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LATHAM & WATKINS LLP

April 30, 2021

Via E-mail

David Joe
Bay Area Air Quality Management District
375 Beale Street, Suite 600
San Francisco, CA 94105
Email: djoe@baaqmd.gov

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

Dear Mr. Joe:

On behalf of Chevron Products Company, a division of Chevron U.S.A. Inc. ("Chevron") and the Chevron Refinery, we appreciate the opportunity to submit these comments on the Bay Area Air Quality Management District ("BAAQMD" or the "District") Proposed Amendments to Regulation 6, Rule 5 ("Proposed Amendments") and accompanying Staff Report, released March 30, 2021.[1] These comments supplement comments previously submitted by Chevron.[2] In addition to these comments, Chevron fully supports the comments submitted by the Western States Petroleum Association ("WSPA").

Chevron has numerous material concerns with respect to the Proposed Amendments, most of which have been previously expressed in Chevron's prior comment letters and those of other industry stakeholders. In addition to providing written comments, Chevron also met with

[1] Given the complexity and potential implications of the Proposed Amendments, 30 days to provide input on Staff's latest proposal is far too short. In addition, much of the information that is needed to conduct a complete analysis of Staff's proposal has not been made available to the public. This information is identified in a California Public Records Act request that we submitted to the BAAQMD on April 16, 2021. As of April 29, 2021, Staff was unable to predict when it would be providing the requested public records. We have endeavored to provide meaningful input within the time permitted and based on the limited information available, but the rulemaking schedule should be adjusted to provide additional time for release of relevant records and public review and input.

[2] Chevron previously submitted comments on this rulemaking to BAAQMD on July 13, 2020, December 16, 2020, and March 1, 2021.

BAAQMD Staff to discuss the Proposed Amendments on November 19, 2019 and September 18, 2020, yet the recently released Staff Report and supporting Appendices fail to correct errors in the analyses that have been raised with Staff, and fail to provide the necessary technical support for this rulemaking. We look forward to working with Staff on their responses to these concerns.

In short, this rulemaking has been procedurally defective, technically inaccurate, and the potential benefits of the Proposed Amendments are overstated andon behalf of Chevron, we have retained three well-respected environmental consulting firms with experts in the fields of air quality modeling, health impacts analysis, refinery operations, and the environmental and socioeconomic impacts associated with the proposed control methods to review the limited information and analysis that has been made public.[3] The most salient findings of these experts are:

- The Staff Report significantly underestimates the costs of installing and operating the proposed control technologies; and

- The Staff Report significantly overstates the projected emission reductions and public health benefits associated with the Proposed Amendments.

The Proposed Amendments have been characterized by some as a choice between imposing potentially enterprise threatening costs on the affected refineries or threatening the health and well-being of residents in the surrounding communities. The findings identified above and more fully explained in **Attachment 1** and in the attached technical reports, show that to be a false narrative. They reveal that while the capital costs will indeed be exorbitant (even higher than the unprecedented costs identified by Staff), the public health benefits will be negligible.

We appreciate your attention to the issues addressed in this letter, and we look forward to discussing them further with you. If you have any questions, please do not hesitate to call me at (714) 755-8105 or email me at michael.carroll@lw.com.

Best regards,

Michael J. Carroll

Michael J. Carroll
of LATHAM & WATKINS LLP

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[3] Reports from Ramboll U.S. Consulting, Inc. and Yorke Engineering, LLC summarizing their findings are attached as **Exhibits A and B**, respectively. Analysis provided by ERM is reflected in Attachment 1.

Attachment 1

TABLE OF CONTENTS

I. THE EXISTING BASELINE EMISSIONS ARE OVERESTIMATED

A. The Staff Report Overestimates PM Emissions From FCCUs

To establish that a regulation is necessary, BAAQMD must provide support for two fundamental assertions. First, BAAQMD must accurately describe the baseline emissions that a rule is intended to address. And second, it must accurately account for the expected emissions reductions due to the rule. The Staff Report has failed to support either of these assertions.

The Staff Report asserts that the FCCUs are responsible for 825 tons of PM_{10} and 800 tons of $PM_{2.5}$ per year.[4] For Chevron's Refinery, the Staff Report claims 245 tons of PM_{10} and 229 tons of $PM_{2.5}$, based on a 2018 facility emissions inventory, which is actually based on testing results from 2016-2017. These five-year-old data are not an appropriate baseline for the reasons identified below.

First, BAAQMD is not using the most up to date emissions information available to it. BAAQMD sent Chevron a letter dated December 10, 2019[5] with the intent to perform PM testing at the FCCU as part of this Rule 6-5 rulemaking process. BAAQMD completed this testing at Chevron in March 2021, but has not included this testing in its analysis. Additionally, BAAQMD completed PM testing at the PBF facility in fall of 2020 and did not include data from that testing either. Instead, BAAQMD relies on five-year-old data that is no longer accurate, as described below. The District has not provided any rational reasoning for not using current and available emissions information, which it clearly has in its possession. Recent testing shows PM emissions at the Chevron Refinery FCCU have been reduced by ***106 tons/year or 43%*** of the reported 2018 emission inventory.

Second, the 2018 PM Chevron Refinery-wide emissions inventory included in the model are higher than what Chevron reported as part of Regulation 12-15, Petroleum Refining Emissions Tracking. It is unclear how the District adjusted emissions inventory data and why they are higher than what was reported to BAAQMD for that reporting year. The District provides no evidence to support its asserted data.

Third, the Staff Report includes PM emissions from sources beyond just the FCCU as noted in "Table 2.1.1: Stack parameters and $PM_{2.5}$ emissions for top 20 sources at Chevron" of the PM modeling report prepared by BAAQMD. Examples include PM from cogeneration and sulfur recovery, and all of these other sources of PM account for more than 50% of the Chevron Refinery's facility-wide PM per Table 2.1.1. To be clear, BAAQMD's proposed rulemaking for FCCUs must use data of emissions from FCCUs, not data from other PM sources irrelevant to this rulemaking.

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[4] Staff Report, at p. 20.

[5] This letter is attached as **Exhibit D.**

Fourth, the PM model includes emissions from the Chevron Refinery's old Hydrogen Plant, a plant that is no longer in operation. While BAAQMD removed some of the equipment associated with the old Hydrogen Plant, the model still includes the old plant's furnace F340 (Source 4158).

Finally, the PM model does not properly account for reductions from the Chevron Richmond Modernization Project. With respect to the Chevron Refinery alone, the Staff Report overestimates Refinery-wide PM emissions by 294 tons per year, or more than 52%. This point was brought to the District's attention in the February 4th Workshop:

> Q: Were the emissions changes from the Chevron modernization project included in modeling?
>
> A: The Air District used the most recent emissions that have been checked and finalized. Emissions changes since 2018 have not all been included. We think modernization projects will apply to sources other than FCCU, so will not affect the analyses of Scenarios A & B. We will check on latter point.

Despite this assurance that Staff would follow up and check if the modeling took the Modernization Project into account, Staff never reached out and, based on the information received from the District, it appears that Staff never updated the model before releasing the final Proposed Amendments. See Section II for additional deficiencies related to the modeling.

B. The Staff Report Fails to Provide Support for Assertion That FCCUs Make up 3 Percent of PM Emissions in Bay Area

The Staff Report asserts that FCCUs make up 3 percent of PM_{10} emissions in the Bay Area with no supporting evidence. BAAQMD must demonstrate that the Proposed Amendments are necessary. By including flawed and unsupported data that inflates the asserted impacts of FCCUs on PM_{10} in the Bay Area, the Staff Report overstates the benefits of the Proposed Amendments, undermines its analysis, and is lacking in any evidentiary support.

C. The Staff Report Includes Emissions From the Marathon Martinez Refinery in Its Inventory of PM Emissions

The Staff Report further inflates the baseline emissions by including emissions from the shuttered Marathon Martinez Refinery. By including emissions that are not occurring and will not occur in the foreseeable future, the Staff Report inappropriately inflates the total baseline emissions by almost 30%. Even if one accepts the Staff Report's other figures—which are also mistaken—the inclusion of a facility that is no longer operating and has no plans to operate again, is completely arbitrary and capricious. The record must include evidence that the Proposed Amendments are necessary. Including the Marathon emissions in the analysis when it

is clear those emissions are no longer occurring, and may never occur again, undercuts the District's analysis and renders the proposed rule unsupported by any substantial evidence.[6]

II. THE BAAQMD $PM_{2.5}$ MODELING HAS SIGNIFICANT TECHNICAL PROBLEMS THAT RENDER IT INACCURATE AND UNRELIABLE

The dispersion modeling performed by BAAQMD in support of the Proposed Amendments is flawed in numerous material respects. There are inaccuracies in the modeled emissions, the stack parameters, and the meteorological data used to determine whether and where ground-level impacts might occur. It is inappropriate to adopt the Proposed Amendments based on such flawed technical support, and the District must correct the modeling analyses, in order to have any substantial evidence supporting the rulemaking.

A. BAAQMD Modeled Facility-Wide Chevron Refinery Emissions That Are Outdated and Overestimated

The District modeled Chevron Refinery $PM_{2.5}$ emissions using a baseline emissions inventory from 2018. The modeling purports to have used 2018 baseline emissions, adjusted to account for emissions reductions at the facility since 2018,[7] yet somehow the modeled $PM_{2.5}$ emissions are still greater than the 2018 Annual Emission Inventory ("AEI") submitted to BAAQMD in April 2019. As shown in **Exhibit C**, the CALPUFF modeling files indicate that the facility-wide modeling included 473 tons per year of $PM_{2.5}$. But the 2018 AEI, for the same set of sources, reported only 456 tons per year of $PM_{2.5}$. Thus, the facility-wide modeling included 17 tons per year ***more*** $PM_{2.5}$ than Chevron reported for 2018.

Further, Chevron's 2019 AEI was submitted to the District in April 2020, and was thus available for use in this dispersion modeling. As shown in **Exhibit C** and Table 1, for the same set of sources modeled in CALPUFF, the facility-wide dispersion model included an extra 81 tons per year of $PM_{2.5}$ emissions ***more*** than what Chevron reported to the District for 2019. And again, when comparing to the 2020 AEI, facility-wide $PM_{2.5}$ emissions for the sources in CALPUFF were 119 tons per year ***more*** than what was reported to the District for those same sources in 2020.[8] Comparing what was modeled in CALPUFF to the most recent emission inventory (2020), the CALPUFF dispersion modeling overestimated facility-wide emissions by **34%**.[9] This overestimation results in a wildly inaccurate depiction of current PM emissions

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[6] *See* the Marathon Petroleum February 26, 2021 10-k filing in which Marathon repeatedly discusses plans to convert the refinery into a renewable diesel facility, available at https://d18rn0p25nwr6d.cloudfront.net/CIK-0001510295/2e568e5d-2387-443e-860e-557a13fa2b27.pdf.

[7] Staff Report, Appendix A.4: Modeling Fine Particulate Matter Emissions from the Chevron Refinery: An Air Quality Analysis (March 2021) at 2 (hereafter "Appendix A.4").

[8] *See* **Exhibit B**.

[9] *See* **Exhibit B**.

from the Chevron Refinery and renders the proposed rulemaking lacking any substantial evidence.

Table 1. Facility-wide $PM_{2.5}$ emissions in BAAQMD CALPUFF modeling compared to Chevron Annual Emission Inventories.

Facility-Wide $PM_{2.5}$ Emissions	BAAQMD CALPUFF Model	2018 AEI	2019 AEI	2020 AEI
Total $PM_{2.5}$ (tons per year)	472.53	455.54	391.98	349.65
Difference from Model (tons per year):	--	(16.99)	(80.56)	(118.58)
Overestimation in Model:	--	4%	21%	34%

Chevron began submitting AEIs in compliance with District Rule 12-15 in 2017 for data year 2016. According to Rule 12-15-206, the AEIs are "intended to represent the actual emissions to the best precision possible based on [the] measurement technologies and estimation methodologies." To date, however, the District has not approved even a single AEI for any of the submitted data years and yet in the Rule 6-5 rulemaking process the District based its modeling on emissions inventory from 2018. The District cannot have it both ways. The District must either expedite the approval of the previously submitted AEIs or admit that the inventories it is relying on are not accurate and not substantial evidence for District rulemaking purposes.

In 2019 it appeared that the District would attempt to gather current emissions data on the FCCU. On December 10, 2019, BAAQMD sent Chevron a letter stating its intent to perform PM testing at the FCCU as part of this rulemaking process.[10] Despite Chevron's attempts to coordinate such testing with the District, Chevron received no information from the District regarding source testing until late 2020 – a year later, and after multiple public workshops to discuss the Proposed Amendments.

The District finally conducted source testing of the Chevron FCCU in March 2021 (the same month in which the Proposed Amendments were released), and Chevron has not yet received the results of that testing from the District. Chevron conducted parallel source testing in the same timeframe and process conditions as the District source testing. The results showed the FCCU had ***43%*** lower emissions than were reported in the 2018 inventory. Given that Chevron's parallel testing with the same test methods showed lower FCCU emissions, it is likely that the District's (as yet unreleased) test results show the same. In all events, this improper sequencing of issuing rulemaking recommendations before gathering basic data makes clear that the Staff Report's recommended action is not based in science or substantial evidence.

[10] *See* **Exhibit D**.

The 2016-2017 Ammonia Optimization source test results were used to estimate annual emissions from the FCCU in 2017 – 2020. The new 2021 source test results show that those annual emissions are overestimated. With demonstrably lower actual emissions from the FCCU today, any assumed reductions from the Proposed Amendments that utilize the inflated emissions estimates as a baseline overestimate the available emission reductions from the FCCU. This, in turn, overestimates the asserted health benefits of the Proposed Amendments, as discussed further below.

The fact that recent PM reductions at the facility, which have been reported to the District in 2019 and 2020 filings and were demonstrated by the District's belated March 2021 source testing, were not incorporated into the dispersion modeling necessarily means that the modeled $PM_{2.5}$ concentrations are not representative of any actual impacts from the Chevron Refinery, much less from the FCCU. Additionally, and as discussed in further detail below, the data used to estimate PM emissions were analyzed using a test method that is widely recognized as having a positive (high) bias. It is inappropriate, and therefore, arbitrary and capricious to model *falsely overstated* emissions from the facility to justify the Proposed Amendments.

B. Facility-Wide $PM_{2.5}$ Modeling Inappropriately Expanded the Study Area

BAAQMD used the facility-wide $PM_{2.5}$ emissions modeling in order to determine the Study Area, which was then used to model FCCU emissions and potential reductions. Based on all emissions sources at both the Chevron Refinery and the PBF Martinez Refinery, the modeled contour delineating $PM_{2.5}$ concentrations of 0.1 $\mu g/m^3$ or greater was set as the Study Area.[11] By using overestimated, and therefore unreliable, emissions from both refineries,[12] the Study Area is larger than it should be, which results in overestimates of potential impacts in any further modeling using this Study Area. The Staff Report acknowledges that changes in baseline emissions from the refinery sources could cause the Study Area to "grow or shrink" and that with higher emissions the Study Area will grow, cover a larger population, and result in greater estimated health impacts.[13]

With modeled facility-wide baseline emissions higher than actual emissions (as described above and shown in **Exhibit C**), the Study Area is larger, and more receptors (grid cells) were modeled. CALPUFF will estimate a concentration at every receptor. When the CALPUFF modeling results are used in the health impact analysis, BenMAP will estimate a health risk and cost for every receptor. Therefore, the more receptors included in the modeling, the higher the overall estimated health risks. Since the Proposed Amendments are focused on the FCCU, only the area where the model predicted $PM_{2.5}$ annual concentrations greater than 0.1 $\mu g/m^3$ ***from the***

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[11] Staff Report at 33-34, Figure 3.

[12] Martinez Refining Company, Comments on Draft Amendments to Regulation 6, Rule 5, at 5-6 (Mar. 1, 2021) ("The data used by the District for determining baseline Condensable Particulate Matter (CPM) for the purposes of the Draft Rule was generated from source tests conducted by the District annually from 2009-2012. This testing is known to be biased high and not representative of refinery PM emissions.")

[13] Staff Report at 41.

FCCU emissions should be included in the BenMAP analysis. Using a larger area determined by modeling the entire Chevron Refinery and PBF Martinez Refinery bears no rational relationship to this proposed FCCU rulemaking and, therefore, does not constitute substantial evidence in support of the Proposed Amendments.

C. BAAQMD'S Choice of Model, Modeling Parameters, and Meteorological Data Are Not Technically Justified

Yorke Engineering, LLC performed a detailed review of the CALPUFF modeling files that BAAQMD provided to Chevron. Unfortunately, BAAQMD failed to provide the full suite of modeling files , so a complete analysis of the District's modeling, and the results obtained, could not be performed. BAAQMD's lack of transparency and Chevron's resulting inability to vet the modeling results on which the District relies to support the Proposed Amendments is fatal to a full and fair rulemaking process. Nonetheless, based on the incomplete information BAAQMD has provided to date, Yorke reviewed the $PM_{2.5}$ dispersion modeling in **Exhibit B**. The problems in BAAQMD's dispersion modelingare summarized here.

Model Selection. The $PM_{2.5}$ dispersion modeling, which estimated ground-level concentrations of $PM_{2.5}$ and was also used as the input to the Health Impacts Analysis, was performed using the CALPUFF model. The version used in the District's modeling was neither the EPA approved version nor the latest version of CALPUFF. Further, while photochemical grid models, like CAMx and CMAQ, are designed to model chemical transformation of emissions (as in secondary $PM_{2.5}$), the District apparently decided against using those models because of "prohibitively large computational cost."[14] This is not a technically defensible reason to justify not usingthe model that is most suited to the application at hand. Staff also asserted that "[t]roubleshooting the model was not feasible within this project schedule."[15] It is indefensible to suggest that an arbitrary timeline for rule adoption should take priority over preparing a full and accurate analysis of that rule.

Model Parameters. BAAQMD ran CALPUFF with certain parameters that are known to affect dispersion of emitted pollutants and therefore impact modeled ground-level concentrations. Building downwash was not modeled, which could have a significant effect on modeled concentrations from sources on or near buildings. Urban dispersion parameters were only used for model cells that were in the "industrial land use" category. All other areas of the modeling grid used rural dispersion parameters, resulting in a less turbulent modeled atmosphere and overestimating ground-level concentrations. BAAQMD also failed to use an algorithm that, if enabled, would have better characterized the shoreline thermal effects (the difference in temperature between water and land) in the Bay Area.

Meteorological Data Development. Insufficient information was provided to assess how the meteorological data were developed in CALMET, a companion processing program to CALPUFF. It was not clear to either Yorke or an air dispersion modeling team at ERM who also

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[14] Appendix A.4 at 10.

[15] *Id*.

reviewed the dispersion modeling, whether BAAQMD used the Chevron Refinery's onsite meteorological data to blend onsite observations with the other meteorological stations in the Weather Research and Forecasting (WRF) model. Doing so would help to simulate the local wind conditions more accurately in the subsequent dispersion modeling, but the limited information BAAQMD provided is insufficient to determine whether or not this was done.

Appendix A.4 (*see* Table 2.2.1 and Appendix B.1) provides an evaluation of the CALMET meteorological data compared to the Chevron Refinery onsite meteorological tower. Notably, as identified by ERM, BAAQMD's evaluation of the meteorological data was performed using a program called METSTAT, which is an outdated tool that has been superseded by a program called AMET. AMET was developed by USEPA and is a more comprehensive tool than METSTAT.

Overall, wind speed was underestimated in CALMET compared to the onsite meteorological station, which will tend to overestimate modeled ground-level concentrations and bias the CALPUFF results to significant overprediction. This discrepancy in wind speed was especially apparent in summer months (Q3), coinciding with the highest predicted ground-level concentrations in CALPUFF.

Additionally, the CALMET wind direction data showed a bias in the clockwise direction compared to observations at the onsite meteorological tower, which would tend to incorrectly bias modeled ground-level concentrations by directing the plume more towards populated areas instead of over the Bay. BAAQMD operates a Sodar station on the Chevron property, which measures wind speed and wind direction with height. These vertical profile data from the on-site Sodar should also have been included in CALMET, which would provide a significantly better vertical atmospheric profile near the FCCU. The vertical atmospheric profile will determine to what extent emitted pollutants disperse in the atmosphere or reach ground-level, and its accuracy is extremely important to achieving accurate modeled concentrations.

Source Parameters. The $PM_{2.5}$ dispersion modeling performed using CALPUFF failed to accurately model the configuration of numerous sources. The base elevations for each source, even if adjusted to use grid average terrain,[16] are inaccurate. The elevations should be representative of the 100-meter modeling grid, and many source elevations are significantly different than ***any*** elevation within 100 meters from that source. The elevation at which a source releases emissions will significantly impact the distance and direction of modeled emissions due to variation in wind speed and direction with height.

Source locations could not be verified to check their accuracy because the modeling used a rare coordinate system and a program to convert the coordinates to a usable format was unavailable. Additionally, and as described above in more detail, the $PM_{2.5}$ emission rates utilized in the model are inconsistent with the Chevron Refinery's 2018 Annual Emission Inventory and significantly higher than the Refinery's 2019 and 2020 Annual Emission Inventories.

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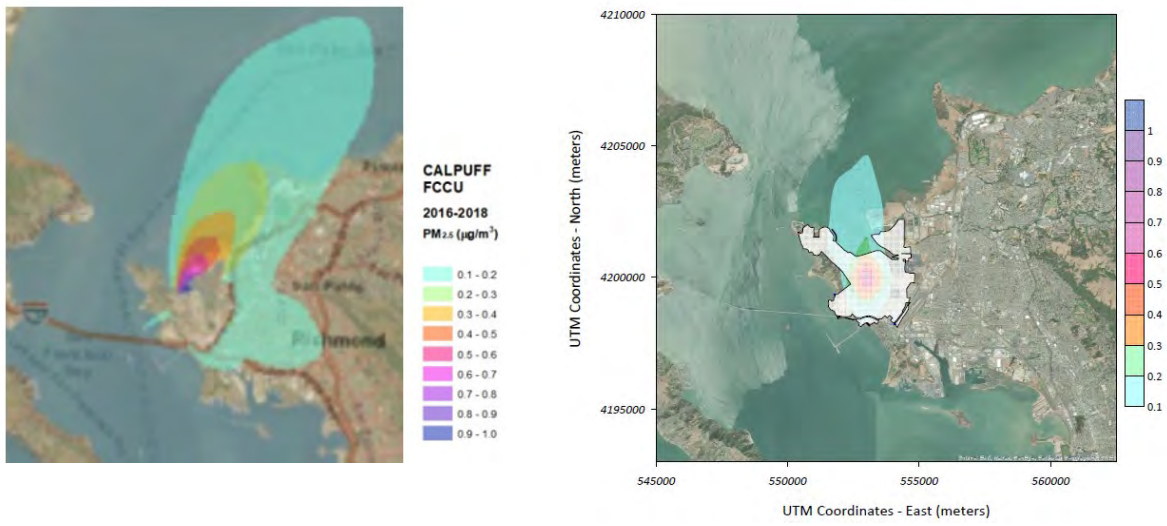
[16] *See* Appendix A.4 at 13-14.

Model Results. As shown in Appendix A.4, Figure 3.2.1, for the FCCU without WGS CALPUFF predicted maximum modeled $PM_{2.5}$ ground-level concentrations of 0.1 - 0.2 $\mu g/m^3$ in a small area where people live, and 0.2 - 0.3 $\mu g/m^3$ in a very small area where people might work. These concentrations are significantly lower than the concentrations presented in Appendix A.4, Table 3.2.1—this table is misleading as the peak offsite concentration it reports is predicted to occur next to the refinery ***in San Francisco Bay***, at a location where no residential or worker receptors are located, as shown in Figure 1(a).

ERM performed $PM_{2.5}$ dispersion modeling using the same modeling inputs (source emissions and stack parameters) as BAAQMD, in the AERMOD model. ERM's analysis used surface data from Chevron's onsite meteorological station, with upper air and supplemental surface data from Oakland International Airport obtained from BAAQMD.[17] As shown in Figure 1(b), using AERMOD and more accurate onsite meteorological data, the results show that modeled ground-level concentrations resulting from FCCU emissions occur over the Bay, avoiding populated areas near the refinery. Further, the magnitude of these concentrations are a maximum of 0.2-0.3 $\mu g/m^3$, significantly less than the District's reported maximum concentration of 0.97 $\mu g/m^3$.



(a) (b)

Figure 1. Modeled $PM_{2.5}$ concentrations with emissions from the FCCU only, (a) as shown in Figure 3.2.1(b) of Appendix A.4, and (b) as modeled by ERM in AERMOD with onsite meteorological data.

[17] Due to the time constraints imposed by the April 30 deadline for comments, ERM used available processed meteorological data for a different time period than was used for the BAAQMD CALPUFF modeling.

Even more compelling is the $PM_{2.5}$ dispersion modeling performed with the current FCCU emissions based on the March 2021 source test results, which are 43% lower than the FCCU emissions modeled by BAAQMD. As shown in Figure 2, the modeled plume is even more limited, with maximum impacts in the range of 0.1-0.2 $\mu g/m^3$ occurring only over the Bay and the nearby landfill. This analysis shows how imperative it is to utilize accurate meteorological and emissions data, and the dispersion modeling analysis must be redone to accurately assess impacts.

Figure 2. Modeled $PM_{2.5}$ concentrations with emissions from the FCCU only, modeled by ERM in AERMOD using the March 2021 emission rate.

