BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

INITIAL STAFF REPORT

Draft Amendments to Regulation 6, Rule 5: Particulate Emissions from Petroleum Refinery Fluidized Catalytic Cracking Units

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I. INTRODUCTION

The Bay Area Air Quality Management District (Air District) is developing amendments to Regulation 6: Particulate Matter, Rule 5: Particulate Emissions from Petroleum Refinery Fluidized Catalytic Cracking Units (Rule 6-5). The purpose of these amendments is to address particulate matter from refinery fluidized catalytic cracking units, which are some of the largest individual sources of particulate matter emissions in the San Francisco Bay Area. The Bay Area does not currently attain all state and national ambient air quality standards for particulate matter, and further reductions of particulate matter emissions are needed to ensure progress towards attainment of the standards. Furthermore, exposure to particulate matter has long been understood as a health hazard based on respiratory health effects, and recent studies have linked particulate matter exposure to a wide range of cardiovascular diseases, impacts to cognitive function, and cancer. [1] Compelling evidence also suggests that fine particulate matter is the most significant air pollution health hazard in the Bay Area, and reductions in particulate matter emissions are needed to achieve further clean air and public health benefits.[2]

Fluidized catalytic cracking units are the largest single source of particulate matter emissions at petroleum refineries. Recent emissions characterization efforts indicate that a potentially large portion of these particulate matter emissions are attributed to condensable particulate matter emissions, and efforts continue to advance the understanding of condensable particulate matter formation and controls. The adoption of Air District Rule 6-5 in 2015 marked the first regulatory step in addressing condensable particulate matter from these fluidized catalytic cracking units in the San Francisco Bay Area. In 2017, the Air District's Clean Air Plan included a control measure to evaluate ongoing progress in reducing these emissions, and to further control particulate matter emissions from fluidized catalytic cracking units. In 2018, the Air District adopted the Expedited Best Available Retrofit Control Technology (BARCT) Implementation Schedule, which identified potential rule development projects to evaluate and implement Best Available Retrofit Control Technology at certain industrial sector facilities pursuant to California Assembly Bill 617 (AB 617). The schedule identified that potentially substantial particulate matter emission reductions could be achieved at these fluidized catalytic cracking units, and further rule amendments should be evaluated and considered. This current rule development effort for amendments to Rule 6-5 follows these previous Air District rulemaking and planning actions to address emissions from these sources. These amendments are needed to ensure that Air District regulations are as health protective as possible and consider recent advances in the understanding and control of condensable particulate matter emissions.

The Air District has released draft amendments to Rule 6-5. This report includes additional information on the draft amendments, including background information, a technical review of sources and emissions controls, and a further discussion of the draft regulatory amendments. Air District staff is soliciting comments on these materials and will consider input received during the public comment period in the further development of these amendments.

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[1] BAAQMD, 2012. Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area. November.

[2] BAAQMD, 2017. Final 2017 Clean Air Plan: Spare the Air – Cool the Climate. April.

II. BACKGROUND

A. Industry Description

Petroleum refining facilities process crude oil into a variety of products, such as gasoline, aviation fuel, diesel and other fuel oils, lubricating oils, and feedstocks for the petrochemical industry. The processing of crude oil occurs in various process units or plants throughout these facilities, including fluidized catalytic cracking units (FCCUs). Four of the five refineries in the San Francisco Bay Area operate fluidized catalytic cracking units: Chevron Products Richmond, PBF Martinez Refinery, Marathon Martinez Refinery, and Valero Benicia Refinery.

B. Fluidized Catalytic Cracking Units

Fluidized catalytic cracking units are complex processing units at refineries that convert heavy components of crude oil into lighter distillates, including gasoline and other high-octane products. Fluidized catalytic cracking units use a fine powdered catalyst that behaves as a fluid when aerated with a vapor. The fluidized catalyst is circulated continuously between a reaction vessel where the catalyst is used to promote the hydrocarbon cracking process and a regenerator where carbonaceous material deposited on the catalyst is burned off. An illustrative diagram of the fluidized catalytic cracking unit is shown in Figure 1.

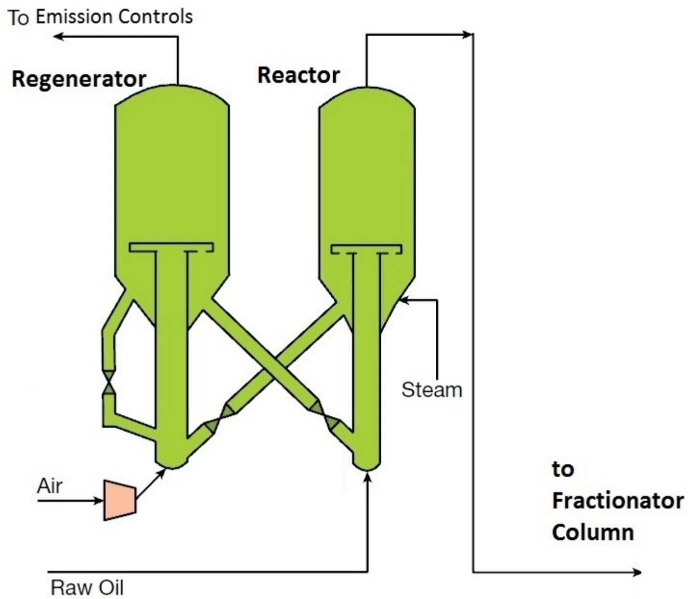

Figure 1 – Petroleum Refinery Fluidized Catalytic Cracking Unit Diagram[3]

Fresh feed is preheated and enters the fluidized catalytic cracking unit at the base of the feed riser, where it is mixed with the heated catalyst. The heat from the catalyst vaporizes the feed and brings the materials up to the desired reaction temperature. The cracking reactions start as the catalyst and hydrocarbon vapor travel up the riser and continue as the materials flow into the reactor. As the cracking reaction progresses, the catalyst surface is gradually coated with carbonaceous material (coke), reducing its efficacy. The cracked hydrocarbon vapors are

[3] Modified from American Institute of Chemical Engineers, 2014. Chemical Engineering Progress (CEP) – An Oil Refinery Walk-Through. May.

separated from the catalyst particles by cyclones in the reactor, and the hydrocarbon vapors are sent to a distillation column for separation and further processing.

The spent catalyst is steam stripped to remove remaining oil on the catalyst and cycled to the regenerator. The coke deposited on the catalyst is burned off in a controlled combustion process with preheated air, reactivating the spent catalyst. The catalyst is then recycled to be mixed with fresh hydrocarbon feed. Catalyst regenerators may be designed to burn the coke completely to carbon dioxide (CO_2) (full burn) or to only partially burn the coke to a mixture of carbon monoxide (CO) and carbon dioxide (partial burn). Because the flue gas from partial burn regenerators have high levels of carbon monoxide, the flue gas is vented to a carbon monoxide gas boiler where the carbon monoxide is further combusted to carbon dioxide.

