MARATHON

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April 7, 2021

VIA Certified Mail and eMail (*wnastri@aqmd.gov*)
Return Receipt Requested

Wayne Nastri
Executive Officer
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

Re: Third Set of Comments on SCAQMD Revised Draft of Proposed Rule 1109.1 – Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries (Revision Date: December 24, 2020)

Dear Mr. Nastri:

On behalf of Tesoro Refining & Marketing Company LLC, a wholly owned subsidiary of Marathon Petroleum Corporation (collectively, "MPC"), MPC appreciates this opportunity to provide South Coast Air Quality Management District (SCAQMD) with additional comments on the Revised Preliminary Draft Proposed Rule 1109.1 Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries (Proposed Rule 1109.1) that was issued on December 24, 2020.[1] Throughout the rulemaking process, MPC staff continues to be active participants in Proposed Rule 1109.1 working group meetings and discussions with SCAQMD staff.

This set of comments supplements MPC's two comment letters submitted to SCAQMD on December 22, 2020 and February 1, 2021 and provide additional detail on key issues concerning the technical feasibility, safety, and cost of NOx emissions controls for BARCT. Please refer to the "Background and Overview" section in these referenced letters for a discussion of MPC's significant overarching concerns that SCAQMD's BARCT technology assessment and Proposed Rule 1109.1 limits have not been appropriately determined, are not technically feasible or cost effective for many of the required installations, and in many cases also present unacceptable safety hazards.

1 SCAQMD, "Revised Preliminary Draft Proposed Rule 1109.1", http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/r1109-1-rule-language---12-24-20.pdf

As presented during Working Group Meeting #19 on Proposed Rule 1109.1, SCAQMD is currently re-evaluating the proposed NOx BARCT limit for large boilers and heaters (rated heat input capacity ≥ 40 million British thermal units per hour (MMBtu/hr)) and considering increasing the currently recommended 2 parts per million by volume (ppmv) limit to 5 ppmv NOx corrected to 3% oxygen.[2] Through this letter, MPC provides supplemental comments further explaining the key issues that SCAQMD must consider with the technical feasibility and costs necessary to continuously comply with a 5 ppmv NOx limit or less. These comments center on technical feasibility and average and incremental cost effectiveness analyses of retrofitting refinery process heaters and boilers with selective catalytic reduction (SCR) systems required to meet the proposed BARCT.

1. Many of the large heaters and boilers at Los Angeles Refinery (LAR) are already well-controlled, and installing further NOx retrofit controls is not cost-effective for these units.

At the request of SCAQMD staff, MPC provided unit-specific information on additional NOx emissions controls projects and corresponding cost estimates for the large heaters and boilers at the Marathon Los Angeles Refinery (LAR).[3] Large heaters and boilers are those with at least 40 MMBtu/hr heat input capacity. Our correspondence also included the current (2020 annual average) NOx emissions performance and corresponding NOx control technologies currently installed for each large heater and boiler. That information is summarized in this letter to support an accurate representation of current NOx performance levels and cost-effectiveness analysis for the BARCT evaluation.

A. Current NOx performance levels

Of the 35 existing large heaters and boilers in operation at LAR, 29 of the units already operate with one or more NOx control technologies such as low NOx burners (LNB) and/or SCR. The heat input capacity-weighted annual average NOx performance during 2020 for these well-controlled heaters and boilers was 31 ppmv NOx corrected to 3% O_2. Excluding those units with an SCR, the heat input capacity-weighted annual average NOx performance during 2020 for the large heaters and boilers with NOx combustion controls was 35 ppmv NOx at 3% O_2. This current performance level is within the range of "typical" emissions representative of ultra-low NOx burner (ULNB) technology at 30 to 40 ppmv NOx as denoted in SCAQMD's February 4, 2021 presentation.[4]

As a result of our significant investments in NOx controls at LAR already, there have been substantial source-wide actual reductions as illustrated in Figure 1.

[2] *See* SCAQMD, Presentation: "Proposed Rule 1109.1 – NOx Emission Reduction for Refinery Equipment and Related Operations, Working Group Meeting #19", March 4, 2021. Accessed at http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/1109-1_wgm19_030421.pdf?sfvrsn=6 in March 2021. See slide 9.

[3] *See* Correspondence from Greg Busch of MPC to Susan Nakamura and Michael Krause of SCAQMD, February 26, 2021.