The District should use AERMOD for their FCCU PM dispersion modeling. CALPUFF was delisted as an EPA preferred model in the 2017 revised Guideline on Air Quality Models (Appendix W to 40 CFR Part 51), although it still is an approved alternative model. CALPUFF was previously the preferred model for long-range transport of emissions from 50 to several hundred kilometers (km). The Guideline recommends modeling the primary portion of $PM_{2.5}$ using a model such as AERMOD. Additionally, BAAQMD requires the Chevron Refinery to use AERMOD for all permitting and Regulation 11-18 related modeling. It is therefore the more appropriate model to use for a regulatory application.

D. Ambient Monitoring Data Does Not Support the BAAQMD Modeled $PM_{2.5}$ Concentrations

As previously discussed in Chevron's comment letter dated December 16, 2020, ambient air monitoring in the vicinity of the Chevron Refinery does not support BAAQMD's modeled $PM_{2.5}$ impacts from the FCCU or the Refinery as a whole. Ambient $PM_{2.5}$ concentrations are measured near the Refinery at BAAQMD's San Pablo Rumrill monitoring station and at three of Chevron's community air monitoring stations (Atchison Village, Point Richmond, and North Richmond). The Chevron Refinery is generally west-southwest of the San Pablo Rumrill Station, and one would expect the measured $PM_{2.5}$ when winds are from this sector to be elevated, if the refinery actually was causing local elevated $PM_{2.5}$. However, as shown in Attachment 1, Figure 2 to the December 16, 2020 comment letter, that is not the case – measured $PM_{2.5}$ from the southwest is lower than from the northeast and southeast quadrants.

Further, the ambient data includes a two-and-a-half-month period in which the Chevron Refinery FCCU was shut down and not operational. If the FCCU is causing significant impacts at local air monitors, there would have been a material decrease in measured $PM_{2.5}$ concentrations during this shut down period. However, there was no statistically significant difference in ambient $PM_{2.5}$ concentrations when the FCCU shut down, which disproves BAAQMD's assumptions.[18]

III. THE HEALTH IMPACTS ANALYSIS IS FLAWED AND OVERESTIMATES $PM_{2.5}$ EXPOSURES

The Health Impact Analysis[19] on which BAAQMD relies is flawed and misleading– exacerbating emissions and exaggerating health impacts. Because of the errors in the modeled emission rates discussed in Section II above, the health impacts – and asserted health benefits predicted from the Proposed Amendments – are inflated. Further, the Health Impacts Analysis as presented demonstrates a lack of transparency, and fails to present the full picture, including model uncertainties, to the Board and the public.

A. Flaws in the $PM_{2.5}$ Dispersion Modeling Create Inaccurate Health Impact Analysis

As described in Section II, the $PM_{2.5}$ dispersion modeling was performed using outdated and overestimated emissions from the Chevron Refinery. The Health Impact Analysis relies on that $PM_{2.5}$ modeling and is based on the difference between the baseline modeled ground-level concentrations, and the modeled ground-level concentrations with FCCU emissions at the proposed limits (0.02 gr/dscf, and 0.01 gr/dscf). Modeling the inflated emissions as a baseline (*see* Table 1) and then modeling the reduction in emissions under the Proposed Amendments,

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[18] *See* **Exhibit E**.

[19] Staff Report, Appendix A.2: Modeling Fine Particulate Matter Emissions from the Chevron Refinery: An Air Quality Health Impact Analysis (Interim DRAFT Report – Version 2) (March 2021) (hereafter "Appendix A.2").

necessarily inflates the difference between those modeled impacts. This in turn inflates the modeled health benefits, and the associated valuation of those benefits. It is arbitrary and capricious not to incorporate current emissions information into the Air Quality Analysis (Appendix A.4) and Health Impact Analysis (Appendix A.2) that form the basis for the Proposed Amendments.

As described in Section II.B, use of facility-wide $PM_{2.5}$ emissions from both the Chevron Refinery and PBF Martinez Refinery to set the Study Area results in alarger than appropriate area in which $PM_{2.5}$ concentrations are modeled. This over-large area is then used as an input to BenMAP for the Health Impact Analysis, thus causing overestimation in the modeling of health impacts. The scientifically appropriate analysis would look at baseline emissions from the FCCU only, and then assess the change in $PM_{2.5}$ concentrations under the FCCU control scenarios.[20] The study area for this appropriate analysis would be smaller, and therefore the modeled health impacts would be smaller, than what is presented in Appendix A.2.

Further, it appears that the Study Area used as the input to BenMAP included receptors where the $PM_{2.5}$ concentrations were *less than* 0.1 $\mu g/m^3$.[21] The more receptors that are included in the analysis, the higher the health risk impacts, since a concentration will be calculated at every receptor. Although the BenMAP modeling files were not provided for review, it appears based on Appendix A.2 that the BenMAP study area extended as far as 65 kilometers from the FCCU, into the long-range transport assessment range. Long-range transport of pollutants is the specific type of assessment for which EPA delisted the use of CALPUFF, and use of CALPUFF modeling results at this range for a regulatory application is inappropriate.

B. BAAQMD Has Not Provided Sufficient Information to Assess the Health Impact Analysis

The only information provided on how the Health Impact Analysis was performed is Appendix A.2 to the Staff Report. No modeling files associated with BenMAP-CE were provided. In order to constitute substantial evidence of the adequacy of the Health Impact Analysis, BAAQMD would need to provide the data inputs and the full set of modeling results from the BenMAP analysis, including: inputs for population estimates, $PM_{2.5}$ concentrations in each modeled scenario (baseline and controlled conditions), concentration-response functions (CRFs), health incidence data, and results associated with the distribution of potential impacts and the percent of baseline incidence. BAAQMD's failure to provide this data precludes an adequate evaluation of the analysis. Based on what can be gleaned from Appendix A.2, Chevron believes BAAQMD is presenting the health impact information in a materially misleading way.

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[20] *See* **Exhibit A**, Ramboll Review of BAAQMD Regulation 6 Rule 5 Rulemaking Documents (April 30, 2021).

[21] *See* **Exhibit B**.

C. BAAQMD Presents A Misleading Health Impact Analysis

Appendix A.2 presents in Table ES.1 the "Baseline Health Impact" of the ***entire*** Chevron Refinery (using the overestimated $PM_{2.5}$ concentrations from the dispersion modeling), as well as the valuation of those impacts from the entire refinery. It is inappropriate to assess and report the health impact of the *entire* refinery when only a single process unit is subject to the Proposed Amendments. There is no value or purpose in showing estimates of emissions from sources that are not included in this rulemaking. The District does not provide the obviously much smaller potential health benefits from the Proposed Amendments, presenting instead only a percent difference from the facility-wide baseline. When those percentages are applied, it becomes clear that the incremental reduction between control scenarios A and B is 0.5 to 1 premature mortality,[22] significantly lower than the values presented in Table ES.1. The precise comparison would be the current FCCU emissions (with accurate and non-inflated emissions data) as baseline, compared to reductions in FCCU emissions under Control Scenarios A and B.

Additionally, the District fails to present the range of uncertainty in the Health Impact Analysis, instead presenting single values as if they were certain. BenMAP analyses typically include an assessment of the statistical uncertainty associated with the concentration-response functions, and provides a distribution of impacts from which uncertainty bounds can be obtained. Confidence intervals would present the full range of potential impacts, possibly including no benefit from the Proposed Amendments. This standard statistical analysis is completely missing in the documentation for the Proposed Amendments.

BAAQMD also fails to present any discussion or acknowledgment of the limitations and uncertainties associated with the epidemiological studies that are the basis of the Health Impact Analysis. Epidemiological studies are often not designed with risk assessment in mind so often do not include all of the asks[23] required to use the studies in a risk assessment. Epidemiological data represent associations, which do not always equate to causality. Causality is difficult to establish because epidemiology studies often have limitations when accounting for confounders and biases, most importantly inadequate individual exposure estimates and the inability to control for many factors that could explain the association between $PM_{2.5}$ and mortality, such as lifestyle factors like smoking. Further, the speciated components of PM that may be associated with particular adverse health effects are yet unknown, but the analyses in Appendix A.2 assume that all PM species are equally toxic.[24] This makes it a very conservative analysis.

BenMAP analyses assume a log-linear response between exposure and health effects—in other words, lower and lower concentrations will result in lower and lower health effects.

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[22] If the uncertainty ranges had been presented in Appendix A.2, this range could be as low as zero. The District should provide the statistical uncertainties in the listed health impacts for a full disclosure of the range of impacts.

[23] https://www.globalepidemiology.com/article/S2590-1133(19)30005-7/pdf and https://www.sciencedirect.com/science/article/pii/S2590113320300018

[24] *See* **Exhibit A** for further discussion and citations.

BenMAP models this response without consideration for a threshold below which effects ***may not be measurable*** and does not consider, for example, a health effect threshold as a lower bound (such as the NAAQS). Additionally, some of the concentration-response functions used in the Health Impact Analysis (i.e., for mortality based on a meta-analysis) are not well justified, and the District fails to discuss the impact of using different concentration-response functions.[25]

IV. THE ANTICIPATED PM EMISSION REDUCTIONS ATTRIBUTABLE TO THE PROPOSED AMENDMENTS ARE OVERSTATED

Meeting the ammonia limit in the Proposed Amendments may actually *increase* filterable PM, NOx, and result in opacity violations. During the 2015 Rule 6-5 rulemaking process, Chevron worked collaboratively with BAAQMD to complete ammonia optimization testing to reduce total PM at Chevron's FCCU. The Staff Report for the original Rule 6-5 recognized that the use of ammonia enhances filterable PM control at FCCs.[26] This optimization study confirmed that a 10 ppm limit was not an appropriate limit for Chevron's ESP. Furthermore, the study showed that filterable PM started to increase when ammonia stack concentrations were below 26 ppm.

Adjusting the ammonia slip could also unnecessarily impact the operations of the FCC Electrostatic Precipitators (ESPs), thus impacting the reliability of the FCC ESPs and result in possible ***increases*** in PM emissions. As required by the current Reg 6-5, Chevron submitted a permit application and proposed a site-specific ammonia slip limit by the August 31, 2017 deadline. To date, BAAQMD staff never issued approvals for the limit as prescribed in the Rule 6-5. On the contrary, the Proposed Amendments ignore the testing by including the original 10 ppm ammonia limit without further justification. Operating Chevron's ESP at this rate would undoubtedly increase filterable PM emissions for the sake of an uncertain decrease in condensable PM emissions.

BAAQMD's own evaluations in 2009 and 2016 showed that ammonia reductions had *no benefit* in reducing secondary PM.[27] The Staff Report does not reference these studies or explain why they are no longer supporting those conclusions.

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[25] *See* **Exhibit A** for further, detailed discussion.

[26] "Although District staff is proposing a stringent ammonia emission limit, they recognize that ammonia and urea injection are used to promote PM control at FCCUs with electrostatic precipitators (ESPs) and that these ESPs are subject to District and federal PM emission limits." (2015 Staff Report, A:3)

[27] BAAQMD, "Fine Particulate Matter Data Analysis and Modeling in the Bay Area", October, 2009, Research and Modeling Section Publication No. 200910-004-PM, pp. 35-37 ("Primary PM levels were not significantly affected by reductions of ammonia emission, secondary $PM_{2.5}$ levels would only be reduced by 0-4 percent even if there were an enormous District-wide ammonia reduction of 15 tons per day (equivalent to 5,475 tons per year), and ammonia reductions were even less effective near ammonia sources because ammonia is not the limiting reactant near

The Staff Report asserts that compliance with the amended Rule 6-5 would reduce PM by 493 tons per year. However, it does not provide any support for this conclusion. Without providing the necessary support for the emissions reductions from the Proposed Amendments, BAAQMD cannot conclude that they are necessary.

V. THE COST OF IMPLEMENTING THE PROPOSED AMENDMENTS IS UNDERESTIMATED

A. Capital Cost for Installing a Wet Gas Scrubber Is Underestimated

The District underestimates the capital costs of a wet gas scrubber. As shown in Table 2 below, the District estimates the capital costs of a wet gas scrubber to be $241 to $579 MM. Chevron has determined that the capital costs are $1,480 MM. The District estimates ignored the actual costs of the Valero wet gas scrubber installation in the 2000s, which was $525-750 MM, and discounted costs for projects in South Coast.[28] Moreover, the actual costs of a wet gas scrubber would be even higher if the District were to mitigate the water resources impacts discussed in Section VIII below.

Table 2 – Estimated Capital Cost for Wet Gas Scrubber

Source	Esimated Capital Cost $MM
BAAQMD non-regenerative (used in cost-effectiveness analysis)	$241 MM
BAAQMD regenerative	$579 MM
Chevron Estimate	$1,480 MM

B. The Staff Report Does Not Account for All Costs of the Proposed Amendments

The Staff Report does not account for increased project costs and labor costs as a result of the COVID-19 pandemic. To comply with local health mandates and to protect the health and wellbeing of our workers and contractors, the costs of implementing and constructing the

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those sources."); D. Fairley and D. Burch (BAAQMD), "Multi-Pollutant Evaluation Method Technical Document, 2016 Update", November 2016, Section 2.5.8 (p. 23) ("Analysis of the modeled changes in ammonium sulfate concentrations as a function of 20% reductions of various precursors showed a reduction of 4%-7% for reductions in directly emitted sulfate, but only about 0.5% reductions for SO2, and essentially zero reductions for ammonia.").

[28] Chevron comments, March 1, 2021, at 5; *see also* WSPA comments, February 26, 2021, at 5.

Proposed Amendments will be higher than reflected in the Staff Report due to social distancing requirements, health monitoring, limitation on group gatherings and the number of hours employees can work. The District should ensure that these hidden costs are considered.[29] The Staff Report also fails to include costs associated with competitive wages, community improvement fees, permitting fees, costs of off-site support facilities (e.g., water treatment plant), site preparation, potential lost production, etc.[30]

VI. STAFF HAS FAILED TO CONDUCT A LEGALLY SUFFICIENT COST-EFFECTIVENESS ANALYSIS

The Staff Report states that "[a]part from required planning to achieve ambient air quality standards, the proposed amendments are also part of the Air District's efforts to meet the requirements of California Assembly Bill 617 (2017) which requires the Air District to implement an expedited schedule for implementing best available retrofit technology (BARCT) at industrial facilities covered by the State's Cap-and-Trade program. The Expedited BARCT Implementation Schedule adopted by the Air District in 2018 identified PM emission reductions at FCCUs as a key area where BARCT controls could have a significant impact."[31] Indeed, the District relies on the 2018 EIR for the AB 617 Expedited Best Available Retrofit Control Technology (BARCT) Implementation Schedule (AB 617 EIR) to provide the entirety of the CEQA coverage for these proposed Amendments.

Health & Safety Code Section 40406 defines BARCT and specifies that, among other factors, economic impacts should be taken into account when establishing BARCT:

> As used in this chapter, "best available retrofit control technology" means an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source.

The provisions of AB 617 related to developing an expedited BARCT implementation schedule were codified through amendments to section 40920.6 of the Health and Safety Code that require each air district to "adopt an expedited schedule for the implementation of best available retrofit control technology (BARCT), by the earliest feasible date."[32] Section 40920.6 is contained within Chapter 10, "District Plans to Attain State Ambient Air Quality Standards."[33]

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[29] Chevron comments, March 1, 2021, at 5; *see also* Chevron comments, December 16, 2020, at 6.

[30] Chevron comments, March 1, 2021, at 5-6; *see also* WSPA comments, February 26, 2021, at 5.

[31] Staff Report, p. 1.

[32] California Health and Safety Code § 40920.6(c)(1).

[33] Note that the legislative intent of Chapter 10 was "that districts shall endeavor to achieve and maintain state ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, and

Section 40920.6 sets forth very specific requirements that must be followed by air districts when establishing BARCT standards, including conducting a cost-effectiveness analysis and an incremental cost-effectiveness. Further, the District is required to "consider . . . the cost effectiveness of a control measure."[34] Health & Safety Code Section 40234 specifically makes 40703 applicable to any regulation adopted by the District. The Staff Report does not comply with the requirements of the California Health & Safety Code for conducting a cost-effectiveness analysis.

Health and Safety Code Section 40920.6(a) provides that prior to adopting rules or regulations applicable to best available retrofit control technology, air districts shall do all of the following:

> (1) Identify one or more potential control options which achieves the emission reduction objectives for the regulation.
>
> (2) Review the information developed to assess the cost-effectiveness of the potential control option. For purposes of this paragraph, "cost-effectiveness" means the cost, in dollars, of the potential control option divided by emission reduction potential, in tons, of the potential control option.
>
> (3) Calculate the incremental cost-effectiveness for the potential control options identified in paragraph (1). To determine the incremental cost-effectiveness under this paragraph, the district shall calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option.
>
> (4) Consider, and review in a public meeting, all of the following:
>
> > (A) The effectiveness of the proposed control option in meeting the requirements of this chapter and the requirements adopted by the state board pursuant to subdivision (b) of Section 39610.
> >
> > (B) The cost-effectiveness of each potential control option as assessed pursuant to paragraph (2).

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nitrogen dioxide by the earliest practicable date." (California Health and Safety Code section 40910) Missing from the list of applicable pollutants is PM.

[34] California Health and Safety Code § 40703.

> (C) The incremental cost-effectiveness between the potential control options as calculated pursuant to paragraph (3).
>
> (5) Make findings at the public hearing at which the regulation is adopted stating the reasons for the district's adoption of the proposed control option or options.

The Staff Report calculated the cost-effectiveness of the proposed regulation at the Chevron Refinery and the PBF Martinez Refinery to be $430,200 per ton and $359,400 per ton, respectively.[35] This is an order of magnitude higher than the cost-effectiveness of any previous regulation adopted by either the District or SCAQMD, which ranged from $2,500 to $46,700 per ton.[36] Table 13 of the Staff Report clearly demonstrates that the costs of the Proposed Amendments ($39 to $40 MM/yr) exceed the District's valuation of the benefits from the Proposed Amendments (ranging from $12 to $33 MM/year). Therefore, the District's own analysis demonstrates that the Proposed Amendments are not cost-effective. Of course, had the analysis accurately accounted for the *ineffectiveness* of the Proposed Amendments (described above), and the actual costs of implementation (described below), the cost-effectiveness of the Proposed Amendments would be even higher. Moreover, the District's cost-effectiveness analysis suffers from the following defects:

Alternative Cost-Effective Options. The Staff Report ignores alternative cost-effective measures that Chevron stands willing to implement. In 2016, as part of the District's current version of Reg. 6-5, Chevron coordinated closely with the District to conduct an Ammonia Optimization Study.[37] The purpose of this joint effort was to determine how Chevron could minimize FCC PM emissions. The Ammonia Optimization Study found that Chevron could potentially reduce FCC PM by up to 35% at minimal costs. Because of the Ammonia Optimization Study, Chevron submitted an Application for Significant Revision to Major Facility Review Permit to the District in 2017 to incorporate these reductions into its facility permit. To achieve these reductions proposed to install a District-approved ammonia analyzer and limit S-4285 to 26 ppmv NH3 corrected to 3% 02, on a daily average basis. To demonstrate compliance with this limit, ammonia injected into A0014 ESP would not exceed 20 pounds per hour on a daily average basis.[38] To date, BAAQMD has not acted on Chevron's application. Despite the District participating in the Ammonia Optimization Study, the District has ignored the opportunity to reduce emissions through cost-effective recommendations from the study. The District should consider these options now as an alternative to the Proposed Amendments.

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[35] Staff Report, Table 6.

[36] Staff Report, Table 4.

[37] **Exhibit F**, p. 7.

[38] **Exhibit F**, p. 24.

The Cost-Effectiveness of the Proposed Amendments is Not Legally Supportable. Even if the District were to ignore that it has underestimated the costs of the Proposed Amendments, the Staff Report's estimation of $359,400 to 430,200 per ton[39] far exceeds the historical cost-effectiveness of rules previously adopted by the District and SCAQMD. Notably, the most costly emission regulation adopted by either the District or SCAQMD was $32,500/ton, as reported in Table 4 of the Staff Report.[40]

VII. BAAQMD UNDERESTIMATED ADVERSE SOCIOECONOMIC IMPACTS

Health and Safety Code Section 40728.5 requires that BAAQMD perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation and "make a good faith effort to minimize adverse socioeconomic impacts." "Socioeconomic impact" means the following:

> (1) The type of industries or business, including small business, affected by the rule or regulation.
>
> (2) The impact of the rule or regulation on employment and the economy of the region affected by the adoption of the rule or regulation.
>
> (3) The range of probable costs, including costs to industry or business, including small business, of the rule or regulation.
>
> (4) The availability and cost-effectiveness of alternatives to the rule or regulation being proposed or amended.
>
> (5) The emission reduction potential of the rule or regulation.
>
> (6) The necessity of adopting, amending, or repealing the rule or regulation to attain state and federal ambient air standards pursuant to Chapter 10 (commencing with Section 40910).

BAAQMD's analysis of socioeconomic impacts is fundamentally flawed in two ways. First, it severely underestimates the relevant impacts and second, it fails to make a good faith effort to minimize these impacts. Because of these failures, adopting the rule as proposed is contrary to the Legislature's directive in Health and Safety Code Section 40728.5.

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[39] Staff Report, Table 6.

[40] *See also* MRC comments, March 1, 2021, at 1-2 (Scenario B); *Id*. at 4 (Scenario A).

A. The Staff Report Severely Underestimates Adverse Socioeconomic Impacts

The Staff Report assumes that there will not be an impact below a significance level of 10% of assumed corporate downstream profit.[41] This threshold is arbitrary and capricious and has no basis in the economic reality of Chevron Refinery operations. Each refinery is unique and operates different equipment in varying cost environments to convert feedstocks into usable products. As a result, refinery economics cannot be based on corporate profit. Moreover, market forces for both feedstocks and products at the local to global scale determine the ability to pass through costs to consumers, not the percentage of corporate profits as indicated by BAAQMD.

As described in Section V, the Staff Report grossly underestimates the costs associated with implementing the control technology necessary to meet the new emissions limits. The Socioeconomic Impact Report prepared by Applied Development Economics uses these incorrect capital costs as the basis of their analysis.[42] Table 3 below shows the annualized costs based on Chevron's cost estimate.

Table 3 – Chevron Estimate of Annualized Costs

FACILITY	CAPITAL COSTS ($MILLIONS)	TOTAL ANNUALIZED COSTS ($MILLIONS /YEAR)
Chevron Products Richmond	**$1,480**	**$239**

Additionally, it is not clear why the report uses Chevron's 2019 revenue instead of 2020. The COVID-19 pandemic's impacts to the economy are wide and deep. The petroleum industry, including refinery operations, has been heavily impacted and the Staff Report should have taken those impacts into account when forecasting future revenue.

Table 4, below, shows a more accurate impact assessment of Rule 6-5 based on Chevron's estimated annualized costs.

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[41] Chevron's U.S. Downstream function not only includes five refineries of various size, complexity, and geographical location, but also chemical manufacturing plants and joint ventures, lubricant manufacturing and sales, technology marketing, fuel marketing terminals, and gas station facilities.

[42] Socioeconomic Impact Analysis, at p. 16.

Table 4 – Impact Analysis Using Chevron's Estimate of Annualized Costs

Refinery	RULE 6-5 ANNUAL COST SCENARIOS ($MILLIONS)		BAAQMD ESTIMATED ANNUAL NET INCOME ($MILLIONS)	RULE 6-5 COSTS AS A PERCENT OF BAAQMD ESTIMATED NET INCOME	
	0.02 gr/dsf standard	0.01 gr/dscf standard		0.02 gr/dsf standard	0.01 gr/dscf standard
Chevron U.S.A. Inc., Richmond	**$15**	**$239**	**$282**[43]	**18.8%**	**84.8%**

As is shown above, a more accurate impact of the Proposed Amendments is 84.8% instead of 13.7%. Carrying these numbers forward, using BAAQMD's arbitrary threshold of ten percent of net income, Chevron would be expected to attempt to reduce other costs or increase revenues by more than $200 million. There is no feasible way for Chevron to absorb these costs or increase revenues to cover $200 million annually.

The Socioeconomic Impact Analysis asserts that "small businesses are not disproportionately impacted by proposed amendments to Rule 6-5."[44] However, it provides absolutely no analysis to support this assertion besides a conclusory statement that none of the eight sources affected by the proposed rule are small businesses. This is not enough analysis to support a conclusion that small businesses will not be disproportionately affected. As discussed above, because the cost inputs are underestimated, so too are the estimates on the impacts of the proposed rule on the measures that would need to be taken to make up for the costs. For example, the Socioeconomic Impact Report asserts that the rule would have the effect of increasing the cost of a gallon of gasoline by $0.02. However, the true costs would be much higher. What would this mean for small businesses who rely on gasoline for transportation or energy needs? We don't know because there is no analysis. These types of impacts must be analyzed before BAAQMD adopts any proposed amendments.

B. The Staff Report Does Not Make Any Effort to Reduce Adverse Socioeconomic Impacts

Health and Safety Code Section 40728.5 requires BAAQMD to make a good faith effort to reduce adverse socioeconomic impacts. This is a mandatory requirement that the Staff Report does not even attempt to comply with. The Staff Report makes no effort to describe how BAAQMD attempted to reduce these adverse socioeconomic impacts. This is a fundamental

[43] Note that we contend that this number is inaccurate. However, for illustration purposes, this shows that even using BAAQMD's inflated net income, the impact is orders of magnitude higher than BAAQMD estimated.

[44] Socioeconomic Impact Analysis, at p. 18.

failure and adopting the proposed regulations without first attempting to reduce adverse socioeconomic impacts would be contrary to law.