The fluidized catalytic cracking unit regenerator is a substantial source of emissions and fluidized catalytic cracking units are the largest single source of particulate matter emissions at petroleum refineries. During the regeneration process, some of the catalyst becomes entrained in the flue gas that exits the fluidized catalytic cracking unit regenerator. In addition to these "catalyst fines", the flue gas also contains other pollutants, including sulfur dioxide (SO_2), oxides of nitrogen (NOx), reactive organic gases (ROG), toxic air contaminants, and other particulate matter (PM) generated in the combustion process. This flue gas is then routed through a train of pollutant abatement devices (see Section III.C. for further information on control technologies). In many abatement trains, ammonia (NH_3) is also injected into the flue gas stream to enhance the efficiency of certain types of pollution control equipment. Ammonia that is not fully consumed in the process can also remain in the flue gas stream (also referred to as "ammonia slip") and may be emitted along with other pollutants in the flue gas. These gaseous pollutants can contribute to the formation of condensable particulate matter (see discussion of condensable particulate matter in Section III.A.).

C. Regulatory History

1. Air District Rules/Regulations

The Air District has adopted a number of rules that address emissions of particulate matter from fluidized catalytic cracking units. Air District Regulation 6: Particulate Matter, Rule 1: General Requirements (Rule 6-1) contains an opacity limit of 20 percent for all sources, including fluidized catalytic cracking units and carbon monoxide boilers. Opacity is a measurement of the degree to which particulates in an exhaust stream or dust plume obscure the ability of an observer to see through the exhaust stream or dust plume. Opacity can also be measured with instrumentation by a beam of light's ability to pass through the exhaust stream without being reflected by any particles in the exhaust stream. As such, opacity is a surrogate for more complicated and time intensive source testing (mass-based measurements) of particulate matter emissions.

The Air District adopted Regulation 6: Particulate Matter, Rule 5: Particulate Emissions from Refinery Fluidized Catalytic Cracking Units (Rule 6-5) in 2015, with the goal of reducing emissions of condensable particulate matter from fluidized catalytic cracking units at Bay Area refineries. Rule 6-5 established an ammonia slip limit of 10 parts per million, volumetric dry (ppmvd) at 3 percent oxygen (O_2), as a daily average. The Rule also provided for an alternative method of compliance for an owner or operator of a fluidized catalytic cracking unit to conduct an ammonia optimization study and establish an enforceable ammonia emission limit based on this optimization. Rule 6-5 was also amended in 2018 for minor clarifications, but no substantive changes were made to these ammonia injection and emission requirements.

Rule 6-5 does not currently contain sulfur dioxide emission limits, but the role of sulfur dioxide as a particulate matter precursor was recognized during the development and adoption of the Rule in 2015, with the potential of addressing sulfur dioxide in future rule amendments. Air District Regulation 9: Inorganic Gaseous Pollutants, Rule 1: Sulfur Dioxide (Rule 9-1) does contain a sulfur dioxide limit for fluidized catalytic cracking units and prohibits the emission of effluent process gas containing sulfur dioxide in excess of 1,000 ppm by volume from a fluidized catalytic cracking unit. Additionally, Rule 9-1 contains general prohibitions on emissions of sulfur dioxide in quantities that result in ground level sulfur dioxide concentrations in excess of 0.5 ppm (continuously for three minutes), 0.25 ppm (averaged over 60 minutes), or 0.05 ppm (averaged over 24 hours).

In addition to existing regulations, the Air District's programmatic and plan-level efforts have identified and included measures and strategies to further reduce particulate matter emissions from fluidized catalytic cracking units.

a) 2017 Clean Air Plan

In 2017, the Air District adopted its current Clean Air Plan: Spare the Air, Cool the Climate (2017 Clean Air Plan or 2017 Plan). The 2017 Plan describes the Air District's approach to reducing emissions of air pollutants, including particulate matter and condensable particulate matter. The 2017 Plan includes control measures to protect the public health and reduce particulate matter, including stationary source control measure SS1: "Fluid Catalytic Cracking in Refineries." Control Measure SS1 includes establishing emission limits to reduce particulate matter emissions at fluidized catalytic cracking units, working to conduct source tests and condensable particulate matter quantification, and evaluating ongoing progress in ammonia optimization and condensable particulate matter testing.

b) AB 617 Expedited BARCT Implementation Schedule

Assembly Bill 617 requires each air district that is in nonattainment for one or more air pollutants to adopt an expedited schedule for implementation of best available retrofit control technology (BARCT) by the earliest feasible date, but not later than December 31, 2023. In December 2018, the Air District's Board of Directors adopted the Expedited Best Available Retrofit Control Technology Implementation Schedule, which identified a number of potential rule development projects to evaluate and implement Best Available Retrofit Control Technology. The schedule includes a rule development project to control emissions of condensable particulate matter from fluidized catalytic cracking units and carbon monoxide gas boilers. Staff identified strategies for addressing these emissions through potential amendments to Rule 6-5 that would address components of condensable particulate matter, including ammonia and sulfur dioxide.

2. Federal Regulations

Federal rules that address emissions from fluidized catalytic cracking units and carbon monoxide boilers include New Source Performance Standards (NSPS) Subparts J and Ja, and National Emissions Standards for Hazardous Air Pollutants (NESHAP) Subpart UUU. New Source Performance Standards Subpart J contains a particulate matter emission limit of 1.0 kilograms of filterable particulate matter per megagram (kg/Mg) (2.0 lb/ton) of coke burnoff in the catalyst regenerator and an opacity limit of 30 percent. New Source Performance Standards Subpart Ja has a particulate matter emission limit of 1.0 g/kg of coke burnoff for fluidized catalytic cracking units reconstructed or modified after May 14, 2007, and a limit of 0.5 g/kg of coke burnoff for fluidized catalytic cracking units newly constructed after May 14, 2007. The National Emissions Standards for Hazardous Air Pollutants Subpart UUU includes various particulate matter emission limit options for compliance.

Note that these existing federal particulate matter limits are based on methods for monitoring and measuring filterable particulate matter only. The federal rules do not contain limits for condensable particulate matter or ammonia slip; however, federal New Source Performance Standards Subpart J contains sulfur dioxide emission limits of 9.8 kg/Mg (20 lb/ton) of coke burnoff, and 50 parts per million by volume (ppmv) sulfur dioxide for a fluidized catalytic cracking unit with an add-on control device. New Source Performance Standards Subpart Ja contains sulfur dioxide emission limits of 50 ppmv on a seven-day rolling average basis and 25 ppmv on a 365-day rolling average basis for fluidized catalytic cracking units constructed, reconstructed, or modified after May 14, 2007.