[4] SCAQMD, Presentation: "Proposed Rule 1109.1 – NOx Emission Reduction for Refinery Equipment and Related Operations, Working Group Meeting #17", February 4, 2021. Accessed at http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/pr1109-1_wgm17_020421.pdf?sfvrsn=6 in March 2021. See slide 5 for NOx performance range associated with ULNB.

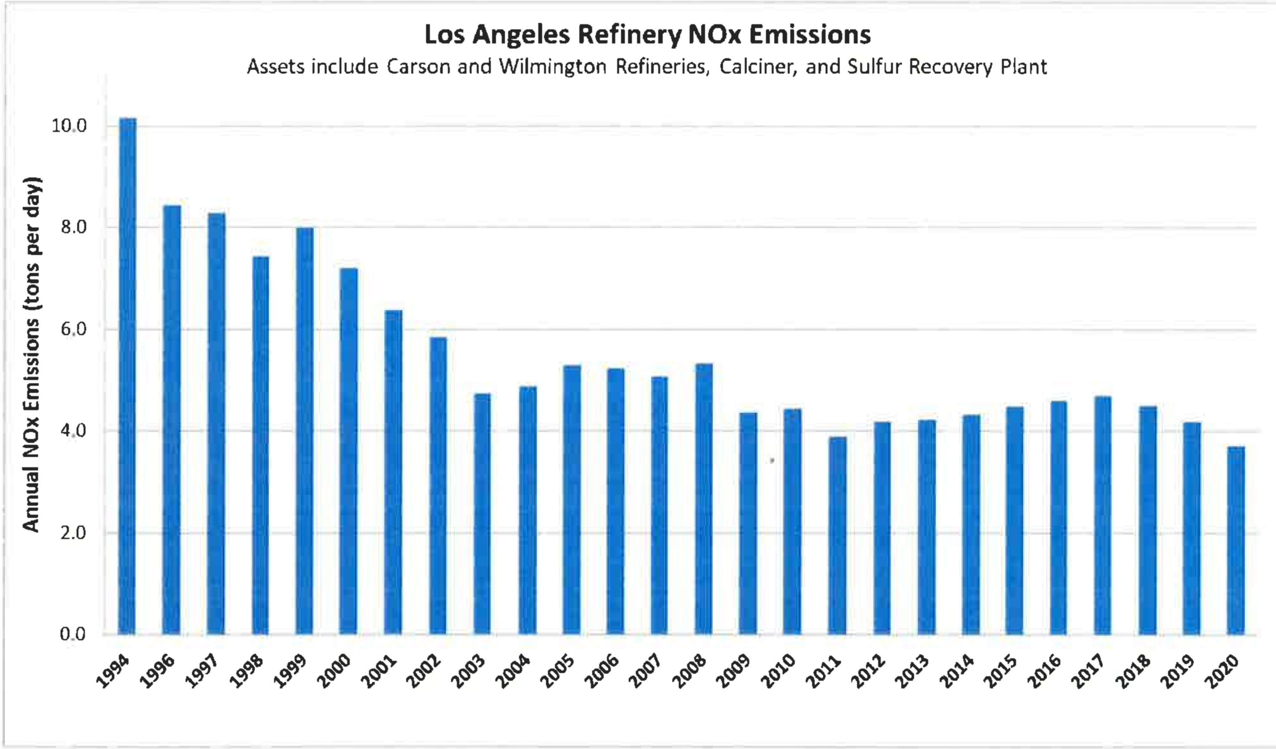

Figure 1: LAR source-wide NOx emissions over time.

B. Cost-effectiveness analysis for well-controlled units

For the baseline level of actual NOx performance for these well-controlled heaters and boilers, any additional NOx controls in the form of new or rebuilt SCR systems and/or complete replacement of a heater or boiler necessary to meet 5 ppmv is not cost-effective. MPC's engineering cost estimates and projected NOx performance levels previously provided to SCAQMD on February 26, 2021 have been developed for those project(s) necessary to meet the proposed limits based on a case-by-case technical analysis of each potentially subject unit. These costs have been estimated incorporating site-specific (i.e., available footprint and space constraints that need to be overcome, regional labor costs) and equipment-specific (i.e., heater exhaust characteristics and operational variability) parameters that are described in MPC's February 1, 2021 letter. In addition, the cost estimates incorporate information from recently installed SCR projects at similar units at MPC's refineries and applied to future potential projects at LAR. In summary, the cost estimates provided to SCAQMD on February 26, 2021 are the most accurate data submitted to date. At the same time, it should be noted that post-project NOx emissions estimates have not been guaranteed by a vendor for all of the LAR heater and boiler designs and operating scenarios.

