

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

## FINAL DRAFT STAFF REPORT

### **Proposed Amendments to Rule 4460 (Petroleum Refinery Fence-line Air Monitoring) and Rule 3200 (Petroleum Refinery Community Air Monitoring Fees) and Proposed Rule 4460 Petroleum Refinery Fence-line Air Monitoring Guidelines**

September 15, 2022

Prepared by: Molly Boyett, Air Quality Specialist  
Chay Thao, Program Manager

Reviewed by: Jonathan Klassen, Director of Air Quality Science  
Jessi Fierro, Director of Air Quality Planning  
Sheraz Gill, Deputy Air Pollution Control Officer

#### **I. SUMMARY**

Assembly Bill (AB) 1647 (the Refinery Statute) requires local petroleum refinery owners and operators to install and operate fence-line air monitoring systems at or near a refinery in accordance with guidance developed by the appropriate local air district, and requires local air districts to install community air monitors at or near sensitive receptor locations around petroleum refineries. The District adopted Rules 4460 (Petroleum Refinery Fence-line Air Monitoring) and 3200 (Petroleum Refinery Community Air Monitoring Fees) to implement the requirements of the Refinery Statute.

On September 17, 2021, the Fresno County Superior Court ruled that District Rule 4460 does not comply with the Refinery Statute. The court held that facilities not currently engaged in crude oil refining may not be exempted from the Refinery Statute's fence-line monitoring requirements. Accordingly, the District must amend Rule 4460 to remove this exemption. Furthermore, the court is requiring the District to remove the monitoring provision specifying the pre-determined set of six pollutants for petroleum refineries with a refining capacity of less than 40,000 barrels per day (bpd), and to issue a revised rule grounded in additional technical analysis to provide greater evidentiary support for a rational connection between the revised rule and the requirements of the Refinery Statute.

Through extensive research and a robust public outreach process, District staff have developed revised proposed Rules 4460 and 3200 to fully address the deficiencies

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

identified by the court.<sup>1</sup> Additionally, District staff have developed Rule 4460 Guidelines which provide detailed requirements for fence-line monitoring plans. This approach will require a thorough, site-specific analysis for each subject facility, to provide useful information for estimating refinery-related pollution exposures and potential health risks and in determining trends in air pollutant levels over time.

## II. BACKGROUND

### A. Requirements of State Legislation for Petroleum Refinery Air Monitoring

In August, 2012, the Chevron Refinery in Richmond, California experienced a major fire that raised serious concerns among elected officials, regulators, and the public about refinery maintenance, internal safety practices, and emergency preparedness in the vicinity of California's oil refineries and other large petrochemical facilities. The Richmond incident, and others that have occurred since 2012, led to intensified community concern in three main areas: 1) lack of sufficient safety controls to prevent accidental releases at refineries and other industrial facilities, 2) inadequate emergency response monitoring systems to effectively inform and protect communities in the event of an accident, and 3) insufficient government oversight to ensure effective emergency preparedness and response to unplanned air contaminant releases.

In response to these concerns, the Governor created the Interagency Refinery Task Force (IRTF) in 2013 with the goal of better coordinating refinery safety and compliance efforts, and improving preparedness for future incidents. The IRTF includes representatives from various state and local agencies including the California Air Resources Board (CARB), the District, and three other air districts with refineries in their jurisdictions: Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), and San Luis Obispo County Air Pollution Control District (SLOCAPCD). In support of IRTF goals, CARB and the California Air Pollution Control Officers Association (CAPCOA) agreed to jointly assess existing emergency air monitoring capabilities and to identify potential improvements to refinery air monitoring systems. As a result of this coordination, the collaborating agencies published several reports and guidance documents for air monitoring in the vicinity of refineries in California, including the *Refinery Emergency Air Monitoring Assessment Report* and the *Analysis of Refinery Chemical Emissions and Health Effects*.<sup>2</sup>

In response to an explosion at a refinery in Torrance, CA in 2015, Assemblymember Al Muratsuchi developed the "California Refinery Jobs and Safety Action Plan," which consisted of five assembly bills to improve public safety at all California refineries,

---

<sup>1</sup>Although the Court's ruling did not specifically find that Rule 3200 failed to comply with the Refinery Statute, the District is proposing amendments to Rule 3200 to ensure consistency with amendments required by the Court for Rule 4460.

<sup>2</sup> <https://ww2.arb.ca.gov/our-work/programs/incident-air-monitoring/refinery-air-monitoring>

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

including AB 1647. Passed on October 8, 2017 and codified at California Health and Safety Code (CH&SC) Section (§) 42705.6, AB 1647 outlines specific requirements for monitoring pollutants released from petroleum refineries, both at/near facility boundaries and in nearby communities. This legislation requires the following: (1) by January 1, 2020, the District shall design, develop, install, operate, and maintain a refinery-related community air monitoring system; 2) by January 1, 2020, petroleum refinery owners and operators must develop, install, operate, and maintain a fence-line monitoring system, per guidance developed by the District; 3) the District and petroleum refinery owners and operators shall collect real-time data from the refinery-related community air monitoring system and the fence-line monitoring system and the data shall be provided to the public as quickly as possible in a publicly accessible format; and 4) petroleum refinery owner and operators shall be responsible for the costs associated with implementing a refinery-related community air monitoring system.

## **B. Current District Rule 4460 and Rule 3200**

The District adopted Rules 4460 and 3200 on December 19, 2019, to implement the requirements of AB 1647 in the Valley. Rule 4460 requires petroleum refineries to install, operate, and maintain a fence-line air monitoring system and to make the real-time data available to the public as quickly as possible. The rule requires the submittal and approval of a fence-line air monitoring plan for establishing and operating the system, and requires consideration of a specified list of air pollutants for monitoring. Facilities not actively refining crude oil are exempt from the rule, but are required to submit a fence-line monitoring plan at least 6 months prior to any planned resumption of crude oil refining operations. Rule 3200 sets forth requirements for petroleum refineries to pay a fee to recover the District's costs of developing and maintaining a refinery-related community air monitoring system to measure and record air pollutant concentrations in the ambient air at or near sensitive receptor locations.

Current Rule 4460 utilizes a tiered approach to require different levels of air monitoring, depending on the size of the permitted facility. Refineries with the capacity to process greater than or equal to 40,000 bpd are required to implement a comprehensive fence-line air monitoring system capable of monitoring 18 different pollutants. The District took into consideration the smaller production capacity and emissions profile associated with less complex refining processes at Valley petroleum refineries, and determined that facilities with the capacity to process under 40,000 bpd should be required to monitor the pollutants most representative of emissions from their facilities. Table 1 below shows the types of equipment and air pollutants refineries must consider in their fence-line monitoring plan as specified in current Rule 4460.

**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

**Table 1: Rule 4460 Table 1 – Equipment and Air Pollutants to be Considered in Fence-line Air Monitoring Plan**

<b>Petroleum Refinery Capacity (barrels per day)</b>	<b>Equipment for Fence-line Air Monitoring System</b>	<b>Pollutants to be Considered in Monitoring Plan</b>
Less than 40,000	Point monitoring or open path system	Sulfur dioxide, hydrogen sulfide, BTEX compounds (benzene, toluene, ethylbenzene and xylene)
40,000 or greater	Open path system and point monitoring as needed	Sulfur dioxide, nitrogen oxides, total VOCs, BTEX compounds (benzene, toluene, ethylbenzene and xylene), formaldehyde, acetaldehyde, acrolein, 1,3 butadiene, styrene, hydrogen sulfide, carbonyl sulfide, ammonia, hydrogen cyanide, hydrogen fluoride, black carbon

Current Rule 3200 establishes a fee schedule, to be paid by petroleum refinery owners and operators, for the cost of designing, developing, purchasing, installing, operating, and maintaining refinery-related community air monitoring systems. To develop the fees included in Rule 3200, the District conducted an evaluation of projected costs associated with the initial capital expenditures as well as ongoing operation and maintenance. Table 2 below outlines the cost to be paid by each applicable petroleum refinery facility for the initial installation of the community air monitoring system. Table 3 identifies the annual fees subject petroleum refinery facilities must pay for ongoing maintenance and operation of the air monitoring system. As required by AB 1647, fees may be reduced by the District in the event that a community air monitor is also used for purposes other than refinery-related emissions monitoring.

**Table 2: Community Air Monitoring System Installation Fees**

<b>Petroleum Refinery Capacity (barrels per day)</b>	<b>Community Air Monitoring Installation Fee Amount</b>
Less than 40,000	\$173,595
Greater than or equal to 40,000	\$715,000

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

**Table 3: Community Air Monitoring Annual Operating and Maintenance Fees**

<b>Petroleum Refinery Capacity (barrels per day)</b>	<b>Annual Operating and Maintenance Fee</b>
Less than 40,000	\$70,729
Greater than or equal to 40,000	\$223,549

## C. Court Ruling

A coalition of community groups advocating for environmental and public health policies sought a writ against the District to revise those portions of Rules 4460 and 3200 which they characterized as exemptions from the fence-line and community air monitoring requirements of CH&SC §42705.6. This coalition also contended that the District failed to deploy community air monitoring stations within the applicable time period, failed to prepare required guidance materials, failed to provide for public review and input into those guidance materials, and violated the statute by choosing to deploy only one community air monitor per petroleum refinery.

