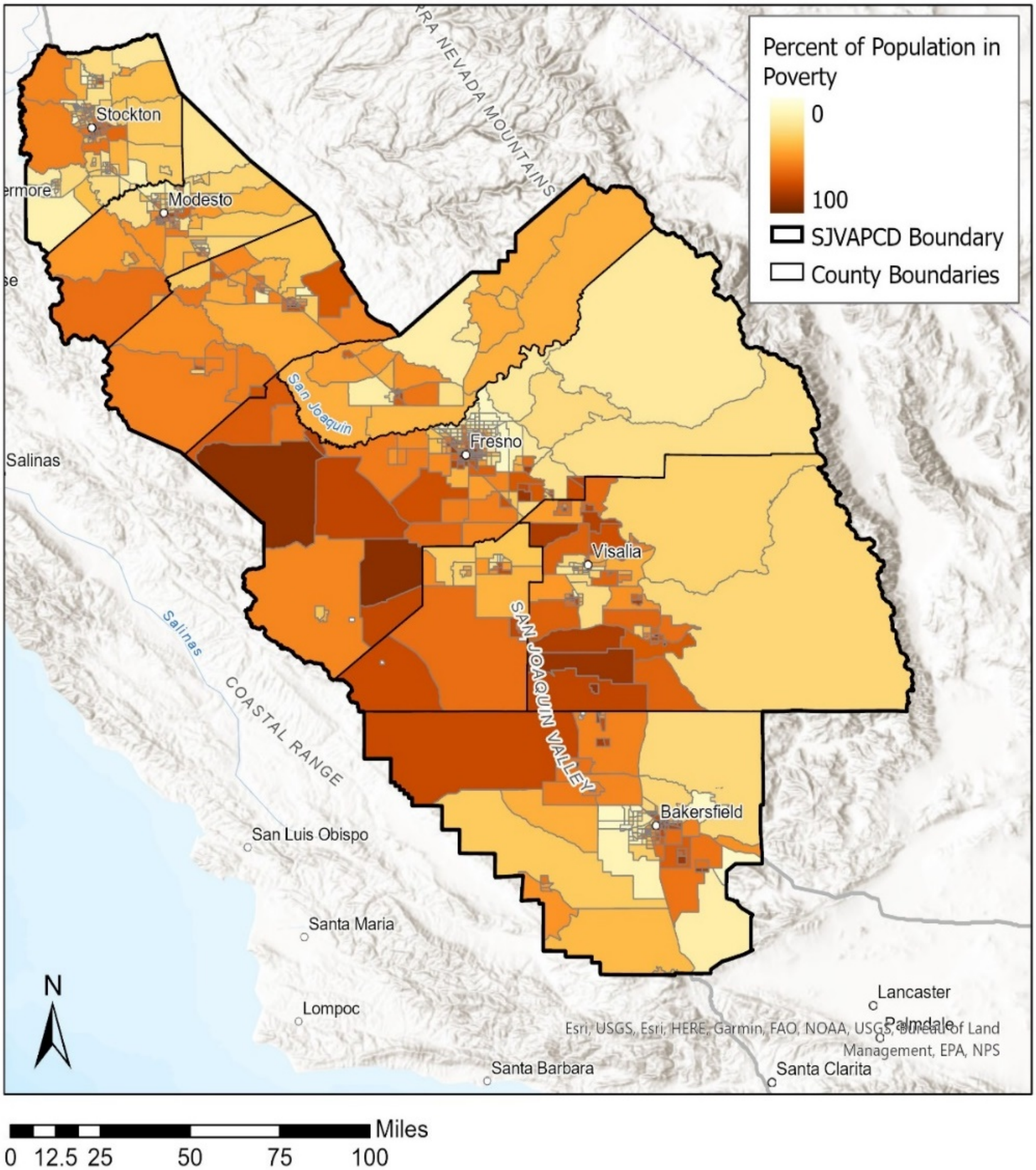
[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Figure 1 shows where the population in poverty or at risk of poverty lives within the District[3] using CalEnviroScreen 3.0 (OEHHA, 2018) data on the percent of population living below two times the federal poverty limit. CalEnviroScreen poverty data is derived from the US Census Bureau's American Community Survey 5-year estimates for 2011 to 2015. CalEnviroScreen uses a poverty threshold of two times the poverty level to account for the higher cost of living in California compared to other parts of the country (OEHHA, 2017).

As shown in Table 4 above, roughly 20 percent of the District population is below the federal poverty limit, depending on the year. Using the higher CalEnviroScreen 3.0 threshold, nearly half (48.7 percent) of District residents are below twice the federal poverty limit (OEHHA, 2018), reflected in the high poverty rates in the map in Figure 1 below.

[3] Note that only the part of Kern County included in the SJVAPCD is shown. There are four census tracts on the eastern border of Kern County that are in the Eastern Kern Air Pollution Control District. The portions of these census tracts that fall outside of the SJVAPCD border are not shown.

Figure 1. Percentage of the Population Living below Two Times the Federal Poverty Level by Census Tract (2018)



Source: OEHHA, 2018.

3.2. REGIONAL ECONOMIC TRENDS

This section tracks the economic trends in the District over the past decade. Total employment growth in the District is slightly below that of California. Overall, employment, the number of establishments, and average pay have all increased across the District during that period.

Table 6 presents employment trends over the same 10-year span. During that period, overall employment throughout the District has also increased. The District as a whole saw a CAGR of 1.48 percent in employment over the last decade, slightly below that of the entire state of California (1.64 percent). No individual county experienced a decline in employment, although Kings County has a notably lower growth rate (0.72 percent) than the other counties in the region.

San Joaquin County was the only county in the District to experience an employment growth rate greater than that of California as a whole. This may be in part due to the California Central Valley Economic Development Corporation's (CCVEDC) efforts to encourage companies to locate within the District through tax credits and incentives and grants (CCVEDC, 2020). A few large employers (Amazon, Tesla, etc.) have moved to San Joaquin County in recent years, creating numerous job opportunities within the county. Some people have also moved from the more expensive Bay Area and Los Angeles-San Diego area to the Central Valley, with San Joaquin County being one of the more popular areas to relocate (Lillis, 2019).

Table 6. Employment Trends by County

County	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	CAGR 2010-2019
Fresno	366,200	370,200	373,500	379,800	387,500	395,700	402,700	407,400	412,783	418,092	1.48%
Kern [a]	313,400	325,700	340,400	347,200	351,700	350,500	348,000	349,500	354,892	360,783	1.58%
Kings	49,900	49,700	50,000	50,400	50,600	51,700	51,500	52,300	53,025	53,233	0.72%
Madera	51,400	52,000	53,500	54,400	54,900	53,500	55,400	56,100	56,958	57,642	1.28%
Merced	93,200	94,500	96,200	98,000	99,700	101,200	102,300	104,600	105,650	106,875	1.53%
San Joaquin	260,000	261,000	267,100	274,600	279,200	286,600	292,600	301,100	304,617	307,842	1.89%
Stanislaus	202,200	202,400	205,900	209,800	213,700	218,200	222,000	224,400	227,533	228,750	1.38%
Tulare	168,100	168,700	168,800	172,200	172,100	178,700	180,700	183,500	183,300	184,350	1.03%
SJVAPCD [a]	**1,504,400**	**1,524,200**	**1,555,400**	**1,586,400**	**1,609,400**	**1,636,100**	**1,655,200**	**1,678,900**	**1,698,758**	**1,717,567**	**1.48%**
California	**16,091,900**	**16,258,100**	**16,602,700**	**16,958,400**	**17,310,900**	**17,681,800**	**18,002,800**	**18,285,500**	**18,460,433**	**18,623,900**	**1.64%**

Source: CA EDD, 2020b.

Notes:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here are for the whole of the county.

Table 7 shows the economic trends by sector in the District by presenting three snapshots from 2009 to 2019 using data from the Bureau of Labor Statistics' (BLS, 2020) Quarterly Census of Employment and Wages (QCEW). The recent influx of new employers explains the continued growth in the utilities, trade and transportation industries. These industries have been the largest employers in the District for the last 11 years, followed closely by agriculture and oil and gas extraction. The education, health and social services industry has seen the greatest increase of establishments in the District over the past decade, although it is the one industry that has experienced a decrease in average pay over that same time frame. The information sector is the smallest industry in the district and has gotten smaller over the last 11 years.

Table 7. Economic Trends in the San Joaquin Valley, 2009-2019 [a]

NAICS	Sector	2009			2014			2019		
		Establish-ments	Employ-ment	Average Annual Pay [c]	Establish-ments	Employ-ment	Average Annual Pay [c]	Establish-ments	Employ-ment	Average Annual Pay
11, 21	Agriculture, Oil and Gas Extraction	7,789	189,766	$29,692	7,438	217,769	$33,068	7,430	217,649	$36,568
23	Construction	6,099	50,178	$55,144	5,377	56,011	$54,022	6,637	70,498	$59,475
31-33	Manufacturing	2,640	105,142	$52,640	2,531	107,702	$53,749	2,715	110,892	$55,863
22, 42, 44-45, 48-49	Utilities, Trade and Transportation	14,041	219,813	$40,871	14,500	246,596	$41,428	16,026	282,861	$43,587
51	Information	602	13,482	$59,608	510	11,035	$68,525	498	6,127	$60,315
52-53	Finance Activities	5,747	44,703	$52,430	5,652	41,123	$55,695	6,443	42,638	$59,747
54-56	Profession and Business Services	7,944	97,494	$45,994	8,391	106,412	$45,985	9,054	116,895	$50,424
61-62	Educational, Health and Social Services	7,503	140,416	$54,050	39,280	184,959	$47,321	53,489	223,552	$48,667
71-72	Leisure and Hospitality	5,960	97,885	$17,407	6,224	111,610	$16,859	7,424	130,279	$19,906
81	Other Services	38,938	53,413	$24,934	5,124	32,856	$33,084	5,603	24,860	$35,245
99	Unclassified	1,730	2,112	$34,651	1,917	3,006	$31,870	4	4	$25,752
SJVAPCD Total/Average [b]		**98,993**	**1,014,404**	**$40,664**	**96,944**	**1,119,079**	**$41,095**	**115,323**	**1,226,255**	**$43,903**

Source: BLS, 2020.