The 25-year average cost effectiveness on a NOx-weighted average to meet a 5 ppmv NOx level at these well-controlled heaters in aggregate is over $110,000 per ton of NOx removed, which is more than twice the $50,000 per ton cost-effectiveness threshold established by the SCAQMD Governing Board in the 2016 Air Quality Management Plan.[5] As explained in MPC's February 1, 2021 letter, in some cases, heater constraints cannot be overcome within the existing unit's physical configuration to feasibly install retrofit controls, so the unit would need to be either disassembled and relocated, or an entirely new unit built in a new location to meet the proposed limits. Such projects at already well-controlled units result in exceedingly high costs for relatively little reduction in NOx emissions.

[5] SCAQMD, "Final 2016 Air Quality Management Plan", Approved March 3, 2017.

In summary, it is not cost-effective to meet a 5 ppmv limit for large heaters and boilers that are already well-controlled for NOx emissions, meaning that these units are already operating at BARCT. As a consequence, this well-controlled equipment should be placed in a separate category that accounts for NOx reduction controls currently in place and not compared to BARCT determinations made for units that have no NOx emissions controls at all.

2. Incremental cost-effectiveness must be considered in the BARCT assessment consistent with California Health and Safety Code (HSC) § 40920.6(a).

In our February 1, 2021 comment letter, MPC requested that SCAQMD address incremental cost-effectiveness in its BARCT analysis as it is obligated to do pursuant to California Health and Safety Code (HSC) Section 40920.6(a)(3). Two relevant examples were provided in that letter to illustrate the impact that incremental cost-effectiveness can have on BARCT for refinery heaters and boilers.

SCAQMD subsequently shared a presentation at the February 11, 2021 Working Group Meeting in which it pointed out that an incremental cost-effectiveness analysis is not actually performed for the BARCT assessment and only "serves as a check" for "incrementally more stringent options" after the BARCT assessment is complete.[6] This approach for conducting the incremental cost-effectiveness fails to meet the requirements of HSC Section 40920.6(a)(3) and renders the incremental cost-effectiveness provision meaningless by ignoring it in the process of evaluating potential BARCT control options. HSC Section 40920.6 makes it very clear that the economic impacts that must be taken into consideration are not limited to whether or not the proposed control option is cost-effective; they also include the *incremental* cost-effectiveness of the proposed control option relative to other more or less stringent control options.

HSC Section 40920.6(a) is excerpted below for reference with key language underlined for emphasis:

> *(a) Prior to adopting rules or regulations to meet the requirement for best available retrofit control technology pursuant to Sections 40918, 40919, 40920, and 40920.5, or for a feasible measure pursuant to Section 40914, districts shall, in addition to other requirements of this division, 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.*

[6] SCAQMD, Presentation: "Proposed Rule 1109.1 – NOx Emission Reduction for Refinery Equipment and Related Operations, Working Group Meeting #18", February 11, 2021. Accessed at http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/pr1109-1_wgm18_02082021.pdf?sfvrsn=18 in March 2021. See slides 42 to 47 for incremental cost-effectiveness.

> *(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).*
>
> *(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.*

Sections (a)(1), (2) and (3) identify the information and analysis that must be developed and considered prior to adopting a new or revised BARCT rule. In accordance with Section (a)(1), the BARCT assessment consists of first identifying potential control options that achieve the emissions reductions objectives for the regulation, regardless of cost-effectiveness. SCAQMD identified in early stages of the rulemaking process that potential control options for large heaters and boilers for reducing NOx emissions generally included forms of ULNB/LNB, SCR, selective non-catalytic reduction (SNCR), and the combination of both technologies.[7]

Section (a)(2) requires determining the cost-effectiveness of each of the control options identified in Section (a)(1) (average cost-effectiveness). However, SCAQMD does not conduct an average cost-effectiveness analysis of each of the control options identified; rather, it has pre-selected a defined NOx concentration and then conducts a cost-effectiveness analysis of this stringent control option to meet the NOx target. If it is determined to be cost-effective on only an average (and not also incremental) basis, then SCAQMD stops the analysis and ignores the other emissions control options that reduce NOx. This approach not only cuts Section (a)(2) short by failing to analyze the cost-effectiveness of the less stringent control option(s), it completely ignores Section (a)(3).