The statute requires local petroleum refinery owners and operators to install and operate fence-line air monitoring systems at or near a refinery in accordance with guidance developed by the appropriate local air district, and requires local air districts to install community air monitors at or near sensitive receptor locations near petroleum refineries. The District adopted Rules 4460 and 3200 to implement the requirements of the Refinery Statute, which apply to the four facilities within the San Joaquin Valley that are characterized as petroleum refineries, all of which are located in Kern County. On September 17, 2021, the Fresno County Superior Court ruled that the District's Rule 4460 does not comply with the Refinery Statute.

The court held that facilities not currently engaged in crude oil refining may not be exempted from the Refinery Statute's fence-line monitoring requirements. Accordingly, the District must amend Rule 4460 to remove this exemption. In addition, for small refineries with a refining capacity of less than 40,000 barrels per day, the court explained that though the Refinery Statute does not require monitoring for every potential refinery-related pollutant identified in state guidance documents, the District did not provide adequate analysis to explain why it included the six, specified pollutants, while excluding any requirement to monitor for other pollutants. The court is requiring the District to remove the monitoring provision specifying the pre-determined set of six pollutants for petroleum refineries with a refining capacity of less than 40,000 barrels per day, and to issue a revised rule grounded in additional, technical analysis to provide greater evidentiary support for a rational connection between the revised rule and the requirements of the Refinery Statute.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

## **D. Petroleum Refining Operations in the San Joaquin Valley**

Rule 4460 applies to facilities that process petroleum as described in the Standard Industrial Classification (SIC) Code under 2911 (Petroleum Refining). Valley facilities classified under this SIC code include Alon Bakersfield Refinery (Bakersfield Renewable Fuels), Kern Oil & Refining Co., San Joaquin Refining Company, and Tricor Refining, LLC (Table 4).

*Alon Bakersfield Refinery (Bakersfield Renewable Fuels)* is an oil refining company located in Bakersfield, California. The facility was sold in May 2020 and is currently being converted to produce renewable diesel from organic feedstock. Alon is not actively processing crude oil and is exempt under current Rules 4460 and 3200, but would be subject to the proposed amendments to Rules 4460 and 3200. The facility currently has an existing fence-line monitoring system installed as a condition of obtaining County use permits. The system gathers real-time measurements of ammonia, hydrogen sulfide, and non-methane hydrocarbons, and transmits the data to the refinery's process information system for operational analysis and to a public website.

*Kern Oil & Refining Co (Kern Oil)* is an oil refining company located in Bakersfield, California. The facility processes up to 27,000 barrels of oil per day, and is a supplier for gasoline and diesel in the southern San Joaquin Valley. The refinery prepared a fence-line air monitoring plan in accordance with existing Rule 4460, which the District made available for public review and comment before approving the plan on January 28, 2021. Kern Oil's fence-line air monitoring system and website have been implemented, and correspondingly, the District has implemented the refinery-related community air monitoring system and website. Both the fence-line and community monitoring systems monitor for BTEX compounds, hydrogen sulfide, and sulfur dioxide, and provide this data in real-time.

*San Joaquin Refining Company* is an oil refining company located in Bakersfield, California. The facility processes up to 15,000 barrels of various petroleum-based products per day, used in asphalt production and a variety of industries with applications for diesel fuel, drilling fluids, fuel additives, hydraulic fluids, lubricants, tires, and more. In accordance with current Rule 4460, the refinery submitted a fence-line monitoring plan which the District made available for public review and comment before approving the plan on April 7, 2021. The plans for both the fence-line and community air monitoring systems proposed to monitor BTEX compounds, hydrogen sulfide, and sulfur dioxide.

*Tricor Refining, LLC* is located in Bakersfield, California at the site of the Golden Bear Oil Specialties Refinery. Ergon, Inc. and San Joaquin Refining Co. purchased the refinery in 2001, and subsequently redesigned the facility into a processing, transloading, and storage facility for hazardous and non-hazardous material, petroleum

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines

September 15, 2022

products, and asphalt. Tricor Refining offers processing capabilities for industrial asphalt customers with its two asphalt blowing stills, emulsion plant and polymer plant. The facility is not actively processing crude oil and is exempt from current Rules 4460 and 3200, but would be subject to the proposed amendments to Rules 4460 and 3200.

**Table 4: San Joaquin Valley Petroleum Refining Operations**

Facility Name	Location	Processing Capacity (bpd)	Status of Refining (2021 CEC Report <sup>3</sup> )
Alon (Bakersfield Renewable Fuels)	Rosedale Highway, Bakersfield, CA	66,000	Non-Refining
Kern Oil & Refining Co.	Panama Lane, Bakersfield, CA	26,000	Operational
San Joaquin Refining Company	Shell Street, Bakersfield, CA	15,000	Operational
Tricor Refining, LLC	Manor Street, Bakersfield, CA	12,500	Non-Refining

In addition to Rule 4460 and Rule 3200, Valley petroleum refineries are subject to multiple District rules, shown to be the most stringent rules feasible for implementation. Refineries are also subject to a variety of performance standards under local, state, and federal regulations to reduce emissions of air pollutants, shown in Table 5 below. Through these requirements, Valley petroleum refineries are required to test for emissions from combustion equipment, continuously monitor for leaks, provide ongoing reporting to the District, and undergo regular District inspections to ensure compliance with all applicable rules. Through compliance with these rules and standards, petroleum refineries have significantly reduced their emissions over time, as displayed in Figure 1 below.

<sup>3</sup> <https://www.energy.ca.gov/data-reports/energy-almanac/californias-petroleum-market/californias-oil-refineries/california-oil>

**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

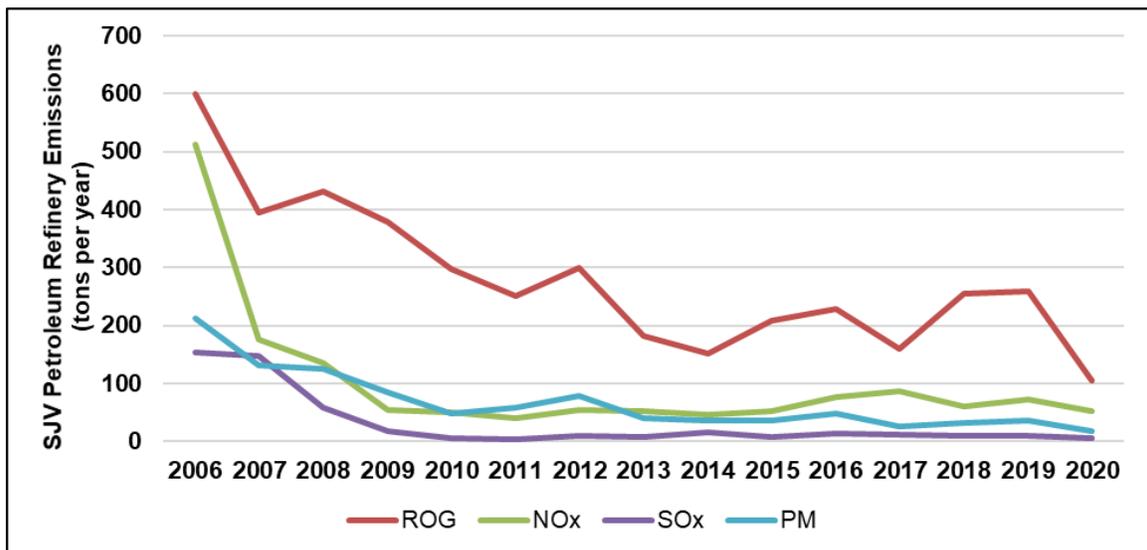
*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

**Table 5: District Rules and New Source Performance Standards Applicable to Petroleum Refineries**

<b>District Rules Affecting Valley Petroleum Refineries</b>
<ul style="list-style-type: none"> <li>• Rule 2201 – New and Modified Stationary Source Review Rule</li> <li>• Rule 4101 – Visible Emissions</li> <li>• Rule 4102 – Nuisance</li> <li>• Rule 4311 – Flares</li> <li>• Rules 4305, 4306, 4307, 4320, 4351 – Boilers, Steam Generators, and Process Heaters</li> <li>• Rule 4453 – Refinery Vacuum Producing Devices or Systems</li> <li>• Rule 4454 – Refinery Process Unit Turnaround</li> <li>• Rule 4455 – Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants</li> <li>• Rule 4623 – Storage of Organic Liquids</li> <li>• Rule 4624 – Transfer of Organic Liquid</li> <li>• Rule 4651 – Soil Decontamination Operations</li> <li>• Rules 4701, 4702 – Internal Combustion Engines</li> <li>• Rule 4703 – Stationary Gas Turbines</li> </ul>
<b>New Source Performance Standards</b>
<ul style="list-style-type: none"> <li>• Subparts J and Ja Standards of Performance for Petroleum Refineries</li> <li>• Subparts K, Ka, Kb Volatile Organic Liquid Storage Vessels</li> <li>• Subpart XX Bulk Gasoline Terminals</li> <li>• Subpart GGG and GGGa Equipment Leaks of VOC at Petroleum Refineries</li> <li>• Subpart QQQ VOC Emissions from Petroleum Refinery Wastewater Systems</li> </ul>