III. TECHNICAL REVIEW

A. Particulate Matter

Particulate matter (PM) is a diverse mixture of suspended particles and liquid droplets, also known as aerosols. Particulate matter varies in terms of size, physical state, chemical composition, and toxicity. Particulate matter emissions can originate from anthropogenic stationary and mobile sources, as well as from natural sources. Particulate matter may consist of elements such as carbon and metals; compounds such as nitrates, organics, and sulfates; and complex mixtures such as diesel exhaust, wood smoke, and soil. Unlike other criteria pollutants which are individual chemical compounds, particulate matter includes all particles that are suspended in the air.

Particulate matter is often characterized and differentiated based on particle size using the following categories:

- **Total Suspended Particulate (TSP)**: Any airborne particulate matter.
- **PM_{10}**: Particulate matter with an aerodynamic diameter equal to 10 microns or less.
- **$PM_{2.5}$**: Particulate matter with an aerodynamic diameter equal to 2.5 microns or less.
- **Ultrafine Particulate Matter**: Particles smaller than 0.1 micron in diameter.

In addition to size ranges, particulate matter is also classified based on how the particles are formed and emitted. Particulate matter can be categorized as "primary" or "secondary" particulate matter. Primary particulate matter refers to particles that are directly emitted in solid or aerosol form, whereas secondary particulate matter refers to particles that are formed in the atmosphere through chemical reactions.

Primary particulate matter includes soot and liquid aerosols from a wide variety of sources, including cars, trucks, buses, industrial facilities, power plants, cooking, and burning wood, as well as dust from construction sites and other ground disturbing operations. Primary particulate matter can be further classified as filterable particulate matter or condensable particulate matter. Filterable particulate matter describes material that is a liquid or solid at the emission point and is released to the atmosphere. Condensable particulate matter describes material that is a gas at the emission point, but immediately condenses to a liquid or solid form when it exits the stack and is exposed to cooler ambient air. This material exists as a gas at the high temperatures that are typically found at stack conditions. As the hot gases leave the stack and are exposed to ambient air, the gas stream is cooled and diluted, and the gaseous compounds are transformed to a liquid or solid state through condensation, nucleation[4], and coagulation processes. The formation of condensable particulate matter can vary based on specific characteristics of the gas stream, such as chemical composition, water vapor concentration, and temperature. Gaseous components such as nitrogen oxides, sulfur oxides, ammonia, and organic compounds can contribute to the formation of condensable particulate matter compounds, including sulfates, nitrates, and organic particles.

Secondary particulate matter may be formed in the atmosphere by gaseous precursors undergoing chemical reactions and physical transformations. In contrast to primary condensable particulate matter, secondary particulate matter can often require minutes, hours, or days to form in the atmosphere. Secondary particulate matter can consist of organic and inorganic compounds that are formed through physical transformations and chemical reactions between precursor gases, including nitrogen oxides, sulfur oxides, ammonia, and organic compounds, that are emitted from various sources.

Even though primary and secondary particulate matter are defined in terms of the processes and sources that produce particulate matter, most individual particles in the atmosphere are in fact a combination of both primary and secondary particulate matter. An individual particle typically begins as a core or nucleus of solid or liquid material, such as carbonaceous material originating from fossil fuels or biomass combustion or geologic dust. Layers of organic and inorganic compounds then condense or deposit onto the particle, causing it to grow in size. These layers are largely comprised of secondary material that is not emitted directly.

1. Health Impacts of Particulate Matter

Since exposure to ambient particulate matter has long been understood as a health hazard,[5] particulate matter was designated as one of the criteria pollutants in the original 1970 federal Clean Air Act. Concerns about particulate matter were initially based on its respiratory health effects, such as aggravating asthma, bronchitis, and emphysema. However, in recent years, many epidemiological studies have linked particulate matter exposure to a much wider range of negative health effects, including cardiovascular effects such as atherosclerosis (hardening of the arteries), ischemic strokes (caused by obstruction of the blood supply to the brain), and heart attacks. Studies also indicate that exposure to particulate matter may be related to other health effects, including reduction in cognitive function, autism, and increased risk of diabetes. Infants and children, the elderly, and persons with heart and lung disease are most sensitive to the effects of particulate matter. Increased $PM_{2.5}$ exposure is also associated with increased risk of severe outcomes from infectious respiratory diseases; a recent study has found that a small increase in long-term exposure to $PM_{2.5}$ can lead to a large increase in the death rate from Coronavirus Disease 2019 (COVID-19).[6]

Analysis by Air District staff found that $PM_{2.5}$ is the most significant air pollution health hazard in the Bay Area, particularly in terms of premature mortality.[7] A large and growing body of scientific evidence indicates that both short-term and long-term exposure to fine particles can cause a wide

[4] Nucleation is the initial process that occurs in the formation of a crystal from a solution, a liquid, or a vapor, in which a small number of ions, atoms, or molecules become arranged in a pattern characteristic of a crystalline solid, forming a site upon which additional particles are deposited as the crystal grows.

[5] The London fogs of the early 1950s that killed thousands of people were primarily caused by particulate matter from coal, which led to the banning of coal burning within the city.

[6] Wu, Xiao et al., 2020. Exposure to air pollution and COVID-19 mortality in the United States. medRxiv 2020.04.05.20054502; doi: https://doi.org/10.1101/2020.04.05.20054502.

[7] BAAQMD, 2017. Final 2017 Clean Air Plan: Spare the Air – Cool the Climate. April.

range of health effects, and studies have concluded that reducing particulate matter emissions can reduce mortality and increase average life span.[8] Although the epidemiological evidence that shows strong correlation between elevated particulate matter levels and public health effects is very well documented, scientists are still working to understand the precise biological mechanisms through which particulate matter damages our health. Research studies have indicated a number of different potential mechanisms through which particulate matter can harm human health, including increases in blood pressure, blood vessel damage, tissue damage from oxidative stress, and DNA damage.[9,10]

The Air District continues to study and evaluate health impacts associated with particulate matter exposure. The Air District developed a multi-pollutant evaluation method (MPEM) to analyze the benefits of control measures and strategies, such as the 2017 Clean Air Plan.[11] In 2019, the Air District, at the request of its Advisory Council, also began convening a series of symposia on particulate matter and its health effects. The Advisory Council concluded that current ambient air quality standards for particulate matter are not adequately health protective, and that further particulate matter reductions would realize additional health benefits.[12]

B. Particulate Matter Emissions from Fluidized Catalytic Cracking Units

As described previously, the fluidized catalytic cracking unit regeneration process generates particulate matter emissions through the combustion process and through the loss of catalyst fines. In addition, other pollutants in the regenerator flue gas, including sulfur dioxide, oxides of nitrogen, and ammonia, can contribute to the formation of condensable particulate matter. When released from the stack, these condensable components can form various particles, including ammonium nitrates and ammonium sulfates. As the formation of condensable particulate matter is complex, condensable particulate matter emission estimates can be informed by a variety of data, including source process parameters, source testing, and monitoring of condensable particulate matter components. Air District estimates of particulate matter emissions, including both filterable and condensable particulate matter, from fluidized catalytic cracking units in the San Francisco Bay Area for calendar year 2018 are shown in Table 1. The Air District continues to study these emissions and may update or refine estimates as staff gathers additional information.

