SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

DRAFT STAFF REPORT

Proposed Amendments to Rule 4311 (Flares)

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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. PM2.5 Health Impacts and Benefits of Implementing NOx Control 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. Due to these significant health risks, EPA establishes health based ambient air quality standards for PM2.5. The District develops attainment plans and implements control measures to lower the amount of PM2.5 throughout the San Joaquin Valley, with the goal of attaining the federal standards.

Within the *2018 Plan for the PM2.5 Standard* the District committed to attain the federal standards for PM2.5, including the 24-hour standard of 35 µg/m^3 by the end of 2024, and the annual standard of 12 µg/m^3 by the end of 2025. Since 1992, the District has adopted nearly 650 rules to implement an aggressive on-going control strategy to reduce emissions in the Valley. District rules and regulations reduce particulate matter

[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.

and NOx emissions, and contribute to the Valley's progress toward attainment of health-based ambient air quality standards.

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

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, per section 182(e) of the Clean Air Act. 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 4311to 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. Through the implementation of the proposed Rule 4311 amendments, an estimated 37.2% reduction from the current NOx emissions level will be achieved in 2024. Based on the emissions inventory used for the *2018 PM2.5 Plan*, this will result in 0.19 tons per day (tpd) of NOx emission 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 San Joaquin Valley (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 $NO_x \leq 15$ ppmv @ 3% O_2, equivalent to 0.018 lb-NO_x/MMBtu
- John Zink Hamworthy ZULE®: Custom sizing; Guaranteed $NO_x \leq 20$ ppmv @ 3% O_2, equivalent to 0.025 lb-NO_x/MMBtu
- Perennial Energy: Custom sizing; Guaranteed $NO_x \leq 20$ ppmv @ 3% O_2, equivalent to 0.025 lb-NO_x/MMBtu
- LFG Technologies: Custom sizing; Guaranteed $NO_x \leq 15$ ppmv @ 3% O_2, equivalent to 0.018 lb-NO_x/MMBtu

Limitations of ultra-low NOx technology

Ultra–low NOx 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.

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

SIC	SIC Industry
5984	Liquefied Petroleum Gas (Bottled Gas) Dealers
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 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.

Landfills have periodically 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 produced 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

CO2 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 MODIFICATIONS 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 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 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 and conditions in the Permit to Operate include this limitation 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 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 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.

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)**
Agriculture Related Digester - Major	4	73,512	2.29
Agriculture Related Digester - Non-major	12	48,125	1.36
Chemical Production and/or Distribution	5	18,182	0.62
Gas Plants	11	169,323	5.76
Landfill	17	2,750,093	72.62
Landfill – Closed	11	532,272	15.84
Oil and Gas Production	161	2,178,620	70.06
Other	6	68,430	1.46
Propane Backup System	6	409	0.01
Refinery	7	96,663	3.29
Wastewater Treatment – Major	6	434,537	13.66
Wastewater Treatment – Non-Major	16	264,604	8.56
Organic Liquid Handling	4	58,215	7.28
Total	**266**	**6,692,984**	**197.96**

Based on this information, 32 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 20 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 nonattainment areas:

- 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 amended 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 20 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)**	**Estimated NOx Reductions (tpd)**	**Percent NOx Reductions**
Oil and Gas Facilities	161	19	1,299,587	0.089	46.4%
Landfill Facilities	28	10	2,576,069	0.095	47.9%
Wastewater Treatment	22	2	334,500	0.018	47.1%
Other Facilities	55	0	0	0	—
Totals	266	31	4,210,156	0.203	37.2%

Estimated NOx reductions are based on three-year average throughputs, and are used for cost-effectiveness purposes. However, for SIP purposes, this represents a 37.2% reduction from the total NOx estimated from three-year average data, and that percentage will be used for the NOx emissions controlled from the rule. For the years 2024 and 2025, the annual average NOx inventory for this category is 0.52 tons per day based on CEPAM Version 1.5, which was used as the inventory for the *2018 PM2.5 Plan*. Applying the 37.2% reduction to this, the SIP NOx reductions from this rule will be 0.19 tons per day in those years.

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.

California Environmental Quality Act (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 California Health and Safety Code 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.

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