VIII. THERE IS NO SUFFICIENT CEQA ANALYSIS FOR THE PROPOSED AMENDMENTS

The District has not conducted an adequate CEQA analysis for the Proposed Amendments. The District is relying entirely on the environmental analysis done in the EIR for a different project, the AB 617 Expedited Best Available Retrofit Control Technology (BARCT) Implementation Schedule.[45] Staff concluded that the Proposed Amendments did not present substantial changes in the project or circumstances or new information that would require a new analysis.[46] The Staff Report relies on Public Resources Code Section 21166, which sets forth the standard for the need to conduct additional environmental review in connection with a previously approved project.[47] This is not the appropriate inquiry under the circumstances because the Proposed Amendments are not the same project[48] that was evaluated in the EIR, and therefore, the District must prepare a separate EIR for the Proposed Amendments.

Furthermore, even if the Proposed Amendments were somehow construed to be the same project analyzed in the EIR, there is significant new information that requires that the District conduct additional environmental review and prepare a subsequent or supplemental EIR.

A. The Proposed Amendments Require a New, Separate EIR

In 2017, the California Legislature passed AB 617, which among other things requires air districts to review the emissions control technology installed on pollution sources located at industrial facilities subject to the Cap-and-Trade program.[49] To address facilities that do not have BARCT in place, each air district was required to adopt an Expedited BARCT

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[45] *See* Staff Report, p. 45.

[46] *Ibid.*

[47] *Ibid.*

[48] The Proposed Amendments are undisputedly a "project" under CEQA. CEQA defines a project as an "activity which may cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment." (Pub. Res. Code, § 21065.) CEQA "projects" include an agency's adoption of a rule or regulation, including those aimed at environmental protection. (See *California Unions for Reliable Energy v. Mojave Desert Air Quality Management District* (2009) 178 Cal.App.4th 1225, 1240.)

[49] EIR, p. 1-11.

Implementation Schedule before the end of 2018.[50] The District therefore prepared an EIR for its Expedited BARCT Implementation Schedule. It certified the EIR in 2018.

The project subject to the EIR included six potential rule developments: 1) organic liquid storage tanks; 2) petroleum wastewater treating; 3) Portland cement manufacturing; 4) refinery fluid catalytic crackers and CO gas boilers; 5) refinery heavy liquid leaks; and 6) petroleum coke calcining.[51] The EIR acknowledged that Expedited BARCT Implementation Schedule would "consist of the implementation of several rule development projects in order to fulfill the requirements of AB 617."[52] To that end, the EIR explained that "BARCT implementation would apply to a wide range of commercial and industrial facilities including petroleum refineries, chemical plants and manufacturing operations."[53] The BARCT review was conducted focusing on the following pollutants: (1) Nitrogen Oxides (NOx); (2) Reactive Organic Gases (ROG); (3) Particulate Matter less than 10 microns (PM_{10}); (4) Particulate Matter less than 2.5 microns ($PM_{2.5}$); and (5) Sulfur Dioxide (SO_2).[54] It noted that "[t]he type of emission capture and control technology that may be used depends on the specific type of pollutant to be controlled" and discussed wet gas scrubbers as a potential control.[55] Concerning the development of rules for "Refinery Fluid Catalytic Crackers and CO Boilers," the Draft EIR states, "PM and SO_2 emissions reductions are expected through optimization of ammonia injection, additional ESP capacity, optimization of newer catalyst additives, and/or wet gas scrubbing.[56] Although the EIR discussed at a general level the possibility of using wet gas scrubbers for refinery FCCUs, it did not contain any detailed discussion or evaluation of environmental impacts from amendments to Rule 6-5.[57]

The EIR contains only a limited discussion of wet gas scrubbers. In its Project Description, it briefly explains what wet gas scrubbers are and how they work.[58] The EIR touches on wet gas scrubbers in relation to a delivery of materials and construction analysis, potential hazard impacts, and water demand. But the EIR does not contain an in-depth review of wet gas scrubbers and their potential impacts.

In contrast to the general discussion in the EIR for the Expedited BARCT Implementation Schedule, the District now proposes amendments to Rule 6-5, which specifically

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[50] *Id*. at p. 4-2.

[51] *Id*. at p. 2-7.

[52] *Id*. at p. 2-5.

[53] *Id*. at p. 2-7.

[54] *Id*. at p. 2-5.

[55] *Id*. at pp. 2-12, 2-14 through 2-15.

[56] *Id*. at p. 2-7.

[57] *Id*. at pp. 1-5, 2-7.

[58] *Id*. at p. 2-14 through 2-15.

regulates Particulate Emissions from petroleum refinery FCCUs. The Proposed Amendments include the following:

- **Emission limits for SO_2 and Total PM_{10} (filterable + condensable PM_{10})**. Staff recommended option is a total PM_{10} limit of 0.01 grains/dscf. The proposed amendments also 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.

- **Monitoring requirements for SO_2 and Total PM_{10}**. SO_2 would require continuous monitoring and Total PM_{10} would require at least one source test per calendar quarter.

- **Elimination of the limited exemption for ammonia optimization**. The exemption provided that facilities that undergo an ammonia optimization study (to determine the amount of ammonia that minimizes Total $PM_{2.5}$) are not subject to the ammonia limits in Rule 6-5. If approved, the amendments would require those facilities to meet the ammonia limit of 10 ppm regardless of ammonia optimization.

None of these amendments were discussed in any detail in the EIR. Moreover, the impacts of these specific amendments were not addressed in the EIR. For example, the EIR does not include any meaningful discussion regarding the following impacts relating to wet gas scrubbers, which are required before BAAQMD can consider adopting the Proposed Amendments:

- Water Usage: The amount of freshwater needed for one wet gas scrubber is considerable, and the estimated freshwater needed for one wet gas scrubber can be over 150 million gallons per year. The EIR acknowledges that estimated water demand for FCCUs can range up to 432,000 gallons per day.[59] This is an enormous amount of water, especially in California, which experiences frequent droughts. **In fact, EBMUD recently declared a stage 1 drought and is asking for 10% reductions in water usage.[60]** Yet despite this significant impact, the EIR does not identify appropriate feasible mitigation measures. Although the EIR proposes the use of recycled water as a mitigation measure, it does not address whether recycled water would be available to the facilities, and even admits that recycled water may not be available to the facilities.[61] It also does not identify further mitigation if such recycled water is not available. Further, there are a number of variables that will

[59] *Id*. at p. 3.4-18.

[60] East Bay Municipal Utility District, *EBMUD Board of Directors Declares Drought* (Apr. 2021) <https://www.ebmud.com/about-us/news/press-releases/ebmud-board-directors-declares-drought/

[61] See EIR, p. 3.4-20.

affect the performance of a wet gas scrubber. The ultimate ability for a wet gas scrubber to achieve the Proposed Amendment limits must be carefully assessed.

- Greenhouse Gas Increase: The EIR summarily concludes that because the facilities must comply with the Cap-and-Trade Program, the Expedited BARCT Implementation Schedule would have a less than significant impact on greenhouse gas (GHG) emissions.[62] However, the District is still obligated to analyze the impact of GHGs, which would increase from higher energy demands of the wet gas scrubber and from less recycling of FCCU PM to cement producers. According to the EIR, one wet gas scrubber may use 95.3 million kilowatt-hours per year of electricity. Based on a utility emission factor of 641 pounds of CO2 per megawatt-hour, that would equate to more than 27,000 metric tons of CO2 per year.

- Electricity Increase: The current CEQA criteria include energy impacts, and the CEQA documentation should evaluate them. The EIR concludes that generally electricity demand would increase, but that such an increase is expected to be met by local suppliers and that the electricity would not be used in a wasteful manner because it would help the District comply with ambient air quality standards.[63] For new installations such as a wet gas scrubber, the facility's local utility must perform a capacity assessment to inform whether these new demands can be met. However, there is no specific discussion as to electricity usage that would increase from refineries operating the wet gas scrubbers and from other offsite facilities operated by other entities to transport water.

- Natural Gas Increase: The EIR concludes that generally natural gas usage would increase, but that such an increase is expected to be met by local suppliers and that the electricity would not be used in a wasteful manner because it would help the District comply with ambient air quality standards.[64] For new installations such as a wet gas scrubber, the facility's local utility must perform a capacity assessment to inform whether these demands can be met. However, there is no discussion as to natural gas usage that would increase from refineries operating the wet gas scrubbers

- Hazardous Materials/Waste Increase: The switch from an electrostatic precipitator to wet gas scrubbers will increase hazardous waste disposal from a given refinery. FCC catalyst fines collected from Chevron's electrostatic precipitator are currently recycled to Portland Cement manufacturing reducing the need for virgin clay in the process. This process only accepts dry catalyst so it will no longer be possible to recycle these fines when they become wet in the scrubber. A Bay Area refinery that installed a wet gas scrubber noted that this project would convert 800 ton/year of

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[62] EIR, p. 3.5-6.

[63] EIR, p. 3.5-12.

[64] EIR, p. 3.5-13.

recyclable waste into 1,600 ton/year non-recyclable hazardous waste and eliminate the benefit of reduced clay usage.[65] The EIR does not contain an adequate discussion regarding this hazardous waste disposal issue.

- NOx emissions increase from lowering ammonia limit: Ammonia injection reduces NOx emissions through selective catalytic reduction on catalyst fines trapped in the ESP. This process can reduce FCC NOx emissions by 20-90%.[66] Replacing the ESP with a WGS will eliminate this co-benefit, resulting in increased NOx emissions or need to install additional NOx control technology. This has not been addressed in either the EIR or Staff Report.

- Filterable PM increase from lowering ammonia limit: There is an optimal range for ammonia addition (and slip) beyond which more ammonia addition does not help and less ammonia does not help either. The limit proposed in the rule is below the optimal range and may result in actual increases of filterable PM emissions for the sake of poorly defined decreases in condensable PM emissions. The EIR provides no analysis of this potential effect.

- Toxic Air Contaminant (TAC) Emissions Increase: The EIR's Toxic Air Contaminant (TAC) analysis assumes that the wet gas scrubber will use NaOH as caustic in a non-regenerative wet gas scrubber.[67] However, due to the significant impact from water usage which Chevron will be unable to mitigate using recycled water, a regenerative wet gas scrubber may be required. Regenerative wet gas scrubbers use an amine solution which could result in increased TAC emissions.[68] The EIR fails to clearly demonstrate the potential toxic emissions associated with the Proposed Regulation.

- Wet Gas Scrubber Plume Impacts: The EIR does not account for the decrease in emissions dispersion from a wet gas scrubber. This could create hyper local emissions impacts and effect the analysis. The EIR also fails to account for changes to aesthetics that could result from the increased visibility of the new wet gas scrubber plume.

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[65] Valero Improvement Project, Addendum to VIP EIR (June 2008) <https://www.ci.benicia.ca.us/vertical/sites/%7BF991A639-AAED-4E1A-9735-86EA195E2C8D%7D/uploads/Valero_Improvement_Project_EIR_Addendum_ESA.PDF>.

[66] U.S. Patent and Trademark Office, Simultaneous Sulfur Oxide And Nitrogen Oxide Control In FCC Units Using Cracking Catalyst Fines With Ammonia Injection (4434147) (1984) <https://patentimages.storage.googleapis.com/87/19/3c/779dbdb6335639/US4434147.pdf>.

[67] EIR, p. 3.2-47, 3.3-18.

[68] There are several amines listed as TACs in BAAQMD Regulation 2-5.

Examples of visible plume from a refinery wet gas scrubber[69]

- Increase in Local Exposure to PM: The EIR does not contain a discussion on the potential increase in local exposure to PM as a result of the installation of wet gas

[69] The Wastewater Blog, *Wet Gas Scrubber* (Dec. 2016) <https://www.thewastewaterblog.com/single-post/2016/12/18/wet-gas-scrubber>; Valero Benicia (Page 1) - Line.17QQ.com.

scrubbers. The District has not adequately evaluated the potential ***increase*** in PM exposure to the nearby community and our employees from a wet gas scrubber plume. Chevron's current FCC electrostatic precipitator emits a relatively dry exhaust at high temperatures which results in PM dissipating in the upper atmosphere over the refinery. This virtually eliminates the impact to the local community. On the other hand, the wet gas scrubber will have a cool, wet plume resulting in a highly visible plume that will go into the local community. The District's own model shows that a wet gas scrubber will have more ground-level exposure for equivalent emissions. However, this impact could be even worse than indicated by the model. The model uses inaccurate base elevations and is not capable of properly modelling a wet plume. These issues could mask the true local community impacts of emissions from a wet gas scrubber.

Chevron also reviewed an EIR for the installation of a wet gas scrubber in a Bay Area refinery.[70] The report states on Page 2-18, "*This will allow the scrubber system to provide for the equivalent control of particulate emissions and eliminate the need to operate the existing electrostatic precipitators (ESPs).*" This means that the wet gas scrubber was no better than the refinery's electrostatic precipitator at controlling PM from FCC. Moreover, the EIR showed a net increase of 2.1 tons/year of PM associated with the wet gas scrubber (see Table 3.1.2-6). This Bay Area refinery has also commented publicly that their FCC cannot comply with the District's proposed 0.01 gr/dscf PM limit, further invalidating the basis for the proposed PM emissions limit.

Based on the above, it is clear that the EIR does not have the project-specific level of detail for this particular rule making.[71] The District must prepare a new EIR for the Proposed Amendments independent of the EIR done for the BARCT Implementation Schedule.[72]

B. The District Must—at the Very Least—Update Its CEQA Analysis for the Proposed Amendments

As discussed above, the Proposed Amendments are a separate project for which the District must conduct a new CEQA analysis. However, even if the Proposed Amendments were to be treated as part of the AB 617 Expedited BARCT Implementation Schedule project, the EIR is not an adequate informational document for the Proposed Amendments. In 2018, it was unclear what exactly the Proposed Amendments for Rule 6-5 would entail. Now that Staff has

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[70] Valero Improvement Project, Addendum to VIP EIR (June 2008) <https://www.ci.benicia.ca.us/vertical/sites/%7BF991A639-AAED-4E1A-9735-86EA195E2C8D%7D/uploads/Valero_Improvement_Project_EIR_Addendum_ESA.PDF>.

[71] See *Sierra Club v. County of Sonoma* (1992) 6 Cal.App.4th 1307, 1319 (a new EIR may be required for a later new project).

[72] See Pub. Res. Code § 21061 (agencies must evaluate the potential environmental impacts of a proposed project and identify feasible methods to reduce or avoid identified significant adverse environmental impacts of the project).

proposed stringent controls, significant new, material information exists as to the potential environmental impacts of the Proposed Amendments. The District must ensure that its analysis and findings are based upon credible substantive evidence, that a reasonable range of alternatives is considered, that the project decisions meet the purpose and need, that significant impacts are avoided or mitigated, and that the whole of the action is identified and analyzed. Thus, at a minimum, the District must prepare a subsequent or supplemental EIR.

First, new information has been presented regarding significant undisclosed impacts of the Proposed Amendments. Under CEQA, a subsequent or supplemental EIR is required when (1) substantial changes are proposed in the project that will require major revisions of the EIR; (2) substantial changes occur in the circumstances under which the project is being undertaken that will require major revisions in the EIR; (3) or new information of substantial importance to the project that was not known and could not have been known at the time the EIR was certified as complete becomes available.[73] Most relevant here is the third occurrence, which requires a showing that "(1) that 'new' information of substantial importance becomes available; (2) that the 'new information' was not known and could not have been known at the time the EIR was certified; and (3) that the 'new information' shows either that the project will have one or more significant effects not previously discussed in the EIR or that significant effects previously examined will be substantially more severe than shown in the EIR."[74,75]

Here, the EIR does not sufficiently address the potential environmental impacts of the Proposed Amendments. As described above, new information regarding the Proposed Amendments has become available and is presented here by Ramboll[76] that demonstrates that their adoption could result in significant impacts, including information regarding increases in water, energy use, GHGs, and NOx and filterable PM emissions associated with the proposed ammonia limit and operation of an expanded electrostatic precipitator or wet gas scrubbers. This critical information was not subject to public review and comment, nor was it evaluated to determine if potential significant environmental impacts may occur. More specifically, as to wet gas scrubbers, new information has been provided regarding each of the impacts as discussed in the bullets above in Section VIII.A. Additionally, the EIR does not contemplate the potential environmental consequences if the Proposed Regulation limits cannot be met. Given the stringency of the Proposed Amendment, it is possible that a refinery cannot meet the limit, in

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[73] Pub. Res. Code § 21166; CEQA Guidelines, §15162.

[74] *A Local & Regional Monitor v. City of Los Angeles* (1993) 12 Cal.App.4th 1773, 1800 [internal citation omitted].

[75] The new-information trigger extends not only to new information about the project's environmental impacts but also to new information about mitigation measures and alternatives. (*Committee for Re-Evaluation of the T-Line Loop v. San Francisco Mun. Transp. Agency* (2016) 6 Cal.App.5th 1237, 1255.)

[76] Eric Lu, Principal of Ramboll, has over 14 years of experience in air quality management and climate change issues. He has expertise with air permitting, air dispersion modeling, risk assessment, litigation support, GHG emissions inventory and reporting and CEQA.

which case the operations may have to cease to operate, which would lead to environmental impacts.

Second, new information of substantial importance exists as to mitigation measures for the Proposed Amendments. A subsequent or supplemental EIR is required when new information of substantial importance shows that "mitigation measures . . . which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure."[77] Further, mitigation is one of the fundamental goals of CEQA, and considered "the teeth of the EIR."[78]

Although the EIR includes wet gas scrubbers as a potential option for compliance with the Rule, which would have a significant impact under CEQA, it does not identify any mitigation measures to address those impacts. For example, there is no analysis of the fresh or reclaimed water infrastructure that would be necessary to support this regional build out. To address such impacts, mitigations could include, for example, a regenerative wet gas scrubber, which would use less water than non-regenerative wet gas scrubbers. Indeed, the District has considered regenerative wet gas scrubbers in other analyses: while the District used non-regenerative wet gas scrubbers in its cost effectiveness calculations, it added a cost estimate showing that a regenerative is twice as expensive. A summary conclusion in the Staff Report that EIR analysis is sufficient cannot be used as a replacement for the robust supplemental environmental analysis that is warranted for this proposed rule.

Third, new information of substantial importance exists as to alternatives for the Proposed Amendments. Supplemental or subsequent environmental review is required when new information of substantial importance shows that "alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the . . . alternative."[79] Here, the District attempts to avoid CEQA review for the Proposed Amendments by relying on a 3-year-old EIR for an entirely different project that only identified two alternatives for the AB 617 BARCT Implementation Schedule: (1) not implementing the Expedited BARCT Implementation Schedule and (2) delaying implementation. The EIR provides no alternatives analysis on the different types of wet gas scrubbers and the impacts of

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[77] CEQA Guidelines, § 15162(a)(3)(D); see also *Moss v. County of Humboldt* (2008) 162 Cal.App.4th 1041, 1057-58.

[78] *Environmental Council of Sacramento v. City of Sacramento* (2006) 142 Cal.App.4th 1018, 1039; *Lincoln Place Tenants Ass'n v. City of Los Angeles* (2007) 155 Cal.App.4th 425, 443, 444 ["The fundamental goals of environmental review under CEQA are information, participation, ***mitigation***, and accountability"] [emphasis added].

[79] CEQA Guidelines, § 15162(a)(3)(D).

each.[80] And although the District previously drafted two rule alternatives for the Proposed Amendments, the EIR does not identify or analyze them in any way, or provide quantitative information that is useful to the public or decisionmakers regarding these alternatives. For example, while the EIR does mention that the potential water demand associated with a wet gas scrubber could result in significant impacts[81], it does not acknowledge the fact that alternatives to the proposed rule would not necessitate a wet gas scrubber or those associated impacts. Despite the Staff Report's claim otherwise, substantial information has been provided to the District regarding the significance of alternatives to the proposed rule.

IX. BAAQMD HAS NOT DEMONSTRATED THAT THE PROPOSED TOTAL PM_{10} LIMIT IS ACHIEVABLE

BAAQMD has provided no analysis or technical support in this rulemaking process demonstrating that the proposed Total PM_{10} limit of 0.010 gr/dscf is feasible, and no assessment of differences between facilities (or even operating conditions at the same facility) that may impact whether that FCCU can meet the proposed limit. This lack of supporting analysis was brought to the District's attention nearly a year ago by the California Air Resources Board (CARB) Enforcement Division, who stated:

> "CARB recommends that the BAAQMD revise the staff report to provide a more comprehensive and transparent analysis of the proposed total PM_{10} limit of 0.02 grains per dry standard cubic foot (gr/dscf) established in section 6-5-301.3. This analysis should account for differences in source test methodologies that may result in an apples-to-oranges comparison. CARB recommends that BAAQMD include a thorough evaluation of total PM_{10} results from refinery FCCUs across California and the US and provide a detailed analysis on the proposed total PM_{10} limit for this draft amendment.
>
> The staff report accompanying BAAQMD draft amendments to Regulation 6, Rule 5, stated the BAAQMD reviewed source test data from FCCUs 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. BAAQMD did not document this analysis or how the district determined that a standard of 0.02 gr/dscf was the most appropriate and effective limit for sources in BAAQMD."[82]

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[80] This lack of discussion also prevented the public from being able to adequately comment on the matter.

[81] EIR, p. 3.4-18.

[82] Email from Ben Sehgal (CARB) to David Joe, "RE: CARB, Enforcement Division has a few comments on the draft amendments to Rule 6-5," (July 14, 2020) (available at https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-6-rule-5-particulate-emissions-from-refinery-fluidized-catalytic-cracking-units/2020-amendment/comments/20200713_carb_0605-pdf.pdf?la=en).

Appendix B to the Staff Report includes a table of source test results from FCCUs in the U.S. Of the source test results for FCCUs equipped with a wet gas scrubber, approximately ***half*** report a total PM_{10} emission rate greater than 0.010 gr/dscf at 5% oxygen, the standard in the Proposed Amendments and several are above 0.02 gr/dscf. The District provides no explanation or commentary whatsoever on why this total PM_{10} emission limit is appropriate, when half of the source tests the District identified failed to meet it. Notably, publicly available data in EPA's WebFIRE database identifies additional source test results from FCCUs with wet gas scrubbers, which showed total PM_{10} emission rates greater than 0.010 gr/dscf, and which the District failed to include in Appendix B.[83]

Based on Ramboll's review of Appendix B, it appears the District may have used the geometric mean of the source data in Appendix B (which, as noted above, does not include all publicly available source test data) to justify the 0.010 gr/dscf limit.[84] However, the average or geometric mean of average emissions from a population of similar units is never an appropriate statistic for establishing an emissions limit. As stated in U.S. EPA's *AP-42 Compilation of Air Pollutant Emissions Factors*, an emissions limit representing the average emissions for such a population would result in half the units not being able to achieve the limit:

> "Because emission factors essentially represent an average of a range of emission rates, approximately half of the subject sources will have emission rates greater than the emission factor and the other half will have emission rates less than the factor. As such, a permit limit using an AP-42 emission factor would result in half of the sources being in noncompliance."

The upper prediction limit at the 99% confidence level (99% UPL) provides an example of an established statistic that does account for normal process and measurement variability. The 99% UPL represents the value below which 95% of future test results will fall with 99% confidence. Using the Bhaumik-Gibbon[85] methodology for log-normal distributions, the 99% UPL for the 28 units listed in Appendix B is 0.078 gr/dscf @ 5% O_2. This demonstrates very low confidence that any individual unit could routinely comply with the proposed limit - only 35% confidence in this case, an unacceptably low value for decision-making.

The District has heard comments throughout this rulemaking from a Bay Area refinery, Valero, consistent with these findings. Valero has a wet gas scrubber and does not meet the Proposed Amendments' Total PM_{10} emission limit in all source tests. Valero provided six sets of source test results in its March 1, 2021 comment letter to BAAQMD, which showed that three of those six source tests exceeded the 0.010 gr/dscf proposed Total PM_{10} limit. In 2017, the result

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[83] *See also* WSPA comments submitted to BAAQMD, April 30, 2021.

[84] *See* **Exhibit A** for further discussion.

[85] Singleton, A. Memorandum: Revised MACT Floor Analysis (2011) for the Industrial, Commercial, and Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants – Major Source, January 4, 2011. EPA-HQ-OAR-2002-0058-3273. https://downloads.regulations.gov/EPA-HQ-OAR-2002-0058-3273/content.pdf (accessed April 2021).

was exactly equal to the proposed limit of 0.010 gr/dscf, with no compliance margin. The District has not stated whether it selected the 0.010 gr/dscf proposed limit with a compliance margin included, to account for fluctuations in the process and inaccuracies in source testing.

BAAQMD should reconsider the proposed PM_{10} emissions limit because there is a low probability it can be achieved at any individual unit if the proposed control technology (WGS) is installed. Further, BAAQMD has not demonstrated that the quality and characteristics of the data that BAAQMD has used to establish the proposed PM_{10} emissions limit are understood and have been properly taken into consideration. Chevron requests that BAAQMD make publicly available all test reports, complete with all supporting data and appendices, for all tests upon which BAAQMD relies for establishing the PM_{10} emissions limit, so that the test methods, data quality and data variability can be independently evaluated and to facilitate assessment of complete data characteristics.

X. BAAQMD SHOULD EVALUATE ALTERNATIVE ANALYTICAL METHODS

The test methods currently required by the Proposed Amendments to measure condensable and filterable PM are materially flawed, and BAAQMD has not responded to numerous comments from all of the affected refineries requesting changes to the test methods, or at least regulatory flexibility in which test methods are used to demonstrate compliance.