Notes:

[a] Includes all of Kern County.

[b] Annual average pay is a weighted average of the eight counties in the SJV APCD weighted by employment in sector.

[c] Annual average pay is adjusted to 2019 dollars using the BEA (2020) GDP deflator.

Table 8 presents the CAGR of the economic data from Table 7. The number of establishments, employment, and average annual pay have all increased over the last 11 years across the District. Health, education, and social services has seen the greatest growth in establishments and employment over that time frame, but it is the one industry that experienced a decrease in average pay (outside of the unclassified businesses). There are fewer establishments in the agriculture, oil, and gas extraction industry today than there were a decade ago, but employment and pay have both increased. The information industry has experienced the greatest decrease in employment across the District.

Table 8. Compound Annual Growth Rate of Establishments, Employment, and Annual Pay [a]

NAICS	Sector	Establishments			Employment			Average Annual Pay		
		2009-2014	2014-2019	2009-2019	2009-2014	2014-2019	2009-2019	2009-2014	2014-2019	2009-2019
11, 21	Agriculture, Oil and Gas Extraction	-0.92%	-0.02%	-0.47%	2.79%	-0.01%	1.38%	2.18%	2.03%	2.10%
23	Construction	-2.49%	4.30%	0.85%	2.22%	4.71%	3.46%	-0.41%	1.94%	0.76%
31-33	Manufacturing	-0.84%	1.41%	0.28%	0.48%	0.59%	0.53%	0.42%	0.77%	0.60%
22, 42, 44-45, 48-49	Utilities, Trade and Transportation	0.65%	2.02%	1.33%	2.33%	2.78%	2.55%	0.27%	1.02%	0.65%
51	Information	-3.26%	-0.48%	-1.88%	-3.93%	-11.10%	-7.58%	2.83%	-2.52%	0.12%
52-53	Finance Activities	-0.33%	2.65%	1.15%	-1.66%	0.73%	-0.47%	1.22%	1.41%	1.32%
54-56	Profession and Business Services	1.10%	1.53%	1.32%	1.77%	1.90%	1.83%	0.00%	1.86%	0.92%
61-62	Educational, Health and Social Services	39.25%	6.37%	21.70%	5.67%	3.86%	4.76%	-2.62%	0.56%	-1.04%
71-72	Leisure and Hospitality	0.87%	3.59%	2.22%	2.66%	3.14%	2.90%	-0.64%	3.38%	1.35%
81	Other Services	-33.34%	1.80%	-17.62%	-9.26%	-5.42%	-7.36%	5.82%	1.27%	3.52%
99	Unclassified	2.07%	-70.90%	-45.50%	7.31%	-73.40%	-46.58%	-1.66%	-4.17%	-2.92%
SJVAPCD Total/Average		**-0.42%**	**3.53%**	**1.54%**	**1.98%**	**1.85%**	**1.91%**	**0.21%**	**1.33%**	**0.77%**

Source: BLS, 2020.

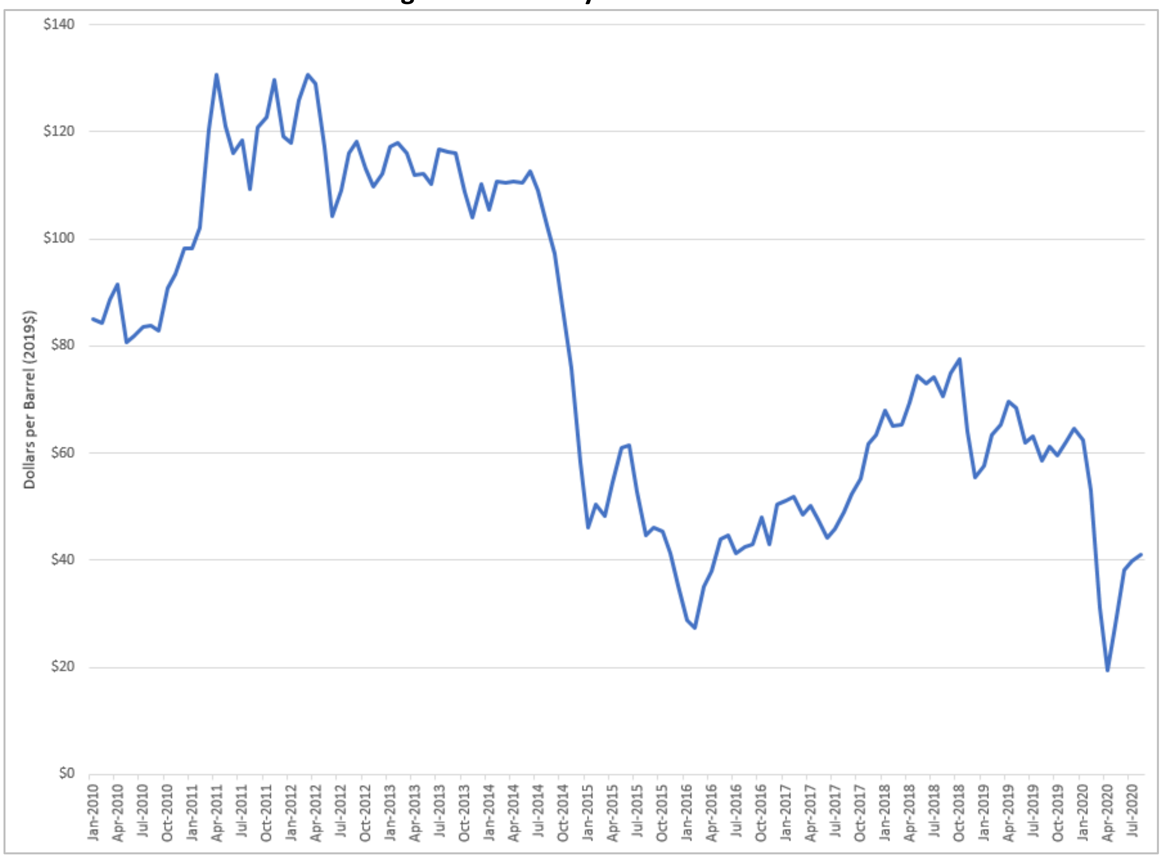
Notes:

[a] Includes all of Kern County.

This proposed rule amendment for flares would primarily impact oil and gas producers in the District. Industry-specific trends, including the price of crude oil, number of producing wells, and overall oil production, are provided below.

Based on U.S. Energy Information Administration (EIA) data, crude oil prices across California have generally increased over the last few years since a significant drop-off in prices at the end of 2014 and into 2015 (EIA, 2020a). In December 2019, the price for a barrel of crude oil was $64.51. This price is below the average monthly price from 2010 to 2019 of $80.74 but is significantly higher than that of January 2016 ($28.83), an increase of 124 percent. Monthly prices from 2010 through July 2020 are shown in Figure 2. Prices dipped considerably in the spring of 2020 (with the onset of the COVID-19 pandemic) but have since started to recover.

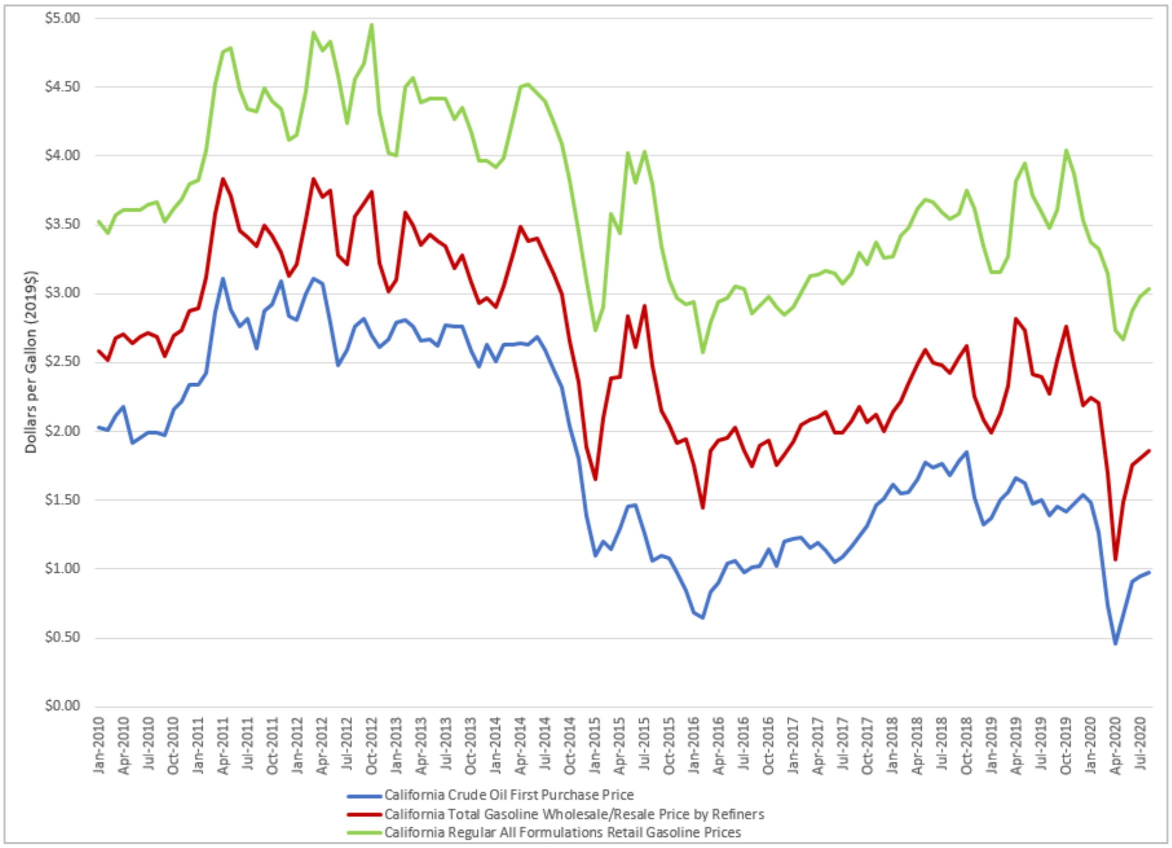
Figure 2. Monthly Crude Oil Price



Source: EIA, 2020a.