[8] EPA, 2018. Integrated Science Assessment for Particulate Matter. October.
[9] BAAQMD, 2017. Final 2017 Clean Air Plan: Spare the Air – Cool the Climate. April.
[10] BAAQMD, 2012. Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area. November.
[11] BAAQMD, 2017. Final 2017 Clean Air Plan: Spare the Air – Cool the Climate. April.
[12] BAAQMD, 2019. Particulate Matter: Spotlight on Health Protection – Symposium Summary: Health Effects and Exposures and Risk. October.

Table 1 – Particulate Matter Emissions from Petroleum Refinery Fluidized Catalytic Cracking Units by Facility

Facility	FCCU Fresh Feed Capacity (barrels per day)[13]	PM_{10} (tons per year)	$PM_{2.5}$ (tons per year)
Chevron Products Richmond[a]	80,000	245	229
Marathon Martinez Refinery[b]	70,000	190	190
PBF Martinez Refinery[a]	67,400	309	300
Valero Benicia Refinery[c]	72,000	83	83
Total	**289,400**	**827**	**802**

[a] Emissions based on reported 2018 facility emissions inventory for filterable and condensable PM.
[b] Reported 2018 facility emissions inventory did not include condensable PM. Emissions shown here are based on average 2020 source test emission rate data for filterable and condensable PM. $PM_{2.5}$ emissions were assumed to be equal to PM_{10} emissions.
[c] Reported 2018 facility emissions inventory did not include condensable PM. Emissions shown here are based on average 2016-2018 source test emission rates data for filterable and condensable PM at flue gas scrubber stack, which includes combined emissions from Valero's fluidized catalytic cracking unit and coker unit. $PM_{2.5}$ emissions were assumed to be equal to PM_{10} emissions.

C. Emission Control Methods for Particulate Matter from Fluidized Catalytic Cracking Units

As discussed previously, flue gas components such as sulfur dioxide, oxides of nitrogen, and ammonia can contribute to condensable particulate matter formation from fluidized catalytic cracking units. Therefore, many control strategies are available to reduce potential condensable particulate matter formation through the control of these condensable components.

1. Reduction of Ammonia Injection and Ammonia Slip

Ammonia is commonly used as a conditioning agent to alter the resistivity and cohesiveness of particles in the gas stream, which can improve the effectiveness of electrostatic precipitators (ESP) in capturing catalyst fines. Excess ammonia that is not consumed in this process can remain in the fluidized catalytic cracking unit flue gas stream (as ammonia slip) and can lead to the formation of condensable particulate matter. Therefore, reducing ammonia injection and ammonia slip can reduce emissions of condensable particulate matter. Potential strategies for achieving these reductions include the optimization of ammonia injection, the use of alternative non-ammonia conditioning agents, and improved removal of particulate matter through electrostatic precipitators or wet gas scrubbing, which may reduce or eliminate the need for ammonia injection. Some of these control strategies may also be used in combination to effectively reduce emissions of condensable particulate matter.

c) Optimization of Ammonia Injection

The use of ammonia in existing abatement systems can be optimized to minimize the amount of ammonia injection and ammonia slip emissions. Optimization of ammonia injection can be achieved through proper process controls, data collection and monitoring, controls for injection timing, and regular maintenance and servicing of abatement equipment. The efficacy of ammonia optimization may be constrained by the capabilities and design of existing abatement equipment, which may vary widely between individual sources. Costs of ammonia optimization may include

[13] U.S. Energy Information Administration, 2019. Refinery capacity data by individual refinery as of January 1, 2019. https://www.eia.gov/petroleum/data.php.

one-time optimization costs and additional ammonia and process monitoring systems, however reductions in ammonia use could result in long-term cost savings.

d) Use of Alternative Conditioning Agents

Ammonia and ammonia-based compounds (such as urea) are commonly used conditioning agents for improved removal of fluidized catalytic cracking unit catalyst fines at electrostatic precipitators. The use of non-ammonia-based compounds for flue gas conditioning could reduce or eliminate ammonia injection and associated ammonia slip emissions. Non-ammonia based conditioning agents used in other industrial applications include sulfur trioxide, sodium compounds, potassium sulfate, and steam injection. Proprietary chemicals have also been developed for flue gas conditioning in power and electricity generation applications. Costs of alternative conditioning agents are anticipated to be comparable to ammonia injection, although some cost differences between specific injection systems and chemicals would be expected. Limited information exists on the feasibility of alternative conditioning agents in refinery fluidized catalytic cracking unit applications.

e) Electrostatic Precipitator

An electrostatic precipitator (ESP) is a control device designed to remove particulate matter from an exhaust gas stream by using electrical energy. The main components of the electrostatic precipitator include discharge electrodes, collection plates, and a plate cleaning system. Particulate matter is removed from the gas stream through a series of steps inside the electrostatic precipitator: 1) a power supply energizes the discharge electrodes to establish an electric field; 2) the gas stream and particles are ionized and charged as they pass through the electric field; 3) the charged particles migrate out of the gas stream and towards collection plates, which are oppositely charged; and 4) the particles collected on the plates are removed for disposal. The removal of particles from the collection plates can be accomplished using different systems. In a dry electrostatic precipitator system, rapping systems are used to vibrate the collection plates and remove the collected particles. In a wet electrostatic precipitator system, particles are removed from the collection plates by rinsing the plates with water.

Ammonia is often injected into flue gas streams to improve the collection efficiency of the electrostatic precipitators, however excess ammonia in the flue gas stream can contribute to condensable particulate matter formation. An electrostatic precipitator system with sufficient collection efficiency and capacity may be able to reduce or eliminate the need for ammonia injection, therefore limiting the amount of potential condensable particulate matter formation. The collection efficiency of an electrostatic precipitator system can be improved by rebuilding the system with additional capacity or by adding additional cells to increase residence time and collection surface area. In addition, advancements in electrostatic precipitator technologies can increase performance of existing systems, especially as these units and components age and degrade. Potential upgrades and replacements include rapping system upgrades, electrode upgrades, and power supply system upgrades. Rapping system upgrades (including rapping scheme optimization and enhanced control systems) can improve plate cleaning, which increases collection area and decreases re-entrainment of particles. Electrode upgrades (including electrode replacement, electrode spacing/configuration upgrades, and use of rigid discharge electrodes) can increase overall collection efficiency. Power supply system upgrades (including high frequency power supplies, switch-mode power supplies, and three-phase power supplies) can deliver higher and more consistent voltage to increase particulate matter collection.