**Figure 1: Valley Petroleum Refinery Emissions Trend**



# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

## **Air Toxics “Hot Spots” Information and Assessment Act**

The State of California enacted the Air Toxics "Hot Spots" Information and Assessment Act (AB 2588) in September 1987. Under this act, stationary sources are required to report the types and quantities of certain toxic substances their facilities routinely release into the air. The District's implementation of AB 2588 in conjunction with local, state, and federal air toxics reduction measures, has resulted in dramatic reductions in emissions of air toxics from existing sources in the San Joaquin Valley. Under this right-to-know law, the District has worked with Valley facilities to quantify emissions of air toxics, determine the health risk caused by those emissions, report emissions and any significant risks through written public reports and neighborhood public meetings, and take steps to reduce such risks. As a result of these efforts, there were no Valley facilities under the California Air Toxics “Hot Spots” program that were identified as posing a significant risk to any Valley resident since 2007.

Under the Air Toxics “Hot Spots” program, the District “prioritizes” facilities to determine which facilities must perform a health risk assessment. In establishing priorities, the District takes into consideration the potency, toxicity, quantity, and volume of hazardous materials released from the facility, the proximity of the facility to potential receptors, and any other factors that the District determines may indicate that the facility may pose a significant health risk.

## **California Refineries**

Petroleum refining activity in the Valley represents under 6% of the total refining activity in California. As compared to petroleum refineries located in southern California or the Bay Area, which may have processing capacities of over 350,000 barrels of crude oil per day, refineries in the Valley range in capacity from 12,500 to 66,000 bpd, the largest active refinery processing 26,000 bpd (as illustrated in the table and figure below). Due to this much smaller scale of operation, emissions from Valley petroleum refineries are also significantly lower than large refineries in other regions. In addition, some Valley refineries only partially refine crude oil prior to shipping the product to the Bay Area for further processing, meaning that emissions from these facilities are also less per barrel processed compared to the larger petroleum refining complexes in the northern and southern portions of the state.

Some of the petroleum refineries in the Valley also focus much of their efforts in refining, blending, or storing a variety of specialized products such as biofuels, asphalt products, drilling fluids, fuel additives, hydraulic fluids, and lubricants that produce significantly less emissions than the larger and more complex crude oil refining processes in other parts of the state.

**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

**Table 6: California Oil Refinery Locations and Crude Oil Processing Capacities**

Refinery Name	Barrels Per Day
Marathon Petroleum Corp., Carson Refinery	363,000
Chevron U.S.A. Inc., El Segundo Refinery	269,000
Chevron U.S.A. Inc., Richmond Refinery	245,271
Marathon Petroleum Co., Martinez/Avon*	166,000*
PBF Energy, Torrance Refinery	160,000
PBF Energy, Martinez Refinery	156,400
Valero Energy, Benicia Refinery	145,000
Phillips 66, Wilmington Refinery	139,000
Phillips 66, Rodeo San Francisco Refinery	120,200
Valero Energy, Wilmington Refinery	85,000
<b><i>Alon Bakersfield Refinery (Bakersfield Renewable Fuels)*</i></b>	<b><i>66,000*</i></b>
Phillips 66, Santa Maria Refinery*	41,800*
<b><i>Kern Oil &amp; Refining Company, Bakersfield Refinery</i></b>	<b><i>26,000</i></b>
<b><i>San Joaquin Refining Company Inc., Bakersfield Refinery</i></b>	<b><i>15,000</i></b>
<b><i>Tricor Refining LLC, Oildale Refinery*</i></b>	<b><i>12,500*</i></b>
Greka Energy, Santa Maria Refinery	9,500
Lunday Thagard, South Gate Refinery	8,500
Valero Wilmington Asphalt Refinery	6,300
<b>Total California Crude Oil Processing Capacity</b>	<b>2,034,471</b>

*Source: California Energy Commission. Data as of January 1, 2021*

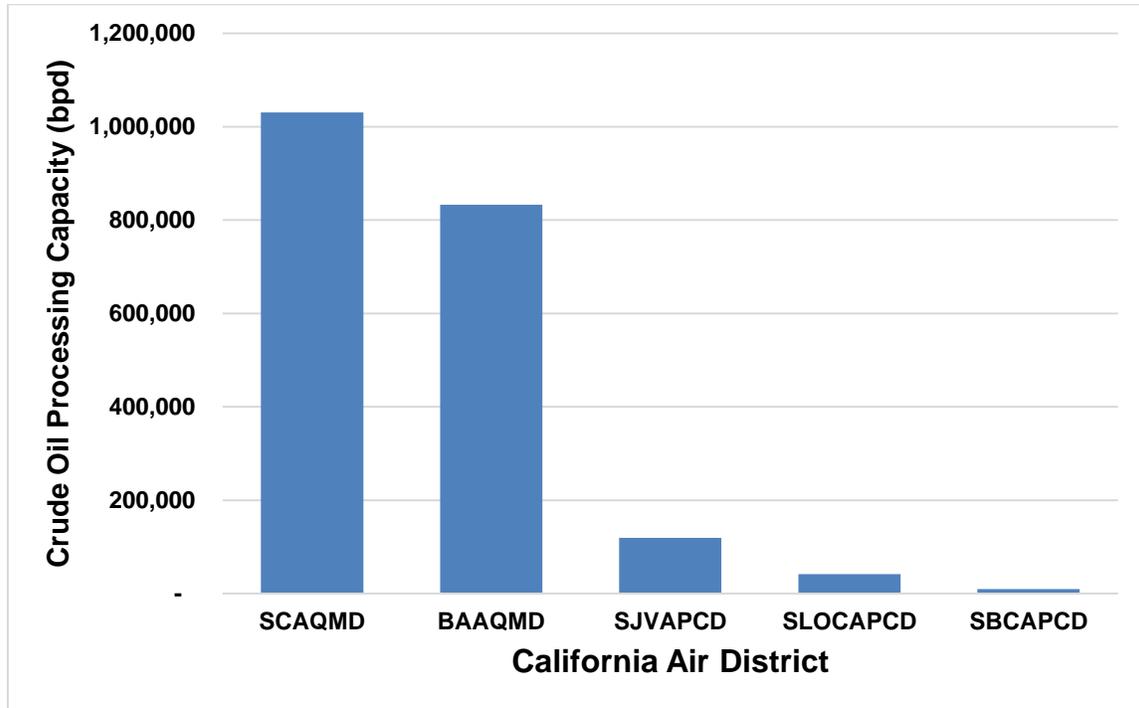
*\*Not reported by California Energy Commission as an active refinery*

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines

September 15, 2022

**Figure 2: Total Crude Oil Refining Capacity by Air District**



## E. Industry Process Description

Petroleum refineries process crude oil into a variety of products, including liquefied petroleum gas, gasoline, kerosene, aviation fuel, diesel fuel, fuel oils, lubricating oils, and feedstocks for the petrochemical industry. Petroleum refining generally begins with the delivery of crude for storage at the refinery, followed by petroleum handling and refining operations, and ending with storage and transfer of the refined products. The refining industry can employ a variety of processes, which can depend on the composition of the crude oil feedstock processed and the petroleum products that they produce. In Chapter 5 of AP-42<sup>4</sup>, U.S. EPA provides a list of petroleum refining process categories (i.e., separation processes, petroleum conversion processes, petroleum treating processes, feedstock and process handling, and auxiliary facilities) along with other associated operations that are specific to the petroleum industry, and associated emission factors.

Crude oil consists of a mixture of hydrocarbon compounds including paraffinic, naphthenic, and aromatic hydrocarbons with small amounts of impurities, including sulfur, nitrogen, oxygen, and metals. The primary pollutants emitted from petroleum

<sup>4</sup> U.S. EPA. (1995). AP-42: Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition [<https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors>]

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

refining are volatile organic compounds arising from leakage, venting, and evaporation of the raw materials and finished products. Operations specific to this industry can also generate sulfur oxides, hydrogen sulfide, particulate matter, and several toxic species. Most of the petroleum refinery related air emissions are associated with catalytic or thermal cracking units, catalytic reformer units, sulfur recovery plants, storage vessels, fluid coking units, wastewater streams, cooling towers, equipment leaks, blowdown systems, vacuum distillation units, steam boilers, process furnaces, process heaters, compressor engines, barge or ship loading, and gasoline loading.