Figure 3 shows the same crude oil prices from above converted into dollars per gallon and also compares that price to the wholesale price of refined gasoline and the reformulated gas price from gas stations (in the state of California, all gasoline must be reformulated, so the "All Formulations" price presented in Figure 3 is the same as the reformulated price). The gross margins between the retail price and the wholesale price tend to be greater than those between the wholesale and crude prices. On average over this 10-year time frame, gas stations recognized a gross margin of $1.08 compared to the refineries' gross margin of $0.77 per gallon (EIA, 2020a-c).

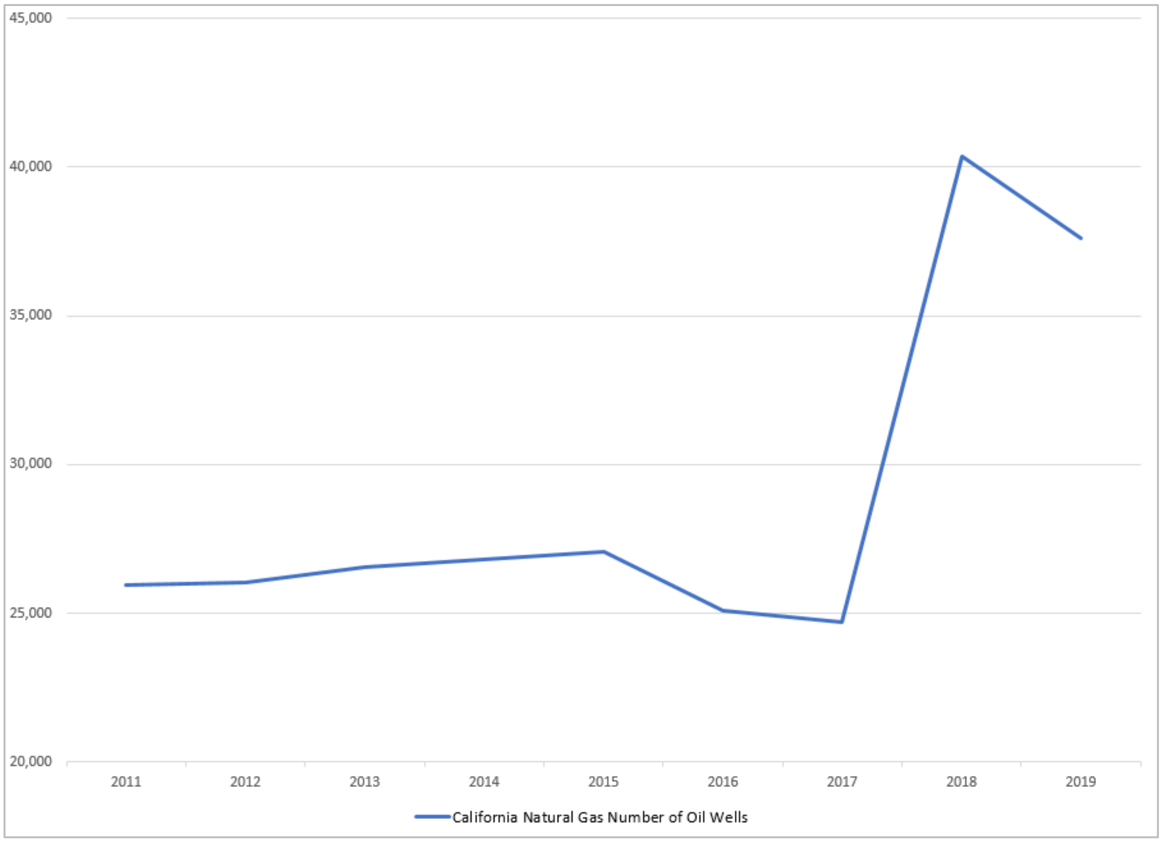
Figure 3. Comparison of California Monthly Price per Gallon of Oil



Source: EIA, 2020a-c.

As presented in Figure 4, the state of California saw a 63 percent increase in the number of oil wells in 2018 from the decade-low mark in 2017 (EIA, 2020d). The number of producing wells decreased in 2019 by 6 percent but is still much higher than at any other point in the last decade.

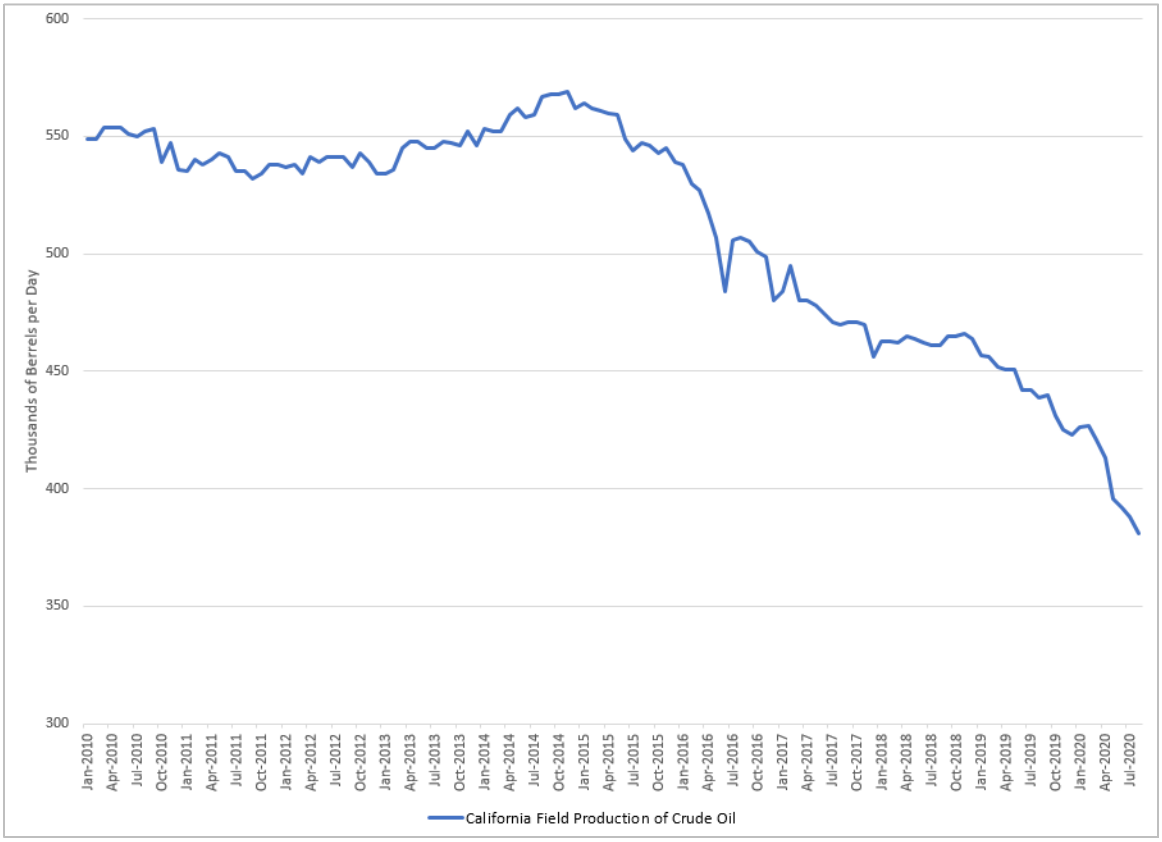
Figure 4. Number of Producing Wells in California



Source: EIA, 2020d.

Oil production has not necessarily coincided with the number of producing wells across California. Monthly crude oil production, as shown in Figure 5, has dropped significantly since a decade-high of 569,000 barrels per day in November 2014 (EIA, 2020e).

Figure 5. Monthly Crude Oil Production in California

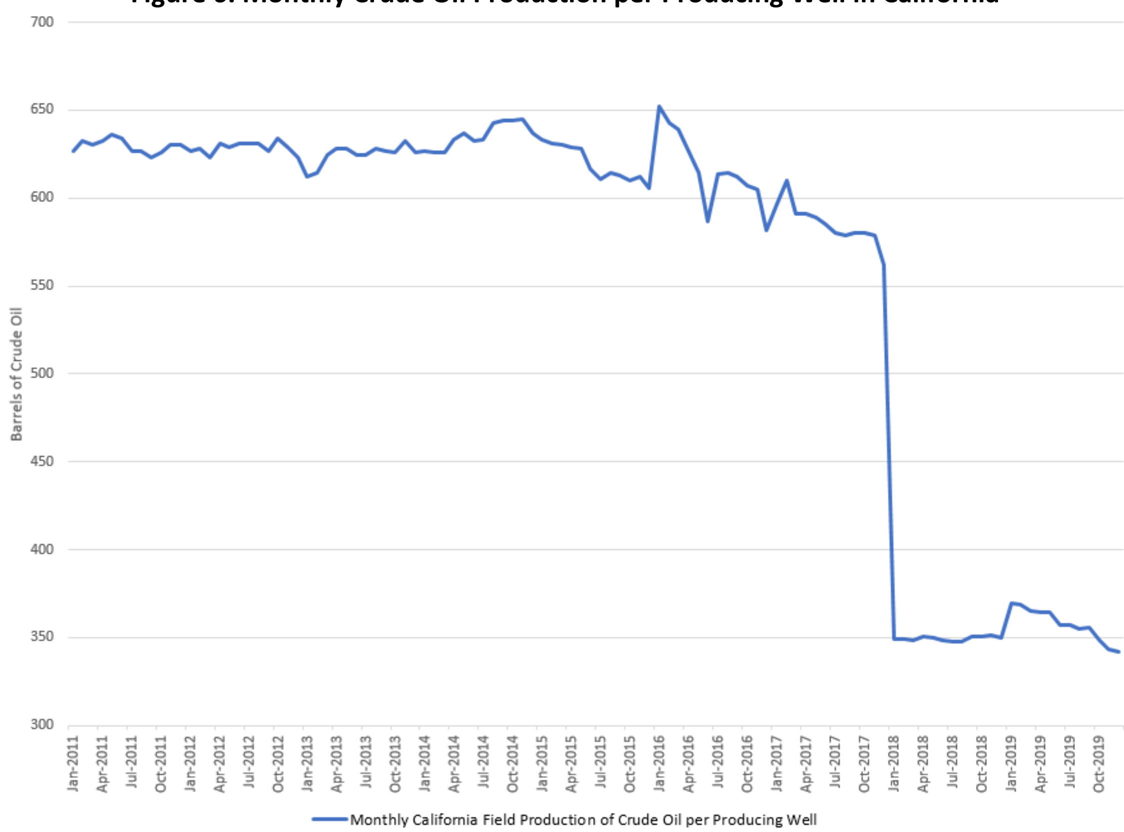


Source: EIA, 2020e.