A. EPA Method 202 Results Include Artifacts That Overestimate Condensable PM

Sampling and analysis of condensable PM (CPM) is known to be extremely difficult due to gaseous components of the sample, such as ammonia and sulfur dioxide, converting to other compounds in the sampling train, such as ammonium and sulfate, which are then reported as CPM. However, in reality not all of that gaseous ammonia and sulfur dioxide would condense in ambient air to form CPM, and thus CPM is overestimated. BAAQMD itself has acknowledged that:

> "[P]otential emission reductions of condensable PM are often difficult to quantify due to the complex nature of condensable PM formation. This formation can be highly dependent on site-specific source parameters, including flue gas properties and composition. Because control strategies typically involve the reduction of condensable components and precursors (such as ammonia and SO_2) instead of a direct limit on condensable PM, reductions of condensable PM emissions associated with these control measures may be difficult to estimate without specific engineering information."[86]

When South Coast Air Quality Management District (SCAQMD) adopted Rule 1105.1 in 2003, limiting PM emissions from FCCUs, the District noted in the Final Environmental Assessment for the Rule that because of the uncertainty around how CPM is formed and

[86] Staff Report, Appendix D, 2018 Final Environmental Impact Report – AB 617 Expedited Best Available Retrofit Control Technology (BARCT) Implementation Schedule at 3.2-25.

measured, the District adopted only a filterable PM emissions limit along with an ammonia limit.[87]

Proposed Sections 6-5-604 and 6-5-605 require determination of condensable PM using USEPA Test Method 202 ("Method 202"). Method 202 is known to have a positive bias due to measurement artifacts that overestimate CPM.[88] The measurement "artifact" arises from gaseous SO_2, which does not condense at atmospheric conditions but reacts in the condensed liquid water collected in the Method 202 apparatus to form sulfate residue, which is indistinguishable from condensable PM. This results in measured condensable PM that is greater than actual condensable PM. This is a widely known issue with Method 202, as even the EPA Method 202 Best Practices Handbook[89] refers to protocols to reduce the "sulfate artifact." [90]

Ammonia also plays a critical role in driving sulfate artifact formation. Ammonia is highly soluble in water, and it acts as a scrubber to pull more SO_2 into the water in the sampling apparatus and to change it into sulfate that cannot be removed with the nitrogen purge that EPA recommends for removing SO_2 adsorbed in the water. Even though this chemistry would not have occurred at all or to this extent in the *atmosphere*, all of the ammonium and sulfate ions captured in the apparatus are counted as condensable PM, which is gross overestimation. At least one study demonstrates that the gaseous SO_2 artifact is greatly increased when ammonia gas also is present.[91]

Because the FCCU emissions data used as a baseline in this rulemaking include a positive bias due to a measurement artifact[92] in the Method 202 samples for condensable PM, those total emissions are not all real-world emissions capable of being controlled. It is likely that the difference between measured and actual condensable PM is significant for Chevron's FCCU.

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[87] SCAQMD, Final Environmental Assessment for Proposed Rule 1105.1 – Reduction of PM10 and Ammonia Emissions from Fluid Catalytic Cracking Units, at 1-3 (Sept. 30, 2003).

[88] *See* **Exhibit A** for further discussion.

[89] EPA Method 202 Best Practices Handbook (January 2016), https://www3.epa.gov/ttn/emc/methods/m202-best-practices-handbook.pdf.

[90] *See also* 82 FR 42512, September 8, 2017.

[91] Carlson, L. *2020 Report on USEPA Method 202 Precursor Bias*, presented at Utility CEMS e-Conference, May 28-29, 2020, available at: https://www.youtube.com/watch?v=R9X_s9BzCbw. *See* at 5:02:00 (last accessed April 2021).

[92] Oxford Languages defines "artifact" in this context as "something observed in a scientific investigation or experiment that is not naturally present but occurs as a result of the preparative or investigative procedure." https://www.google.com/search?q=artifact&oq=artifact&aqs=chrome..69i57j46i433j0i433l2j0j0i433l2j5.1528j0j3&sourceid=chrome&ie=UTF-8 (accessed April 2021).

Sulfuric acid in the FCCU flue gas is typically considered condensable PM because it condenses to a liquid mist at atmospheric temperatures. Sulfuric acid concentrations in the FCCU flue gas are typically a small fraction of the SO_2 concentration (typically 1% to 6%[93] but may be somewhat higher depending on FCCU operation). Ammonia also is present in the flue gas at Chevron; therefore, sulfuric acid will be captured instead as filterable PM because it readily reacts with ammonia to form ammonium sulfate, a filterable solid at sample collection temperatures. Thus, the filtered sample gas entering the Method 202 sample train contains SO_2 but not significant sulfuric acid. Ammonia greatly increases the SO_2 water artifact in the Method 202 samples.[94]

Based on preliminary analysis of the March 2021 stack test results at Chevron, the condensable PM samples contain significant amounts of sulfate and ammonium. Because the sulfuric acid is captured as filterable PM, the sulfate derives from SO_2. The results show that the total PM_{10} results are very likely biased high by as much as ***19-24%*** due to this SO_2 water artifact. In the District's estimates of reductions from the Proposed Amendments, therefore, some of the estimated reductions are from CPM testing artifacts and will not translate to actual emission reductions (and, therefore, will not have any health benefits). Without a reliable method that accurately represents CPM in the FCCU exhaust, refinery FCCU emission estimates are inflated and there can be no confidence that the Proposed Amendments will result in real world emission improvements even if new control devices are installed.

B. The Proposed Amendments Should Allow Use of the OTM-37 Method

In recognition of the artifact issues described above, EPA developed a dilution sampling method in 2002 known as Conditional Test Method 039 (CTM-039).[95] EPA has referred to dilution sampling as the "gold standard" for measuring PM emissions from stationary sources.[96] Federal and international standards for decades have relied on dilution sampling methods for measuring PM emissions from mobile source engines, so they are well established as a

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[93] *Technical Update: Estimating Total Sulfuric Acid Emissions from Stationary Power Plants*, Product ID 3002012398, Electric Power Research Institute, Palo Alto, California, 2018. https://www.epri.com/research/products/3002012398 (accessed April 2021)

[94] Carlson, L. *2020 Report on USEPA Method 202 Precursor Bias*, presented at Utility CEMS e-Conference, May 28-29, 2020, available at: https://www.youtube.com/watch?v=R9X_s9BzCbw. *See* at 5:02:00 (last accessed April 2021).

[95] *Conditional Test Method 039: Measurement of PM 25 and PM 10 Emissions by Dilution Sampling (Constant Sampling Rate Procedures)*, July 2002. https://www.epa.gov/sites/production/files/2020-08/documents/ctm-039.pdf (accessed April 2021).

[96] Myers, R. Condensable PM Test Method Improvement Workshop, 2007. https://www3.epa.gov/ttnemc01/methods/m202doc10.pdf (accessed April 2021).

measurement principle.[97,98] In 2018, EPA collaborated to develop an updated version of CTM-039 known as OTM-37 which incorporates changes to improve sensitivity for measuring low $PM_{10}/PM_{2.5}$ concentrations.[99] EPA is conducting a condensable PM research study to better understand condensable formation and to see how measurement approach affects the measured results. EPA is currently evaluating OTM-37 (Measurement of Direct $PM_{2.5}$ and PM_{10} Emissions at Low Concentrations by Dilution Sampling) against Method 202 and anticipates finishing that study in 2023.[100]

OTM-37 is a dilution test method, which is a more appropriate test method for analyzing CPM from a stack, especially one with sulfur oxides and ammonia present and very low concentrations of PM. The benefits of OTM-37 compared to Method 202 are, at a minimum, as follows:

- OTM-37 measures condensable PM more accurately because it replicates conditions in the stack gas plume as it mixes and cools in the atmosphere near the stack which govern condensable PM formation.
- OTM-37 avoids the SO_2 water artifact present in Method 202 because the method avoids condensation of water vapor present in the stack gas sample.
- OTM 37 collects and measures filterable and condensable PM together on the same sample filter, without distinguishing between them, using the same well-proven equipment and procedures used for ambient air $PM_{2.5}$ monitoring. This improves results comparability with ambient air PM monitoring results and thus enables more effective ambient air PM attainment strategies.
- For application to wet stacks, OTM-37 can be modified by substituting a Method 5 nozzle for the $PM_{10}/PM_{2.5}$ cyclones, similar to performance test approaches which substitute Method 5 in lieu of Method 201A.

OTM-37 has the potential to better represent CPM emissions from sources like FCCUs without the SO_2 water artifacts and resulting bias of Method 202. Given the known issues with Method 202, BAAQMD should ensure that the Proposed Amendments utilize the best test

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[97] 40 CFR 1065 *Engine Testing Procedures*.

[98] ISO 8178-1:2020, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 1: Test-bed measurement systems of gaseous and particulate emissions.* https://www.iso.org/obp/ui/#iso:std:iso:8178:-1:ed-4:v1:en (accessed April 2021).

[99] *Other Test Method 37: Measurement of Direct PM2.5 and PM10 Emissions at Low Concentrations by Dilution Sampling (Constant Sampling Rate Procedure)*, May 2018. https://www.epa.gov/sites/production/files/2020-08/documents/otm37-pm10-2.5_r1_05-24-2018.pdf (accessed April 2021).

[100] Nash, D. *Condensable PM (CPM) Measurement Method Comparison: Understanding CPM Formation*, presented at the 43rd Stationary Source Sampling and Analysis for Air Pollutants Conference, Point Clear, Alabama, April 14-19, 2019; Johnson, S., *MTG Highlights*, EPA OAQPS Highlights Webinar, April 21, 2021, Source Evaluation Society.

method to determine Total PM_{10} emissions. BAAQMD has allowed the use of such dilution test methods to demonstrate permit compliance in a Major Facility Review Permit issued to Russell City Energy Company, LLC in Hayward, CA in September 2019.[101] Chevron has not received any explanation for why such test method flexibility could not be incorporated into the Proposed Amendments.

C. EPA Method 201A Is Inappropriate for Filterable PM Measurement for "Wet Stacks"

Proposed Sections 6-5-604 and 6-5-605 require measurement of filterable PM using USEPA Test Method 201A ("Method 201A"). Method 201A clearly states that this method cannot measure filterable PM in stack exhausts where water droplets are present. Thus, installation of a wet gas scrubber to comply with the Proposed Amendments' Total PM_{10} emission limit will create operating conditions (a wet stack) that make it impossible to measure filterable PM using the test method required by the Proposed Amendments. The District has not reconciled this discrepancy or provided any flexibility that would allow a refinery to comply with the Proposed Amendments. This is just one example of how internally inconsistent the Proposed Amendments are, and how the District has not performed a full analysis of the Proposed Amendments such that they are technically feasible and capable of being complied with.

XI. BAAQMD HAS FAILED TO SUPPORT ITS REQUIRED FINDINGS

The rulemaking does not meet the requirements of the Health and Safety Code. Health and Safety Code Section 40727 requires that BAAQMD make certain findings before adopting a rule, including findings of necessity, consistency, and non-duplication. As described throughout this letter and below, the record before the Board does not support these findings.

A. Necessity

The Staff Report's conclusion regarding "necessity" is premised on flawed or missing input data and does not support the required finding that the Proposed Amendments are necessary. "'Necessity' means that a need exists for the regulation, or for its amendment or repeal, as demonstrated by the record of the rulemaking authority."[102] The record before the Board does not include the support required to reach the conclusion that these amendments are necessary for at least four reasons.

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[101] BAAQMD, Major Facility Review Permit issued to Russell City Energy Company, LLC (#B8136), Permit Condition #26117, part 31 (Sept. 24, 2019) ("As indicated above, the Owner/Operator shall measure the contribution of condensable PM (back half) to the total PM_{10} and $PM_{2.5}$ emissions. However, the ***Owner/Operator may propose alternative measuring techniques to measure condensable PM such as the use of a dilution tunnel*** or other appropriate method used to capture semi-volatile organic compounds." (emphasis added)).

[102] Cal. Health & Saf. Code § 40727(b)(1).

First, the Staff Report overestimates the current emissions from fluid catalytic cracking units. Without an accurate baseline for an emissions source, it is impossible to come to the conclusion that a need exists to reduce emissions associated with that source.

Second, the Staff Report overestimates the emissions reductions that would occur because of the Proposed Amendments. Without an accurate accounting for how effective the Proposed Amendments would be, it is impossible to come to the conclusion that the regulation is needed.

Third, the Staff Report does not provide support for its assertion that FCCUs make up 3 percent of all PM emissions in the Bay Area.

Fourth, the Staff Report includes emissions from the Marathon Martinez Refinery in its inventory of PM emissions, which is permanently closed.[103]

B. Consistency

Before adopting a regulation, BAAQMD must make a finding of consistency. "Consistency" means that the regulation is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.[104] The Proposed Amendments are not consistent with federal regulations. The rule's definition of "condensable particulate matter is "Liquid droplets that coalesce, or gaseous emissions that condense to form liquid or solid particles. These liquid and/or solid particles are identified as condensable organic or condensable inorganic particulate matter using EPA Test Method 202."[105] However, both 40 CFR 51.50 and 40 CFR 51 Appendix M, EPA Method 202, Section 3.1 defined "condensable particulate matter" as "material that is vapor phase at stack conditions, but condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid PM *immediately after discharge from the stack*" [emphasis added]. The proposed Rule cites to the EPA Test Method 202 but fails to use the same definition as is included in that federal regulation.

Additionally, the proposed Rule requires a different method to measure filterable PM than the federal requirements in NSPS Subpart J. The District is proposing EPA Method 201A. This method specifies that the temperature of the probe and filter box be 250 ± 25°F. On the other hand, Subpart J requires the use of EPA Methods 5B and 5F, which require a probe and filter box temperature of 320 ± 25°F. Therefore, the affected refineries will need to use two methods to measure the same pollutant. Therefore, the Proposed Amendments are not consistent with federal regulations.

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[103] https://www.reuters.com/article/us-refineries-operations-marathon-ptrlum/marathon-petroleum-to-permanently-close-two-u-s-oil-refineries-idUSKBN24X3XU

[104] Cal. Health & Saf. Code § 40727(b)(4).

[105] Proposed Rule 6-5-203.

C. Non-Duplication

BAAQMD must make a finding that the Proposed Amendments are not a duplication of existing requirements.[106] Here, the Proposed Amendment includes new monthly reporting requirements under a new Section 6-5-404. The monthly reporting requirement is unnecessary as it would be duplicative with existing Regulation 1-522.8.

Additionally, the Proposed Amendments add a source testing requirement under new sections 6-5-503, 6-5-604 and 6-5-605, for quarterly stack testing. The source test reporting requirement is redundant with Title V permit conditions for the refineries that already require notification prior to testing. Therefore, these provisions are duplicative of current state and federal law.

XII. CONCLUSION

Chevron would like to request that BAAQMD staff evaluate the up-to-date emissions in its possession and propose compliance options that can bring meaningful improvements to local health quality. Below is an overview of compliance options BAAQMD should consider; however, this list is not meant to be exhaustive. Additional considerations will need to be evaluated.

- Focus on $PM_{2.5}$ and not PM_{10}, so that the focus is on the pollutant that has a true health impact as noted in the Staff Report and PM modeling.
- Account for necessary maintenance and eventual plant shutdowns/startups when establishing limits. Otherwise, facilities face unnecessary compliance burdens when they inevitably shutdown.
- Eliminate emissions limits that do not have a ***direct*** correlation with PM emissions, such as SO_2 and ammonia limits. A $PM_{2.5}$ limit alone should be established.
- Conduct a study on the appropriate FCCU PM stack testing method, and/or wait until EPA completes their analysis of EPA Method 202 and OTM-37. Without accurate stack data, the local community will not realize a ***quantifiable*** improvement in potential health effects.
- Harmonize source testing and reporting requirements with existing EPA and BAAQMD regulations, both in terms of frequencies and actual requirements.
- Establish a $PM_{2.5}$ limit based on source testing data that is representative for Bay Area refineries, in terms of size, complexity, and configuration. A 0.02 gr/dscf $PM_{2.5}$ limit at 5% O_2, may be more appropriate. BAAQMD has a long history of establishing limits in this manner, and Chevron hopes it returns to this practice of proposing limits based on accurate and representative data.

[106] Cal. Health & Saf. Code § 40727(b)(5).

EXHIBIT A

RAMBOLL

ENVIRONMENT
& HEALTH

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Review of BAAQMD Regulation 6 Rule 5 Rule Making Documents

Date: April 30, 2021

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Dear Mr. Carroll:

At your request, Ramboll US Consulting, Inc. (Ramboll) has reviewed the Bay Area Air Quality Management District (BAAQMD) Regulation 6 Rule 5 (Proposed Amendments) Rulemaking documents including its Staff Report[1] detailing the rule changes and background. Our findings reflect the limited time available for our review and information provided. To the extent that additional information or time is provided, our findings may change.

SUMMARY OF FINDINGS

The technical limitations of the PM_{10} source testing methods should be further evaluated to ensure that the PM_{10} emission limits proposed are achievable and that the ability to assess compliance with the proposed PM_{10} emission limits is feasible. The District has not addressed these technical source test method issues in its Staff Report for the Proposed Amendments. In this manner, the Proposed Amendments include PM_{10} emission limits that may not meaningfully represent actual PM_{10} emissions from the regulated units. Furthermore, without a reliable means to assess compliance to those PM_{10} limits, the limits themselves are meaningless. Demonstrating compliance with these limits would in essence be subject to uncontrolled variability and bias in the test methods, where one facility may pass and one may not simply because of limitations of the test methods. The technical issues are highlighted in subsequent discussion herein.

The health impact assessment should better represent the benefits between the two scenarios, and thus, more accurately reflect the consideration of the Proposed Amendments. Currently, the analyses in support of the Proposed Amendments includes an analysis of impacts from all facility emissions, which is not relevant to the current rule. It is unclear what the purpose of including this baseline analysis was, when instead results should be presented for the two scenarios (A and B), which would show a much smaller difference between the two scenarios. In addition, if only emissions from the FCCU are considered, the modeling domain should be evaluated, likely leading to a smaller population that may be impacted

[1] Joe, D. and Finkle, J. Staff Report: Proposed Amendments to Regulation 6, Rule 5: Particulate Emissions from Petroleum Refinery Fluidized Catalytic Cracking Units, Bay Area Air Quality Management District, March 2021. Available at https://www.baaqmd.gov/rules-and-compliance/rules/reg-6-rule-5-particulate-emissions-from-refinery-fluidized-catalytic-cracking-units. Accessed April 2021.

by the Proposed Amendments. Also, the results should be presented with uncertainty bounds around the single point estimates currently presented, as this would provide a more complete picture of the analysis results. The uncertainties also should be more fully described and discussed including assumptions regarding the selection of health endpoints and the underlying studies that form the basis of the analysis. Lastly, health impacts should be placed into context (i.e., with regards to how they compare to baseline health rates for the area). We expand on these issues below.

The Proposed Amendments and staff report have not adequately addressed CEQA. The reliance upon the AB617 Expedited BARCT Implementation Schedule Project DEIR/FEIR has left many potentially significant environmental impacts unassessed and unaddressed. The fundamental purpose of such an analysis is to ensure that decision makers are informed of all of the potentially significant impacts and in essence trade-offs associated with a discretionary action. Notably, there may be potentially significant impacts related to NOx emissions (and therefore ozone impacts), water usage, toxics, hazards, energy, aesthetics, and greenhouse gases. Many of these potentially significant environmental impacts can also have health consequences for the surrounding community and even larger population centers. The current CEQA analysis appears to be deficient relative to the potentially significant impacts of the Proposed Amendments.

The Proposed Amendment and staff report include cost effectiveness calculations that are substantial deviations from past practice by the BAAQMD and other air agencies. As discussed below, BAAQMD's cost effectiveness calculations show that the proposed control measures do not meet the historical thresholds for acceptable cost effectiveness applied in other rules. Combined with the other issues discussed above, BAAQMD's current analyses do not clearly substantiate that the benefits outweigh the extraordinarily high cost per ton of PM_{10} removal stated in the Proposed Amendments, nor do the current analyses fully assess if meaningful community and health benefits are achievable in a cost effective manner. Further analyses that address the identified issues are necessary to evaluate the options for the Proposed Amendments to provide a more complete picture of the options.

SOURCE TEST METHODOLOGY ISSUES

1. The BAAQMD is relying upon EPA Method 202 for measuring condensable PM emissions, which is subject to a key measurement artifact that most likely impacts the accuracy of the data that BAAQMD has used to establish the proposed PM_{10} emissions limit and future testing of emissions. The BAAQMD should address these issues in the Proposed Regulation.

   – EPA Method 202 for measuring condensable PM emissions is subject to a measurement "artifact"[2] from gaseous SO_2, which does not condense at atmospheric conditions but reacts in the condensed stack gas water vapor collected in the Method 202 apparatus during tests to form sulfate residue that is indistinguishable from condensable PM. This results in measured condensable PM that is greater than actual PM, and it is likely that the difference between measured and actual condensable PM is significant for Chevron's FCCU. Gaseous SO_2 is a secondary PM precursor, but secondary PM is explicitly excluded from the definitions of reportable filterable PM and condensable PM emissions at 40 CFR §51.50.

   – EPA acknowledges that the SO_2 water artifact exists in the original method and is reduced by procedures specified in the 2010 method revision (75 Fed. Reg. 80118, December 21, 2010.). But EPA does not say that the artifact is eliminated or reduced to an acceptable level for all

[2] Oxford Languages defines "artifact" in this context as "something observed in a scientific investigation or experiment that is not naturally present but occurs as a result of the preparative or investigative procedure." https://www.google.com/search?q=artifact&oq=artifact&aqs=chrome..69i57j46i433j0i433l2j0j0i433l2j5.1528j0j3&sourceid=chrome&ie=UTF-8. Accessed April 2021.

source types and situations. Since the 2010 Method 202 revision was published, additional studies show the SO_2 water artifact remains significant relative to actual condensable PM in some situations, including when SO_2 and ammonia are both present in the stack gas as they are at the Chevron FCCU.[3,4,5]

- A recent and ongoing industry study demonstrates that the gaseous SO_2 water artifact is greatly increased when ammonia gas also is present.[3] Other studies using the current version of Method 202 also confirm the SO_2 water artifact is significant for conditions studied.[4,5]
- In recognition of these issues, EPA is conducting a condensable PM research study to better understand condensable formation and how measurement approach (specifically, EPA Method 202, a cooled impinger method, and OTM 37, a dilution sampling method) affects the measured results.[6,7] Industry organizations (American Petroleum Institute, National Council for Stream and Air Improvement) are co-funding portions of EPA's study under collaborative agreements, underscoring the critical importance to both government air agencies and industry of achieving accurate condensable PM measurements.

2. The BAAQMD should consider another method such as OTM-37 to address the issues highlighted above regarding EPA Method 202. In recognition of the artifact issues described above, EPA developed a dilution sampling method in 2002 known as Conditional Test Method 039 (CTM-039).[8] EPA staff have referred to dilution sampling as the "gold standard" for measuring PM emissions from stationary sources.[9] U.S. federal, state and international standards for decades have relied on dilution sampling methods for measuring PM emissions from mobile source engines, so dilution sampling is well established and widely accepted as a measurement principle.[10,11] In 2017-2018, EPA collaborated to develop an updated version of CTM-039 now known as OTM-37, which

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[3] Carlson, L. *2020 Report on USEPA Method 202 Precursor Bias*, presented at Utility CEMS e-Conference, May 28-29, 2020. Available at: https://www.youtube.com/watch?v=R9X_s9BzCbw. See at 5:02:00. Accessed: April, 2021

[4] Huang, Y.M., Huang, S.H., Lin, C.W., Yang, H.H., Chen, C.C. Evaluation of Bias in the Measurement of Condensable Particulate Matter with Method 202. Aerosol Air Qual. Res. 21, 200149, 2021. https://doi.org/10.4209/aaqr.2020.04.0149. Accessed February 2021.

[5] Wang, G., Deng, J., Zhang, Y., Li, Y., Ma, S., Hao, J. and Jiang, J. Evaluating Airborne Condensable Particulate Matter Measurement Methods in Typical Stationary Sources in China, *Environ. Sci. Technol.* 2020 54 (3), 1363-1371. https://pubs.acs.org/doi/abs/10.1021/acs.est.9b05282. Accessed April 2021.

[6] Nash, D. *Condensable PM (CPM) Measurement Method Comparison: Understanding CPM Formation*, presented at the 43rd Stationary Source Sampling and Analysis for Air Pollutants Conference, Point Clear, Alabama, April 14-19, 2019

[7] Johnson, S., *MTG Highlights*, EPA OAQPS Highlights Webinar, April 21, 2021, Source Evaluation Society

[8] *Conditional Test Method 039: Measurement of PM 25 and PM 10 Emissions by Dilution Sampling (Constant Sampling Rate Procedures)*, July 2002. https://www.epa.gov/sites/production/files/2020-08/documents/ctm-039.pdf. Accessed April 2021.

[9] Myers, R. Condensable PM Test Method Improvement Workshop, 2007. https://www3.epa.gov/ttnemc01/methods/m202doc10.pdf. Accessed April 2021.

[10] 40 CFR 1065 *Engine Testing Procedures*.