For treatment of high-volume flue gas streams, installations of electrostatic precipitators typically require a large amount of space, although advancements in precipitator design and technology can reduce the size and space needed. Costs of new and expanded electrostatic precipitators can vary based on the specific installation, design, capacity, and other constraints. Cost data and estimates reported by the US Environmental Protection Agency (EPA) and South Coast Air Quality Management District (South Coast AQMD) on capital costs for a new electrostatic precipitator and electrostatic precipitator expansions for fluidized catalytic cracking units range widely. Most estimates and reported capital costs data ranged from $10 million dollars to $80 million dollars, although costs for some facilities were reported to be substantially higher; one facility in South Coast AQMD reported total capital costs of $340 million dollars.[14,15,16] Costs for component replacements and upgrades to existing electrostatic precipitator systems would be anticipated to be much lower than the costs of a new electrostatic precipitator or electrostatic precipitator expansion.

Potential hazards associated with electrostatic precipitators include risks for fire or explosion, which can occur if flammable hydrocarbons enter the unit and mix with oxygen in the presence of an ignition source. One such incident occurred in February 2015 at the ExxonMobil Refinery located in Torrance, California, in which the U.S. Chemical Safety and Hazard Investigation Board found that an explosion at the refinery's electrostatic precipitator occurred due to weaknesses in the refinery's process safety management system.[17] Standard industry practices and vendor safety recommendations, including frequent inspection and maintenance, air filter cleaning, use of hydrocarbon sensors, and electronic controls for process automation can reduce risks from operation of electrostatic precipitators.

f) Wet Gas Scrubbing

Wet gas scrubbing is a process that is used to remove liquid or solid particles from a gas stream. The process removes these particles by transferring them to a liquid, which is typically water or a reagent solution. In a typical wet gas scrubbing system, the scrubbing liquid is sprayed into the spray tower, and the flue gas stream enters at the bottom of the tower and flows upwards through the scrubbing liquid. As the gas stream passes through the scrubbing liquid, particles from the stream are collected as they impact the liquid droplets. Some wet gas scrubbing systems are also designed to capture gaseous pollutants that can be absorbed into the scrubbing liquid. The scrubbing liquid is then collected by mist eliminators or separators for treatment and discharge, or for regeneration and further use. Various types of scrubbers exist with different features, such as tower design, spray operations, energy usage level, and liquid collection and regeneration systems. In addition to capturing filterable particulate matter, the wet gas scrubbing process can also remove condensable components, such as ammonia, as well as reduce or eliminate the need for ammonia injection altogether.

Because the wet gas scrubbing process uses water or reagent solutions, these systems often require high volumes of water consumption. As the scrubbing liquid is passed through the scrubber, water is evaporated due to the high temperature of the flue gas stream. Spent scrubbing liquid that contains the captured pollutants also needs to be routed for treatment and discharge. Additional makeup water is therefore required to maintain continued wet gas scrubbing

[14] EPA, 2008. Regulatory Impact Analysis of the Petroleum Refinery (EPA-452/R-08-002). April.
[15] South Coast AQMD, 2003. Final Staff Report for Proposed Rule 1105.1. September.
[16] South Coast AQMD, 2010. Final Staff Report SOx RECLAIM, Part 1: BARCT Assessment & RTC Reductions Analysis. November.
[17] U.S. Chemical Safety and Hazard Investigation Board, 2017. Investigation Report – ExxonMobil Torrance Refinery Electrostatic Precipitator Explosion, Torrance, California. No. 2015-02-I-CA. May.

operations. Estimated water demand for installations of wet gas scrubbers for fluidized catalytic cracking units in California range from 120,000 to 430,000 gallons per day.[18,19]

Costs of new wet gas scrubbing systems can vary based on specific design and site constraints, as well as additional equipment or infrastructure required for operation. Cost data and estimates reported by the US Environmental Protection Agency and South Coast AQMD on capital costs for wet gas scrubbing systems for fluidized catalytic cracking units range from $20 million dollars to $100 million dollars.[20,21,22] Costs for the installation of a wet gas scrubbing equipment train at the Valero Benicia Refinery in 2010 was estimated at $750 million dollars;[23] the installation of the wet gas scrubbing equipment train at this facility also involved the replacement of existing furnaces and treatment of emissions from both the fluidized catalytic cracking unit and the coker unit.

2. Reduction of Sulfur Dioxide Emissions

As discussed previously, sulfur dioxide emissions generated through the fluidized catalytic cracking unit catalyst regeneration process can also lead to the formation of condensable particulate matter. Potential strategies for achieving reductions of sulfur dioxide and condensable particulate matter include the use and optimization of sulfur dioxide-reduction additives, feed hydrotreating, and removal of sulfur dioxide and particulate matter through wet gas scrubbing. Some of these control strategies may be used in combination to effectively reduce emissions of condensable particulate matter.

g) Optimization of Sulfur Dioxide-Reducing Additives

Sulfur dioxide-reducing additives are used to remove sulfur oxides from fluidized catalytic cracking unit regenerator flue gas. These additives typically consist of a metal oxide agent, such as a magnesium-based agent, and may contain other catalytic components. The sulfur dioxide removal process occurs through a multi-step mechanism. Sulfur dioxide is formed in the regenerator as coke is burned off the spent catalyst, and a portion of the sulfur dioxide is converted to sulfur trioxide (SO_3) in the presence of excess oxygen. The metal oxide agent chemically bonds with the sulfur trioxide to form a metal sulfate, which recirculates back to the reactor and reacts with hydrogen to form a metal oxide or a metal sulfide and water. The metal sulfide further reacts with steam to form a metal oxide and hydrogen sulfide. The hydrogen sulfide generated is routed for further treatment and sulfur recovery.