Section (a)(3) makes it clear that the determination of what constitutes BARCT is based not only on whether or not a potential control option is cost-effective, but also on its incremental cost-effectiveness relative to other potential control options. Incremental cost-effectiveness involves comparing the cost-effectiveness of each control option relative to the next most stringent control option.

In order to conduct the Section (a)(3) analysis, one must have determined the average cost-effectiveness for each of the control options identified in Section (a)(1) so they can be ranked in order of stringency. This approach of examining both average and incremental cost-effectiveness for all potential control options is further evidenced by Section (a)(4), which requires consideration of all three analyses in total for potential control options as BARCT: 1) emissions reduction effectiveness; 2) average cost-effectiveness; and 3) incremental cost-effectiveness between potential control options.

Instead, SCAQMD stops evaluating the cost-effectiveness of the control options identified in Section (a)(1) once it determines that one of the identified control options, beginning with the most stringent, is cost-effective. Thus, by short-cutting the step required under Section (a)(2), SCAQMD does not have the

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7 SCAQMD, Presentation: "Proposed Rule 1109.1 – Refinery Equipment, Working Group Meeting #4", September 12, 2018. Accessed at http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/pr1109-1-wgm4.pdf?sfvrsn=6 in March 2021. See slides 20 to 22.

information that it needs to conduct the third step under Section (a)(3), rendering HSC Section 40920.6(a)(3) meaningless.

Considering incremental cost-effectiveness in a control technology evaluation as outlined above is also consistent with EPA rules and policy for similar control technology-based programs. For example, a best available control technology (BACT) evaluation for new and modified emissions units subject to the Prevention of Significant Deterioration (PSD) program establish use of both average and incremental cost-effectiveness. The use of incremental cost-effectiveness for BACT determination is demonstrated in numerous PSD permit actions and is clarified in EPA guidance.[8] Similarly, EPA's best available retrofit technology (BART) guidelines for the regional haze rule recommend use of an incremental cost-effectiveness analysis and provide detailed steps for its use in evaluating control technologies for reducing emissions of NOx, sulfur dioxide (SO_2), and direct particulate matter (PM).[9]

MPC provided examples of applying the incremental cost-effectiveness analysis in our February 1, 2021 letter. Another example is provided below for the H-101 heater at LAR and utilizing the cost-effectiveness and NOx performance data that were provided to SCAQMD on February 26, 2021. In this case, the average cost-effectiveness for the combined ULNB and SCR retrofit is less than the $50,000 threshold, but the incremental cost-effectiveness of adding ULNB to SCR is over $500,000 as compared to the "next less expensive control option" of installing only the SCR. Examining only the average cost-effectiveness masks the significant and unwarranted costs of installing ULNB for an additional 0.001 tons per day of NOx reduction. This demonstrates that ignoring incremental cost-effectiveness in the assessment of potential control options can lead to absurd results.

Table 1: Cost-effectiveness calculations for H-101 NOx retrofit emission controls.

Control Technology Option	Annual NOx Performance Level (ppmvd @ 3% O_2) [1]	NOx Emissions Reduction Compared to Current Conditions (tpd)	Capital Investment Cost ($MM)	25-Year Average Cost-effectiveness ($/ton) [2]	Incremental Cost-effectiveness ($/ton)
Current conditions	65.4 ppmv (2020 annual average)				
ULNB only	55.6 ppmv	0.018	$7.2	44,788	--
SCR only [3]	5.2 ppmv	0.109	$32.1	35,120	33,237
Combined ULNB + SCR	4.4 ppmv	0.110	$39.3	41,877	559,844
Heater replacement with combined ULNB + SCR	1.8 ppmv	0.113	$214.1	210,811	7,421,046

[1] Current NOx concentrations reflect the use of air preheat system in the heater design. The annual NOx performance level is used to calculate cost-effectiveness. The controlled NOx performance level on a shorter averaging period will innately be higher that the annual performance level due to variable operating conditions, as described in MPC's

[8] US EPA, "NSR Workshop Manual – 1990", OAQPS-2020-841. Accessed at https://www.epa.gov/sites/production/files/2015-07/documents/1990wman.pdf in March 2021. See Section IV.D.2. This document is included on the list of EPA's Guidance Documents accessed at https://www.epa.gov/guidance/guidance-documents-managed-office-air-and-radiation in March 2021.