## F. Refinery Emergency Air Monitoring Assessment Report

The Refinery Statute requires the monitoring guidance developed by District, to the extent feasible, be informed by refinery-related guidance prepared by the State. This State guidance includes the *California Refinery Emergency Air Monitoring Assessment Report (REAMAR)*, prepared by CARB and CAPCOA to assess existing emergency air monitoring capabilities and to identify potential improvements to refinery air monitoring systems in order to support the goals of the IRTF. CARB and CAPCOA have published two volumes of the REAMAR to date: *Objective 1: Delineation of Existing Capabilities* (May 2015), and *Objective 2: Evaluation of Air Monitoring Capabilities, Gaps, and Potential Enhancements* (March 2019).

*REAMAR Objective 1* provides a comprehensive inventory of emergency air monitoring assets and capabilities located in and around California's fifteen major oil refineries. This report serves as the basis for CARB and CAPCOA's ongoing assessment and guideline development for improving public and worker safety at oil refineries, and provides a foundation for the *REAMAR Objective 2*. *Objective 2* presents recommendations to improve emergency air monitoring, as well as monitoring of ongoing routine emissions, at California's major refineries and the communities that surround them. The recommendations cover air monitoring technology, modeling, and coordination. The report acknowledges the variability among refineries, and advises that implementation of each recommended strategy must be suited to each facility's size, operations, specific location, and its surrounding receptors, keeping in mind the practical limitations of current and emerging technologies and the timeframes necessary for full implementation.

## G. OEHHA Report

The California Environmental Protection Agency's (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) collaborated with CARB and the IRTF to identify and develop information on chemicals emitted from refineries and their health effects in order to assist air agencies in developing plans for air monitoring in California. OEHHA published the *Analysis of Refinery Chemical Emissions and Health Effects* in March 2019, which identified 188 chemicals emitted from California refineries, including emissions that occur routinely in daily operations, as well as accidental and other non-

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines

September 15, 2022

routine emissions. The report prioritizes the chemicals according to their emissions levels and toxicity, and identifies 18 chemicals as top candidates for air monitoring near refineries (Table 7). The presence of a chemical on this list does not necessarily mean that all refineries release it at all times or in significant quantities.<sup>5</sup>

**Table 7: Top Pollutants Recommended by OEHHA for Air Monitoring**

Acetaldehyde
Ammonia
Benzene
1,3-Butadiene
Cadmium
Diethanolamine
Formaldehyde
Hydrogen Fluoride
Hydrogen Sulfide
Manganese
Naphthalene
Nickel
Nitrogen Oxide
Polycyclic Aromatic Hydrocarbons (PAH)
Particulate Matter (PM)
Sulfur Dioxide
Sulfuric Acid
Toluene

The following describes in further detail the pollutants recommended by OEHHA for air monitoring at petroleum refineries. OEHHA provides a more detailed list of possible pollutants and their health effects in the *Analysis of Refinery Chemical Emissions and Health Effects* report.

## Aldehydes

Aldehydes are products of incomplete combustion of hydrocarbons and other organic materials. Formaldehyde and acetaldehyde are two of the most common aldehydes produced in industry, detected in both ambient air emissions and at several refinery process units such as boilers, cokers, crude units, FCCUs, heaters, and incinerators. Exposure to aldehydes can cause irritation to the eyes, skin, and respiratory pathways, and prolonged exposure can have lasting health effects.

<sup>5</sup> Office of Environmental Health Hazard Assessment. (2019). *Analysis of Refinery Chemical Emissions and Health Effects*. Retrieved from: <https://oehha.ca.gov/media/downloads/faqs/refinerychemicalsreport032019.pdf>

## SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

### Ammonia

Ammonia gas is colorless, pungent-smelling, and corrosive. Refineries may release ammonia from several types of process units, but predominantly from FCCUs. OEHHA found ammonia to be the most commonly released routine facility emission of all the chemicals they examined in their report. Exposure to high concentrations of ammonia may induce adverse health impacts, primarily to the respiratory system.

### BTEX Compounds (Benzene, Toluene, Ethylbenzene, and Xylene)

BTEX is a specified subset of aromatic hydrocarbons compounds containing benzene, toluene, ethylbenzene, and xylene. These chemicals appear naturally in crude oil and can be associated with emissions from refineries as they are released partly due to incomplete combustion of natural gas as well as emissions from petroleum and storage and transfer. In addition, other combustion sources such as wood burning and fossil fuel combustion also contribute to BTEX emissions. The negative health effects associated with BTEX exposure include neurological impairment and cancer.

### Cadmium

Cadmium is a soft silver-white metal, usually found in combination with other elements. The main sources of cadmium in the air are the burning of fossil fuels such as coal or oil and the incineration of municipal waste. Inhalation exposure to cadmium may result in adverse health effects to the kidneys or lungs.

### Hydrogen Sulfide

Hydrogen sulfide (H<sub>2</sub>S) is a corrosive and highly flammable colorless gas, characterized by its pungent odor of rotten eggs. Oil refineries may emit hydrogen sulfide from various process units, such as boilers, crude units, heaters, storage tanks, cokers, FCCUs, wastewater treatment, and incinerators. It is one of the most commonly reported chemicals emitted during refinery incidents. Exposure at high concentrations can cause irritation, unconsciousness, and death.

### Manganese

Manganese is a naturally occurring metal associated with a number of refinery process units, including oilers, cooling towers, crude units, heaters, storage tanks, cokers, FCCUs, and incinerators. Exposure to manganese has the potential to cause adverse health effects and appears to target the nervous system.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

## Nickel

Nickel is a silvery metal that occurs naturally in the environment at low levels. A variety of sources generate nickel air emissions, including oil refining operations. Exposure to nickel emissions can have negative effects on the respiratory and immune systems.

## Nitrogen Oxides

Nitrogen oxides (NOx) represent a group of highly reactive gasses released into the air from combustion sources. Refineries emit NOx during non-routine processes and from many process units, such as boilers, crude units, heaters, storage tanks, cokers, FCCUs, incinerators, and flares. Refineries have also reported NOx releases during multiple fire incidents between 2001 and 2012. Exposure to NOx emissions may result in both acute and chronic health effects, primarily to the respiratory system.

## Polycyclic Aromatic Hydrocarbons

Polycyclic Aromatic Hydrocarbons (PAH) are a class of chemicals that occur naturally in coal, crude oil, and gasoline. There are many sources of PAHs in the air, including volcanoes, automobile exhaust, and cigarette smoke. Petroleum refineries may emit PAHs from multiple process units, such as separators, boilers, cooling towers, crude units, heaters, storage tanks, cokers, FCCUs, wastewater treatment, incinerators, and vents. The majority of health effects of PAHs stem from long term exposure.

## Particulate Matter

Sources of particulate matter (PM) can be natural or anthropogenic. Particulate matter has shown to have a direct impact that adversely affects human health. Combustion sources as well as motor vehicles and earth moving operations contribute to elevated PM concentrations. There are existing regulations that address the ambient concentrations of particulate matter with aerodynamic diameters less than 10 µm (PM10) and less than 2.5 µm (PM2.5). The majority of PM produced by combustion falls in the PM2.5 size designation.

## Sulfur Dioxide

Sulfur Dioxide (SO<sub>2</sub>) is a colorless, irritating gas with a choking or suffocating odor. It is one of the most commonly reported routine and non-routine chemicals emitted from California refineries. Acute and chronic health effects include impairment and irritation of the respiratory system.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

## Sulfuric Acid

Sulfuric acid is a colorless, oily liquid that exists in water vapor and particulates. Used in petroleum refinery operations as a catalyst during alkylation and in various treatment processes, this chemical has been detected in refinery air emissions and reported in both fire and non-fire incidents. Studies have shown that exposure to sulfuric acid targets the respiratory system, and can lead to altered lung and airway function.

## Volatile Organic Compounds

Volatile Organic Compounds (VOCs) include non-methane hydrocarbons (NMHC) and oxygenated NMHC such as alcohols, aldehydes, and organic acids. Several of OEHHA's top recommended pollutants are VOCs, including BTEX, 1,3-butadiene, PAHs, aldehydes, naphthalene, and diethanolamine. VOCs, mainly hydrocarbons, originate from production processes, storage tanks, transport pipelines, and waste areas. Hydrocarbons are some of the most commonly reported chemicals emitted during refinery incidents. The health effects of these compounds vary, but long term exposure can have lasting adverse health effects.

## **H. Air Monitoring Technologies**

A petroleum refinery fence-line air monitoring system is a combination of equipment that measures and records air pollutant concentrations at or near the property boundary of a petroleum refinery. Refineries may need to employ multiple technologies to ensure adequate compound identification. Conventional fence-line air monitoring technologies include open path and point air monitors. Open path air monitoring systems utilize lasers and reflectors to measure levels of a variety of gaseous compounds along industrial facility fence-lines, and can be configured to detect the origination point of increased pollution concentration levels. These systems range in cost, depending on the number of units needed to adequately cover a fence-line. Point air monitors are installed in a stationary location and measure concentrations of criteria pollutants, toxics, and particulate matter, depending on the configuration selected for the system, at a single location. Open path systems are typically more costly than point monitors.