From 2011 to 2019, oil production per well has generally decreased (EIA, 2020d-e). As shown in Figure 6, 2018 represented a dramatic downturn in per-well production, namely due to the sudden increase in the number of wells producing oil in California that year.

The downward trend since 2016 in both oil production and the number of producing wells seen in Figure 3 through Figure 5 represent the changing dynamics of the oil extraction industry. Fracking has become an increasingly deployed method of oil extraction, especially in top producing states like Texas, North Dakota, and New Mexico. The California state government places more restrictions on this practice than these other states, while some municipalities and counties have outright banned fracking (Nikolewski, 2018). In recent years, state policymakers have also pushed measures that promote renewable energy. California is also a more expensive state for oil companies to operate in. Extraction is more difficult since the oil in California is generally heavier. As a result, many companies have moved to other states such as Texas.

Figure 6. Monthly Crude Oil Production per Producing Well in California

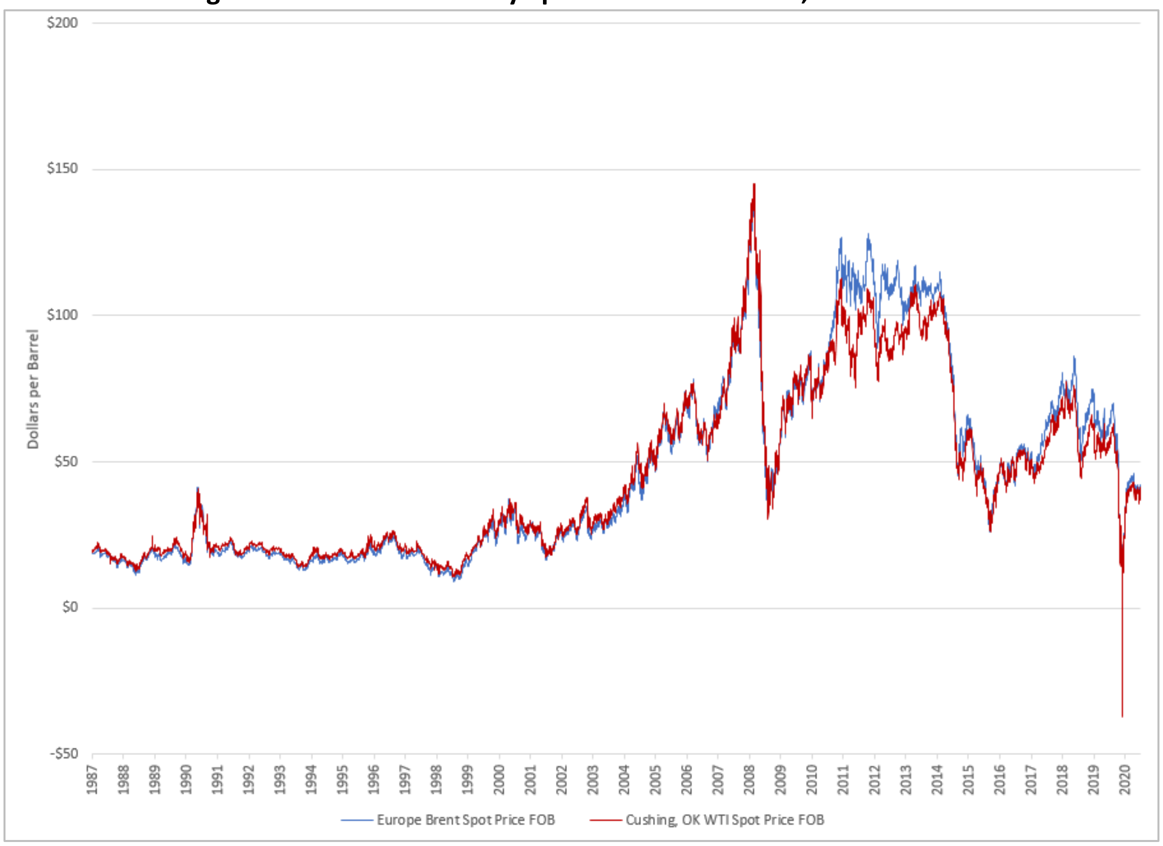


Source: EIA, 2020d-e.

Figure 7 shows daily spot prices for crude oil going back to 1987 (EIA, 2020f-g). There are two main spot price indicators used for crude oil trade: the West Texas Intermediate (WTI) spot price and the Brent Crude spot price. The WTI price is the benchmark in the United States since it refers to oil that is extracted from U.S. wells and sent via pipeline to Cushing, Oklahoma. At the same time, the EIA has determined that the price of Brent crude oil is a better indicator of prices throughout the U.S. than WTI (EIA, 2014). Brent crude oil is extracted from four oil fields in the North Sea and is the price used in nearly two-thirds of contracts globally, making it the global benchmark for crude oil prices (Bradfield, 2018). Of note, both the WTI and Brent spot indicators represent free on board (FOB) prices, which means that the buyer is liable for any damage to the goods while being shipped to them.

As can be seen in Figure 7, the WTI crude oil price dropped below zero for one day in April 2020, the first time this had ever happened. This was determined to be the result of weak demand (likely due to a decrease in travel across the country due to the COVID-19 pandemic), storage capacity reaching its limits, and unconstrained oil production (Wallace, 2020). It has since begun to recover, although not to 2019 levels.

Figure 7. WTI vs Brent Daily Spot Price of Crude Oil, 1987-Present



Source: EIA, 2020f-g.

3.3. IMPACTS OF THE COVID-19 PANDEMIC

The COVID-19 pandemic has resulted in the third oil price collapse that the oil and gas extraction industry has seen in just the last 12 years. This price shock, unlike the previous two, was swift, resulting in wide-ranging changes across the industry in a short period of time. Stay-at-home orders in California and around the world resulted in depressed demand for gas. Even as some of these restrictions have now eased, a combination of job losses and remote work means that far fewer people are commuting. Travel for recreational activities is reduced as well, whether because facilities are closed or have restrictions in place or because people are reluctant to expose themselves to illness. Those who have lost their jobs as a result of the coronavirus are conscious of their expenses, including on travel.

The COVID-19-driven lack of demand coincided with a massive oversupply of oil that left the industry with very little storage space (Kasler, 2020). This combination of supply and demand mismatches resulted in an 87 percent drop in the Brent per-barrel price of oil from January to April of 2020 (McCarthy, 2020). Gas prices have also dropped nationwide. For instance, over a one month period from late February to late March 2020, the price of gas dropped significantly across California, falling from $3.49 to $3.20 statewide, while the prices in the metro areas of Fresno and Madera-Chowchilla both fell from about $3.33 to just under $3.00 over that same timeframe (Sheehan, 2020). The average price of regular unleaded gasoline in California in late September 2020 ($3.22) was about 70 cents cheaper than a year prior ($3.95) (AAA, 2020).[4] Fresno and Merced Counties have seen similar changes to their average gas prices, albeit with slightly lower prices than the statewide average.

Oil and gas companies started to decrease rate of production in response to demand changes. The number of oil rigs operating across the country has dropped by more than 70 percent since the end of August 2019 (Flores, 2020). California has seen a similar drop in oil rigs within the state, declining from 18 rigs in operation in late August of 2019 to just four at the end of August 2020 (Baker Hughes, 2020). By and large, California's oil and gas production is centered in the San Joaquin Valley, with a majority of oil production in Kern County specifically. Before the pandemic began, nearly 10,000 people were employed within the oil and gas extraction industry in Kern County (Kasler, 2020). Rigs account for about 100 jobs each (Flores, 2020), which means that California's oil and gas industry closures over the past year resulted in the loss of approximately 1,400 jobs.

The pandemic has also halted maintenance projects at refineries and pumps across the globe. With companies either shutdown or at limited working capacity, the supply of spare parts for repairs has dwindled. Maintenance workers are unable to conduct equipment inspections. There will likely be a backlog of maintenance projects after all lockdowns are lifted, and companies will want to get as much maintenance work done as soon as possible given the lost production time (Yagova, George, and Sharafedin, 2020). Typically, companies perform maintenance inspections during lulls in production. Instead, they will need to conduct these inspections when production should be picking up. This will further delay crude production, slowing the industry's ability to recover.

Unlike previous economic hits to the industry, oil and gas extraction will likely not recover quickly from this downturn. Where some industries are hoping for a "V-shaped" recovery, oil and gas extraction is more likely to recover in a "U-shaped," with a protracted downturn before recovery begins (Flores, 2020). The industry will likely be looking at flat or even decreased demand post-pandemic, with technology leading supply response instead of workers (Barbosa et al, 2020).

Because the COVID-19 pandemic has dramatically altered metrics used to estimate socioeconomic impacts, such as revenue and employment, ERG uses a "COVID-adjusted baseline" for these metrics, as discussed further in Section 4.1.2 below.

[4] Not all of the gasoline purchased in California is produced from California crude oil sources: "California produces about one-third of the crude oil it uses. Most of the rest comes from South America, the Middle East and Alaska" (Kasler, 2020). Nonetheless, low gas prices in California and elsewhere affect California oil producers and refineries.