Optimized use of these additives can reduce sulfur dioxide emissions that contribute to condensable particulate matter formation. In addition, advancements in additive technology and process controls may present additional potential for emissions reductions. Costs for optimizing sulfur dioxide-reducing additives may include one-time optimization costs and additional process monitoring and additive handling systems. Costs data and estimates from EPA, South Coast AQMD, and industry literature for annual usage of additives are less than $3 million dollars per

[18] City of Benicia, 2008. Valero Improvement Project – Addendum to VIP EIR, SCH No. 2002042122. June.
[19] South Coast AQMD, 2007. Final EIR for ConocoPhillips Los Angeles Refinery PM_{10} and NOx Reduction Project, SCH No. 2006111138. June.
[20] EPA, 2008. Regulatory Impact Analysis of the Petroleum Refinery (EPA-452/R-08-002). April.
[21] South Coast AQMD, 2003. Final Staff Report for Proposed Rule 1105.1. September.
[22] South Coast AQMD, 2010. Final Staff Report SOx RECLAIM, Part 1: BARCT Assessment & RTC Reductions Analysis. November.
[23] Valero Benicia Refinery, 2012. Valero Improvement Project (VIP) Construction Report for the period ending June 30, 2012. August.

year.[24,25,26,27] Costs of different additives are anticipated to be comparable to existing additives, although optimized use of advanced additives may present some long-term cost savings from increased efficiency and reduced additive usage.

h) Feed Hydrotreating

Removal of sulfur compounds in feed material prior to introduction to the fluidized catalytic cracking unit can reduce the amount of sulfur dioxide that is eventually generated through the fluidized catalytic cracking unit process. Refineries remove sulfur and other undesirable compounds from hydrocarbon feedstocks through feed hydrotreating. In the hydrotreatment process (also referred to as hydro-desulfurization), hydrogen is added to a feedstock stream over a bed of catalyst typically containing molybdenum with nickel or cobalt. Sulfur compounds in the feed react with hydrogen to form hydrogen sulfide (H_2S), which is then removed from the stream through an amine treatment system and routed to a sulfur recovery unit.

All refineries employ some form of feed hydrotreating, but additional treating or more severe hydrotreatment can further reduce sulfur content in the feed. The feasibility and costs of upgrades to existing hydrotreating systems can vary widely based on site-specific and operational considerations. These factors can include the condition, design, and capacity of the existing system, as well as the extent of upgrades being implemented.

i) Wet Gas Scrubbing

Wet gas scrubbing is described above in Section II.C.1. For wet gas scrubbing systems that are designed to control sulfur dioxide, an alkaline reagent, such as caustic soda (NaOH), soda ash, or lime, is typically added to the scrubbing liquid. These reagents are used to drive sulfur dioxide absorption into the scrubbing liquid. As described previously, spent scrubbing liquid that contains the captured pollutants is then routed for treatment and discharge, or regenerated for further use.

IV. DRAFT RULE AMENDMENTS

The purpose of the draft amendments to Rule 6-5 is to further address particulate matter emissions, including condensable particulate matter emissions, from fluidized catalytic cracking units and associated carbon monoxide boilers. Air District staff reviewed and considered a variety of information in the development of the draft amendments, including existing regulations, industry and academic literature, stakeholder input, emissions and compliance data, and information on control and monitoring technologies. The draft amendments include new and modified limits on ammonia and sulfur dioxide, as well as a direct limit on total PM_{10}, which includes both filterable and condensable particulate matter. The draft new and modified limits on ammonia and sulfur dioxide reflect levels of stringency that have been widely achieved at multiple facilities. Control of these pollutants has been historically demonstrated and implemented through various federal, state, and regional regulatory programs, and the reduction of these condensable gaseous components has been shown to reduce the formation of condensable particulate matter. The draft amendments also include a new limit on total PM_{10} emissions, which include both filterable and condensable particulate matter. This direct limit on total PM_{10} would ensure that both filterable and condensable particulate matter emissions are adequately controlled, and that abatement

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[24] EPA, 2008. Regulatory Impact Analysis of the Petroleum Refinery (EPA-452/R-08-002). April.
[25] South Coast AQMD, 2003. Final Staff Report for Proposed Rule 1105.1. September.
[26] South Coast AQMD, 2010. Final Staff Report SOx RECLAIM, Part 1: BARCT Assessment & RTC Reductions Analysis. November.
[27] Evans, Martin (Intercat/Johnson Matthey), 2008. Evaluating FCC flue gas emission-control technologies. Digital Refining, 2008 Q1.

systems are optimized to reduce overall total particulate matter emissions. The draft amendments also include modifications to existing rule language to clarify provisions and improve monitoring requirements.

A. Purpose

Amendments to Rule 6-5 are being developed to further reduce emissions of total particulate matter, including condensable particulate matter. The draft amendments contain requirements to control total particulate matter and reduce flue gas components and pollutants that contribute to condensable particulate matter formation. The draft amendments also contain testing and monitoring requirements to determine compliance with emission limits and provide further information on condensable particulate matter emissions and control performance.

B. Applicability

Draft amendments to Rule 6-5 would apply to fluidized catalytic cracking units and associated carbon monoxide boilers at Bay Area petroleum refineries. Four of the five petroleum refineries in the San Francisco Bay Area operate fluidized catalytic cracking units.

C. Exemptions

Section 6-5-111 – Limited Exemption, Emissions Abated by Wet Scrubber: The draft amendments to Rule 6-5 modify the exemption under Section 6-5-111 regarding emissions abated by wet scrubber. Under the currently adopted Rule 6-5, emissions abated by a wet gas scrubber are not subject to any requirements of the rule. Because the draft amendments include new requirements (described in the sections below), Section 6-5-111 is changed to a limited exemption to clarify that emissions abated by a wet scrubber are only exempt from the requirements related to ammonia limits in Section 6-5-301.1. Emissions abated by a wet scrubber would be subject to the additional limits and requirements included in these draft amendments.

Section 6-5-112 – Limited Exemption, Emissions during Startup or Shutdown Periods: The draft amendments to Rule 6-5 clarify the limited exemption under Section 6-5-112 for emissions during startup and shutdown periods. The amendments clarify that the exemption for these periods are only applicable to the short-term daily ammonia limit in Section 6-5-301.1 and short-term 7-day rolling average limit for sulfur dioxide in Section 6-5-301.2.2. Long-term limits in Section 6-5-301 would continue to apply.

Section 6-5-115 – Limited Exemption, Ammonia Optimization: The draft amendments also modify the limited exemption under Section 6-5-115 regarding ammonia optimization. Under the currently adopted Rule 6-5, owners/operators that implement an optimization of ammonia and/or urea injection are exempt from the ammonia emission limit in Section 6-5-301.1. Under the draft amendments, all sources previously exempt under Section 6-5-115 would be subject to the ammonia emission limit in Section 6-5-301.1 effective January 1, 2023.

D. Definitions

Section 6-5-207 – Fluidized Catalytic Cracking Unit (FCCU): The draft amendments clarify language regarding the applicability of the rule requirements to commingled emissions from a fluidized catalytic cracking unit and other sources. For the purposes of this rule, commingled emissions are considered fluidized catalytic cracking unit emissions. This is stated in the current rule under Section 6-5-101; the draft amendments include this language in the fluidized catalytic cracking unit definition for further clarity.