It is important to consider the limitations of available equipment, such as detection limits for each chemical and time-resolution capabilities. To determine the appropriate technology for a fence-line monitoring system, refineries should take into account geospatial layout of the plant, potential release sources, local meteorology, atmospheric dispersion characteristics of the compounds of concern, and the relative risk to likely receptors based on these criteria.<sup>6</sup>

---

<sup>6</sup> CARB and CAPCOA. (2019). *Refinery Emergency Air Monitoring Assessment Report. Objective 2: Evaluation of Air Monitoring Capabilities, Gaps and Potential Enhancements*. Air Resources Board, California Environmental

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

## Open Path Systems

Open path systems use a light signal, projected along a straight unobstructed path, to continuously detect and measure concentrations of chemical compounds along the distance covered by the light signal in real-time. The light source emits light towards a detector either at the opposite end of the light path (bi-static configuration), or co-located with the light source (mono-static configuration) if the light is reflected back by a reflector, providing path-averaged concentrations of multiple pollutants simultaneously. Some of the optical technologies used in these systems include the following:

**Ultra Violet Differential Optical Absorption Spectroscopy:** An Ultra Violet Differential Optical Absorption Spectroscopy (UV-DOAS) system utilizes a high powered UV light to measure the absorption spectra, as opposed to a signal produced by a single wavelength. By doing so, this separates the absorption data of multiple target analytes. By using software, as well as a predetermined subset of known gases, the Open-Path UV-DOAS is able to quantify multiple target gases.

**Tunable Diode Laser Absorption Spectroscopy:** Tunable Diode Laser Absorption Spectroscopy (TDLAS) utilizes a laser tuned to be within a strict frequency range. This range is typically exclusive to the target gas in question. The laser is then tuned to match the desired frequency of the target gas, primarily Hydrogen Sulfide (H<sub>2</sub>S). The concentration of the target gas along the path can be determined from the absorption at a particular wavelength.

**Fourier Transform Infrared:** Fourier Transform Infrared (FTIR) system utilizes a beam of infrared light to measure the absorption spectra of the infrared spectrum. A light source directs infrared light at retroreflectors or another unit, and a detector receives the returning light. The change in intensity, frequency, and wavelength is then used to calculate the concentration of various target gases in the atmosphere. With this sampling method it is possible to measure a total alkane concentration.

## Point Monitors

Point monitors extract ambient air at a specific location and perform the measurement within the system. They are the primary instrument types used in EPA-approved methodologies for measuring air pollutants. These type of monitors use a variety of technologies, including the following:

---

Protection Agency. California Air Pollution Control Officers Association Air Monitoring Committee. Retrieved from <https://ww2.arb.ca.gov/our-work/programs/incident-air-monitoring/refinery-air-monitoring>

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

**Gas Monitoring:** In addition to the open path options for monitors, there are also single point monitors that can measure a range of target gases by utilizing methods such as chemiluminescence, UV-fluorescence, and gas chromatography. These instruments and their methods are widely used throughout multiple regulatory air monitoring networks, and are accepted by both the EPA and CARB for the measurement of gases such as NO<sub>2</sub>, H<sub>2</sub>S, and SO<sub>2</sub>.

**Particulate Matter:** Point monitors that measure particulate matter employ methods such as gravimetry, beta attenuation, light scattering/absorption, and tapered element oscillating microbalance. These instruments range from hourly to minute averages and cover a range of PM types including PM<sub>1.0</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, and speciated particulate matter. The previously mentioned instruments and methods are in use throughout regulatory air monitoring networks and are accepted by EPA and CARB for the criteria pollutants.

**Total VOC Monitoring:** A Photoionization Detector (PID) takes Volatile Organic Compounds (VOCs) and charges the compounds with a large amount of high-energy photons which energizes the sample compounds. The energized compounds then pass by the photoionization detector, which subjects the positively charged compounds to a magnetic field and forces them to a collector electrode to determine the concentration of total VOCs. A Flame Ionization Detector (FID) is similar to the PID but utilizes a flame, typically fueled by hydrogen, to ionize the sample before the detector reads the sample and determines the concentration of total VOCs.

**GC-MS:** Gas chromatography (GC) with mass spectrometry (MS) utilizes a gas chromatograph with a mass spectrometer as a secondary detector. The sample will pass through a GC with a PID or FID as the primary detector, which will separate the sample based on retention time. The sample then passes to the mass spectrometer, which will ionize and separate the sample by its mass to charge ratio. The advantage of this technique is the utilization of multiple separation methods for analysis, which can supplement instances in which certain compounds will output similar spectra using GC despite being vastly different chemically.

Air monitoring for most of OEHHA's 18 recommended pollutants is presently conducted in some refineries and surrounding communities, as specified in Table 8 below.

**Table 8: Monitoring Equipment Capabilities for Recommended Pollutants**

Pollutant	Available Real-Time Monitoring Equipment	Status of Use
Acetaldehyde	AKA Ethanal / Ethyl Alcohol: UV-DOAS	Fence-line monitoring at some refineries. Statewide air toxics monitoring network (major urban areas).

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

Ammonia	UV-DOAS chemiluminescence	Fence-line and community monitoring at some refineries, as well as process unit level monitoring.
Benzene	FTIR, UV-DOAS, Auto GC	Fence-line monitoring at some refineries. Statewide air toxics monitoring network (major urban areas).
1,3-butadiene	FTIR, UV-DOAS, Auto GC	Fence-line monitoring at some refineries. Statewide air toxics monitoring network (major urban areas).
Formaldehyde	FTIR, UV-DOAS	Fence-line and community monitoring at some refineries. Statewide air toxics monitoring network (major urban areas).
Hydrogen Fluoride	FTIR, UV-DOAS	Fence-line and community monitoring at some refineries.
Hydrogen Sulfide	UV-DOAS, UV fluorescence	Personal monitors at most refineries. Process unit level, ground level, fence-line, and community monitoring at some refineries.
NOx	FTIR, UV-DOAS, chemiluminescence	Fence-line and community monitoring at some refineries.
Particulate Matter	UV-DOAS beta attenuation	Community monitoring at some refineries (PM2.5 only). Regulatory and special purpose monitoring programs.
Sulfur Dioxide	FTIR, UV-DOAS, UV fluorescence	Process unit level monitoring, ground level monitoring, fence-line and community monitoring at some refineries.
Toluene	FTIR, UV-DOAS, Auto GC	Fence-line monitoring at some refineries. Statewide air toxics monitoring network (major urban areas).

## I. Rulemaking Efforts in Other Air Districts

### Bay Area Air Quality Management District (BAAQMD)

BAAQMD adopted Regulation 12, Rule 15 (Petroleum Refining Emissions Tracking) and the associated *Air Monitoring Guidelines for Petroleum Refineries* on April 20, 2016, to track air emissions and crude oil composition characteristics from petroleum refineries and support facilities over time, and to establish air monitoring systems to provide air quality data along refinery boundaries. Per BAAQMD Regulation 12, Rule 15, a petroleum refinery owner/operator must submit for approval a plan for establishing and operating a fence-line monitoring system. This plan shall include detailed information describing the equipment to be used to monitor, record, and report air pollutant levels, the siting, operation, and maintenance of this equipment, and procedures for implementing data quality assurance and quality control. Within one year of the approval of an air monitoring plan, the petroleum refinery owner/operator must install and operate a fence-line monitoring system in accordance with the plan.

In accordance with the BAAQMD Guidelines, refinery operators must measure benzene, toluene, ethylbenzene, xylenes (BTEX), and hydrogen sulfide concentrations

## SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

at refinery fence-lines with open path technology capable of measuring in the parts per billion range, regardless of path length. Refinery operators must also consider open path measurement of sulfur dioxide, alkanes or other organic compound indicators, 1,3-butadiene, and ammonia concentrations in their submitted air monitoring plan, and provide rationale for not monitoring any of these pollutants. The BAAQMD Guidelines allow the use of surrogates to measure concentrations of a more easily speciated compound as a proxy for monitoring for one of the suggested pollutants.

BAAQMD amended Regulation 12, Rule 15 on December 19, 2018 to address public concerns about the refinery operators being responsible for siting and operating community air monitors. BAAQMD is now responsible for siting and operating the monitors, which they will fund through a broad-based major source fee (BAAQMD Regulation 3, Schedule X). BAAQMD amended Regulation 12, Rule 15 most recently on November 3, 2021, with updates to several definitions in the rule to ensure that the facilities that produce fuels and other products from non-petroleum feedstock remain subject to the rule. This amendment added an exemption for refineries processing less than 20,000 barrels per stream day of any organic feedstock.

Since rule adoption, the five affected refineries in BAAQMD have developed and implemented their individual air monitoring plans. These facilities are all currently monitoring for BTEX compounds, hydrogen sulfide, and sulfur dioxide. Two of the refineries opted not to monitor alkanes, citing benzene or hexane as reasonable surrogates. Only one Bay Area refinery is monitoring for 1,3 butadiene and ammonia; other refineries provide rationale for excluding these, stating that these compounds are either not produced at their facilities or not emitted in measurable amounts.