4. SOCIOECONOMIC IMPACT ANALYSIS

ERG calculated the direct impacts of the proposed rule amendments by comparing the costs of compliance to profits of affected facilities. ERG estimated potential employment impacts using IMPLAN's (2020a) input-output model. Additionally, ERG used the IMPLAN model to capture indirect and induced impacts (i.e., impacts that might arise if directly impacted entities reduce purchases from their suppliers and households adjust their spending as a result of changes in earnings).

4.1. DATA SOURCES AND METHODOLOGY

To estimate socioeconomic impacts, ERG compares the costs of compliance with the potential amendments with profits per facility. ERG sought to create a profile, including employment, revenue, profits, and average pay per employee, for each affected sector. The process of estimating each of these profile elements also requires other data to be used (e.g., facility name, address).

This section describes the data sources used to create the baseline industry profile, how this profile was adjusted to capture the impacts of the COVID-19 pandemic, and how socioeconomic impacts were estimated.

The sections that follow detail the resulting profile of affected entities and the socioeconomic impacts of compliance with the potential rule amendments.

4.1.1. Baseline Industry Profile Estimates

SJVAPCD (2020b) provided ERG with an initial list of affected facilities, including fields for facility ID, facility description, Standard Industrial Classification (SIC) code, number of emissions sources, and unit location.

ERG next identified additional data points for use in the analysis. For instance, SJVAPCD's (2020b) facility data includes a SIC code which ERG converted to the North American Industry Classification System (NAICS) codes. NAICS codes are used with other sources of economic data in the analysis based on a combination of U.S. Census Bureau (2020b) concordances.[5] Where a SIC code could map to multiple NAICS codes, ERG used information on companies' websites or other search tools about what type of industry they are engaged in to assign a NAICS code. (See Table A-2 for a list of the NAICS code(s) that mapped to each SIC code.)

Employment and revenue data for most private industries were drawn from the U.S. Census Bureau's (2020b) Economic Census, using 2017 data for California. Where data for certain industries

[5] SIC codes were last updated in 1987, and NAICS codes were first issued in 1997. The U.S. Census Bureau's (2020b) concordances map 1987 SIC codes to 1997 NAICS codes, and from there to the NAICS codes that are revised every five years (thus far in 2002, 2007, 2012, and 2017). SIC and NAICS codes are available at different levels of granularity. The SIC codes used in SJVAPCD's (2020a) data are 4-digit SIC codes, and ERG mapped these to 4-digit NAICS codes.

were not available, [6] ERG instead used estimates from the U.S. Census Bureau's (2015) Statistics of U.S. Businesses for 2012 for California or, if that was not available, the U.S. Census Bureau's (2020c) estimates for 2017 for the U.S.[7]

For the agricultural sector, revenue data are available in the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS, 2019) Census of Agriculture for California for 2017, using the "market value of agricultural products sold." Employment data are drawn from the California Employment Development Department (CA EDD, 2020b) and are for California for 2017.

To estimate average payroll per employee, data for private entities by sector come from BLS' (2020) QCEW. For state and local government entities, data are from the U.S. Census Bureau's (2017a) State and Local Government Employment and Payroll and U.S. Census Bureau's (2017b) Government Units Survey. For federal entities, data are an Office of Personnel Management (OPM, 2017) estimate of the average base salary for full-time permanent employees.

ERG estimated profits for private industries by multiplying revenue figures by the average profit rate for each NAICS for 2010 through 2013 using data from the Internal Revenue Service (IRS, 2016) "SOI Tax Stats - Corporation Source Book." The profit rate was calculated as "Net Income (less deficit)" divided by "Total Receipts."[8] (See Appendix B for profit rates by NAICS code.) For agricultural industries (which are not included in the IRS data at a granular level) ERG used data from the Risk Management Association's (RMA, 2020 Annual Statement Studies). The RMA studies are prepared standardized income statements from data submitted by individual enterprises to assess risk and evaluate financial performance relative to other enterprises in the same industry.

4.1.2. COVID-19-Adjusted Baseline Industry Profile Estimates

To reflect the impact of the COVID-19 pandemic, ERG estimates **"COVID-adjusted" baseline**, which alters employment, revenue, and payroll figures for each facility using IMPLAN (2020a) data. IMPLAN's "Evolving Economy" data use economic data points from the second quarter of 2020 to reflect the impacts on the pandemic, taking into account industry losses, shifts in household spending and behavior, stimulus checks and unemployment benefits, and Paycheck Protection Program (PPP) loans (Demski, 2020). IMPLAN uses only the second quarter 2020 data, adjusts it for seasonality, and annualizes the single quarter of data to represent an entire year. This annualization approach means that IMPLAN models 2020 as if the entire year had an economy like in the early stages of the pandemic, without the relatively normal first quarter of 2020 and without any level of recovery later in the year (Clouse, 2020).

[6] U.S. Census (2020b) Economic Census data were not available for California for NAICS 1151 Support Activities for Crop Production, 2212 Natural Gas Distribution, 2213 Water, Sewage and Other Systems, and 5324 Commercial and Industrial Machinery and Equipment Rental and Leasing.

[7] U.S. Census Bureau (2020c) Statistics of U.S. Businesses estimates for 2017 that include state-level revenue data will not be released until January 2021.

[8] 2013 is the most recent year for which profit rate data are available.

While the IMPLAN data for 2020 reflect the impacts of the COVID-19 pandemic and government response, it is important to note that it does not *only* capture the impacts of the pandemic, as other trends may also be captured in the changes between 2018 and 2020 (Clouse, 2020).

Using outputs of the IMPLAN model, ERG estimates the percentage change in employment, revenue, and payroll by NAICS between 2018 (the second-most recent year for which data are available) and 2020 (the “Evolving Economy” dataset, the most recent estimate). District-wide, this approach suggests that revenue contracted by 8 percent, and employment contracted by 9.9 percent (see Table 9). This likely underestimates the impacts of COVID because of continued economic growth through 2019 into the start of 2020. The impact of COVID is more appropriately against a baseline that incorporates this additional growth. Such a baseline would be higher than it was in 2018, and the economic decline in the second quarter of 2020 due to COVID shown in Table 9 would likely be even larger when compared against the later baseline (were such data available).

Table 9. District-Wide COVID-19 Impacts

	2018	2020 Q2 [a]	% Change
Revenue	$333.1 billion	$306.5 billion	-8.0%
Employment	2.0 million	1.8 million	-9.8%

Source: IMPLAN, 2020a.

Note:

[a] Data are modeled for an entire year as if it were like the second quarter of 2020 (i.e., the early stage of the pandemic.)

To estimate the impacts of the COVID-19 pandemic on individual industries, ERG multiplied the percentage change from 2018 to the second quarter of 2020 in the IMPLAN model by the baseline data to produce “COVID-adjusted” estimates for each NAICS code (which was then mapped onto SIC codes for use in conjunction with the cost data provided by SJVAPCD (2020c)). In most industries, this results in decreased revenue and employment, but *increased* average payroll per employee, reflecting the fact that more workers in lower-paid occupations have been laid off than workers in higher-paid administrative and executive occupations (Clouse, 2020).

The industries with the largest decrease in revenue and employment between 2018 and the second quarter of 2020 include restaurants (a 46.7 percent decrease in revenue and 49.6 percent decrease in employment), support activities for crop production (a 32.2 percent decrease in revenue and 13.9 percent decrease in employment), and dry cleaning and laundry services (a 30.0 percent decrease in revenue and a 34.8 percent decrease in employment).

Notably, some sectors saw substantial revenue growth in 2019 through the first quarter of 2020, and thus appear to show less substantial impacts using the COVID-19-adjusted baseline. These sectors include oil and gas extraction (a 33.6 percent increase in revenue, state and local governments (a 15.0 and 9.6 percent increase in revenue, respectively), hospitals (a 7.4 increase in revenue), and the administrative and support and waste management and remediation service sector (between a 5 and 10 percent increase in revenue, depending on the specific industry).

This increase in revenue in the oil and gas industry and state and local governments is primarily the result of the forces driving economic growth prior to COVID-19. To account for this, IMPLAN’s estimated the effect of growth in employment and increased labor productivity in these sectors between 2018 and 2020 prior to COVID-19, which, combined, suggest an increase in output (IMPLAN, 2020c). While IMPLAN’s “Evolving Economy” dataset represents their best available estimate of the economy in 2020 based on the economic data that are currently released, the modeling approach has limitations. For instance, it is not possible to separate trends in an industry sector between 2018 and the second quarter of 2020 from the specific impacts of COVID-19 on the economy between the first and the second quarter of 2020. Using second quarter of 2020 data and applying it to the entire year also does not capture any lagging impacts of the COVID-19 pandemic that may take time to be seen in the data. Given the shortcomings of the dataset, IMPLAN suggests using both the 2018 and 2020 models to compare the results (Clouse, 2020). ERG has done this in the sensitivity analysis in Section 4.4.3 below.

While the pattern recovery from the COVID-19 pandemic is unknown, many sectors may have fully or partially recovered by the time compliance with the potential rule amendments is required. To capture this, while the primary analysis includes the worst-case scenario of no recovery, ERG also performed three sensitivity analyses assuming 30 percent, 70 percent, or 100 percent recovery (i.e., return to the 2018 baseline) (see the results presented in Section 4.4.3).

Note that the industries with lower revenue in 2018 than the second quarter of 2020 in the IMPLAN (2020a) data actually fare worse in terms of economic impacts under the COVID-19 recovery sensitivity analyses, because they are modeled as gradually returning to their (lower) 2018 revenue levels. This includes oil and gas extraction, one of the main industries affected by the potential amendments.

See Appendix B for detail on the revenue, employment, and payroll adjustments for the sectors affected by the potential amendments.

4.1.3. Estimating Impacts on Affected Entities

Cost estimates (i.e., the direct cost of the potential rule amendments by SIC code) were provided by SJVAPCD (2020b). Total costs were calculated by summing the one-time capital costs (annualized over a 10-year period using a 10 percent discount rate) and ongoing annual costs. (Note that this approach does not account for the fact that costs will not be incurred for several years, thus resulting in greater cost and impacts estimates than an approach that takes into account the time value of money.)