Section 6-5-212 – Total Particulate Matter 10 Microns or Less in Diameter (Total PM_{10}): For the purposes of this rule, the draft amendments to Rule 6-5 define total particulate matter 10 microns or less in diameter (total PM_{10}) in Section 6-5-212 as material emitted to the atmosphere as filterable particulate matter or condensable particulate matter less than 10 microns in diameter. Condensable particulate matter is currently defined in the rule under Section 6-5-203.

Section 6-5-213 – Total Particulate Matter 2.5 Microns or Less in Diameter (Total $PM_{2.5}$): For the purposes of this rule, the draft amendments to Rule 6-5 define total particulate matter 2.5 microns or less in diameter (total $PM_{2.5}$) in Section 6-5-213 as material emitted to the atmosphere as filterable particulate matter or condensable particulate matter less than 2.5 microns in diameter. Condensable particulate matter is currently defined in the rule under Section 6-5-203.

E. Standards

Section 6-5-301 – Fluidized Catalytic Cracking Unit (FCCU) Emission Limits: The draft amendments to Rule 6-5 establish and modify fluidized catalytic cracking unit emission standards for ammonia slip, sulfur dioxide, and total particulate matter.

Section 6-5-301.1: Under the draft amendments, the ammonia emission limit of 10 parts per million by volume, dry basis (ppmvd) corrected to 3 percent oxygen on a daily average remains unchanged from the currently adopted rule. As described above in the “Exemptions” section, the draft amendments modify the limited exemption under Section 6-5-115 such that sources previously exempt from the ammonia emission limit in Section 6-5-301.1 would be subject to this limit effective January 1, 2023. The ammonia limit of 10 ppmvd is equivalent to the ammonia limit for fluidized catalytic cracking units adopted by South Coast AQMD in their South Coast AQMD Rule 1105.1, which has been achieved by multiple refineries with electrostatic precipitators or wet gas scrubbers.

Sections 6-5-301.2.1 and 301.2.2: The draft amendments include a new sulfur dioxide limit of 50 ppmvd corrected to zero (0) percent oxygen on a seven-day rolling average basis, and 25 ppmvd corrected to 0 percent oxygen on a 365-day rolling average basis. These limits are equivalent to the sulfur dioxide limits in federal New Source Performance Standards Subpart Ja, which are required for fluidized catalytic cracking units constructed, reconstructed, or modified after May 14, 2007. These sulfur dioxide emission levels have been achieved at multiple refineries throughout California and the US through the implementation of sulfur dioxide-reducing additives and/or wet gas scrubbers.

Section 6-5-301.3: The draft amendments include a new limit for total PM_{10}, which includes both filterable PM_{10} and condensable particulate matter. The draft amendments require an owner/operator of a fluidized catalytic cracking unit to comply with a total PM_{10} limit of 0.020 grains per dry standard cubic foot (gr/dscf) on a rolling four-quarter average basis. The total PM_{10} limit in the draft amendments is based on the Air District’s review of source test data from fluidized catalytic cracking units at refineries throughout California and the US. Emissions performance at these existing facilities varied, with measured total PM_{10} levels ranging from 0.008 to 0.034

gr/dscf.[28,29] The draft total PM_{10} limit of 0.020 gr/dscf represents an achievable level of control that has been demonstrated to be feasible at multiple facilities through the use of various control technologies, including electrostatic precipitators and wet gas scrubbers.

Under the draft amendments, compliance with the total PM_{10} limits would be determined based on the rolling four-quarter average calculated as the time-weighted average of source tests (which must be performed on at least a quarterly basis). Other emission monitoring systems approved by the APCO would also be allowed for monitoring and compliance demonstration with the total PM_{10} limit.

F. Administrative Requirements

Section 6-5-403 – Ammonia Optimization: The draft amendments include clarifications to the ammonia optimization requirements in Section 6-5-403 to align this section with the provisions of the draft amendments in Section 6-5-115.1.

Section 6-5-404 – Reporting Requirements: Draft Section 6-5-505 requires monthly reporting of monitoring data collected pursuant to Sections 6-5-501, as well as quarterly reporting of source test results and data collected pursuant to Section 6-5-503.

G. Monitoring and Records

The owner/operator of any source subject to the emission limits in Section 6-5-301 must monitor and record all parameters necessary to demonstrate compliance with the respective provisions of the applicable standards set forth in Rule 6-5.

Section 6-5-501 – Ammonia Monitoring: For fluidized catalytic cracking units subject to the ammonia emission limit in 6-5-301.1, ammonia monitoring requirements in Section 6-5-501 remain unchanged from the currently adopted rule.

Section 6-5-502 – Sulfur Dioxide Monitoring: Under draft Section 6-5-502, refineries subject to the draft sulfur dioxide limits in Section 6-5-301.2 are required to comply with the continuous emission monitoring requirements of District Regulation 1, Sections 520 and 522.

Section 6-5-503 – Total PM_{10} and Total $PM_{2.5}$ Monitoring: Under draft Section 6-5-503, refineries subject to the total PM_{10} limit in Section 6-5-301.3 are required to implement a source testing protocol or other total PM_{10} and total $PM_{2.5}$ emission monitoring system approved by the APCO. The source testing protocol must include at least one source test each calendar quarter for total PM_{10} and total $PM_{2.5}$ emissions in accordance with Sections 6-5-604 and 6-5-605.

Section 6-5-504 – Records: Draft amendments to Section 6-5-504 extend the current recordkeeping requirements to include all monitoring records required under Sections 6-5-501, 502, and 503. Section 6-5-504 has also been renumbered accordingly.

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[28] EPA, 2016. Comprehensive Data Collected from the Petroleum Refining Sector – Petroleum Information Collection Request for Petroleum Refinery Sector New Source Performance Standards and National Emissions Standards for Hazardous Air Pollutants Risk and Technology. July. https://www.epa.gov/stationary-sources-air-pollution/comprehensive-data-collected-petroleum-refining-sector.

[29] EPA, 2015. Compilation of Air Pollutant Emissions Factors (AP-42), Fifth Edition, Volume I, Chapter 5: Petroleum Industry, 5.1 Petroleum Refining. April.

H. Manual of Procedures

Section 6-5-601 – Compliance Determination: Draft amendments to Section 6-5-601 include additional provisions regarding the performance of source tests for compliance. Under the draft amendments, source tests must meet the requirements set forth in the District Manual of Procedures, Volume IV, Source Test Policy and Procedures. Draft amendments to Section 6-5-601 also include clarifications to align this section with the draft amendments in Section 6-5-112 pertaining to emissions during startup and shutdown periods. The amendments clarify that the exemption for these periods are only applicable to the short-term daily ammonia limit in Section 6-5-301.1 and short-term seven-day rolling average limit for sulfur dioxide in Section 6-5-301.2.2.