[11] ISO 8178-1:2020, *Reciprocating internal combustion engines — Exhaust emission measurement — Part 1: Test-bed measurement systems of gaseous and particulate emissions*. https://www.iso.org/obp/ui/#iso:std:iso:8178:-1:ed-4:v1:en. Accessed April 2021.

incorporates changes to improve sensitivity for measuring low $PM_{10}/PM_{2.5}$ concentrations.[12] The advantages of dilution methods include:

A. OTM 37 avoids the SO_2 water artifact present in Method 202 because the method avoids condensation of water vapor present in the stack gas sample.

B. OTM 37 measures condensable PM more accurately because it replicates conditions which govern condensable PM formation in the stack gas plume as it mixes and cools in the atmosphere near the stack.

C. OTM 37 collects and measures filterable and condensable PM together on the same sample filter, without distinguishing between them and thereby eliminating a large source of measurement error compared with EPA Methods 201A and 202, using the same well-proven sample collection and analysis equipment and procedures used for ambient air $PM_{2.5}$ monitoring. This improves results comparability with ambient air PM monitoring results and thus enables more effective strategies for attaining ambient air PM standards.

D. For application to wet stacks, OTM 37 can be modified by substituting a Method 5 nozzle for the $PM_{10}/PM_{2.5}$ cyclones and thereby determining total PM emissions as a surrogate for PM_{10}, similar to performance test approaches that have been approved by regulatory agencies, which substitute EPA Method 5 or 5B in lieu of Method 201A.

PROPOSED PM_{10} EMISSIONS LIMITS FOR WGS CONTROLS

3. BAAQMD proposes a PM_{10} emissions limit of 0.010 grains per dry standard cubic foot (gr/dscf)[13] corrected to 5% oxygen (O_2) and cites data for other FCCU units with wet gas scrubbers (WGS) listed in Appendix B of the District's staff report.[14] BAAQMD does not explain precisely how the proposed emission limit was derived from these data. Appendix B lists average PM_{10} emissions for 28 FCCUs equipped with WGS. Total PM_{10} concentration exhibits a wide range of values, and contributions of filterable PM and condensable PM to total PM_{10} emissions are not provided. No details indicating and differences in unit or air pollution control characteristics are provided. Therefore, there is no valid reason to exclude any of the listed units when evaluating the data.

4. The arithmetic average PM_{10} concentration for these 28 units is 0.0143 gr/dscf @ 5% O_2. However, an examination of the data shows they do not fit a normal distribution (Figure 1a); therefore, the arithmetic average is not an appropriate statistic to characterize average performance. The data do fit a lognormal distribution (Figure 1b), therefore the arithmetic average of the log-transformed data (i.e., the geometric mean) better represents the average performance. The geometric mean is 0.010 gr/dscf @ 5% O_2, which is the same as BAAQMD's proposed emissions limit but without a compliance buffer to allow for operational and test method variability.

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[12] *Other Test Method 37: Measurement of Direct PM2.5 and PM10 Emissions at Low Concentrations by Dilution Sampling (Constant Sampling Rate Procedure)*, May 2018. https://www.epa.gov/sites/production/files/2020-08/documents/otm37-pm10-2.5_r1_05-24-2018.pdf. Accessed April 2021.

[13] Reference temperature and pressure for volumetric parameters is not stated.

[14] *Appendix B: Source Test Results From Petroleum Refinery Fluidized Catalytic Cracking Units Throughout The United States*, undated. https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-6-rule-5-particulate-emissions-from-refinery-fluidized-catalytic-cracking-units/2020-amendment/documents/20210330_sr_0605_app_b-pdf.pdf. Accessed April 2021.

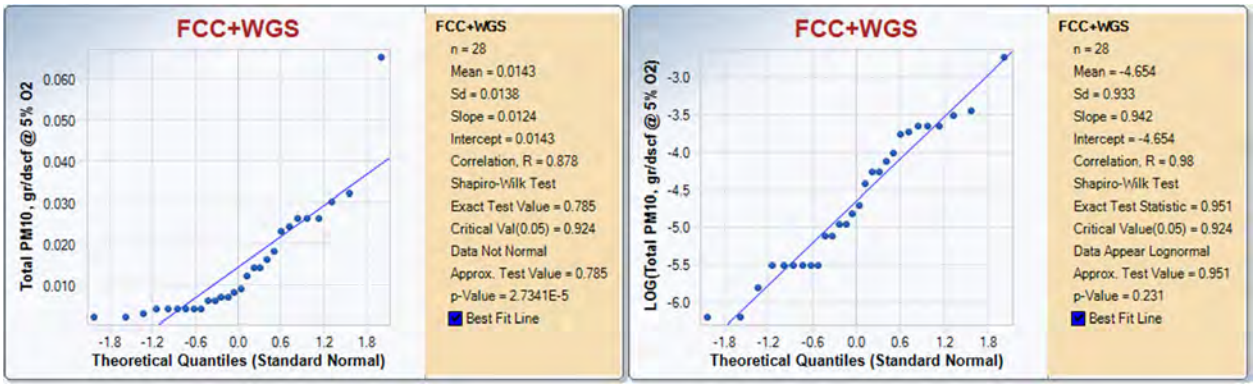

Figure 1: Q-Q frequency distribution plots of average PM_{10} emissions data for FCCU with WGS, (a – left) for raw data and (b – right) log-transformed data.

5. There is low confidence that BAAQMD's proposed PM_{10} emissions limit can be achieved because it does not account for normal process and measurement variability in establishing the proposed PM_{10} emissions limit. The average or geometric mean of average emissions from a population of similar units is never an appropriate statistic for establishing an emissions limit. As stated in U.S. EPA's AP-42 *Compilation of Air Pollutant Emissions Factors*, an emissions limit representing the average emissions for such a population would result in half the units not being able to achieve the limit:

> *"Because emission factors essentially represent an average of a range of emission rates, approximately half of the subject sources will have emission rates greater than the emission factor and the other half will have emission rates less than the factor. As such, a permit limit using an AP-42 emission factor would result in half of the sources being in noncompliance."*

6. The upper prediction limit at the 99% confidence level (99% UPL) provides an example of an established statistic that does account for normal process and measurement variability. The 99% UPL represents the value below which 95% of future test results will fall with 99% confidence. Using the Bhaumik-Gibbon methodology[15] for log-normal distributions, the 99% UPL for the 28 units listed in Appendix B is 0.078 gr/dscf @ 5% O_2, almost eight times higher than the proposed PM_{10} limit. This demonstrates very low confidence that any individual unit could routinely comply with the proposed limit - only 35% confidence in this case, an unacceptably low value for decision-making.

7. We recommend that BAAQMD make publicly available all test reports, complete with all supporting data and appendices, for all tests upon which BAAQMD relies for establishing the PM_{10} emissions limit, so that the test methods, data quality and data variability can be independently evaluated and to facilitate assessment of complete data characteristics.

[15] Singleton, A. Memorandum: Revised MACT Floor Analysis (2011) for the Industrial, Commercial, and Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants – Major Source, January 4, 2011. EPA-HQ-OAR-2002-0058-3273. https://downloads.regulations.gov/EPA-HQ-OAR-2002-0058-3273/content.pdf. Accessed April 2021.

8. Therefore, BAAQMD should reconsider the proposed PM_{10} emissions limit because there is an unacceptably low probability that it can be achieved at any individual unit if the proposed control technology (WGS) is installed. Further, BAAQMD has not demonstrated that the quality and characteristics of the data that BAAQMD has used to establish the proposed PM_{10} emissions limit are understood and have been properly taken into consideration. Any alternative emissions limit based on ESP should be evaluated similarly.

ISSUES RELATED TO HEALTH IMPACTS

9. The modeling summary (Appendix A.2) does not provide all of the data inputs and a full set of modeling results from the BenMAP analysis, including inputs for population estimates, $PM_{2.5}$ concentrations or deltas, concentration-response functions (CRFs), and health incidence data and results associated with the distribution of potential impacts and the percent of baseline incidence, which precludes a full evaluation of the analysis.

10. It is unclear why the baseline analysis includes estimated benefits from reductions of all facility emissions, as the rule applies only to the FCCU. A more appropriate analysis would include a baseline scenario only for FCCU emissions and a control scenario with regulated FCCU emissions. The difference would then be the benefits from regulating the FCCU emissions. By presenting the benefits from regulating all facility emissions to a zero $PM_{2.5}$ level, this greatly inflates overall benefits and is misleading for the purposes of this rule. Alternatively, the analysis could just include only results for the Scenario A and B analyses as presented in the current modeling document (i.e., Table 3.1, Appendix A.2). Also, results of the incremental benefits between Scenario A and B should be presented (i.e., a difference of about 0.5 to 1 premature mortality), which is far less than the health impacts presented for the current baseline scenario.

11. Modeling all facility emissions will extend the range of impacts to a larger (and more populated) area, also leading to inflated health impacts.

12. The analysis does not consider or fully discuss the uncertainties of the health impact analysis (as presented in Appendix A.2) including:

    A. The lack of confidence intervals for health impacts, thereby excluding a full consideration of the possible range of impacts, which could include no benefit.

        i. BenMAP analyses typically include an assessment the statistical uncertainty associated with the CRFs and provides a distribution of impacts from which uncertainty bounds can be obtained, this is missing in the documentation for the rule (i.e. Appendix A.2).

    B. The lack of a full description and discussion of limitations and uncertainties associated with the epidemiological studies that are the basis of the health impact assessment including:

        i. Epidemiological data represent associations, which do not equate to causality. Therefore, the analysis assumes from the outset that facility FCCU emissions are causally associated with health effects at the exposure concentrations resulting from these emissions, even though there is no scientific consensus regarding effects at very low levels of exposure to PM (i.e., below the NAAQS).

        ii. Causality is difficult to establish because epidemiology studies have limitations, most importantly inadequate exposure estimates and the inability to control for many factors that could explain the association between $PM_{2.5}$ and mortality such as lifestyle factors (e.g., smoking).

iii. The components of PM that may be associated with adverse health effects are yet unknown, but BenMAP analyses assume that all PM, regardless of composition, is equally toxic. Several reviews have evaluated the scientific evidence of health effects from specific particulate components (e.g., Rohr and Wyzga 2012;[16] Lippmann and Chen, 2009;[17] Kelly and Fussell, 2007[18]). These reviews indicate that the evidence is strongest for combustion-derived components of PM (such as from vehicles) including elemental carbon, organic carbon and various metals (e.g., nickel and vanadium), however, there is still no definitive data that points to any particular component of PM as being more toxic than other components. Therefore, by not accounting for the relative toxicity of PM components, BenMAP analyses are likely to be conservative.

iv. BenMAP analyses assume a log-linear response between exposure and health effects, without consideration for a threshold below which effects may not be measurable and does not consider for example a health effect threshold (such as the NAAQS).

v. The use of some of the CRFs, that are not typically used by US EPA in similar health impact analyses is not well justified and the impact of using different CRFs is not discussed. For example, a range of mortality estimates are provided that reflect the use of different epidemiological studies, including studies that have been used by EPA in previous health impact assessments (e.g., Krewski et al. 2009; Lepeule et al. 2012; Woodruff et al. 1997, as cited in Appendix A.2). Additional studies, however, were also included that are not normally used by US EPA (Jerrett et al. 2013 and Vodonos et al. 2018, as cited in Appendix A.2). The specific CRFs from these studies should be provided together with further justification and the relative impact on the results.

C. There is no context for the health effects estimates, and in particular for the mortality ranges. Therefore, the potential benefits may appear larger than they actually are. For example, the actual health impacts are not provided for the FCCU emission contributions under Scenario A and B. Also, BenMAP presents results as a percentage of the baseline health statistics, which helps to place the health impacts into context with overall health effect rates in the area.

POTENTIALLY SIGNIFICANT ENVIRONMENTAL IMPACTS

13. The AB617 Expedited BARCT Implementation Schedule Project DEIR/FEIR (AB617 DEIR/FEIR) does not identify the Proposed Regulation 6 Rule 5 BARCT limit as part of the scope of the analysis. In Section 1.3.3, the AB617 DEIR/FEIR identifies controlling PM emissions from FCCUs, however, there does not appear to be any other information in the document regarding the achievable limits associated with any of those control options. As further evidence of the inadequacy of the AB617 DEIR/FEIR, the only alternatives contemplated are a “no project” and a ”delayed schedule”. A CEQA evaluation of the Proposed Amendments should specifically contemplate the alternatives to the Proposed Amendment. Such an Alternatives analysis would include an evaluation of the different limits considered (i.e., the 0.02 gr/dscf or 0.01 gr/dscf). Given the myriad of concerns regarding the Proposed Amendments, the CEQA analysis that

[16] Rohr A.C., R.E. Wyzga, 2012. Attributing health effects to individual particulate matter constituents. *Atmos Environ*., 62, 130-152.

[17] Lippmann, M., L.C. Chen, 2009. Health effects of concentrated ambient air particulate matter (CAPs) and its components. *Crit. Rev. Toxicol*., 39, 865e913.

[18] Kelly, F.J., J.C. Fussell, 2007. Particulate Toxicity Ranking Report. Report Number 2/07. Environmental Research Group, Kings College, London.

accompanies the Proposed Amendments should clearly and specifically evaluate the environmental consequences of the control requirements to meet the Proposed Amendments.

A. As shown in this EPA document, there are a number of variables that will affect the performance of a wet gas scrubber.[19] The ultimate ability for a wet gas scrubber to achieve the Proposed Amendment limits must be carefully assessed. The AB617 DEIR/FEIR does not demonstrate that any of this was considered and that the environmental impacts assessed reflect a wet gas scrubber that can achieve the Proposed Regulation limits. This same issue applies to the Electrostatic Precipitators analysis in the AB617 DEIR/FEIR. The documents released as part of the Proposed Amendments illustrate the variability in the control technology (see Table B.1 of Appendix B from the BAAQMD staff report).

B. Related to this unknown, the AB617 DEIR/FEIR fails to clearly evaluate the water usage and hazardous material impacts that may occur to achieve the Proposed Regulation limits. While the AB617 DEIR/FEIR includes some water estimates and discussion on hazardous materials, there is nothing to demonstrate that the values reported in the AB617 DEIR/FEIR are the levels of water required to meet the limits of the Proposed Amendment, nor is the hazardous materials issue assessed relative to what is required to achieve the Proposed Amendment limits. Furthermore, since the AB617 DEIR/FEIR has identified a significant water impact, the CEQA analysis should evaluate alternatives that specifically consider other options that would not lead to a significant water impact.

C. The AB617 DEIR/FEIR also fails to clearly demonstrate the potential toxic emissions associated with the Proposed Regulation. Notably, the AB617 DEIR/FEIR discusses potential NaOH and ammonia emissions, however, it's not substantiated that the amounts discussed correlate to the potential emissions associated with the Proposed Amendments.

14. The documents released as part of the Proposed Amendments illustrate the variability in the control technology and that is possible that even with the best available control technology, that the proposed limit might not be achievable (see Table B.1 of Appendix B from the BAAQMD staff report). The AB617 DEIR/FEIR does not contemplate the potential environmental consequences if the Proposed Regulation limits can't be met. Given the stringency of the Proposed Amendment, it is possible that a refinery cannot meet the limit, in which case the operations may have to cease to operate. In the case of a refinery ceasing to operate, the environmental impacts can include, but are not necessarily limited to, those that would result from the importing of gasoline and diesel to meet demand, increased refining capacity at other refineries, and the loss of transportation ability throughout the region if the supply cannot be replaced. Given the facts at hand, it would be reasonable to expect that the CEQA analysis supporting the Proposed Amendment should contemplate this outcome.

15. The AB617 DEIR/FEIR fails to evaluate impact of potential increases in NOx emissions on ozone and health impacts due to the Proposed Amendments limits on ammonia. As part of this overall process, there is NOx control and the limitations on ammonia may impact the NOx control. The analysis should include an evaluation of NOx and what impact the in the Proposed Amendment will have on NOx emissions. It is well understood that sufficient ammonia contact with NOx is necessary to control the NOx emissions.[20]

[19] Available at: https://www3.epa.gov/ttncatc1/dir1/cs6ch2.pdf. Accessed: April 2021.

[20] Available at: https://www.epa.gov/sites/production/files/2017-12/documents/scrcostmanualchapter7thedition_2016revisions2017.pdf. Accessed: April 2021.

16. The AB617 DEIR/FEIR did not evaluate the Proposed Regulation's energy impacts. The current CEQA criteria include this and the CEQA documentation should evaluate it. Notably, the CEQA documentation should assess the energy usage and evaluate that usage relative to the criteria in Appendix F of the CEQA Guidelines. The AB617 DEIR/FEIR already identifies increased energy usage (see page 3.5-12), and thus it would be reasonable for the CEQA analysis to update those estimates based on the Proposed Amendment and evaluate it relative to the CEQA Energy criteria.

    A. The energy analysis should also account for the potential energy impacts related to the treatment and transport of the increased water consumption caused by the control technology such as WGS.

17. The AB617 DEIR/FEIR dismisses the potential GHG impacts of the project. The AB617 DEIR/FEIR already identifies increased energy usage (see page 3.5-12), and thus there will clearly be an energy demand to operate the additional control technologies as well as energy for things such as the conveyance of water. Based on the AB617 DEIR/FEIR, one wet gas scrubber may use 95.3 million kWh per year of electricity. Based on a utility emission factor of 641 lbs CO_2 per MWh (from CalEEMod), that would equate to more than 27,000 metric tons of CO_2 per year. Based on this rough estimate, it is clear that the CEQA evaluation should include a full GHG evaluation.

18. The AB617 DEIR/FEIR does not contemplate changes to the aesthetics based on potential changes from plume characteristics due to the Proposed Amendments. A wet gas scrubber can have a visible plume.[21] CEQA requires an evaluation of aesthetics that.[22] The CEQA analysis for the Proposed Amendments should evaluate this potentially significant impact.

COST EFFECTIVENESS APPROACH

19. The Bay Area Air Quality Management District (BAAQMD) is deviating from its normal cost effectiveness assessment standards. In the Staff Report for the Proposed Amendment, BAAQMD states that it is adopting the amendments to Rule 6-5 to satisfy the requirement of AB-617 to require BARCT for non-attainment pollutants, however, the Staff Report appears to ignore an obvious finding in their own analysis regarding cost effectiveness.

    The California Health and Safety Code defines BARCT as follows:

    – "Best available retrofit control technology means an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source".[23]

    In establishing BARCT, a district must do all of the following:[24]

    – Identify one or more potential control options that achieve the emission reduction objectives for the regulation.

    – Review the information developed to assess the cost-effectiveness of the potential control option. For purposes of this paragraph, "cost-effectiveness" means the cost, in dollars, of the potential control option divided by emission reduction potential, in tons, of the potential control option.

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[21] Available at: https://www3.epa.gov/ttncatc1/dir1/cs6ch2.pdf. Accessed: April 2021.

[22] Available at: https://resources.ca.gov/CNRALegacyFiles/ceqa/docs/ab52/final-approved-appendix-G.pdf. Accessed: April 2021.

[23] H&SC § 40406.

[24] H&SC § 40920.6.

- Calculate the incremental cost-effectiveness for the potential control options. To determine the incremental cost-effectiveness under this paragraph, the district shall calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option.
- And consider the effectiveness of the proposed control option, the cost-effectiveness of each potential control option, and the incremental cost-effectiveness between the potential control options.

California air agencies have traditionally followed the above requirements by estimating the cost of installing the control technology selected, and dividing it by the pollution reduced to get cost effectiveness values in dollars per ton. This is typically done in detail by amortizing the capital costs over the expected lifetime of the control equipment, adding that to the operating costs, and dividing that sum by the expected annual emissions reductions in tons. Nowhere in this calculation are the costs of health impacts considered. The point of requiring BARCT is of course to improve health and welfare. The BAAQMD has done this calculation on page 21 of the Staff Report on the Proposed Amendments to Regulation 6 Rule 5 and these show that the cost effectiveness of the available control technologies far exceeds all previously used bases for a cost effectiveness threshold (see Table 4 for historical cost effectiveness data from previously adopted rules in the Staff Report). The cost effectiveness calculated by BAAQMD (which may underpredict the costs as BAAQMD themselves acknowledge on page 26 of the Staff Report) is more than five times higher, and potentially ninety-seven times higher than the historical cost effectiveness from previously adopted rules and amendments. The Proposed Amendment would be a significant deviation from past BAAQMD practice and common approaches for BARCT.

CLOSING

We appreciate the opportunity to perform this review. Please feel free to call Eric Lu at (949) 798-3650 if you have any comments or questions.

Yours sincerely,

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EL:eg

EXHIBIT B

Yorke
ENGINEERING, LLC
www.YorkeEngr.com

April 27, 2021

Mr. Michael J. Carroll
Latham & Watkins LLP
650 Town Center Drive, 20th Floor
Costa Mesa, CA 92626-1925
Direct: (714) 755-8105
E-mail: Michael.Carroll@LW.com

Subject: Latham & Watkins - Chevron Richmond BAAQMD FCC CALPUFF Modeling Review

Dear Mr. Carroll:

BAAQMD conducted CALPUFF modeling to assess $PM_{2.5}$ reductions from the proposed Regulation 6, Rule 5 rule making for Fluidized Catalytic Cracking Units (FCCU). This review focuses on the modeling conducted for the Chevron Richmond Refinery sources.

BAAQMD modeled three scenarios:

- Baseline – all sources at Chevron using 2018 emissions.
- Existing FCCU
- FCCU with wet gas scrubber (WGS) to meet emission reduction to 0.01 gr/dscf

The following outlines Yorke's findings from the review of Appendix A.4: Modeling Fine Particulate Matter Emissions from the Chevron Richmond Refinery: An Air Quality Analysis (Interim DRAFT Report – Version 2), and the limited CALPUFF modeling files. BAAQMD provided the CALPUFF input file (.inp extension) and the output files (.nc and .txt extensions) for each scenario.

Executive Summary

A number of inconsistencies and omissions were made in the CALPUFF $PM_{2.5}$ dispersion modeling which could have significantly impacted the modeled ground-level $PM_{2.5}$ concentrations. Given the uncertainty that such discrepancies create, and the fact that this modeling is being used to support a regulatory application, the dispersion modeling should be revised to address these issues.

Most notably, underestimating wind speed in a dispersion model will result in over-estimated ground-level concentrations. BAAQMD's comparison of the meteorological data used in the modeling compared to observations at Chevron's onsite meteorological station show that wind speeds were generally underestimated compared to actual wind speeds. This difference between the model data and observed data was especially large in summer months, which is also when the highest ground-level $PM_{2.5}$ concentrations were modeled by CALPUFF.

BAAQMD also failed to utilize the Sodar data located at the Chevron facility, which would have provided an onsite wind direction and wind speed profile traversing vertically in the atmosphere and improved the accuracy of the dispersion modeling of Chevron sources. The modeled meteorological data showed a bias in wind direction that resulted in the plume from Chevron

sources being directed more toward populated areas, rather than over the Bay. This will have the effect of overestimating health impacts.

Further, certain model parameters were not utilized that would have improved the modeling to better represent the dispersion of the Chevron sources. These parameters would have, if enabled, considered the effects of buildings on air movement near sources; accounted for the urban (and more turbulent, and therefore more dispersive) nature of the entire modeling grid; and better modeled the difference in air temperature between water and land near the Bay. Failing to utilize modeling parameters that most accurately model air dispersion casts significant doubt on the resulting modeled $PM_{2.5}$ concentrations.

Additionally, the following issues with the CALPUFF modeling were noted and are discussed below:

- The version of CALPUFF used was neither the EPA approved version, nor the latest version.
- BAAQMD failed to utilize other models that may have been more appropriate in these circumstances.
- The base elevations used for source parameters are not accurate, and in many cases not representative of the elevations within 100 meters (the grid size) from the source.
- Use of overestimated $PM_{2.5}$ emissions in the modeling resulted in a Study Area that was larger than it should have been, and therefore resulted in an overestimation of health impacts in the subsequent Health Impact Analysis.

The inherently conservative nature of regulatory air dispersion models, along with the inaccuracies in the use of this model, meteorological data, and emissions, created unreasonable uncertainty in the $PM_{2.5}$ dispersion modeling and health benefits analysis presented in this rulemaking.

Model Selection

CALPUFF version 6.42 (level 110325) was used in the assessment. This version of the model is neither the EPA approved version 5.8.5 (level 151214) nor the latest version 7.2.1 (level 150618). For a regulatory application such as this, the EPA approved version would be the most appropriate version.

CALPUFF was delisted as an EPA preferred model in the 2017 revised *Guideline on Air Quality Models* (Appendix W to 40 CFR Part 51), although it still is an approved alternative model. CALPUFF was previously the preferred model for long-range transport of emissions from 50 to several hundred kilometers (km). The *Guideline* recommends modeling the primary portion of $PM_{2.5}$ using a model such as AERMOD.

BAAQMD considered using the Community Multiscale Air Quality (CMAQ) because of its plume-in-grid module that simulates $PM_{2.5}$ at subgrid resolutions. The District tested the model, "but failed to complete the test due to prohibitively large computational cost."

It appears that CALPUFF was selected by BAAQMD due to ease and speed of operation. However, excluding the use of CMAQ due to the cost is not reasonable based on the exceptionally high control equipment costs this rule may require.

Model Parameter Selection

Building downwash was not modeled and could have a significant impact on the ground-level concentrations, especially from sources located on or near buildings.

Urban dispersion parameters were only used for cells that fell into the industrial land use category (IURB=13). All other areas were modeled with rural dispersion parameters. This means that a less turbulent atmosphere will be represented in most of the region, which will overestimate the ground-level concentrations.