To estimate impacts, the direct costs of the rule (i.e., the cost of compliance with the rule) are compared to profits for each SIC code. Because each SIC code can include multiple NAICS codes, and because it is unknown which facilities are those with costs, ERG compared the costs of compliance with the proposed amendments to profits.

To estimate both direct employment impacts of the potential rule amendments and indirect and induced effects, ERG used IMPLAN's (2020a) input-output model. IMPLAN "is a regional economic analysis software application that is designed to estimate the impact or ripple effect (specifically backward linkages) of a given economic activity within a specific geographic area through the implementation of its Input-Output model" (IMPLAN Group LLC, 2020b).

Based on the costs to affected facilities, the IMPLAN model estimates how many jobs might be lost in reaction to the costs to affected firms. It also estimates indirect costs (i.e., the impact to affected firms' suppliers when the direct cost of rule compliance causes affected firms to reduce their purchases from those companies) and induced impacts (i.e., how households that have lost income in turn adjust their purchases).

4.1.4. Aggregating to the Sector Level

While the inputs to the analysis are estimated on a NAICS code or SIC code basis, the results are presented with those more granular industries aggregated into a smaller number of sectors:

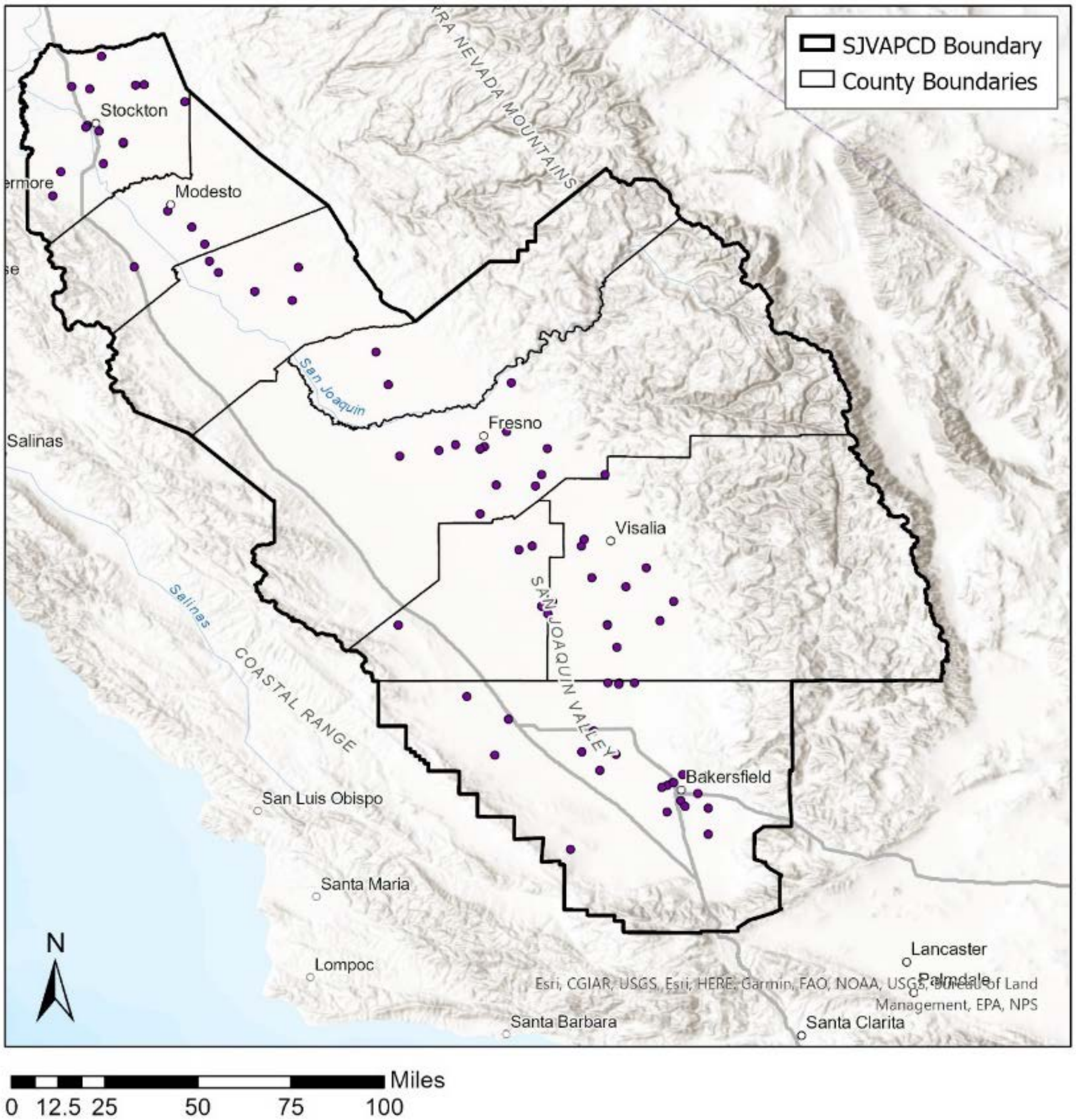
- Oil and Gas Production
- Wastewater Treatment – Major
- Landfill
- Other Industries (those not directly affected by the rule, but that may see indirect or induced impacts).

These SIC code to sector mappings were developed by SJVAPCD (2020c). See Appendix A for a concordance between SIC codes and sectors.

4.2. PROFILE OF AFFECTED ENTITIES

Figure 8 shows the location of facilities operating flares (whether affected by the rulemaking or not). The map was created by using ArcGIS Pro 2.6.0 to geocode the affected facilities. Out of the 167 affected facilities, 92 were mapped while the remaining facilities did not have sufficient location information. Facilities are spread throughout the San Joaquin Valley. There are higher concentrations of facilities near highly populated metro areas, although there are not many facilities located in the center of cities. Many of the unmapped facilities are oil and gas producers, located in fields far from population centers. Kern County contains 99 of these affected facilities, likely owing to the large number of oil and gas facilities located within the county.

Figure 8. Map of Facilities Operating Flares



Source data: SJVAPCD, 2020b; CARB, 2020; ERG estimates.
Map created by ERG using ArcGIS® software by Esri

Table 10 includes a profile of facilities affected by the potential amendments to Rule 4311 (i.e., those that will incur compliance costs). A total of 26 facilities will incur costs for installing ultra-low NOx flare technology.

Table 10. Profile of Facilities Affected by Potential Amendments to Rule 4311—Flares

Sector	Total Facilities	Affected Facilities	% Affected	Total		
				Employees	Revenue	Profits
Oil and Gas Production	74	14	18.9%	604	$1,024,168,123	$75,060,224
Wastewater Treatment – Major [a]	13	2	15.4%	107	$474,087,512	—
Landfill	28	10	35.7%	476	$1,883,250,638	$71,281,368
Other Industries	52	0	0.0%	N/A	N/A	N/A
Total	**167**	**26**	**15.6%**	**1,187**	**$3,381,506,273**	**$146,341,592**

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.
Note:
[a] As government agencies, wastewater treatment facilities do not have profits, so profit values are not shown here.

Table 11 shows the characteristics of the average facility affected by the potential amendments to Rule 4311. (The exact characteristics of individual facilities could be either higher or lower than these average estimates.)

Table 11. Characteristics of Average Facilities Affected by Potential Amendments to Rule 4311—Flares

Sector	Average per Facility			Average Annual Pay per Employee
	Employees	Revenue	Profits	
Oil and Gas Production	43	$73,154,866	$5,361,445	$38,934
Wastewater Treatment – Major [a]	54	$237,043,756	—	$23,376
Landfill	48	$188,325,064	$7,128,137	$29,973
Average	**46**	**$130,057,934**	**$5,628,523**	**$33,935**

Sources: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.
Note:
[a] As government agencies, wastewater treatment facilities do not have profits, so profit values are not shown here.

4.3. COMPLIANCE COST ESTIMATES

Compliance costs were estimated by SJVAPCD (2020c), and include:

- One-time costs for replacement with ultra-low NOx flare technology by January 1, 2024.
- Annual operating and maintenance (O&M) costs for the new flares, beginning by January 1, 2024, and continuing indefinitely.

Total costs are calculated by annualizing the one-time retrofit costs that will be incurred by 2024 over a 10-year period using a 10 percent interest rate, and then summing annualized one-time costs and annualized costs to yield the total.[9]

[9] Note that this is a conservative cost estimate in the sense that costs that will not be incurred until the beginning of 2024 are not discounted to account for the time value of money between 2024 and now.

Table 12 shows the one-time, annual, and total annualized costs incurred by sector. Costs would total **$7.4 million**, with the majority of these incurred by the "Oil and Gas Production" sector.

Table 12. Costs of Compliance with Potential Amendments to Rule 4311—Flares

Sector	Retrofit Capital Costs [a]	Retrofit O&M Costs [b]	Total Annualized Costs [d]
	One-Time	Annual	Annualized One-Time + Annual
	2024	2024+	—
Oil and Gas Production	$28,223,558	$513,156	$5,106,410
Wastewater Treatment – Major	$1,398,425	$109,936	$337,523
Landfill	$8,157,588	$641,301	$1,968,911
Total	**$37,779,571**	**$1,264,393**	**$7,412,844**

Source: SJVAPCD, 2020c.

[a] Includes one-time capital costs for retrofit with ultra-low NOx flare technology.

[b] Includes operating and maintenance costs for the new units.

[c] The total annualized cost is calculated by summing annualized one-time costs (annualized over a 10-year period using a 10 percent discount rate) and annual costs.

4.4. IMPACTS ON AFFECTED ENTITIES

4.4.1. Direct Impacts

One possible metric for determining economic feasibility is a comparison of total annualized costs to profits for affected facilities, with a threshold of 10 percent of profits indicating a finding of a finding of significant adverse impact (Berck, 1995). Therefore, ERG uses this comparison to aid in the District's determination of economic feasibility of the rule amendments.

As shown in Table 13, overall rule impacts are approximately **5.1 percent of profits.** The "Oil and Gas Production" sector would face the highest impacts, at **6.8 percent** of profits.