Section 6-5-602 – Determination of Ammonia and Oxygen: Draft amendments to Section 6-5-602 specify additional requirements for APCO approved ammonia monitoring systems. Under the draft amendments, ammonia monitoring systems must meet the requirements of US Environmental Protection Agency Performance Specification 18.[30] Although US Environmental Protection Agency Performance Specification 18 was not specifically developed for use with ammonia monitoring systems, Air District staff has consulted with US Environmental Protection Agency staff and determined this specification to be appropriate for these monitoring systems. The US Environmental Protection Agency strongly encourages that operators of ammonia monitoring systems consider the use of Performance Specification 18.[31] The draft amendments also clarify that compliance with the ammonia limits in Section 6-5-301.1 shall be determined by the monitoring systems installed pursuant to Section 6-5-501.

Section 6-5-603 – Determination of Sulfur Dioxide: Draft Section 6-5-603 states that compliance with the sulfur dioxide limits in Section 6-5-301.2 shall be determined by monitoring systems that meet the requirements of District Regulation 1, Section 522.

Section 6-5-604 – Determination of Total Particulate Matter 10 Microns or Less in Diameter (Total PM_{10}): Draft Section 6-5-604 states that total PM_{10} shall be determined by the summation of filterable PM_{10} as measured by US Environmental Protection Agency Test Method 201A and condensable particulate matter as measured by US Environmental Protection Agency Test Method 202. Compliance with the total PM_{10} limit in Section 6-5-301.3 shall be determined by the time-weighted average of all source tests conducted in the preceding four calendar quarters.

Section 6-5-605 – Determination of Total Particulate Matter 2.5 Microns or Less in Diameter (Total $PM_{2.5}$): Draft Section 6-5-605 states that total $PM_{2.5}$ shall be determined by the summation of filterable $PM_{2.5}$ as measured by US Environmental Protection Agency Test Method 201A and condensable particulate matter as measured by US Environmental Protection Agency Test Method 202.

I. Potential Emissions Reductions

Based on staff's understanding of fluidized catalytic cracking units emissions and performance at the Bay Area petroleum refineries, staff anticipates that fluidized catalytic cracking units at Marathon Martinez Refinery and Valero Benicia Refinery would be able to comply with the draft emission limits without substantial modifications. Therefore, potential emission reductions at these facilities would be minimal. Fluidized catalytic cracking units at Chevron Products Richmond

[30] EPA, 2019a. Performance Specification 18 – Performance Specifications and Test Procedures for Gaseous Hydrogen Chloride (HCl) Continuous Emission Monitoring Systems at Stationary Sources. January.
[31] EPA, 2019b. Air Emission Measurement Center (EMC) Other Test Methods. May. https://www.epa.gov/emc/emc-other-test-methods.

and PBF Martinez Refinery would not meet the draft emission limits, and staff anticipates that emission reductions would be required at these facilities to comply with the draft limits. Estimates of potential emission reductions associated with the draft emission limits are shown in Table 2. As described previously, the Air District continues to study these emissions and may update or refine emission reduction estimates as staff gathers additional information.

Table 2 – Estimates of Potential Particulate Matter Emission Reductions from Petroleum Refinery Fluidized Catalytic Cracking Units by Facility

Facility	Estimated PM_{10} Reductions (tons per year)
Chevron Products Richmond	80
Marathon Martinez Refinery[a]	–
PBF Martinez Refinery	170
Valero Benicia Refinery[a]	–
Total	**250**

[a] Fluidized catalytic cracking units at Marathon Martinez Refinery and Valero Benicia Refinery are anticipated to be able to comply with the draft limits without substantial changes, therefore no emissions reductions are estimated for these facilities.

V. RULE DEVELOPMENT / PUBLIC PARTICIPATION PROCESS

The Air District adopted the AB 617 Expedited Best Available Retrofit Control Technology (BARCT) Implementation Schedule in December 2018. As part of the schedule, staff identified potential efforts to develop amendments to Rule 6-5 that would address particulate matter, including condensable particulate matter components such as ammonia and sulfur dioxide. An update on the implementation of currently adopted refinery rules and rule development efforts on amendments to Rule 6-5 was presented at a Board of Directors Stationary Source Committee meeting in April 2019. In September and October 2019, staff convened meetings of the Air District's Refinery Rules Technical Working Group to engage with stakeholders on technical topics related to the rule development effort for amendments to Rule 6-5. Members of the technical working group, which include representatives from industry, community-based organizations, and regulatory agencies, provided input on control technologies and testing/monitoring methods related to fluidized catalytic cracking units and particulate matter control. Air District staff also conducted site visits to potentially affected refineries to better understand each fluidized catalytic cracking unit operation and site-specific considerations.

Air District staff has published the draft amendments to Rule 6-5 and Initial Staff Report for public review, and is soliciting comments on these materials. Staff will consider input received during the public comment period and further develop the rule amendments. As part of the rule development process, staff also evaluates potential environmental impacts as required by the California Environmental Quality Act (CEQA), Public Resources Code Section 21000 et seq. Potential environmental impacts related to projects under the AB 617 Expedited Best Available Retrofit Control Technology Implementation Schedule, including amendments to Rule 6-5, were previously analyzed in an Environmental Impact Report (EIR) certified by the Air District Board of Directors in December 2018. In evaluating potential environmental impacts related to the amendments to Rule 6-5, staff will assess the impacts addressed in the certified Environmental Impact Report, and determine if additional analysis of impacts from amendments to Rule 6-5 is required pursuant to the California Environmental Quality Act.

Staff will prepare final proposal and staff report, along with other supporting documents, for further review and comment prior to a Public Hearing. Staff anticipates presenting proposed rule amendments for consideration by the Air District Board of Directors at a Public Hearing in the fourth quarter of 2020.

VI. CONCLUSION / RECOMMENDATIONS

The Air District is developing amendments to Rule 6-5 to further address particulate matter emissions, including condensable particulate matter emissions, from petroleum refinery fluidized catalytic cracking units and associated carbon monoxide boilers. Fluidized catalytic cracking units are some of the largest individual sources of particulate matter emissions in the San Francisco Bay Area, and further reductions of particulate matter are needed to ensure progress towards attainment of the ambient air quality standards and reduce public health impacts from particulate matter exposure. The draft amendments are intended to ensure that Air District regulations are as health protective as possible and consider recent advances in the understanding and control of condensable particulate matter emissions. Air District staff has published the draft amendments to Rule 6-5 and Initial Staff Report for public review and encourages interested parties to submit comments for consideration. Air District staff will continue to further develop and evaluate the rule amendments in preparation of presenting final proposed rule amendments for consideration by the Air District Board of Directors.

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