### South Coast Air Quality Management District (SCAQMD)

SCAQMD adopted Rule 1180 (Refinery Fenceline and Community Air Monitoring) and the associated guidance document on December 1, 2017 to require real-time fence-line air monitoring systems and to establish a fee schedule to fund refinery-related community air monitoring systems that provide air quality information to the public about levels of various criteria air pollutants, volatile organic compounds, metals and other compounds, at or near the property boundaries of petroleum refineries and in nearby communities. SCAQMD Rule 1180 requires that fence-line air monitoring systems measure for sulfur dioxide, NO<sub>x</sub>, total VOCs, formaldehyde, acetaldehyde, acrolein, 1,3-butadiene, styrene, BTEX, hydrogen sulfide, carbonyl sulfide, ammonia, black carbon, hydrogen cyanide, and hydrogen fluoride, however, subject operators may provide justification for not monitoring for one or more pollutants. The SCAQMD *Rule 1180 Refinery Fenceline Air Monitoring Plan Guidelines* provide further information about required elements of the plans and data quality control. Notably, SCAQMD exempts petroleum refinery operations that have a capacity to process 40,000 bpd or less, due to the reduced emissions originating from smaller facilities and the burdensome cost of compliance with rule requirements for operations with smaller revenues.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

Since rule adoption, the five affected refineries in SCAQMD have developed and implemented their individual air monitoring plans. These facilities are all currently monitoring for the full list of pollutants SCAQMD Rule 1180 requires for consideration, though four refineries do not use and therefore exclude hydrogen fluoride from monitoring. In addition to the required pollutants, one facility opted to include cyclohexane, hexane, methane, methanol, and propylene in their monitoring plan because their selected monitoring technology has the capability to detect additional gases that are present as possible emissions from the refinery.

## San Luis Obispo County Air Pollution Control District (SLOCAPCD)

In response to AB 1647, SLOCAPCD established a Memorandum of Understanding (MOU) with Phillips 66 Santa Maria Refinery, the only petroleum refinery located within their district. Phillips 66 developed the *Community/Fence-line Air Monitoring Plan* following the guidance established in South Coast's *Rule 1180 Refinery Fenceline Air Monitoring Plan Guidelines* as recommended by SLOCAPCD. Taking into consideration the full list of pollutants required in SCAQMD's rule, Phillips 66 determined through analysis that only nitrogen dioxide, sulfur dioxide, black carbon, and non-methane VOC were present at detectable limits at the refinery fence-line and therefore would be included in their monitoring plan.

## Santa Barbara County Air Pollution Control District (SBCAPCD)

SBCAPCD adopted Rule 364 (Refinery Fenceline and Community Air Monitoring) and associated guidelines on May 21, 2020 to address the requirements of AB 1647. Currently, there is only one refinery in Santa Barbara County subject to Rule 364. SBCAPCD took this facility's processes and emissions into consideration when determining the requirements of the rule. The final rule requires monitoring of BTEX compounds, sulfur dioxide, and hydrogen sulfide at the refinery fence-line. The rule also addresses the need for SBCAPCD to install and operate a refinery-related community air monitoring system, and has a cost recovery provision to cover the costs of the community monitoring system.

## State of Colorado

On June 23, 2021, Colorado Governor Jared Polis signed a bill (HB21-1189) adding new requirements for certain stationary sources of hazardous air pollutants, including petroleum refineries. The bill requires affected facilities to conduct fence-line monitoring of covered air toxics, to use an emergency notification service to communicate to nearby communities in the event of an incident or exceedance of a notification threshold, and to pay an annual share of the costs of conducting community-based monitoring to the Colorado Department of Public Health and Environment (CDPHE). The bill defines covered air toxics as hydrogen cyanide, hydrogen sulfide, and benzene,

**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

and authorizes CDPHE to list additional hazardous air pollutants by rule. Affected petroleum refineries are required to begin fence-line monitoring by January 1, 2023.

Table 9 below shows the pollutants required for fence-line monitoring in current District Rule 4460 in comparison with the pollutants required for monitoring in all other California air districts with refineries in their jurisdiction.

**Table 9: Pollutants Required for Fence-line Monitoring in California Air Districts**

SJVAPCD (Current Rule 4460)		SCAQMD (Rule 1180)		BAAQMD (Reg 12-15)	SLOCAPCD (MOU)	SBCAPCD (Rule 364)
≥ 40,000 bpd	< 40,000 bpd	≥ 40,000 bpd	< 40,000 bpd			
Acetaldehyde*		Acetaldehyde*	No Monitoring Required			
Acrolein*		Acrolein*				
				Alkanes or other organic compound indicators*		
Ammonia*		Ammonia*		Ammonia*		
Benzene*	Benzene*	Benzene*		Benzene		Benzene
Black Carbon*		Black Carbon*			Black Carbon	
1,3 Butadiene*		1,3 Butadiene*		1,3 butadiene*		
Carbonyl Sulfide*		Carbonyl Sulfide*				
Ethylbenzene*	Ethylbenzene*	Ethylbenzene*		Ethylbenzene		Ethylbenzene
Formaldehyde*		Formaldehyde*				
Hydrogen Cyanide*		Hydrogen Cyanide*				
HF*		HF*				
H2S*	H2S*	H2S*		H2S		H2S
NOx*		NOx*			NOx	
SO2*	SO2*	SO2*		SO2*	SO2	SO2
Styrene*		Styrene*				
Toluene*	Toluene*	Toluene*		Toluene		Toluene
Total VOCs*		Total VOCs*			VOCs	
Xylene*	Xylene*	Xylene*		Xylene		Xylene

\*Compound may be excluded from monitoring if refinery provides sufficient justification in plan.

Some districts include a provision in their rule allowing a refinery to exclude certain pollutants from monitoring, as long as the refinery provides sufficient justification for the exclusion in their fence-line monitoring plan. Due to this allowance, several refineries in the Bay Area and South Coast excluded one or more of the pollutants required in their respective rules. Table 10 below shows which pollutants the refineries in California actually identified for monitoring in their fence-line monitoring plans.

**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

**Table 10: Refinery Fence-line Monitoring in California**

	Refinery	Processing Capacity (bpd)	Pollutants Identified for Monitoring in Plans
<b>SCAQMD</b>	Marathon Carson/Wilmington	363,000	All required in Rule 1180 except HF
	Chevron El Segundo	269,000	
	PBF Energy Torrance	160,000	
	Phillips 66 Wilmington	139,000	All required in Rule 1180 except HF, and additional detectable gases
	Valero Wilmington	85,000	All required in Rule 1180
<b>BAAQMD</b>	Chevron Richmond	245,271	BTEX, H2S, SO2, alkanes
	Marathon Martinez	161,500	All required in Reg 12-15, except using hexane as surrogate for alkanes
	PBF Energy Martinez	156,400	BTEX, H2S, SO2, alkanes
	Valero Benicia	145,000	BTEX, H2S, SO2
	Phillips 66 Rodeo	120,200	BTEX, H2S, SO2, alkanes
<b>SJVAPCD</b>	Kern Oil & Refining Co	26,000	BTEX, H2S, SO2
	San Joaquin Refining	15,000	BTEX, H2S, SO2
<b>SLOCAPCD</b>	Santa Maria Refinery	41,800	Black Carbon, NOx, SO2, VOCs
<b>SBCAPCD</b>	Greka Energy	9,500	BTEX, H2S, SO2

Proposed amendments to Rule 4460 will require monitoring for a comprehensive list of criteria pollutants and toxic air contaminants recommended by OEHHA for monitoring, unless a refinery can provide sufficient justification for not monitoring a specified pollutant. Table 11 below shows the District’s proposed list of pollutants in comparison with the pollutants required for monitoring in all other California air districts.

**Table 11: Pollutants Required for Fence-line Monitoring in California Air Districts, with Proposed Amendments to District Rule 4460**

<b>SJVAPCD (Proposed Rule 4460)</b>	<b>SCAQMD (Rule 1180)</b>		<b>BAAQMD (Reg 12-15)</b>	<b>SLOCAPCD (MOU)</b>	<b>SBCAPCD (Rule 364)</b>
	≥ 40,000 bpd	< 40,000 bpd			
Acetaldehyde*	Acetaldehyde*	No Monitoring Required			
	Acrolein*				
			Alkanes or other organic compound indicators*		
Ammonia*	Ammonia*		Ammonia*		
Benzene	Benzene*		Benzene		Benzene
	Black Carbon*			Black Carbon	
1,3 Butadiene*	1,3 Butadiene*		1,3 butadiene*		
Cadmium*					

**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

	Carbonyl Sulfide*			
Diethanolamine*				
Ethylbenzene	Ethylbenzene*		Ethylbenzene	Ethylbenzene
Formaldehyde*	Formaldehyde*			
	Hydrogen Cyanide*			
HF*	HF*			
H2S	H2S*		H2S	H2S
Manganese*				
Naphthalene*				
Nickel*				
NOx*	NOx*		NOx	
PAH*				
PM*				
SO2	SO2*		SO2*	SO2
	Styrene*			
Sulfuric Acid*				
Toluene	Toluene*		Toluene	Toluene
	Total VOCs*			VOCs
Xylene	Xylene*		Xylene	Xylene

\*Compound may be excluded from monitoring if refinery provides sufficient justification in plan.