Table 13. Economic Impacts for Entities Affected by Potential Amendments to Rule 4311—Flares

Sector	Average Annualized Cost per Facility	Average Profits per Facility	Cost as % Profits
Oil and Gas Production	$364,744	$5,361,445	6.80%
Wastewater Treatment – Major [a]	$168,762	—	—
Landfill	$196,891	$7,128,137	2.76%
Average	**$285,109**	**$5,628,523**	**5.07%**

Sources: ERG estimates based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Note:

[a] As government agencies, wastewater treatment facilities do not have profits, so profit values are not shown here.

4.4.2. Employment, Indirect and Induced Impacts

In addition to the primary metric for estimating direct impacts on revenue (i.e., costs), ERG also assessed potential direct impacts on employment, indirect impacts, and induced impacts using IMPLAN's (2020a) input-output model. The IMPLAN model uses the direct costs of the rule to estimate "ripple effect (specifically backward linkages) of a given economic activity within a specific geographic area through the implementation of its Input-Output model" (IMPLAN, 2020b).

Outputs from the IMPLAN model include:

- **Direct employment impacts** caused if facilities with compliance costs under the potential amendments were to attempt to offset these costs by reducing the number of employees.
- **Indirect revenue and employment impacts** that capture how directly affected firms might react to the direct cost of rule compliance by reducing purchases from their suppliers, and how those suppliers might in turn reduce employees.
- **Induced revenue and employment impacts** that capture how households will adjust their spending as a result of any changes in earnings.

Table 14 summarizes these impacts, which, taken together, could have a total impact on the District economy of **$8.0 million and 18 jobs.**

Table 14. Direct, Indirect, and Induced Impacts of Potential Amendments to Rule 4311—Flares

Sector	Direct		Indirect		Induced		Total	
	Revenue (Costs)	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment
Oil and Gas Production	$5,106,410	6	$15,360	0	$957	0	$5,122,727	6
Wastewater Treatment – Major	$337,523	1	$3,879	0	$986	0	$342,389	1
Landfill	$1,968,911	9	$66,347	0	$2,033	0	$2,037,291	9
Other Industries	$0	0	$290,871	1	$218,116	1	$508,987	2
Total	**$7,412,844**	**15**	**$376,457**	**1**	**$222,092**	**1**	**$8,011,393**	**18**

Sources: ERG estimates based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020a; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

Table 15 compares these impacts to the total size of the District economy (as estimated in the IMPLAN model). These impacts represent **less than 0.01 percent** of revenue and employment District-wide.

Table 15. Comparison of Total Impacts against the District-Wide Economy for Potential Amendments to Rule 4311—Flares

	Total Rule Impacts	Size of District Economy [a]	% of District Economy
Revenue	$8,011,393	$306,518,988,618	0.003%
Employment	18	1,806,161	0.001%

Source: ERG estimates based on IMPLAN, 2020a.

Note:

[a] While the SJVAPCD only includes a portion of Kern County, the data shown here include the whole of the county.

4.4.3. COVID-19 Sensitivity Analysis

As discussed in Section 4.4.3, the primary estimates used in this analysis reflect a "COVID-19-adjusted baseline" where the baseline economic indicators are adjusted using the percentage change between IMPLAN's (2020a) 2018 and second quarter of 2020 "Evolving Economy" model. ERG also conducted three sensitivity analyses that capture varying degrees of economic recovery from the pandemic (i.e., 30 percent, 70 percent, 100 percent).

Table 16 shows how the results of the analysis would vary under these three recovery sensitivity analyses. Counter-intuitively, costs as a percentage of profits would actually *increase* under the recovery scenarios. This is because the sector most heavily impacted by the rule, "Oil and Gas Production," has higher revenue in IMPLAN's (2020a) model under the 2018-based 100 percent recovery scenario than under the second quarter of 2020 model used for the primary estimate.

Induced impacts also increase slightly with greater COVID-19 recovery, likely because IMPLAN's (2020a) 2020 model takes into account changes in household income and spending patterns (e.g., stimulus checks, unemployment checks, increased saving) that are removed in the recovery scenarios.

Table 16. Results of COVID-19 Sensitivity Analyses for the Impacts of Rule 4311—Flares

Analysis	Recovery from COVID-19 Baseline	Direct			Indirect		Induced		Total	
		Revenue (Costs)	Costs % Profits	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment	Revenue	Employ-ment
Primary Estimate	0%	$7,412,844	5.07%	16	$441,314	2	$189,155	1	$8,043,314	19
Sensitivity Analysis 1	30%	$7,412,844	5.34%	16	$421,857	1	$199,037	1	$8,033,738	18
Sensitivity Analysis 2	70%	$7,412,844	5.76%	16	$395,914	1	$212,211	1	$8,020,970	18
Sensitivity Analysis 3	100%	$7,412,844	6.11%	15	$376,457	1	$222,092	1	$8,011,393	18

Sources: ERG estimates based on SJVAPCD, 2020b; SJVAPCD, 2020c; U.S. Census Bureau, 2015; U.S. Census Bureau, 2020b; U.S. Census Bureau 2020c; NASS, 2019; CA EDD, 2020; U.S. Census Bureau, 2020a; U.S. Census Bureau, 2020d; U.S. Census Bureau, 2017a; U.S. Census Bureau, 2017b; BLS, 2020; IMPLAN, 2020a; OPM, 2017; IRS, 2016; RMA, 2020.

4.5. IMPACTS ON SMALL ENTITIES

The entities affected by the potential amendments may include small entities (i.e., small businesses and/or small government entities).

For private entities, small businesses are defined in the California Small Business Procurement and Contract Act (Cal. Gov't Code § 14837) as an independently owned and operated, non-dominant business with principal office located in California with fewer than 100 employees and earning less than $15 million in revenues.

For government entities, the Regulatory Flexibility Act definition is that "a small governmental jurisdiction is a government of a city, county, town, township, village, school district, or special district with a population of less than 50,000."

Because ERG did not estimate costs on a facility-specific basis, it is not possible to identify whether any small entities are among the facilities that will incur costs under the potential rule. To the extent that small entities face similar costs to large entities but have lower profits, compliance costs will make up a greater proportion of their profits. However, since the majority of the flares that are anticipated to incur costs to comply with the rule are located at local government facilities (landfills, wastewater treatment plant) or at oil and gas facilities, many of which are large employers, the impact of this rule on small businesses as defined above may not be significant.

4.6. IMPACTS ON AT-RISK POPULATIONS

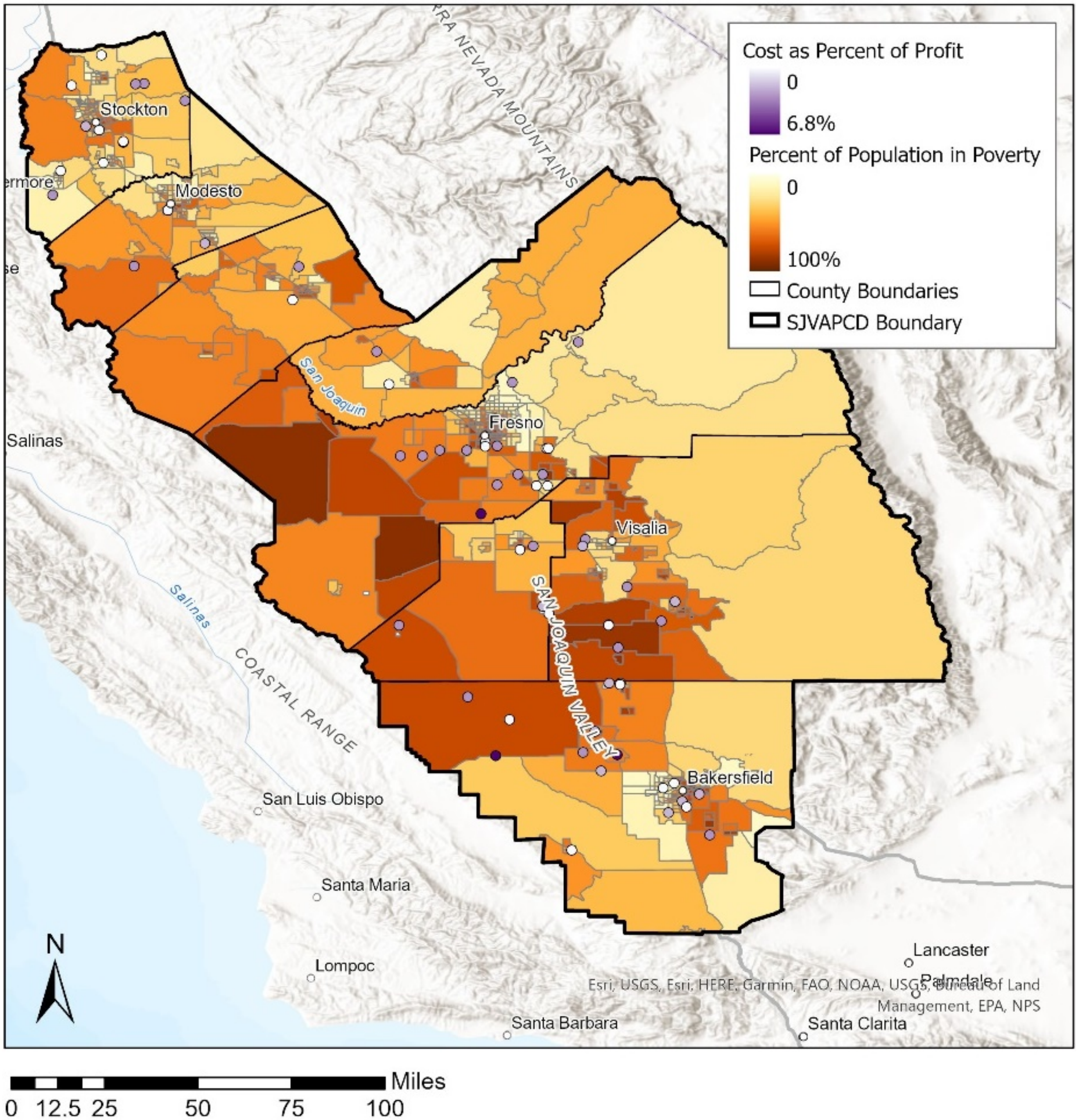
Cal. Gov't Code § 65040.12 defines environmental justice as "the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies."