[9] 40 CFR 51, Appendix Y, "Guidelines for BART Determinations Under the Regional Haze Rule". See Section IV.D.4.e.: "How do I calculate incremental cost effectiveness?"

comment letters. As a result, this table presents for completeness a heater replacement option assuming that the combined ULNB and SCR cannot achieve 5.0 ppm NOx on a shorter-term averaging period.
[2] The average cost-effectiveness analysis is conducted on a 25-year life, but as described in this letter, it is highly uncertain that the expected useful life of both the advanced SCR systems necessary to meet BARCT and the refinery process or source itself will approach 25 years.
[3] The SCR system is assumed to be 92% efficient in controlling inlet NOx. A dual bed SCR or other larger SCR system may be needed to reach this level of NOx performance, and the corresponding substantial costs for these types of SCR systems are not considered in this example.

If implementation of the most cost-effective control option achieves significant reductions, and implementation of the next most stringent control option achieves only modest additional reductions at greatly increased costs, the decision-maker might decide to forego imposing the additional increment associated with the more stringent option and determine that the less stringent option constitutes BARCT. This analysis is part of the "economic impacts" that must be taken into consideration under HSC Section 40406 when establishing BARCT.

MPC requests that SCAQMD reconsider its misinterpretation of HSC Section 40920.6(a) and complete all steps required for determining proposed BARCT levels and consider incremental cost-effectiveness of the proposed control option relative to other more or less stringent control options.

3. Refinery heaters that are designed and operated with air preheat systems have higher NOx concentrations, and this category of heaters has not been appropriately evaluated by SCAQMD in the NOx BARCT evaluation.

In the February 1, 2021 comment letter, MPC and its third-party consultant shared important technical concerns associated with higher NOx exhaust concentrations that are inherent to refinery heaters with combustion air preheat systems, as follows:

> *Some high heat release heaters have air preheaters (APH) that raise the combustion air temperature to improve heater efficiency resulting in fuel savings and in lower greenhouse gas emissions. However, NOx formation increases with the use of an APH since higher combustion air temperatures raises peak flame temperatures. Therefore, NOx performance limits for heaters with APHs are higher compared to heaters without APHs.*

Depending on the level of air preheat and the corresponding air temperature at the outlet of the preheat system, NOx concentrations are 2 to 3 times that of heaters without air preheat. As a result, applying SCR or other vent-end control technologies will not continuously meet a short-term NOx emissions standard of 5.0 ppm or less.

MPC operates several heaters at LAR that are designed with air preheat for improved energy efficiency, including the H-101 heater in the example above. For all of these heaters, the NOx exhaust concentration can be much higher than equivalent heaters without air preheat. Consequently, retrofitting these heaters with a new SCR, or replacing those existing SCR already used at these heaters with a new SCR, is not expected to achieve 5.0 ppmv NOx at 3% O_2 on a continuous basis. Further, removing the air preheat systems at these units creates serious redesign issues and higher NOx mass emissions due to reduced energy efficiency, as is documented in the February 1, 2021 letter at Attachment D, Section 2.3.

SCAQMD has not appropriately considered the technical feasibility, cost effectiveness, and NOx performance level for refinery heaters that are designed and operated with combustion air preheat.

4. SCAQMD has not considered cost-effectiveness calculations for operating and maintaining a very high-performance SCR system and continues to overstate useful life.

MPC's comments submitted December 22, 2020 include a discussion on SCAQMD's inappropriate assumption that the useful life of a new SCR system for discounted cash flow (DCF) purposes at a petroleum refinery is 25 years. Not all SCR systems are alike. Those that have existed for 25 years are not the same physical and operational design as those being considered for proposed BARCT, and they would not continuously meet the NOx limit and ammonia slip performance that SCAQMD is considering. MPC reiterates that SCAQMD has not considered the impacts on useful life for the types of SCR systems being considered for BARCT and also has not accounted for the long-term uncertainties in the operational state of the refinery processes themselves.

The types of SCR systems envisaged by SCAQMD for complying with BARCT for all types of large refinery heaters and boilers are the same as the design and complexity as the conventional SCRs considered in the 25-year useful life assumption. The advanced, larger systems being considered for BARCT potentially include more working parts subject to wear and replacement over time, including multiple ammonia injection grids and/or staged catalyst beds that are not proven in real-world application for the variety of large refinery heater and boiler designs. Additionally, these systems will need to operate at extremely sensitive levels of precision with respect to temperature, catalyst functionality, etc., and perform at a very high reliability to approach the proposed BARCT limits. This creates the potential for increased degradation and subject the equipment to replacement sooner than with conventional SCR systems. SCAQMD has not demonstrated that the useful life of such systems will approach or meet 25 years.