BAAQMD did not use the Sub-Grid TIBL algorithm (MSGTIBL = 0) in CALPUFF, which if enabled would better characterize the shoreline thermal effects that are very pronounced in the Bay Area.

Meteorological Data Development

Insufficient information was provided to fully assess how the meteorological data were developed in CALMET. It appears five local meteorological stations were used in the CALMET initiation along with the Weather Research and Forecasting (WRF) data. One of the stations was the Chevron Refinery onsite meteorological tower.

Table 2.2.1 and Appendix B.1 provides an evaluation of the CALMET meteorological data compared to the five local meteorological stations, although it does not identify the location for the CALMET meteorological data, i.e., is it for one grid cell or averaged over many. The CALMET meteorological data from only the grid cell that hosts the given meteorological station should be compared to the actual station data.

Parameters such as wind speed and direction are highly variable in the complex terrain that encompasses the Chevron facility. The Chevron meteorological tower is approximately 2 kilometers east of the FCCU, in an area that is at sea level, flat and surrounded by wetlands. The FCCU is located on the eastern edge of the ridge running from Pt San Pablo to Nickols Knob, in very complex terrain. Based on the terrain features next to the FCCU, it is expected that the dominant wind direction would line up with the ridge, a slight left shift from the Chevron meteorological tower data, which would tend to direct the modeled plume more towards the Bay. No data were provided in the report or model files to assess whether the terrain features next to the FCCU were accurately accounted for in CALMET.

Overall, windspeed was underestimated in CALMET compared to all five meteorological stations, which will tend to overestimate modeled ground-level concentrations. The gross error (the mean absolute difference in prediction-observation) of the CALMET wind direction compared to all stations is 36 degrees, or a 10% error. The CALMET model wind direction bias compared to the Chevron meteorological tower showed shifts in the wind to the right compared to observed data. This would tend to incorrectly bias modeled ground-level concentrations by directing the plume more towards population instead of over the Bay.

In comparison to the Chevron meteorological tower the CALMET summer (Q3) wind speeds were significantly underestimated, and temperatures were significantly overestimated. This time frame coincided with the highest predicted concentrations in CALPUFF. This inconsistency from actual localized meteorological parameters biased the CALPUFF results to significant overprediction.

The CALMET vertical meteorological profile was compared to Oakland upper air station and showed reasonable similarity. Since Chevron operates a Sodar next to the meteorological tower, these vertical profile data from the on-site Sodar should also have been included in CALMET and would provide a significantly better vertical atmospheric profile near the FCCU. The vertical atmospheric profile will determine to what extent emitted pollutants disperse in the atmosphere or reach ground-level, and its accuracy is extremely important to achieving accurate modeled concentrations.

Source Parameters and Emissions

The stack parameters for the top 20 existing sources are the same in the CALPUFF, Table 2.1.1 as provided by Chevron. The base elevation presented in Table 2.1.1 matches the Chevron stack parameter file, although the Gridded Terrain Elevation is significantly different.

The BAAQMD report notes that "The base elevation for each source provided usually does not match grid-averaged terrain elevation, and if these base elevations are used, some short stacks could be represented as emitting at or below ground level" or vice-versa. But the elevations should be representative of the 100m grid, and many are significantly different than any elevation within 100 m from a source.

Base elevation calculated in CALPUFF is generally higher than actual elevations. Sources 7502, 7503, 7504 and 7535 are the only sources where the base elevation appears underestimated, all the rest are overestimated.

The map projection (coordinate system) selected was Lambert Conformal Conic using NWS-84 datum. Unfortunately, this is a rarely used datum, so no conversion program was available to check the accuracy of the locations of the sources.

For the baseline scenario, modeling included source 4158 which is a furnace associated with the old hydrogen plant and has been permanently shut down and should not be included in the model.

Also, for the baseline, Source 6015, the D&R Flare, had no parameters included in Chevron stack parameter listing, although the parameters selected seemed reasonable (the exit temperature and velocity are EPA default screening values).

For the FCCU-WGS scenario the stack height selected for the FCCU with WGS was 73.46 meters (241 feet). This is higher than the EPA good engineering practice (GEP). Per 40 CFR 51.1(ii) GEP stack height is the greater of 65 meters or H + 1.5L, where H is height of nearby structure(s) and L is lesser dimension of height of projected width of the nearby structure(s).

For the FCCU GEP to be higher than 65m, there would need to be a 96 foot tall building or a less tall but long building nearby. No such building exists near the FCCU, and the WGS is not expected to be that large. Therefore, for regulatory modeling, the stack height cannot exceed GEP.

The modeling used out-of-date emissions information. BAAQMD used 2018 data because 2019 and 2020 had not been approved yet. These data appear to overestimate facility wide emissions especially for the FCCU. Based on the methodology BAAQMD applied, the higher the emissions, the farther the study area extends. Therefore, overestimation of emissions will cause the model to over predict the study area, and the more receptors that are included in the analysis, the higher the health risk impacts, since a concentration will be calculated at every receptor.

Results

As shown in Appendix A.4, Figure 3.2.1 for the FCCU without WGS case, CALPUFF predicted the maximum annual $PM_{2.5}$ concentration of 0.1 - 0.2 $\mu g/m^3$ in a small area where people live and 0.2 - 0.3 $\mu g/m^3$ in a very small area where people might work. These concentrations are significantly lower than the concentrations presented in Appendix A.4, Table 3.2.1 which is misleading as the peak offsite concentrations were predicted to occur next the facility in San Francisco Bay, at a location where people could never be.

Since the proposed regulation is focused on the FCCU, only the area where the model predicted $PM_{2.5}$ annual concentrations greater than 0.1 $\mu g/m^3$ from the FCCU emissions should be included in BenMAP analysis, not the larger area determined using the entire facility.

Figure D.2 shows that higher concentrations were predicted in the summer. This is a time frame when the CALMET wind speed was significantly underestimated and temperatures were significantly overestimated, which will tend to overestimate modeled ground-level concentrations.

If the modeled facility baseline emissions are higher than actual emissions, the study area (area with concentrations above 0.1 $\mu g/m^3$) would be larger, and more receptors (grid cells) would be modeled. The model will estimate a concentration at every receptor. BenMAP will estimate a health risk/cost for every receptor. Therefore, the more receptors included in the modeling, the higher the overall estimated health risks.

It appears that the study area used as the input into BenMAP included receptors where the $PM_{2.5}$ concentrations were less than 0.1 $\mu g/m^3$. The more receptors that are included in the analysis, the higher the health risk impacts, since a concentration will be calculated at every receptor. It appeared that the BenMAP study area extended as far as 65 kilometers from the FCCU, into the long-range transport assessment range, the specific type of assessment for which EPA delisted the use of CALPUFF.

The nc output files are in the binary netCDF format but could not be viewed with standard netCDF plotting software. Thus, the model results could not be confirmed.

Model Uncertainty

The objective of regulatory models is to not underestimate maximum concentrations. Therefore, bias is already built into the CALPUFF model.

BAAQMD states on Page 41 of the Staff Report “there are considerable uncertainties embedded in different parts of the underlying calculations, including: (a) estimated emissions; (b) modeled concentrations; (c) population distributions; and (d) concentration-response functions. These uncertainties were not carried forward in calculating the ranges reported in Tables 11 and 12. Therefore, the true benefits could be much larger, or much smaller, than those ranges suggest”.

In addition to the uncertainties outlined by BAAQMD, the biases in the meteorological data outlined above tended toward significant overprediction of $PM_{2.5}$ concentrations in CALPUFF.

The statement of limitations by BAAQMD, along with the inaccuracies in use of models, meteorological data, and emissions, creates unreasonable uncertainty in the health benefits analysis.

CONCLUSION

Should you have any questions or concerns, please contact me at (619) 375-9142.

Sincerely,

Julie Mitchell
Senior Air Quality Scientist
Yorke Engineering, LLC
JMitchell@YorkeEngr.com

EXHIBIT C

		BAAQMD CALPUFF	2018 AEI		2019 AEI		2020 AEI	
Source No.	Source Name	PM2.5 Emission Rate (ton/yr)	PM2.5 Emissions (ton/yr)	Difference from model	PM2.5 Emissions (ton/yr)	Difference from model	PM2.5 Emissions (ton/yr)	Difference from model
1	3234_1	0.12	0.12	0.00	0.12	0.00	--	--
2	4038_1	2.88	1.99	-0.89	1.86	-1.03	0.31	-2.57
3	4040_1	1.27	0.82	-0.45	0.67	-0.60	0.22	-1.05
4	4042_1	2.29	1.24	-1.05	1.27	-1.02	0.40	-1.89
5	4044_1	1.09	0.69	-0.40	0.97	-0.12	0.27	-0.82
6	4059_1	1.00	1.00	0.00	1.02	0.02	0.29	-0.71
7	4060_1	1.17	1.17	0.00	1.11	-0.06	0.23	-0.93
8	4061_1	2.83	1.17	-1.65	1.23	-1.60	0.38	-2.44
9	4068_1	0.59	0.59	0.00	0.71	0.11	0.25	-0.34
10	4069_1	0.27	0.28	0.00	0.29	0.02	0.08	-0.20
11	4072_1	4.23	4.24	0.00	4.00	-0.23	0.90	-3.33
12	4073_1	2.11						
13	4073_2	2.11						
14	4073_3	2.11						
15	4073_4	2.11	8.47	0.01	8.78	0.32	5.30	-3.15
16	4076_1	0.04						
17	4076_2	0.04						
18	4076_3	0.04						
19	4076_4	0.04						
20	4076_5	0.04						
21	4076_6	0.04						
22	4076_7	0.04						
23	4076_8	0.04	0.32	0.00	0.25	-0.07	0.20	-0.12
24	4129_1	1.82	1.82	0.00	1.96	0.13	0.51	-1.31
25	4131_1	4.11	1.77	-2.34	2.13	-1.98	0.36	-3.75
26	4133_1	1.65	1.65	0.00	1.92	0.27	0.44	-1.20
27	4135_1	2.03	2.04	0.00	3.27	1.24	0.87	-1.16
28	4152_1	0.29	0.29	0.00	0.21	-0.08	0.06	-0.24
29	4154_1	0.30	0.30	0.00	0.19	-0.11	0.06	-0.24
30	4155_1	2.84	2.84	0.00	2.20	-0.63	0.78	-2.06
31	4158_1	0.69	0.69	0.00	0.03	-0.65	0.00	-0.69
32	4159_1	1.23	0.59	-0.64	0.57	-0.66	0.19	-1.04
33	4161_1	2.04	0.71	-1.34	0.76	-1.28	0.22	-1.83
34	4164_1	0.95	0.31	-0.64	0.45	-0.50	0.12	-0.83
35	4167_1	0.82	0.83	0.00	0.97	0.15	0.38	-0.45
36	4168_1	2.29	2.29	0.00	2.66	0.37	0.64	-1.65
37	4169_1	2.39	2.39	0.00	2.66	0.27	0.86	-1.53

		BAAQMD CALPUFF	2018 AEI		2019 AEI		2020 AEI	
Source No.	Source Name	PM2.5 Emission Rate (ton/yr)	PM2.5 Emissions (ton/yr)	Difference from model	PM2.5 Emissions (ton/yr)	Difference from model	PM2.5 Emissions (ton/yr)	Difference from model
38	4172_1	2.23						
39	4172_10	2.23						
40	4172_11	2.23						
41	4172_12	2.23						
42	4172_13	2.23						
43	4172_14	2.23						
44	4172_15	2.23						
45	4172_16	2.23						
46	4172_2	2.23						
47	4172_3	2.23						
48	4172_4	2.23						
49	4172_5	2.23						
50	4172_6	2.23						
51	4172_7	2.23						
52	4172_8	2.23						
53	4172_9	2.23	35.66	0.03	21.26	-14.37	52.31	16.68
54	4173_1	1.50						
55	4173_10	1.50						
56	4173_11	1.50						
57	4173_12	1.50						
58	4173_13	1.50						
59	4173_14	1.50						
60	4173_2	1.50						
61	4173_3	1.50						
62	4173_4	1.50						
63	4173_5	1.50						
64	4173_6	1.50						
65	4173_7	1.50						
66	4173_8	1.50						
67	4173_9	1.50	21.01	0.02	47.08	26.09	38.25	17.25
68	4187_1	0.36	0.36	0.00	0.44	0.07	0.32	-0.04
69	4188_1	1.23	1.23	0.00	0.13	-1.09	0.09	-1.14
70	4189_1	0.56	0.56	0.00	0.05	-0.52	0.04	-0.52
71	4191_1	2.39	2.39	0.00	5.77	3.38	4.98	2.59
72	4227_1	6.55	6.55	0.01	3.03	-3.52	0.76	-5.78
73	4228_1	3.98	3.99	0.00	1.26	-2.72	0.74	-3.24
74	4229_1	9.00	9.01	0.01	8.25	-0.74	8.36	-0.64
75	4285_1	228.41	228.61	0.21	201.71	-26.70	205.67	-22.74
76	4329_1	3.84						
77	4329_2	3.84	7.68	0.01	4.56	-3.11	7.58	-0.10
78	4330_1	3.84	0.68	-3.16	0.58	-3.25	--	--
79	4333_1	3.37	1.65	-1.72	1.36	-2.01	0.09	-3.27
80	4336_1	3.86	0.86	-3.00	0.85	-3.01	0.08	-3.78
81	4349_1	0.32	0.32	0.00	0.03	-0.30	0.03	-0.29
82	4350_1	44.92	44.97	0.04	22.51	-22.41	3.20	-41.73
83	4352_1	46.17	46.21	0.04	23.12	-23.04	3.35	-42.82
84	4396_1	0.24	0.12	-0.12	0.12	-0.12	--	--
85	4465_1	0.01						
86	4465_2	0.01						
87	4465_3	0.01	0.04	0.00	0.77	0.73	1.36	1.32
88	4471_1	0.19	0.19	0.00	1.49	1.30	1.63	1.44

		BAAQMD CALPUFF	2018 AEI		2019 AEI		2020 AEI	
Source No.	Source Name	PM2.5 Emission Rate (ton/yr)	PM2.5 Emissions (ton/yr)	Difference from model	PM2.5 Emissions (ton/yr)	Difference from model	PM2.5 Emissions (ton/yr)	Difference from model
89	4472_1	0.00	0.00	0.00	2.08	2.07	2.25	2.25
90	6010_1	0.04	0.04	0.00	0.10	0.05	0.07	0.02
91	6012_1	0.13	0.13	0.00	0.05	-0.09	0.20	0.06
92	6013_1	0.27	0.27	0.00	0.35	0.08	0.62	0.35
93	6015_1	0.03	0.03	0.00	0.00	-0.03	0.03	0.00
94	6016_1	0.24	0.24	0.00	0.27	0.03	0.23	-0.01
95	6019_1	0.04	0.04	0.00	0.05	0.01	0.05	0.01
96	6021_1	0.53	0.53	0.00	1.60	1.07	2.27	1.74
97	6039_1	0.07	0.07	0.00	0.06	-0.01	0.31	0.24
98	6051_1	0.07						
99	6051_2	0.07						
100	6051_3	0.07						
101	6051_4	0.07						
102	6051_5	0.07						
103	6051_6	0.07	0.41	0.00	0.39	-0.02	0.33	-0.07
104	7013_1	0.00	0.00	0.00	0.00	0.00	0.03	0.03
105	7501_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
106	7502_1	0.01	0.01	0.00	0.01	0.00	--	--
107	7503_1	0.05	0.05	0.00	0.05	0.00	--	--
108	7504_1	0.05	0.05	0.00	0.05	0.00	--	--
109	7508_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	7511_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111	7512_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112	7513_1	0.02	0.02	0.00	0.06	0.03	0.03	0.01
113	7514_1	0.00	0.00	0.00	0.03	0.03	0.00	0.00
114	7515_1	0.01	0.01	0.00	0.01	0.00	0.01	-0.01
115	7516_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
116	7521_1	0.01	0.00	-0.01	0.00	-0.01	0.00	-0.01
117	7531_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118	7535_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	9321_1	0.90	0.90	0.00	0.18	-0.72	0.07	-0.84
TOTAL EMISSIONS:		**472.53**	**455.54**	**-16.99**	**391.98**	**-80.56**	**349.65**	**-118.58**
		Overestimation:		**4%**		**21%**		**34%**

EXHIBIT D

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

December 10, 2019

Shawn Lee
Chevron Richmond Refinery
841 Chevron Way
Richmond, CA 94801

Re: Source Testing at Fluidized Catalytic Cracking Units

Dear Shawn:

As we have discussed during the past several months, the Air District is developing both amendments to existing rules and new rules that will affect refineries and refinery sources. As part of the rule development process, the Air District routinely evaluates and gathers emissions information on potentially affected sources. The purpose of this letter is to inform you of the Air District's intent to gather source test data related to the current rule development effort on draft amendments to Regulation 6, Rule 5: Particulate Emissions from Refinery Fluidized Catalytic Cracking Units (Rule 6-5).

Draft Amendments to Rule 6-5

The draft amendments to Rule 6-5 would address particulate matter emissions from fluidized catalytic cracking units (FCCUs) and associated carbon monoxide (CO) gas boilers at Bay Area petroleum refineries. For this rule development effort, the Air District intends to conduct source tests at these FCCUs and CO boilers to gather information on total PM emissions (including both filterable and condensable PM) and PM composition. The Air District also intends to collect associated process information to better understand the generation of emissions from these sources.

Coordination and Testing

Air District staff understands that prior to conducting source tests, the following items may need to be addressed:

- Identification and/or installation of appropriate sampling ports and work platforms;
- Identification of proper safety and site access requirements;
- Identification of approved source test contractors;
- Development, review, and approval of test plans; and
- Pre-testing site visits.

Please contact Jerry Bovee at jbovee@baaqmd.gov or (415) 749-4601 to set up a meeting to discuss coordination on these items, or other pre-testing items you may want to discuss. Air District staff also understands that facilities may elect to perform source testing themselves; Air District staff can discuss potential coordination with these efforts. The Air District anticipates conducting this source testing by early 2020.

The Air District appreciates your participation and engagement to date and anticipates our continued collaboration in the Air District's rule development

process. Please let me know if you have any questions or concerns pertaining to our intention to conduct this source testing.

Sincerely,

Elizabeth Yura
Director, Community Engagement and Policy Division
Bay Area Air Quality Management District

cc: Jerry Bovee
Air Quality Engineering Manager
Meteorology and Measurement Division

EXHIBIT E

Attachment 1 - Figures Analyzing Ambient Air PM Monitoring Data for Richmond/San Pablo during an FCC shutdown

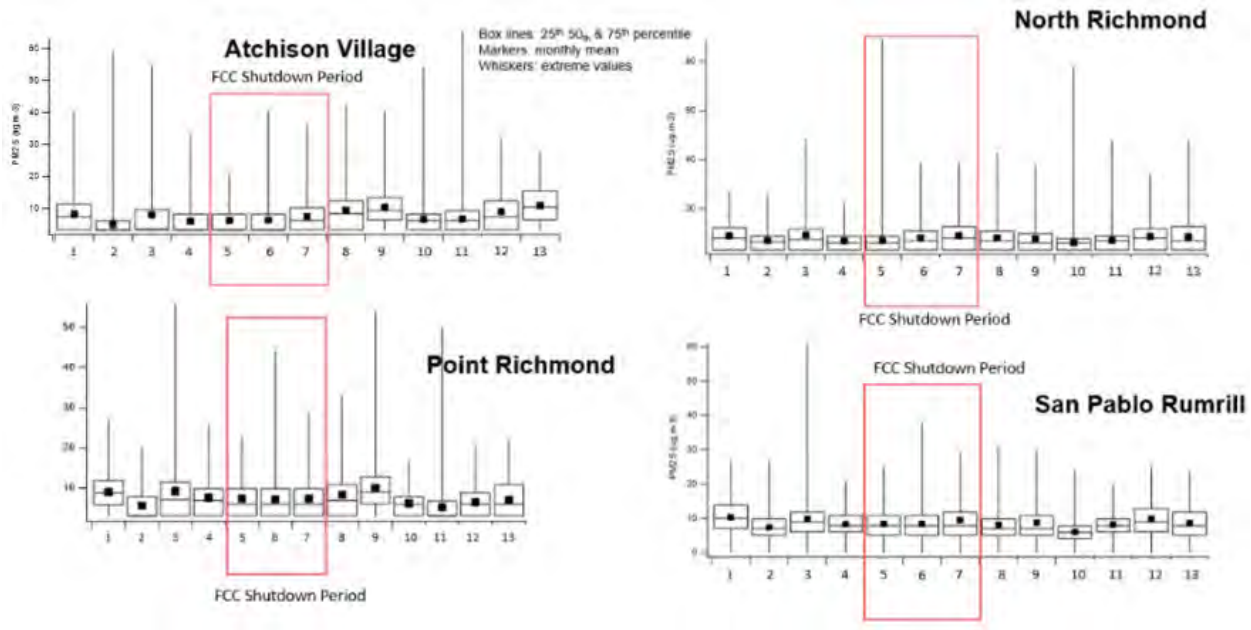
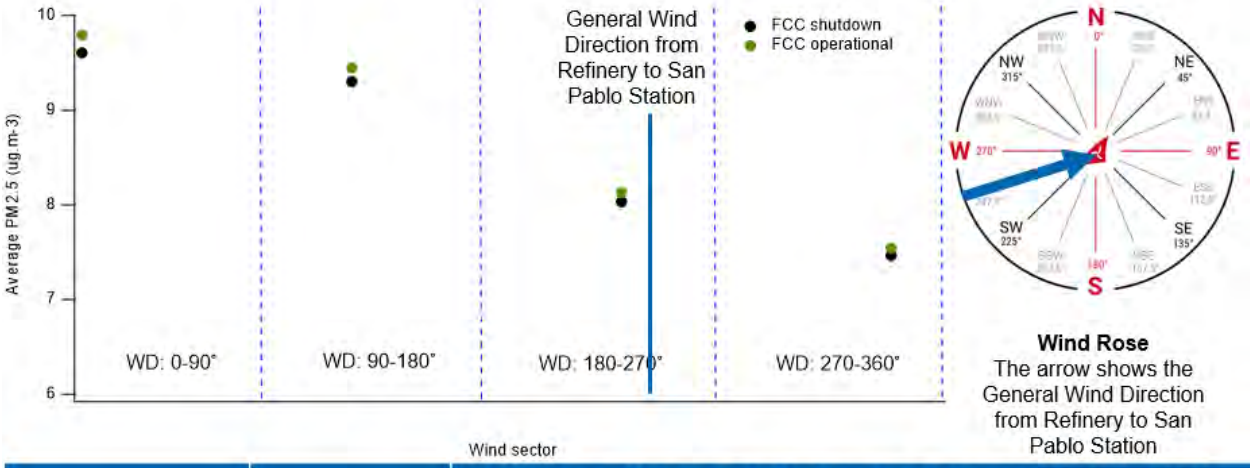


Figure 1: 1-h average $PM_{2.5}$ concentration at air quality monitors nearby Richmond Refinery for 13 months surrounding an FCC shutdown show no discernable difference.



Wind sector	p-value	Average PM 2.5 statistically different for periods of FCC shutdown vs. operational periods?
0-90°	0.63	No
90-180°	0.46	No
180-270°	0.68	No
270-360°	0.81	No

Figure 2: $PM_{2.5}$ concentrations at BAAQMD San Pablo Rumrill Station by wind sector show no statistical difference between periods when FCC was operational vs. shutdown. The impact of Richmond Refinery's FCC emissions on ambient $PM_{2.5}$ levels would predominantly be associated with southwesterly winds (wind sector: 180-270º). Additionally, air quality is generally better when coming from the direction of the refinery in the 180-270º and 270-360º quadrants.

EXHIBIT F

Chevron

Shawn Lee
HES Manager, Richmond Refinery
Tel 510 242 1400
ShawnLee@chevron.com

August 31, 2017

Via Certified Mail

Mr. Bhagavan Krishnaswamy
Air Quality Engineering Manager
Bay Area Air Quality Management District
375 Beale Street
San Francisco, CA 94105

Submittal of Optimization and Demonstration Protocol Final Report and Revised Application for Significant Revision to Major Facility Review (MFR) Permit, Plant# A0010, A-0014 FCC ESP; Regulation 6-5-403.4

Dear Mr. Krishnaswamy:

Pursuant to Regulation 6-5-403.1, the Chevron Products Company, Richmond Refinery has elected to establish an enforceable ammonia emission limit for the FCCU via ammonia optimization in lieu of compliance with the ammonia emission limits in Regulation 6-5-301.

Please find enclosed Chevron Products Company's submittal of the Final Report for the Optimization and Demonstration Protocol pursuant to Regulation 6-5-403.4. Accompanying this report is a revision to the February 25, 2016 application for a significant revision to the Chevron Richmond Refinery's Major Facility Review (MFR) Permit. This revision includes additional revisions to Permit Condition #11066, following completion of the Optimization and Demonstration Protocol pursuant to Regulation 6-5-403, including an enforceable ammonia emission limit pursuant to Regulation 6-5-403.4. Permit application fees were submitted with the February 25, 2016 submittal

Trade Secret Information

Attachment 2 contains confidential business information that are trade secrets of Chevron Products Company, a division of Chevron U.S.A. Inc, as defined by the California Public Records Act, Government Code Section 6254.7 et seq., and 40 CFR Part 2, Subpart B, 18 USC 1905 and 5 USC 552(b)(4). This response is protected from public disclosure under California law, including Government Code Section § 6254.7, and the District's procedures in Section 11 of the District's Administrative Code. Because of the sensitive and competitive nature of the information, Chevron Products Company requests that the BAAQMD afford the information Confidential Business Information treatment indefinitely. A redacted copy of Attachment 2 can be obtained upon request.