The entities affected by the potential amendments may operate facilities in areas with a high number of at-risk populations. To help further the District's environmental justice goals, ERG overlaid data on the impacts of the rule with data on poverty using data from CalEnviroScreen 3.0 (OEHHA, 2018). (Note that not every facility in a given industry will necessarily be impacted by the rule, but this analysis does not include an assessment of impacts on individual facilities.)

Figure 9 presents the percent of the population living below two times the poverty rate overlaid with potentially affected facilities. While there is no statistical correlation between affected facilities and poverty, many of the potentially impacted facilities are located in census tracts with high percentages of the population living in poverty[10]. The majority of facilities face impacts of over six percent. These facilities are primarily in the "Oil and Gas Production" sector, most of which are located in Kern County. Many of these facilities are not represented on the map due to insufficient address information. This could impact vulnerable populations in Kern County, which is one of two counties that has experienced a decline in median income from 2010 to 2018 and experienced a smaller decline in poverty rate compared to the other counties in the District.

[10] Correlation was assessed using the Generalized Linear Regression tool in ArcGIS Pro 2.6.0 and found R^2= 0.

Figure 9. Map of Facilities in Relation to Population Living in Poverty



Source data: SJVAPCD, 2020b; CARB, 2020; ERG estimates; OEHHA, 2018.

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APPENDIX A. SECTOR, SIC CODE, AND NAICS CODE CONCORDANCES

Table A-1 shows the concordance between SIC codes and sectors developed by SJVAPCD (SJVAPCD, 2020c). SIC codes that were not in the original concordance but that might have indirect and induced impacts were assigned the sector "Other Industries."

Table A-1. SIC Code to Sector Concordance used to Analyze the Impacts of 4311—Flares

SIC Code	SIC Industry	Sector
1311	Crude Petroleum and Natural Gas	Oil and Gas Production
4952	Sewerage Systems	Wastewater Treatment – Major
4953	Refuse Systems - Materials Recovery Facilities	Landfill

Source: SJVAPCD, 2020c.

Table A-2 shows the NAICS codes that map to the SIC codes used in the analysis (limited to the NAICS codes assigned to the facilities in the District that may be affected by the potential amendments). This concordance was primarily developed using the U.S. Census Bureau's (2020a) SIC to NAICS concordances. Where multiple NAICS codes map to one SIC code, ERG used information on companies' websites or other search tools about what type of industry they are engaged in to assign a NAICS code.

Table A-2. SIC to NAICS Concordance for Facilities that may be Affected by Potential Amendments to Rule 4311—Flares

SIC Code	SIC Industry	Corresponding NAICS
1311	Crude Petroleum and Natural Gas	2111 (Oil and Gas Extraction)
4952	Sewerage Systems	9993 (Local Government)
4953	Refuse Systems - Materials Recovery Facilities	5622 (Waste Treatment and Disposal), 9993 (Local Government)

Source: ERG estimates based on SJVAPCD, 2020b; U.S. Census Bureau, 2020a.

APPENDIX B. PROFIT RATES BY NAICS INDUSTRY

Table B-1 shows the profit rates used for private industry, which were estimated using the average rate for 2000 through 2013 data from the Internal Revenue Service (IRS, 2016) "SOI Tax Stats - Corporation Source Book."

Table B-1. Profit Rate by NAICS Industry for Facilities Affected by Rule 4311—Flares

NAICS	Industry	Average	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
2111	Oil and Gas Extraction	7.33%	6.53%	5.55%	0.85%	5.50%	8.04%	14.89%	16.06%	11.11%	10.31%	2.50%	8.29%	5.99%	3.50%	3.50%
5622	Waste Treatment and Disposal	3.47%	1.83%	2.78%	1.49%	-0.78%	3.05%	5.19%	-1.57%	6.69%	4.14%	6.25%	6.27%	4.23%	4.92%	4.13%
9993	Local Government	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Source: ERG estimates based on IMPLAN, 2020a.

Note: Profit rate calculated as "Net Income (less deficit)" divided by "Total Receipts."

APPENDIX C. COVID-19 BASELINE ADJUSTMENTS BY NAICS INDUSTRY

Table C-1 shows the percentage change in revenue, employment, and average pay per employee by NAICS code, derived by comparing IMPLAN's (2020) datasets for 2018 and the "Evolving Economy" dataset developed using data for the second quarter of 2020.

Table C-1. COVID-19 Adjustments by NAICS Industry for Facilities Affected by Rule 4311—Flares

NAICS	Industry	COVID-19-Adjusted Change in Baseline		
		Revenue	Employment	Average Pay
2111	Oil and Gas Extraction	33.55%	29.86%	6.47%
5622	Waste Treatment and Disposal	9.90%	3.37%	7.41%
9993	Local Government	9.59%	4.86%	5.84%

Source: ERG estimates based on IMPLAN, 2020a.

APPENDIX E

Rule Consistency Analysis
For Proposed Amendments to Rule 4311

December 17, 2020

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RULE CONSISTENCY ANALYSIS FOR PROPOSED AMENDMENTS TO RULE 4311

I. REQUIREMENTS FOR RULE CONSISTENCY ANALYSIS

Pursuant to Section 40727.2 of the California Health and Safety Code, prior to adopting, amending, or repealing a rule or regulation, the District performs a written analysis that identifies and compares the air pollution control elements of the rule or regulation with corresponding elements of existing or proposed District and United States Environmental Protection Agency (EPA) rules, regulations, and guidelines that apply to the same source category. The rule elements analyzed are emission limits; monitoring and testing requirements; recordkeeping and reporting requirements; and operating parameters and work practice requirements.

II. ANALYSIS

A. District Rules

Facilities could be subject to other District rules including:

- Rule 1070 Inspections
- Rule 1081 Source sampling
- Rule 1100 Equipment Breakdown
- Rule 2010 Permits Required
- Rule 2201 New and Modified Stationary Source Review Rule
- Rule 2520 Federally Mandated Operating Permits
- Rule 4001 New Source Performance Standards
- Rule 4101 Visible Emissions
- Rule 4102 Nuisance
- Rule 4201 Particulate Matter Concentration
- Rule 4454 Refinery Process Unit Turnaround
- Rule 4623 Storage of Organic Liquids
- Rule 4624 Organic Liquid Loading
- Rule 4801 Sulfur Compounds

The above-listed rules are not in conflict with, nor are they inconsistent with the requirements of Proposed Rule 4311.

B. Federal Rules, Regulations, and Policies

1. EPA Control Techniques Guideline (CTG) Document

Based on the EPA "Control Techniques Guidelines and Alternative Control Techniques Documents for Reducing Ozone-Causing Emissions" document[1], there are no EPA CTGs applicable to this source category and, therefore, no conflicts or inconsistencies with the proposed requirements of Rule 4311.

2. EPA Alternative Control Techniques (ACT) Document

Based on the EPA "Control Techniques Guidelines and Alternative Control Techniques Documents for Reducing Ozone-Causing Emissions" document, there are no EPA ACTs applicable to this source category and, therefore, no conflicts or inconsistencies with the proposed requirements of Rule 4311.

3. EPA New Source Performance Standard (NSPS)

40 CFR 60.18 (General Control Device Requirements) and 40 CFR 65.147 (Flares)

40 CFR 60.18 specifies certain minimum equipment performance standards for equipment used as control devices. In the case of flares, the CFR specifies certain heat content requirements for flared gases, sizing requirements and tip velocity along with operating standards to ensure there are no visible emissions during flaring episodes.

4. National Emission Standard for Hazardous Air Pollutants (NESHAP)

Based on the list in 40 CFR 61 (NESHAP) there is no NESHAP standard for flares.

5. Maximum Achievable Control Technology (MACT)

40 CFR 63 Subpart CC – National Emission Standards for Hazardous Air Pollutants From Petroleum Refineries

40 CFR 63.670 includes standards for flare tip velocity, pilot flame presence, flow monitoring, emergency flaring provisions, and recordkeeping, in line with 40 CFR 60.18. 40 CFR 63.671 includes requirements for continuous parameter monitoring systems (CPMS) if installed to demonstrate compliance with 40 CFR 63.670.

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

[1] Control Techniques Guidelines and Alternative Control Techniques Documents for Reducing Ozone-Causing Emissions. (2016). Retrieved November 5, 2020 from https://www.epa.gov/ground-level-ozone-pollution/control-techniques-guidelines-and-alternative-control-techniques

40 CFR 63.987 includes standards in line with 40 CFR 60.18.

6. Consolidated Federal Air Rule

40 CFR 65 Subpart G - Closed Vent Systems, Control Devices, and Routing to a Fuel Gas System or a Process

40 CFR 65.147 requires the same performance, equipment, operation, and heat content standards for flares as 40 CFR 60.18.

40 CFR 65.157, §65.158, §65.159, and §65.164 require performance testing, monitoring, recordkeeping, and reporting standards for flares in use as VOC control devices to assure compliance with 40 CFR part 63.

7. EPA Best Available Control Technology (BACT) Requirements

There have been no BACT determinations for flares addressing NO_x emissions or requiring add on controls to limit NO_x emissions from flares in the EPA's BACT/LAER Clearinghouse. BACT has universally been considered "good combustion practices".[2]

8. EPA Policy on Recordkeeping

The recordkeeping requirement in Rule 4311 is consistent with EPA's policy to keep and maintain records for at least five years.

III. CONCLUSION

Based on the above analysis, District staff found that the proposed amendments to Rule 4311 would not conflict with any District or federal rules, regulations, or policies covering similar stationary sources.

[2] Environmental Protection Agency [EPA]: Clean Air Technology Center - RACT/BACT/LAER Clearinghouse. Retrieved November 4, 2020 from https://cfpub.epa.gov/rblc/index.cfm?action=PermitDetail.PollutantInfo&Facility_ID=28072&Process_ID=110560&Pollutant_ID=149&Per_Control_Equipment_Id=158312

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