The following table compares the types of monitoring equipment being used for refinery fence-line systems operating throughout the state (Table 12).

**Table 12: Equipment Utilized for Fence-line Air Monitoring at Petroleum Refineries**

<b>SJVAPCD</b>	<b>SCAQMD</b>	<b>BAAQMD</b>	<b>SBCAPCD</b>	<b>SLOCAPCD</b>
<ul style="list-style-type: none"> <li>• Open-path UV DOAS</li> <li>• UV Fluorescence Hydrogen Sulfide monitors</li> </ul>	<ul style="list-style-type: none"> <li>• Open-path UV DOAS</li> <li>• Open-path TDL</li> <li>• Open-path FTIR</li> <li>• GC-PID (Photoionization Detector)</li> <li>• Extractive FTIR</li> <li>• Organic Gas Detectors (point sampling)</li> <li>• TDLAS (monostatic Tunable Diode Laser Absorption Spectroscopy)</li> </ul>	<ul style="list-style-type: none"> <li>• Open-path UV DOAS</li> <li>• Open-path TDL</li> <li>• Open-path FTIR</li> <li>• Point monitor for diesel PM and H2S</li> <li>• Aethalometer (black carbon)</li> <li>• TDLAS</li> <li>• UV Fluorescence Hydrogen Sulfide monitors</li> </ul>	<ul style="list-style-type: none"> <li>• Open-path UV DOAS</li> </ul>	<ul style="list-style-type: none"> <li>• Point Monitoring</li> </ul>

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

The equipment required to comply with regulations in SCAQMD and BAAQMD is estimated to cost refinery operations a minimum of \$2,000,000, and up to \$4,200,000, depending on the number of air monitors needed to adequately cover the facility perimeter. The direct cost to refinery operations to implement fence-line air monitoring systems is in addition to community air monitoring fees charged by both air districts, with initial community monitoring capital cost-recovery fees ranging from approximately \$200,000 to \$1,000,000 per refinery. Both air districts also charge an ongoing annual maintenance fee that ranges from approximately \$200,000 to \$900,000 per facility.

District staff conducted a thorough analysis of regulatory requirements and air monitoring guidance in other air districts to develop the proposed amendments to Rules 4460 and 3200. District staff have worked to develop regulations that address the intent of AB 1647 legislation by requiring air quality monitoring to provide useful information for estimating refinery-related pollution exposures and potential health risks and in determining trends in air pollutant levels over time.

### **III. PROPOSED AMENDMENTS TO RULES 4460 AND 3200**

#### **A. Proposed Amendments to Rule 4460 (Petroleum Refinery Fence-line Air Monitoring)**

District staff developed the proposed amendments to Rule 4460 through a public process, taking into consideration the goals of AB 1647, input from affected parties, state-provided guidance, and monitoring technological capabilities. Recognizing the variability among refineries and nearby communities, the District believes an approach that requires a site-specific analysis is most likely to provide useful information for estimating refinery-related pollution exposures and potential health risks and in determining trends in air pollutant levels over time. To ensure that all appropriate facilities are subject to Rule 4460, District staff are proposing to remove the exemption for facilities not currently engaged in refining crude oil. Further, the District will remove the provisions for a pre-determined set of pollutants and equipment requirements based on processing capacity. Proposed amendments to Rule 4460 will require monitoring for a comprehensive list of criteria pollutants and toxic air contaminants recommended by OEHHA for monitoring, unless a refinery can provide sufficient justification for not monitoring a specified pollutant. Additionally, amendments include a requirement to develop an air monitoring plan in accordance with Rule 4460 Guidelines, which the District developed concurrently with proposed amended Rule 4460.

#### **Purpose/Applicability (Section 1.0/Section 2.0)**

Staff has added or amended language to provide clarity.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

## **Definitions (Section 3.0)**

District staff have added a definition for Rule 4460 Petroleum Refinery Fence-line Air Monitoring Plan Guidelines, which is the written framework to be used by the APCO to evaluate a refinery fence-line air monitoring plan.

## **Exemptions (Existing Section 4.0)**

Proposed updates would remove the exemption for refineries not currently engaged in refining crude oil. There are two facilities in the Valley that would be newly subject to the full requirements of Rule 4460 through the removal of this exemption.

## **Requirements (Existing Section 5.0/Proposed Section 4.0)**

Staff has added or amended language to provide clarity on rule requirements.

## **Fence-line Air Monitoring Plan (Existing Section 6.0/Proposed Section 5.0)**

*Section 5.1* – District staff is proposing the deadline for owners and operators of petroleum refineries to submit fence-line air monitoring plans be updated from July 1, 2020 to April 1, 2023, which provides a timeframe consistent with what was provided in the current rule when it was adopted.

*Section 5.3* – Updates to this section include removal of the specified monitoring provisions for facilities based on their processing capacity (Table 1 under existing 6.3). District staff is proposing to replace these provisions with requirements for all facilities to address the full list of OEHHA recommended pollutants in their fence-line monitoring plans, unless they can provide sufficient justification for not monitoring a specified pollutant. The proposed list of air pollutants will replace the existing Table 1, and will be as displayed below.

Table 1: Air Pollutants to be Addressed in Fence-line Air Monitoring Plan

Acetaldehyde
Ammonia
Benzene
1,3-Butadiene
Cadmium
Diethanolamine
Ethylbenzene
Formaldehyde
Hydrogen Fluoride
Hydrogen Sulfide

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines

September 15, 2022

Manganese
Naphthalene
Nickel
Nitrogen Oxide
Polycyclic Aromatic Hydrocarbons (PAH)
Particulate Matter (PM)
Sulfur Dioxide
Sulfuric Acid
Toluene
Xylene

In addition, proposed amendments include a requirement for refineries to consider monitoring pollutants beyond those in Table 1 that are produced through their facility's specific activities and processes, and at a minimum, monitor benzene, toluene, ethylbenzene, xylene, hydrogen sulfide, and sulfur dioxide.

*Section 5.4* – District staff are proposing to extend the time provided for a refinery to submit an updated air monitoring plan following an unplanned modification at their facility from 10 days to 30 days, to allow sufficient time to prepare the updated plan.

*Section 5.6* – Proposed amendments include a provision that monitoring plans shall be consistent with the Rule 4460 Petroleum Refinery Fence-line Air Monitoring Plan Guidelines.

Other proposed amendments to Section 5 include revised language to provide clarity.

## **Fence-line Air Monitoring Implementation Timeline Requirements (Existing Section 7.0/Proposed Section 6.0):**

Proposed amendments would remove Section 7.2 from the rule, as the amendments will also remove the distinct requirements for refineries based on processing capacity.

Proposed amendments would remove Section 7.3 and Section 7.4 from the rule, as refinery facilities not refining crude oil will no longer be exempt from the requirements of the rule.

## **Refinery Fence-line Air Monitoring Plan Review Process (Existing Section 8.0/Proposed Section 7.0):**

Language would be added in this section to provide clarity.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

## **Reporting – (Existing Section 9.0/Proposed Section 8.0)**

*Section 8.1* – Staff are proposing to extend the time provided for a refinery to submit a quarterly report from 30 days to 45 days following the end of the calendar quarter, to allow sufficient time to prepare the report.

*Section 8.2* – Proposed amendments would add a requirement for refinery owners and operators to submit a follow-up report to the APCO, ten calendar days following a monitoring system’s detection of a pollutant exceeding its threshold defined in the approved air monitoring plan. The report shall include:

- The pollutant detected,
- The pollutant’s notification threshold,
- The initial date and time the exceedance was detected,
- The date and time the exceedance ended or if it is ongoing,
- The predominant wind speed and direction throughout the exceedance period, and
- Indication whether or not the suspected source of the exceedance is located within the refinery’s fence-line.
- If the suspected source of the exceedance is located within the refinery’s fence-line, the report shall also include:
  - The specific processes or equipment from where the release is suspected to have originated, and
  - All corrective actions taken

## **Recordkeeping – (Existing Section 10.0/Proposed Section 9.0)**

No changes proposed at this time.

### **B. Proposed Rule 4460 Petroleum Refinery Fence-line Air Monitoring Plan Guidelines**

Proposed Rule 4460 Section 5.6 requires that all fence-line monitoring plans be consistent with the Rule 4460 Petroleum Refinery Fence-line Air Monitoring Plan Guidelines. District staff developed these guidelines concurrently with the proposed amendments to Rule 4460, to inform refinery owners and operators about the elements necessary to complete an air monitoring plan, and provide a written framework to be used by the APCO to evaluate submitted monitoring plans. The guidelines cover pollutants required to be monitored at refinery fence-lines, air monitoring technologies, quality assurance and quality control, data display, and public notification requirements.