Richmond Refinery
Chevron Products Company
A Division of Chevron U.S.A. Inc
841 Chevron Way, Richmond, CA 94801

If you have any questions concerning the Final Report or application, please contact Ms. Callie Nguyen, (510)-242-5212.

Sincerely,

Steven Young for

Shawn Lee

Attachments

cc: Mr. Nick Maiden
Senior Engineer
Bay Area Air Quality Management District
375 Beale Street
San Francisco, CA 94105

Optimization and Demonstration Protocol Final Report

Regulation 6-5-403

Chevron Products Company
Richmond Refinery

August 31, 2017

Optimization and Demonstration Protocol Final Report

Table of Contents

INTRODUCTION

On December 16, 2015, the Bay Area Air Quality Management District (BAAQMD) adopted Regulation 6, Rule 5, which regulates particulate matter (PM) from Fluid Catalytic Cracking Units (FCCU). In lieu of compliance with the FCCU ammonia emissions limit (10 ppmvd at 3% O2, daily average) in Regulation 6-5-301, the owner/operator of a refinery may instead establish an enforceable ammonia emission limit for the FCCU via Ammonia Optimization under Regulation 6-5-403. Chevron Products Company, Richmond Refinery elected to use the alternative compliance option in Regulation 6-5-403.

The Richmond Refinery developed the Optimization and Demonstration Protocol (ODP) per 6-5-403 which was submitted, along with an application for a Significant Revision to a Major Facility Review Permit, to BAAQMD on February 25, 2016. The ODP was amended on June 29, 2017 to include information allowing the Richmond Refinery to conduct this protocol under the District's trial testing policy until the issuance of revised permit conditions rather than the original deadline of June 30, 2017.

PURPOSE

The purpose of the ODP was to collect data from and study the impact on emissions and operability at the Fluid Catalytic Cracker (FCC) S-4285 when ammonia injection into the Electrostatic Precipitator (ESP) A-0014 is reduced. This information will then form the basis for establishing the Optimized Ammonia Emissions Concentration in Regulation 6-5-403.4.

PROTOCOL OVERVIEW

This Optimization and Demonstration Protocol consisted of two phases: Optimization and Demonstration. In the Optimization phase, emissions and process data was collected while the FCCU decreased levels of ammonia injection to determine the optimum level of ammonia injection to minimize all emissions of FCCU PM2.5, including condensable particulate matter, while maintaining acceptable long-term ESP operation and acceptable compliance margins for other existing FCCU emissions limits. In the Demonstration phase, emission and process data were collected while the FCCU targeted operating at the optimized ammonia injection level. In both phases, the following data was collected:

Measure through stack testing:

- Filterable PM (non-sulfuric PM) by EPA Method 5B
- Ammonia emissions by BAAQMD Method ST-1B
- PM10, PM2.5, and condensable PM by EPA Method 201A/202

Monitor and Record

- ESP Secondary Current
- ESP power, sparking, arcing.
- All stack emissions monitored by existing CEMS

A total of ninety-four test runs were conducted between March 30, 2016 and June 27, 2017, while the FCCU was operating at typical operational postures, but at various ammonia injection levels.

The ammonia injection rate was held constant during source testing which generally consisted of multiple runs over approximately 12 hours. When not source testing, the ammonia injection rates were maintained close to the target rate but were adjusted as needed to control opacity levels at the FCC stack.

Fluid Catalytic Cracker Overview

The FCC converts heavy oils into lighter products such as gasoline and LPG. The FCC cracking process uses high temperatures and a catalyst to crack the gas oil feed molecules into a mixture of small molecules which are separated into different streams to be used in downstream process units. The catalyst, when aerated, behaves like a fluid and continuously recirculates from the reactor (where a cracking reaction deactivates the catalyst) to the regenerator (where the coke is removed from the catalyst to reactivate it).

Regenerated catalyst and oxidized gases exit the regenerator. Most catalyst fines return to the reactor, however, some of the catalyst fines entrained in flue gas travel to 14 two-stage cyclones where the majority are removed from the flue gas. The remaining flue gas is abated by the electrostatic precipitator (ESP) to remove fine particulate before exiting the FCC stack.

The ESP is an air pollution control device that manages particulate matter (PM) and opacity emissions in accordance with Title V permit conditions, Consent Decree requirements, and Federal EPA regulations. The ESP imparts a negative charge to particles by injecting ammonia into the flue gas at the ESP inlet and collects and removes these particles by applying an electric field through positively charged electrodes. Ammonia injection is critical for maintaining proper ESP performance and is necessary to comply with opacity and Title V PM limits.

Overview of Operational and Maintenance Parameters of the Fluid Catalytic Cracker

The primary operational parameters for the Richmond FCC are located within the Reactor and Regenerator. For the reactor, the major parameters are total hydrocarbon feed and reactor riser temperature. These two variables largely effect the amount of coke that is formed within the unit, which in turn drives how the regenerator is operated. The coke formed within the reactor must be completely combusted within the regenerator for FCC operation. The amount of coke that is formed in the reactor effects the total amount of air required for combustion and the temperature at which the regenerator operates. A key functional parameter for the regenerator and reactor is the amount of daily fresh catalyst additions required to maintain catalyst activity and unit stability which during normal operations is approximately 8 tons/day.

A wide range of typical unit operations has been experienced over the course of the ODP. Factors external to the ODP have required us to operate at a range of total hydrocarbon feed rates and riser temperatures. The catalyst addition rate has also varied over the course of this run. Reliability issues with the catalyst addition and withdrawal systems prevented the minimum amount of catalyst from being added for a period of time earlier this year. These time periods were excluded from the statistical analysis of opacity, as they are not representative of normal operations.

Maintenance at the FCC includes a major turnaround approximately 5 years. The Richmond FCC is shut down to complete preventative maintenance work and repairs to equipment such as the cyclones and nozzles as this equipment experiences normal degradation over time. Based on the typical run of FCC equipment, decreases in cyclone efficiency and nozzle wear will likely result in more catalyst exiting the regenerator, and entering the ESP downstream. Based on this normal operation, it is likely more ammonia at the ESP may be required over the course of the cyclones' and nozzles life to control opacity and filterable PM.

Environmental Overview

The FCC is subject to an array of environmental requirements including Maximum Achievable Control Technology (MACT), New Source Performance Standards (NSPS), Consent Decree, and Title V Permit Conditions. A table of environmental requirements has been included for reference as Attachment 1. The table is a summary of FCC environmental requirements of interest and should not be considered comprehensive.

RESULTS

Over the course of the ODP ammonia injection rates at the ESP were systematically decreased to predetermined target rates and then source tested using a selection of emissions tests collectively referred to as "FCC Emissions Tests", see Table 2. A table of source test results are provided in Attachment 2. All figures referenced herein are included in Attachment 3.

Table 2. FCC Emissions Tests

Parameter	Reference Method	Measurement Principle
NH3	BAAQMD ST-1B	Ion selective electrode
Non-Sulfuric PM	EPA Method 5B	Gravimetry
PM2.5, PM10, and Condensable PM	EPA 201A/202	Gravimetry (F1/2 + B1/2)

In 2015, before the ODP, the ESP generally averaged an ammonia injection rate of 40 lbs/hr. Over the course of the ODP the ammonia injection rate was reduced from 58 lbs/hr to 13 lbs/hr. The results indicate that as ammonia injection rates are decreased emissions from ammonia and condensable particulate matter also decrease. However, the emissions reductions in filterable particulate matter (and opacity levels) begin to increase with ammonia injection reductions, particularly at lower injection rates. Please refer to Fig. 2, Fig. 3, and Attachment 2 for stack emission results. Total Particulate Matter has decreased as a result of the reduction in ammonia injection from an emission rate of 75 lbs/hr to 49 lbs/hr, see Fig. 10. The relationship between the variability in opacity levels and lower ammonia injection rates can be seen in Fig. 5 and Fig. 6. The cause of the variability and unstable opacity levels at lower ammonia injection rates is most likely from the normal variation in the operation of the FCC.

The increase in filterable particulate matter and opacity emissions is a result in the loss of ESP performance due to lower ammonia injection rates. As the ammonia injection rate is decreased the spark rate begins increasing. Once the spark rate reaches its upper control limit of approximately 8 sparks/minute the ESP reduces secondary current to prevent the spark rate from exceeding the upper control limit. This control mechanism protects the ESP from electrical fires and damage. Controlling the spark rate by drastically reducing the secondary current ensures that the ESP runs reliably but compromises the ESP's ability to effectively maintain a minimum secondary current to remove filterable particulate matter, see Fig. 4. As a result of the loss in the ESP's ability to maintain a minimum secondary current the FCC has higher emissions of Total Suspended Particulate (TSP) which, during the ODP, resulted in one deviation of Permit Condition #11066 Part #7A (21 lb/hr).

Statistical Analysis of Results

The resulting data of the ODP was subjected to standard statistical analyses. The primary focus of the statistical analysis was to understand what impacts to ammonia slip emissions, opacity levels, and filterable particulate matter

may occur when ammonia injection rates are decreased. This report will only discuss the variables in which a correlation coefficient was considered highly correlated or statistically significant in relation to ammonia injection rates and ammonia slip.

The data of the ODP was subjected to both correlation and regression analyses. A correlation analysis is a method of statistical evaluation used to study the strength of a relationship between two variables. The correlation between two variables can be positive or negative. Once a strong correlation coefficient was determined for any of the ODP's variables a regression analysis was conducted to estimate the relationship between a dependent variable (e.g. ammonia slip) and one or more independent variables (e.g. ammonia injection rate).

The statistical analysis validated that the ammonia injection rate is highly correlated with ammonia slip and that ammonia slip is highly correlated with condensable PM emissions. As ammonia injection rates increase the ammonia slip and condensable emissions at the stack also increase, see Fig. 7. The analysis also indicates a statistically significant relationship between opacity and NH3 injection rate, see Fig. 8.

Using the data gathered from the regression analysis a predictive model was developed to predict ammonia slip levels at certain ammonia injection rates. Using this predictive model the Richmond Refinery developed a target ammonia slip concentration at the stack based on injection rates that is protective of workers and local community members and assures compliance with other emissions limits.

The lowered ammonia injection rates have resulted in significant reductions in ammonia slip and condensable particulate emissions as shown in Fig. 2. Over the course of the ODP as ammonia injection rates were varied the maximum and minimum ammonia emission rates were 38.1 lbs/hr and 0.7 lbs/hr, respectively. Maximum and minimum condensable PM emission rates were 103 lbs/hr to 5.7 lbs/hr, respectively. However, the reduced effectiveness of the ESP due to lowered secondary current and less ammonia injection resulted in higher opacity levels at the FCC stack.

Based on the statistical analysis and study of the various FCC operational postures in regards to the ODP, it is apparent that the biggest predictor for ammonia and PM emissions at the FCC stack is the control of ammonia injection at the ESP inlet. Because ammonia injection rate is highly correlated with ammonia slip emissions (r^2 = +0.68) it is the primary predictor and control for ammonia slip emissions at the stack.

At the beginning of the ODP, the ammonia injection rate was only held constant during periods of source testing. When source testing was not occurring, the ammonia injection rate was held close to the target rate, but would be adjusted to control opacity levels to maintain compliance with consent decree and federal standards. In order to study possible impacts on opacity levels, in June 2017, the ammonia injection rate (and consequently ammonia slip emission rate) was held constant even during periods of non-testing at 13 lbs/hr and later at 15 lbs/hr.

When ammonia injection rates were held constant at 13 lbs/hr and 15 lbs/hr without adjustment, opacity levels gradually increased until the NSPS or MACT standards were either in or near a deviation of the standard. Please see attachment 1 for list of environmental standards. In addition to risking environmental deviation, the FCC stack created visible impact with a steady white plume of catalyst that resulted in worker health complaints, see Fig. 9.

Similar to the constant ammonia injection rate of 13 lbs/hr, the constant injection rate at 15 lbs/hr also saw opacity continue to climb which resulted in an exceedance of the 3-hr MACT standard. To minimize unreliable opacity performance the ammonia injection rate was increased to 20 lbs/hr. The Refinery has maintained an ammonia

injection rate of 20 lbs/hr since August 1, 2017 and find that this injection rate provides continual compliance with MACT, NSPS, and Consent Decree standards during normal operation. This injection rate also decreases the visibility of the catalyst plume reducing impact to workers and the community. Using the regression analysis predictive model the predicted ammonia slip at an ammonia injection rate of 20 lbs/hr is 14.4 ppmv @ 3% O2 with a standard deviation of 3.86 ppmv. Figure 6 demonstrates the impact and importance of maintaining ammonia injection at 20 lbs/hr as lower injection rates show an increase in opacity level and variability. To assure substantial compliance during normal operation Richmond Refinery proposes a final ammonia slip limit three standard deviations above the predicted ammonia slip value of 26 ppmv @ 3% O2 as a daily average.

Conclusion

Pursuant to Reg 6-5-403.4 and based on the results of the ODP, the Optimized Ammonia Emissions Concentration at the FCC stack should be 26 ppmv @ 3% O2, daily average. This value optimizes reductions in ammonia slip (condensable PM and PM2.5), while maintaining compliance with opacity standards and maintaining integrity of the ESP. To account for operational variability this limit is based on the 99.7th percentile (mean plus three standard deviations) of the projected ammonia slip concentration at 20 lbs/hr injection rate.

At 20 lbs/hr ammonia injection, the ODP demonstrated the FCC could comply with NSPS and MACT opacity standards, but cannot comply with the current existing secondary current and TSP requirements in Permit Condition 11066 Part #7A. Based on source test data conducted at ammonia injection rates of approximately 20 lbs/hr the Refinery proposes a new TSP limit of 27 lbs/hr which is based on the 99.7th percentile (mean plus three standard deviations) of the expected TSP emission rate of 22 lbs/hr with a standard deviation of 1.8 lbs/hr. At levels below 20 lbs/hr injection rate, the ODP demonstrated the FCC achieved poor and unreliable opacity performance.

Included with this final report are the required application forms to include the proposed ammonia slip limit and to modify the parametric conditions in permit condition #11066 in the Major Facility Review (MFR) permit.

FCC Environmental Limits

Emission Standard	Opacity	CO	ESP Inlet Temp	ESP Secondary Current	PM	NOx	NH3	SO2	Feed	POC
Title V	• 30%, 6-min non-rolling avg in 1 hr	• 500 ppmv @ 0% O2, 1-hr avg • 67 ppmvd @ 3% O2, 30-day roll avg • 50 ppmvd @ 3% O2, year avg • 100 ppmv @ 0% O2, 365-day roll avg • 258.4 tons, 12 mo. roll	• 550 °F minimum, 1-hr avg	• Shall be fully charged at all times of operation • 200 mA minimum for any TR set, 3 hrs avg OR no more than 2 TR sets < 200 mA, 3-hr roll avg with remaining TR sets > 296 mA, 3-hr roll avg	• 21 lb/hr TSP, 365-day roll avg preceding last source test • 1 lb/1000 lb coke burn-off • 92 tons, 12-mo. roll	• 220 ppmv @ 3% O2, 24-hr roll avg • 40 ppmvd @ 0% O2, 7-day roll avg • 180 ppmv @ 3% O2, 30-day roll avg • 150 ppmv @ 3% O2, year avg • 20 ppmvd @ 0% O2, 365-day roll avg • 1504.7 tons, 12 mo. roll	• 500 lbs NH3 injection maximum, 1-hr avg	• 330 ppmv @ 3% O2, 24-hr roll avg • 50 ppmvd @ 0% O2, 7-day roll avg • 9.8 lb/1000 lb coke burn-off, 7-day roll avg OR feed <0.3 wt% S, 7-day roll avg • 25 ppmvd @ 0% O2, 365-day roll avg • 2199.4 tons, 12 mo. roll	• 80,000 BPD, day avg for any 15 days triggers POC testing • 80,000 BPD, year avg • 90,000 BPD, day avg	• 6.1 tons, 12 mo. roll
NSPS J	• 30%, 6-min non-rolling avg in 1 hr	• 500 ppmvd @ 0% O2, 1-hr roll avg			• 1.0 kg/1000 kg coke burn off			• with SOx reducing catalyst, 90% reduction or 50 ppmvd @ 0% O2, 7-day roll avg **OR** • without SOx-reducing catalyst, 9.8 lbs/1000 lb of coke burn-off **OR** • feed < 0.3% wt% S, 7-day roll avg		
MACT II	• 20% on 3-hour rolling avg • During startup, shutdown, or hot standby the inlet velocity to primary cyclone must be >20 ft/s for each hour or duration of event	• 500 ppmv @ 0% O2, 1-hr roll avg • During startup, shutdown, or hot standby exhaust gas from regen must be 1 vol% O2 minimum (dry basis), 1-hr avg								
Consent Decree		• 500 ppmv @ 0% O2, 1-hr roll avg • 100 ppmv @ 0% O2, 365-day roll avg			• 1.0 kg/1000 kg of coke-burn-off, 3-hr roll avg	• 40 ppmvd @ 0% O2, 7-day roll avg • 20 ppmvd @ 0% O2, 365-day roll avg		• 50 ppmvd @ 0% O2, 7-day roll avg • 25 ppmvd @ 0% O2, 365-day roll avg		

Attachment 1

APPLICATION FOR SIGNIFICANT REVISION
TO MAJOR FACILITY REVIEW PERMIT
APPLICATION NO. (T.B.D.)

for

Chevron Products Company – Richmond Refinery
FCC Electrostatic Precipitator (A-0014)

1. FACILITY INFORMATION

Owner:	Chevron USA, Inc.
Facility Name:	Chevron Products Company - Richmond Refinery
BAAQMD Facility No.:	A0010
Address:	841 Chevron Way Richmond, CA 94801
Contact Name:	Mr. Shawn Lee
Phone Number:	(510) 242-1400
E-mail:	ShawnLee@chevron.com

2. DESCRIPTION OF PROPOSED REVISION

Chevron USA, Inc. is submitting this follow-up revision to its February 25, 2016 application to the Bay Area Air Quality Management District (District) for a significant revision to the Chevron Richmond Refinery's Major Facility Review (MFR) Permit to modify Permit Condition #11066 for FCC Electrostatic Precipitator (A-0014). Permit application fees were submitted with the February 25, 2016 submittal. This revision includes additional revisions to Permit Condition #11066, following completion of the Optimization and Demonstration Protocol pursuant to Regulation 6-5-403, including an enforceable ammonia emission limit pursuant to Regulation 6-5-403.4.

Pursuant to Regulation 6-5-403.1, the Chevron Products Company, Richmond Refinery has elected to establish an enforceable ammonia emission limit for the FCCU via ammonia optimization in lieu of compliance with the ammonia emission limits in Regulation 6-5-301. As described in the Optimization and Demonstration Protocol Final Report submitted with this application on August 31, 2017, the proposed enforceable ammonia emission limit will require operating the FCC ESP outside of the parametric conditions found in Permit Condition #11066, Part# 7A.

Chevron is therefore requesting the District amend Permit Condition #11066 by removing Permit Condition #11066 Part #7A3, #7A4 and Part #7A5; amending Part #7A and Part #15 to read as follows:

Amend Part #7A (deletions denoted by red strike-out; additions in underline red text):

"The TSP emitted from S-4285 after abatement shall not exceed ~~2127~~ lb/hr, averaged over any consecutive 365 day period using the time weighted average of all District-accepted third party and District performed source tests conducted on S-4285. District accepted third party tests shall be defined as those tests that meet all of the criteria in 7b. (basis: BACT)
To demonstrate compliance with the ~~2127~~ lb/hr emission limit, owner/operator shall calculate the time weighted average of all District accepted third party and District performed particulate source tests conducted on S-4285 over the 365 day period preceding the most recent source test. Within 45 days of test completion, owner/operator shall calculate the time weighted average and submit the calculation with comprehensive report of the test results to the District's Source Test Manager for review. The calculation shall be done using the following procedure…"

Amend Part #15 (deletions denoted by red strike-out; additions in underline red text):

"Ammonia injected to pre treat flue gas feed into A0014 ESP shall not exceed ~~5020~~ lbs/hr. (basis: toxics) The owner/operator shall install a District-approved ammonia analyzer by October 31, 2017. The owner/operator of S-4285 shall not exceed 26 ppmv NH3 corrected to 3% O2, on a daily average basis. To demonstrate compliance with this limit ammonia injected into A0014 ESP shall not exceed 20 lbs/hr on a daily average basis.

No later than December 1, 2017, the owner/operator will validate the District-approved ammonia analyzer by completing at least one source test using BAAQMD Method ST-1B. The owner/operator will submit to the APCO an application to revise the ammonia slip limit, adjusting for any bias between the ammonia analyzer and BAAQMD Method ST-1B. Until this application is submitted and the ammonia slip limit is revised, the owner/operator shall demonstrate compliance with the ammonia slip limit of 26 ppmv NH3 corrected to 3% O2 by not exceeding 20 lbs/hr ammonia injection on a daily average basis."

The proposed change will impact Table VII.C.2.1 and Table II-B of the MFR Permit, as shown below (additions are in underline format).

Table VII.C.2.1 Process Units
Applicable Limits and Compliance Monitoring Requirements

FCC
S-4285 Fluid Catalytic Cracking Unit

Type of Limit	Citation of Limit	FE Y/N	Future Effective Date	Limit	Monitoring Requirement Citation	Monitoring Frequency (P/C/N)	Monitoring Type
~~Secondary current of TR~~	~~Cleaner Fuels Project FCC Mod Condition #11066 Part 7a5 and Part 7a6~~	~~Y~~		~~Average shall not be less than 200 milliamps averaged over any three hour period. [applicable to S-4285 and A-0014] or No more than 2 TR sets may be less than 200 milliamps averaged over any three hour period, as long as the remaining TR sets maintain an average secondary current~~	~~Cleaner Fuels Project FCC Mod. Condition #11066 Part #7a3~~	~~P, daily basis C~~	~~Monitor Monitor/alarm set at 200 milliamps~~

				~~above 296 milliamps averaged over any three hour period [applicable to S-4285 and A-0014]~~			
NH3	Cleaner Fuels Project FCC Mod. Condition 11066 Part 15	Y		Ammonia (NH3) injection rate shall not exceed 20 lbs/hr on a daily average basis [applicable to S-4285 and A-0014]	Regulation 2-6-409.2.2	P/D	Recordkeeping
NH3	6-5-403, Condition #11066 Part #15	N		Shall not exceed 26 ppmv @ 3% O2 as a daily average.	Condition #11066 Part 15	P	NH3 injection monitor and recorder
~~ESP Inlet Temperature~~		~~Y~~		~~Minimum of 550 F averaged over any one hour period [applicable to S-4285 and A-0014]~~	~~Cleaner Fuels Project FCC Mod. Condition #11066 Part 7a4~~	~~C~~	~~Inlet temperature monitor and recorder~~
~~Secondary current of TR~~	~~Cleaner Fuels Project FCC Mod. Condition #11066 Part 7a5~~	~~Y~~		~~Average shall not be less than 200 milliamps averaged over any three hour period. [applicable to S-4285 and A-0014]~~	~~Cleaner Fuels Project FCC Mod. Condition #11066 Part 7a3~~	~~P, daily basis~~	~~Monitor~~
~~Secondary current of TR~~	~~Cleaner Fuels Project FCC Mod. Condition #11066 Part 7a5~~	~~Y~~		~~No more than 2 TR sets may be less than 200 milliamps averaged over any three hour period, as long as the remaining TR sets maintain an average secondary current above 296 milliamps averaged over any three hour period [applicable to S-4285 and A-0014]~~	~~Cleaner Fuels Project FCC Mod. Condition #11066 Part 7a3~~	~~C~~	~~Monitor/alarm set at 200 milliamps~~

Table II-B Abatement Devices

Source Number	Description	Source(s) Controlled	Applicable Requirement	Operating Parameters	Limit or Efficiency
~~A-0014~~	~~K-13, FCC Electrostatic Precipitator, Single Electrostatic Precipitator~~	~~S-4285~~	~~Condition #11066 Item #7a5, Condition #11066 Item #7a3, Condition #11066 Item #7a6~~	~~Monitor~~	~~Average secondary current of TR shall not be less than 200 milliamps averaged over any three hour period~~ ~~Or~~ ~~No more than 2 TR sets may be less than 200 milliamps averaged over any three hour period, as long as the remaining TR sets maintain an average secondary current above 296 milliamps averaged over any three hour period~~
A-0014	K-13, FCC Electrostatic Precipitator, Single Electrostatic Precipitator	S-4285	Condition #11066 Item #7		~~3~~ 27 lb TSP/hr, average of four source tests per calendar year

A-0014	K-13, FCC Electrostatic Precipitator, Single Electrostatic Precipitator	S-4285	Condition #11066 Item #15		26 ppmv NH3 @ 3% O2 on a daily average basis
A-0014	K-13, FCC Electrostatic Precipitator, Single Electrostatic Precipitator	S-4285	Condition #11066 Item #15		Ammonia (NH3) injection rate shall not exceed ~~500~~ 20 lbs/hr as a daily average
~~A-0014~~	~~K-13, FCC Electrostatic Precipitator, Single Electrostatic Precipitator~~	~~S-4285~~	~~Condition #11066 Item #7a1~~	~~Inlet temperature monitor and recorder~~	~~Minimum of 55 F ESP Inlet Temp averaged over any one hour period~~

Attached to this submittal are the following completed District MFR permit application forms: Form P101-B, Stationary Source Summary, Applicable Requirements and Compliance Summary, Certification Statement, and Data Form A.