The useful life of an SCR emissions control system is representative only insomuch that the corresponding emissions unit or the source itself also continues to operate for the entire duration after installation of the control technology. Given the significant economic and downward market shifts for transportation fuel demand, it is uncertain that LAR will operate in its same functionally equivalent state for the entire life of the new SCRs. Further, the Governor of California issued Executive Order (EO) N-79-20 with a goal *"... that 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035. It shall be a further goal of the State that 100 percent of medium- and heavy-duty vehicles in the State be zero-emission by 2045 for all operations where feasible and by 2035 for drayage trucks. It shall be further a goal of the State to transition to 100 percent zero-emission off-road vehicles and equipment by 2035 where feasible."* Another EO in California that was issued in 2018 (B-55-18) sets a carbon neutrality goal of zero by 2045. Effectively, these EOs will prevent the sale of vehicles with combustion engines using transportation fuels. As LAR is the largest transportation fuels refinery in California by crude oil distillation capacity, these EOs and possible future regulatory actions pursuant to it create inherent uncertainty in the long-term operational viability of LAR.

The implementation of a project to meet BARCT that requires new controls such as SCR will require a number of years due to lengthy design planning time frames necessary for these complex projects and carefully choreographed and scheduled process unit turnarounds. Based on the lengthy time frames needed to implement these projects coupled with the established goals in the EO that will reduce demand for these fuels, the window of useful life is much less than 25 years. For example, for an SCR that is designed and installed in 2025 for a process unit that primarily produces a gasoline blendstock, with EO N-79-20 likely to cause continued demand destruction for gasoline in advance of the 2035 goal for new passenger cars and trucks, it is reasonable to estimate the useful life for an SCR project at this refinery process heater to be at 10 years and not more than 15 years.

In consideration of these issues that have not been addressed or considered by SCAQMD (i.e., the uncertain life of advanced SCRs being considered for BARCT at various types of large refinery heaters and boilers, and the inherent market forces that impact the operational viability of LAR's processes and heaters in the coming years), a 10- to 15-year useful life for an SCR retrofit at a refinery process heater or boiler is reasonable and appropriate for BARCT.

Conclusions

SCAQMD has inappropriately determined BARCT in Proposed Rule 1109.1:

- It is not cost-effective to meet a 5 ppmv NOx limit for large heaters and boilers that are already well-controlled for NOx emissions, meaning that these units are already operating at BARCT. Well-controlled equipment should be placed in a separate category that accounts for NOx reduction controls currently in place and not compared to BARCT determinations made for units that have no emissions controls at all.
- SCAQMD misinterprets the use of incremental cost-effective analysis required by HSC Section 40920.6(a). Incremental cost-effectiveness must be considered for any proposed control option (i.e., ULNB, SCR, and the combination of these technologies) relative to other more or less stringent control options that reduce NOx emissions.
- SCAQMD has not appropriately considered the technical feasibility, cost effectiveness, and NOx performance level for refinery heaters that are designed and operated with combustion air preheat systems.
- A 25-year useful life for purposes of calculating cost-effectiveness of a NOx retrofit project at an existing refinery heater or boiler ignores the uncertainty of the life of advanced SCR systems being considered for BARCT and the inherent market forces that impact the operational viability of LAR's processes and heaters in the coming years. A 10- to 15-year useful life for an SCR retrofit at a refinery process heater or boiler is reasonable and appropriate for BARCT.

Please note that in submitting this letter, MPC reserves the right to supplement its comments as it deems necessary, especially if additional or different information is made available to the public regarding the Proposed Rule 1109.1 rulemaking process.

Thank you for the opportunity to provide comments. We are glad to discuss further and look forward to continued dialogue.

Sincerely,

Travis Beltz
for

Brad Levi
Vice President – Los Angeles Refinery

cc: ***SCAQMD***
Sarah Rees – Deputy Executive Officer
Susan Nakamura – Assistant Deputy Executive Officer
Michael Krause – Planning and Rules Manager

cc: ***SCAQMD Governing Board***
Dr. William Burke – Governing Board Chairman
Hon. Ben Benoit – Governing Board Vice-Chairman
Hon. Lisa Bartlett – Governing Board Member
Hon. Joe Buscaino – Governing Board Member
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Hon. Carlos Rodriguez – Governing Board Member
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ecc: 2021-04-07 MPC Third Comment Letter on Revised Draft of SCAQMD PR1109.1
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