Consistent with the proposed amended Rule 4460, the guidelines require refineries to address the full list of OEHHA recommended pollutants, including ethylbenzene and xylene, and consider any additional pollutants emitted by the facility in their fence-line

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

monitoring plans. Should owner or operator of a petroleum refinery propose to not monitor one or more of the specified pollutants, sufficient justification shall be included in the proposed fence-line air monitoring plan in accordance with the Rule 4460 Guidelines, which will require demonstration of one or more of the following:

- 1) The pollutant is not emitted through the refinery's activities and processes;
- 2) Real-time air monitors capable of reliably measuring the pollutant are not available;
- 3) The expected concentration levels of the pollutant at the fence-line are below the detection limits of currently available real-time monitoring equipment; or
- 4) Other technical justifications as appropriate.

Proposed Rule 4460 and Guidelines require that at minimum, a refinery shall monitor benzene, toluene, ethylbenzene, xylene, hydrogen sulfide, and sulfur dioxide.

## **C. Proposed Amendments to Rule 3200 (Petroleum Refinery Community Air Monitoring Fees)**

Consistent with CH&SC §42705.6, Rule 3200 sets forth requirements for petroleum refineries to be responsible for the costs associated with District implementation of a petroleum refinery community air monitoring system. Proposed amendments to Rule 3200 would remove the exemption and provisions for non-crude oil refining facilities.

The following paragraphs discuss the intended purpose of each section of Rule 3200.

### **Purpose and Applicability (Section 1.0/Section 2.0)**

No changes proposed at this time.

### **Definitions (Section 3.0)**

District staff are proposing to remove the definition for "operating," as the proposed rule would no longer make a distinction between operating and non-operating petroleum refineries.

### **Exemptions (Section 4.0)**

Proposed updates would remove the exemption for refineries not currently engaged in refining crude oil. There are two facilities in the Valley that would be newly subject to the full requirements of Rule 3200 through the removal of this exemption.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

## **Equipment and Installation Fees (Existing Section 5.0/Proposed Section 4.0)**

Proposed amendments would update the deadline for refineries to pay the community air monitoring installation fee from July 1, 2020, to April 1, 2023, for those facilities which have not yet paid this fee, which provides a timeframe consistent with what was provided after the District adopted the existing rule. In addition, some language would be removed to provide clarity.

## **Annual Operating and Maintenance Fees (Existing Section 6.0/Proposed Section 5.0)**

Proposed amendments would update the year a petroleum refinery shall begin paying a community air monitoring annual operating and maintenance fee from 2021 to 2023.

## **Refinery Facilities Not Refining Crude Oil (Existing Section 7.0)**

Proposed amendments would remove this section from the rule, as facilities not refining crude oil will no longer be exempt from the requirements of the rule.

## **Increases in Petroleum Refinery Capacity (Existing Section 8.0/Proposed Section 6.0)**

No changes proposed at this time.

## **Late Fees (Existing Section 9.0/Proposed Section 7.0)**

No changes proposed at this time.

## **V. ANALYSES**

### **A. Emission Reduction Analysis**

The proposed amendments to Rules 4460 and 3200 do not directly reduce emissions from petroleum refineries. Indirect emissions benefits may be realized due to the potential for early detection of leaks and quick action to control such fugitive emissions.

### **B. Socioeconomic Analysis**

The proposed amendments to Rules 4460 and 3200 do not directly reduce emissions from petroleum refineries. Indirect emissions benefits may be realized due to the potential for early detection of leaks and quick action to control such fugitive emissions.

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

Pursuant to CH&SC §40728.5(a), the District is required to conduct a socioeconomic analysis of proposed rules or rule amendments that will significantly affect air quality or emissions limitations prior to rule adoption. The proposed rule amendments have neither effect, and therefore a socioeconomic analysis is not required for this rule amendment project.

## **C. Rule Consistency Analysis**

Pursuant to CH&SC §40727.2, prior to adopting, amending, or repealing a rule or regulation, the District is required to perform 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 EPA rules, regulations, and guidelines that apply to the same source category. The elements analyzed are emission standards, monitoring and testing requirements, and recordkeeping and reporting requirements. Based on the following analysis, District staff found that proposed Rule 4460 and Rule 3200 do not conflict with any District or federal rules, regulations, or policies covering similar stationary sources.

### District Rules

There is no other District prohibitory rule or regulation tailored specifically for petroleum refinery fence-line and community air monitoring. The requirements of other District rules affecting petroleum refineries are not in conflict with, nor are they inconsistent with, the requirements of Proposed Rule 4460.

Pursuant to CH&SC §40727.2 (g) a rule consistency analysis of Rule 3200 is not required. Rule 3200 does not strengthen emission limits or impose more stringent monitoring, reporting, or recordkeeping requirements.

### Federal Rules, Regulations, and Policies

Based on the following analysis, District staff found that Rule 4460 would not conflict with any federal rules, regulations, or policies covering similar stationary sources.

In December 2015, U.S. EPA promulgated a final national rulemaking in 40 CFR Part 63.658 for fence-line monitoring of benzene at petroleum refining process units and related emission points that are a major source as defined by section 112(a) of the Clean Air Act and that emit or have equipment containing or contacting one or more of the hazardous air pollutants identified in Table 1 of 40 CFR 63.658. 40 CFR § 63.658 is not applicable to the four facilities operating under District permit as petroleum refineries, as this MACT standard (Subpart CC, aka "Refinery MACT 1") only affects major sources of HAP emissions. The refineries permitted by the District are area sources of HAP emissions. Two Valley refineries are each limited by permit condition to facility-wide emissions of less than 10 tons per year of any single hazardous air pollutant, and less than 25 tons per year of any combination of hazardous air pollutants, and the two remaining refineries, though not limited by permit condition, have actual

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

emissions below these limits. As this regulation does not apply to Valley refineries subject to Rule 4460 and Rule 3200, there is no conflict between the proposed rules and the federal regulation.

There are no applicable Control Technique Guidelines (CTG), Alternative Control Techniques (ACT), New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), Best Available Control Technology (BACT), or Maximum Achievable Control Technology (MACT) guidelines for Petroleum Refineries that require real-time fence-line or community air monitoring.

EPA Policy on Recordkeeping: EPA has a policy that mandates stationary sources keep and maintain records for at least five years. Proposed District Rule 4460 is consistent with EPA recordkeeping policy.

## **D. Environmental Impact Analysis**

Based on the District's assessment of the Rule Amendments, the District concludes that the Rule 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 CEQA Guidelines § 15378.

The Rule Amendments will include the removal of an exemption for facilities not currently refining crude oil in Rule 4460 and Rule 3200, updated list of pollutants required for monitoring by refineries in Rule 4460, and additional reporting requirements in Rule 4460. According to Section 15061 (b)(3) of the CEQA Guidelines, a project is exempt from CEQA if, "(t)he activity is covered by the general rule 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, substantial evidence supports the District's assessment that assuming the Rule Amendment is a "project" under CEQA, it will not have any significant adverse effects on the environment.

Furthermore, the Rule Amendment is an action taken by a regulatory agency, the San Joaquin Valley Air Pollution Control 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

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

*Final Draft Staff Report for Rules 4460 and 3200 and Rule 4460 Guidelines*

September 15, 2022

---

exemption.” No construction activities or relaxation of standards are included in the Rule Amendments.

Therefore, the District has determined for all the above reasons, the proposed rule amendments are exempt from CEQA. Pursuant to Section 15062 of the CEQA Guidelines, District staff will file a Notice of Exemption upon Governing Board approval of Rule Amendments.

## **VI. RULE DEVELOPMENT PROCESS**

### **A. Public Workshops for Rules 4460 and 3200 and Rule 4460 Guidelines**

The District held an initial scoping meeting on February 1, 2022, followed by a public workshop on April 26, 2022 to present, discuss, and receive feedback on potential amendments to Rules 4460 and 3200. The District held a second public workshop June 28, 2022, to present the draft rule amendments and Rule 4460 Guidelines, with a public comment period ending July 15, 2022. All significant comments received have been reviewed and incorporated into the final draft staff report as appropriate. A summary of comments received and District responses is included as Appendix A.

### **B. Public Hearing for Rules 4460 and 3200 and Rule 4460 Guidelines**

In accordance with CH&SC §40725, the proposed amendments to Rules 4460 and 3200, proposed Rule 4460 Guidelines, and the final draft staff report were publicly noticed and made available prior to the Governing Board public hearing to consider adoption of the proposed amendments and Guidelines. A 30-day public comment period was provided beginning August 16, 2022. The public was also invited to provide comments to District Governing Board members during the public hearing.

**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

*Final Draft Staff Report for Rules 4460 and 3200 and  
Rule 4460 Guidelines*

September 15, 2022

---

This page is intentionally blank.