Also attached to this submittal is a map of the Richmond Refinery, showing its property boundaries and the location of A-0014.

3. EMISSIONS

The proposed amendment will not increase the source's potential-to-emit PM10 or PM2.5, but decrease them. While the TSP limit is increasing from 21 lb/hr to 27 lb/hr, this limit applies only to filterable particulate matter pursuant to the historic basis of the limit and historical compliance test method, EPA Method 5B. There are no physical (e.g. piping or equipment) or operational modifications proposed. The FCC's potential to emit PM10 and PM2.5, which includes condensable particulate matter (Regulation 2-1-229 and 2-1-241), will not increase. Instead, this application will add an ammonia slip limit, which will decrease condensable particulate matter in an amount greater than the increase in filterable particulate matter (see Figure 10 and Attachment 3 in FINAL REPORT). Therefore, the FCC will decrease the potential to emit for PM10 and PM2.5.

4. APPLICABLE REQUIREMENTS

Key applicable air quality requirements are discussed below.

4.1 District Regulation 2, Rule 1 – Permits, General Requirements

The FCC Electrostatic Precipitator currently abates the FCC Plant (S-4285), as shown in Table II-B of Chevron's MFR Permit. The proposed amendment is neither a modification, as defined in 2-1-234, nor an alteration, as defined in 2-1-233. S-4285, abated by A-0014, will decrease its potential to emit PM10 and PM2.5 (see emission discussion above). As a result, the proposed revision is not subject to 2-1-301 or 2-1-302.

This application is categorically exempt from the California Environmental Quality Act (CEQA) per 2-1-312.1 because the proposed amendment does not involve permitted emission increases or physical modifications.

The source is located over 1000 feet from the nearest K-12 school. Therefore, this project is not subject to the public notification requirements of Regulation 2-1-412 (see Attachment B, Facility Map).

4.2 District Regulation 2, Rule 2 – New Source Review

Regulation 2-2 only applies to new and modified sources subject to the requirements of 2-1-301. The proposed amendment to Permit Condition #11066 is not subject to 2-1-301 because it is neither a modification, as defined in 2-1-234, nor an alteration, as defined in 2-1-233. S-4285, abated by A-0014, will decrease its potential to emit PM10 and PM2.5 (see emission discussion above).

4.3 District Regulation 2, Rule 5 – New Source Review of Toxic Air Contaminants

The proposed amendment is not subject to Regulation 2-5 or a Health Risk Screening Analysis because there is no increase in permitted emissions.

4.4 District Regulation 2, Rule 6 – Major Facility Review

The proposed amendment qualifies as a significant permit revision under 2-6-226 because it is a change to a federally enforceable permit condition and relaxes a monitoring and recordkeeping condition.

4.5 District Regulation 3 - Fees

Regulation 3 specifies permit fee requirements. As detailed below, total fees for the project amount to $62,195.00. Two checks totaling to this amount were submitted with the initial application submitted on February 25, 2016.

Permit Fees

Description	**Amount**
Filing Fee (3-306)	$ 452.00
Initial Permit Fee (Schedule G-4)	$ 58,509.00
MFR Filing Fee (Schedule P)	$ 897.00
MFR Significant Permit Revision Fee (Schedule P)	$ 2,337.00
Total	**$ 62,195.00**
[1] Reference: District Regulation 3, Section 306 and Schedule P, dates June 3, 2015. The Risk Screening Fee and Toxic Surcharge does not apply because toxic air contaminant emissions are not expected to change due to no change in permitted throughput limits or emissions limits.	

5. REFERENCES

1. Chevron Products Company, Facility # A0010, Major Facility Review Permit, August 1, 2014.

2. Bay Area Air Quality Management District, Rules and Regulations, as of August 2017, http://www.baaqmd.gov .

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 Ellis Street, San Francisco, CA 94109
Engineering Division (415) 749-4990
www.baaqmd.gov fax (415) 749-5030

Form P-101B
Authority to Construct/
Permit to Operate

1. Application Information

BAAQMD Plant No. A0010 Company Name Chevron Products Company

Equipment/Project Description Permit Condition #11066 Amendment (A-0014); see application package for details

2. Plant Information

If you have not previously been assigned a Plant Number by the District or if you want to update any plant data that you have previously supplied to the District, please complete this section.

Equipment Location _____

City _____ Zip Code _____

Mail Address _____

City _____ State _____ Zip Code _____

Plant Contact _____ Title _____

Telephone ( ) _____ Fax ( ) _____ Email _____

NAICS (North American Industry Classification System) see www.census.gov/epcd/naics02/naico602.htm 32411

3. Proximity to a School (K-12)

The sources in this permit application (*check one*) ☐ Are ☒ Are not within 1,000 ft of the outer boundary of the nearest school.

4. Application Contact Information

All correspondence from the District regarding this application will be sent to the plant contact unless you wish to designate a different contact for this application.

Application Contact Callie Nguyen Title Environmental Specialist

Mail Address 841 Chevron Way

City Richmond State CA Zip Code 94801

Telephone (510)-242-521 Fax (510) 242-3762 Email Callie.nguyen@chevron.com

5. Additional Information

The following additional information is required for all permit applications and should be included with your submittal. Failure to provide this information may delay the review of your application. Please indicate that each item has been addressed by checking the box. Contact the Engineering Division if you need assistance.

☐ If a new Plant, a local street map showing the location of your business

☒ A facility map, drawn roughly to scale, that locates the equipment and its emission points

☒ Completed data form(s) and a pollutant flow diagram for each piece of equipment.
(See www.baaqmd.gov/Forms/Engineering.aspx)

☒ Project/equipment description, manufacturer's data

☒ Discussion and/or calculations of the emissions of air pollutants from the equipment

6. Trade Secrets

Under the California Public Records Act, all information in your permit application will be considered a matter of public record and may be disclosed to a third party. If you wish to keep certain items separate as specified in Regulation 2, Rule 1, Section 202.7, please complete the following steps.

☐ Each page containing trade secret information must be labeled "trade secret" with the trade secret information clearly marked.

☐ A second copy, with trade secret information blanked out, marked "public copy" must be provided.

☐ For each item asserted to be trade secret, you must provide a statement which provides the basis for your claim.

7. Small Business Certification *You are entitled to a reduced permit fee if you qualify as a small business as defined in Regulation 3. In order to qualify, you must certify that your business meets all of the following criteria:*

☐ The business does not employ more than 10 persons and its gross annual income does not exceed $600,000.

☐ And the business is not an affiliate of a non-small business. (Note: a non-small business employs more than 10 persons and/or its gross income exceeds $600,000.)

8. Accelerated Permitting *The Accelerated Permitting Program entitles you to install and operate qualifying sources of air pollution and abatement equipment* ***without waiting for the District to issue a Permit to Operate****. To participate in this program you must certify that your project will meet all of the following criteria. Please acknowledge each item by checking each box.*

☐ Uncontrolled emissions of any single pollutant are each less than 10 lb/highest day, or the equipment has been precertified by the BAAQMD.

☐ Emissions of toxic compounds do not exceed the trigger levels identified in Table 2-5-1 (see Regulation 2, Rule 5).

☐ The project is not subject to public notice requirements (the source is either more than 1000 ft. from the nearest school, or the source does not emit any toxic compound in Table 2-5-1).

☐ For replacement of abatement equipment, the new equipment must have an equal or greater overall abatement efficiency for all pollutants than the equipment being replaced.

☐ For alterations of existing sources, for all pollutants the alteration does not result in an increase in emissions.

☐ Payment of applicable fees (the minimum permit fee to install and operate each source). See Regulation 3 or contact the Engineering Division for help in determining your fees.

9. CEQA *Please answer the following questions pertaining to CEQA (California Environmental Quality Act).*

A. Has another public agency prepared, required preparation of, or issued a notice regarding preparation of a California Environmental Quality Act (CEQA) document (initial study, negative declaration, environmental impact report, or other CEQA document) that analyzes impacts of this project or another project of which it is a part or to which it is related? ☐YES ☒NO If no, go to section 9B.

Describe the document or notice, preparer, and date of document or expected date of completion:

Not applicable

B. List and describe any other permits or agency approvals required for this project by city, regional, state or federal agencies:

None

C. List and describe all other prior or current projects for which either of the following statements is true: (1) the project that is the subject of this application could not be undertaken without the project listed below, (2) the project listed below could not be undertaken without the project that is the subject of this application:

Ammonia Optimization pursuant to Regulation 6-5-403

10. Certification *I hereby certify that all information contained herein is true and correct. (Please sign and date this form)*

Steven Yang | Air Team Lead | 8/31/2017

Steven Yang	Air Team Lead		8/31/17
Name of person certifying (print)	Title of person certifying	Signature of person certifying	Date

Send all application materials to the **BAAQMD Engineering Division, ~~939 Ellis Street~~, San Francisco, CA 94109.**

Engineering Division
Bay Area Air Quality Management District
939 Ellis Street, San Francisco, CA 94109 • 749-4990

Major Facility Review
Certification Statement

FACILITY NAME:	Chevron Products Company - Richmond Refienery	FACILITY #:	A0010

STATEMENT OF COMPLIANCE:

I certify the following:

Read each statement carefully and initial each box for confirmation.

☒ *Based on information and belief formed after reasonable inquiry, the source(s) identified in the Applicable Requirements and Compliance Summary form that is(are) in compliance will continue to comply with the applicable requirement(s);*

☒ *Based on information and belief formed after reasonable inquiry, the source(s) identified in the Applicable Requirements and Compliance Summary form will comply with future-effective applicable requirement(s), on a timely basis;*

☒ *Based on information and belief formed after reasonable inquiry, information on application forms, all accompanying reports, and other required certifications is true, accurate, and complete;*

☒ *All fees required by Regulation 3, including Schedule P have been paid.*

STATEMENT OF NON-COMPLIANCE

Read statement carefully. Initial box for confirmation if statement is true.

I certify the following:

☒ *Based on information and belief formed after reasonable inquiry, the source(s) identified in the Schedule of Compliance application form that is(are) not in compliance with the applicable requirement(s) will comply in accordance with the attached compliance plan schedule.*

Signature of Responsible Official

30 Aug 2017
Date

Kory Judd
Name of Responsible Official

Engineering Division
Bay Area Air Quality Management District
939 Ellis Street, San Francisco, CA 94109 • 749-4990

Stationary Source Summary
Page 1

FACILITY NAME: Chevron Products Company - Richmond Refinery	FACILITY ID: A0010

♦ DISTRICT USE ONLY ♦

Application #: _____ **Application Received:** _____

Application Filing Fee: _____ **Application Deemed Complete:** _____

I. FACILITY IDENTIFICATION

1. Facility Name: Chevron Products Company - Richmond Refinrey	
2. Four digit SIC: 2911	EPA Plant ID: A0010
3. Parent Company (if different than Facility Name):	
4. Mailing Address: Post Office Box 1272, Richmond, CA 94801	
5. Street Address or Source Location: 841 Chevron Way, Richmond, CA 94801	
6. UTM C oordinates (if required):	
7. Source Located within 50 miles of the state line: ☐ Yes ☒ No	
8. Source Located within 1000 feet of a school: ☐ Yes ☒ No	
9. Type of Orginzation: ☒ Corporation ☐ Sole Ownership ☐ Government ☐ Partnership ☐ Utility Company	
10. Legal Owner's Name: Chevron U.S.A. Inc.	
11. Owner's Agent name (if any):	
12. Responsible Official: Kory Judd	
13. Plant Site Manager/Contact: Shawn Lee	Telephone #: (510) 242-1400
14. Type of Facility: Petroleum Refinery	
15. General description of processes/products: Refining crude oil into various petroleum products.	
16. Is a Federal Risk Management Plan pursuant to Section 112(r) required? ☒ Yes ☐ No (If application is submitted after Risk Management Plan due date, attach verification that the plan is registered with the appropriate agency.)	

FACILITY NAME: Chevron Products Company - Richmond Refinery	FACILITY ID: A0010

II. TYPE OF PERMIT ACTION

	CURRENT PERMIT (permit number)	EXPIRATION (date)
☐ Initial Title V Application		
☐ Permit Renewal		
☒ Significant Permit Modification	August 1, 2014 - Renewal	August 10, 2016
☐ Minor Permit Modification		
☐ Administrative Amendment		

III. DESCRIPTION OF PERMIT ACTION

1. Does the permit action requested involve:
☐ Temporary Source ☐ Voluntary Emissions Caps
☐ Acid Rain Source ☐ Alternative Operating Scenarios
☐ CEM's ☒ Abatement Devices
☒ Source Subject to MACT Requirements [Section 112]
☐ Source Subject to Enhanced Monitoring

2. Is source operating under a Compliance Schedule? ☐ Yes ☒ No

3. For permit modification, provide a general description of the proposed permit modification:

Addition of ammonia slip conditions in Permit Condition #11066. Remove Permit Condition #11066, Part #7A3, #7A4 and #7A5, the secondary current parametric conditions on the FCC ESP (A-0014) and alter Permit Condition #11066 #7a in order to comply with ammonia slip conditions.

Signature of Responsible Official

Kory Judd
Print Name of Responsible Official

General Manager, Richmond Refinery
Title of Responsible Official and Company Name

Date: 30 Aug 2017

Engineering Division
Bay Area Air Quality Management District
939 Ellis Street, San Francisco, CA 94109 • (415) 749-4990

Major Facility Review
Applicable Requirements & Compliance Summary

FACILITY NAME: Chevron Products Company - Richmond Refinery **FACILITY #:** A0010

Source #(s): A0014 (abates FCC Plant, S-4285) **Source Name(s)** FCC Plant ESP

APPLICABLE REQUIREMENTS

In numerical order, list all equipment with any applicable requirements. Include any work practice standards or throughput limits pursuant to NSR or District Regulations. Indicate the date during the permit term that the applicable requirement(s) will be effective. If more lines are required, please use additional forms. If information does not fit in the space allotted, attach documentation and reference it on this form. Use the "FE" column to state whether the requirement is federally enforceable. Type or print legibly.

APPLICABLE REGULATIONS	FE	TEST METHODS (if any)	MONITORING PROTOCOL	REPORTING PROTOCOL	RECORDKEEPING PROTOCOL	COMPLIANCE (Y, N)	FUTURE EFFECTIVE DATE
Reg 6-1-302, 6-1-502	Y		Regulation 1	Regulation 1	Regulation 1	Y	
40 CFR 60 Subpart J 60.102(a) (2)	Y		40 CFR 60 Subpart J 60.105(a) (1)	40 CFR 60 Subpart J 60.106	40 CFR 60 Subpart J 60.106	Y	
Reg 6-1-310	Y	EPA Method 5B	Regulation 1	Regulation 1	Regulation 1	Y	
Reg 6-1-311	Y	EPA Method 5B	Regulation 1	Regulation 1	Regulation 1	Y	
40 CFR 60 Subpart J 60.102(a) (1)	Y	EPA Method 5B	40 CFR 60 Subpart J 60.106	40 CFR 60 Subpart J 60.106	40 CFR 60 Subpart J 60.106	Y	
Condition #11066 Item #3	Y	EPA Method 5B	Condition #11066 Item #9	Regulation 1	Condition #11066 Item #11	Y	
Condition #11066 Item #7	Y	EPA Method 5B	Condition #11066 Item #7b	Regulation 1	Condition #11066 Item #7c	Y	
Condition #11066 Item #7a4	Y		Condition #11066 Item #7a4	Regulation 1	Condition #11066 Item #7a4	Y	
Condition #11066 Item #7a5	Y		Condition #11066 Item #7a3	Regulation 1	Condition #11066 Item #7a3	Y	
Reg 6-5-403	Y					Y	
Reg 6-5-501	Y		Reg 6-5-501	Regulation 1	Reg 6-5-502	Y	1/1/2018
40 CFR 63 1564-1565	Y		40 CFR 63 1572	40 CFR 63 1575	40 CFR 63 1576	Y	

8/31/2017
Date

Data Form A
ABATEMENT DEVICE

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

939 Ellis Street . . . San Francisco, CA 94109. . . (415) 749-4990 . . . Fax (415) 749-5030

for office use only

Abatement Device: Equipment/process whose primary purpose is to reduce the quantity of pollutant(s) emitted to the atmosphere.

1. Business Name: Chevron Richmond Refinery Plant No: A0010
   (If unknown, leave blank)
2. Name or Description FCC Electrostatic Precipitator Abatement Device No: A- 0014
3. Make, Model, and Rated Capacity Environmental Elements Corporation
4. Abatement Device Code (See table*) 24 Date of Initial Operation 1981
5. With regard to air pollutant flow into this abatement device, what sources(s) and/or abatement device(s) are **immediately** upstream?

   S- 4285 **S-** _____ **S-** _____ **S-** _____ **S-** _____
   S- _____ **A-** _____ **A-** _____ **A-** _____ **A-** _____ **A-** _____
6. Typical gas stream temperature at inlet: 570 °F

If this form is being submitted as part of an application for an ***Authority to Construct***, completion of the following table is mandatory. If not, and the Abatement Device is *already in operation,* completion of the table is requested but not required.

	Pollutant	Weight Percent Reduction (at typical operation)	Basis Codes *(See Table**)*
7.	Particulate		
8.	Organics		
9.	Nitrogen Oxides (as NO_2)		
10.	Sulfur Dioxide		
11.	Carbon Monoxide		
12.	Other:		
13.	Other:		

14. ☐ Check box if this Abatement Device burns fuel; complete lines 1, 2 and 15-36 on Form C (using the Abatement Device No. above for the Source No.) and attach to this form.
15. With regard to air pollutant flow from this abatement device, what sources(s), abatement device(s) and/or emission point(s) are ***immediately*** downstream?

    S- _____ **A-** _____ **A-** _____ **A-** _____ **P-** _____ **P-** _____

Person completing this form: Callie Nguyen Date: 8/31/2017

P:www\FormA (revised: 7/99)

*ABATEMENT DEVICE CODES

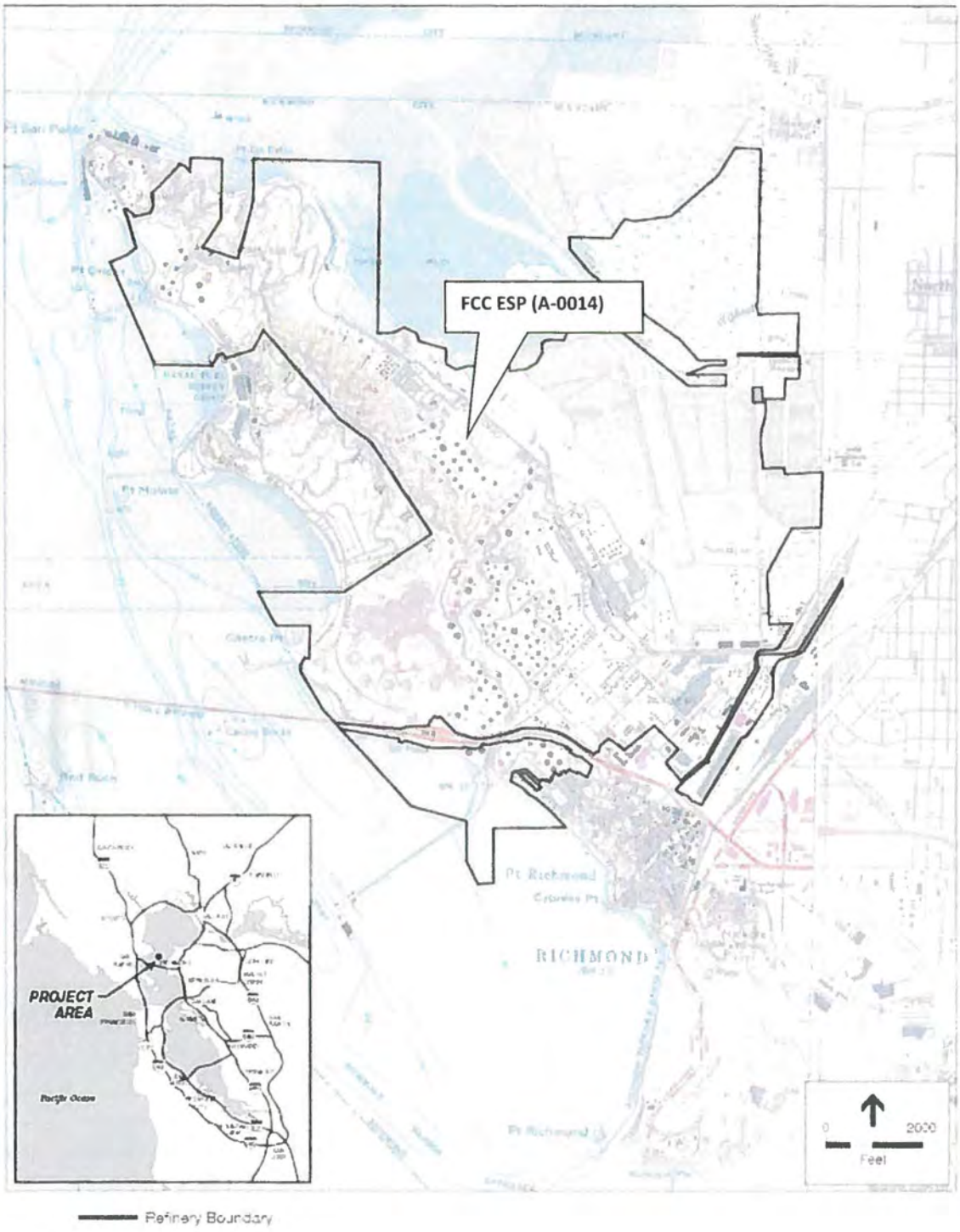
Code	DEVICE
	ADSORBER (See Vapor Recovery)
	AFTERBURNER
1	CO Boiler
2	Catalytic
3	Direct Flame
4	Flare
5	Furnace-firebox
6	Other
	BAGHOUSE (See Dry Filter)
	CYCLONE (See Dry Inertial Collector and Scrubber)
	DUST CONTROL
68	Water Spray
	DRY FILTER
7	Absolute
8	Baghouse, Pulse Jet
9	Baghouse, Reverse Air
10	Baghouse, Reverse Jet
11	Baghouse, Shaking
12	Baghouse, Simple
13	Baghouse, Other
14	Envelope
15	Moving Belt
16	Other
	DRY INERTIAL COLLECTOR
17	Cyclone, Dynamic
18	Cyclone, Multiple (12 inches dia. or more)
19	Cyclone, Multiple (less than 12 inches dia.)
20	Cyclone, Simple
21	Settling Chamber, Baffled/Louvered
22	Settling Chamber, Simple
23	Other
	ELECTROSTATIC PRECIPITATOR
24	Single Stage
25	Single Stage, Wet
26	Two Stage
27	Two Stage, Wet
28	Other
	INCINERATOR (See Afterburner)
	INTERNAL COMBUSTION ENGINE CONTROL
69	Catalyzed Diesel Particulate Filter
70	Non-Cat. Diesel Part. Filter w/ Active Regeneration
71	Diesel Oxidation Catalyst
72	Oxidation Catalyst
	KNOCK-OUT POT (See Liquid Separator)
	LIQUID SEPARATOR
29	Knock-out Pot
30	Mist Eliminator, Horizontal Pad, Dry
31	Mist Eliminator, Panel, Dry
32	Mist Eliminator, Spray/Irrigated
33	Mist Eliminator, Vertical Tube, Dry
34	Mist Eliminator, Other
35	Other
	NO_X CONTROL
66	Selective Catalytic Reduction (SCR)
67	Non-Selective Catalytic Reduction (NSCR)
73	Selective Non-Catalytic Reduction (SNCR)
	SCRUBBER
36	Baffle and Secondary Flow
37	Centrifugal
38	Cyclone, Irrigated
39	Fibrous Packed
40	Impingement Plate
41	Impingement and Entrainment
42	Mechanically Aided
43	Moving Bed
44	Packed Bed
45	Preformed Spray
46	Venturi
47	Other
	SETTLING CHAMBER (See Dry Inertial Collector)
	SULFUR DIOXIDE CONTROL
48	Absorption and Regeneration, for Sulfur Plant
49	Claus Solution Reaction, for Sulfur Plant
50	Dual Absorption, for H2S04 Plant
51	Flue Gas Desulfurization, for Fossil Fuel Combustion
52	Reduction and Solution Regeneration, for Sulfur Plant
53	Reduction and Stretford Process, for Sulfur Plant
54	Sodium Sulfite-Bisulfite Scrubber, for H2S04 Plant
55	Other
	VAPOR RECOVERY
56	Adsorption, Activated Carbon/Charcoal
57	Adsorption, Silica
58	Adsorption, Other
59	Balance
60	Compression/Condensation/Absorption
61	Compression/Refrigeration
62	Condenser, Water-Cooled
63	Condenser, Other
64	Other
	MISCELLANEOUS
74	Soil Vapor Extraction Abatement System
65	Not classified above

**BASIS CODES

Code	Method
0	Not applicable for this pollutant
1	Source testing or other measurement **by plant**
2	Source testing or other measurement **by BAAQMD**
3	Specifications from vendor
4	Material balance by plant using engineering expertise and knowledge of process
5	Material balance **by BAAQMD** using engineering expertise and knowledge of process
6	Taken from AP-42 ("Compilation of Air Pollutant Emission Factors," EPA)
7	Taken from literature, other than AP-42
8	Guess

(revised: 8/08)

Map of Chevron Richmond Refinery
FCC ESP (A-0014)



Source: Chevron 2008.

8/31/2017