Marathon Petroleum Company LP

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Michael Krause
Manager, Planning and Rules
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

Sent via email

Re: Proposed Rule 1109.1 -
NOx Emission Reduction for Refinery Equipment

Dear Mr. Krause,

Marathon Petroleum Corporation (MPC) appreciates this opportunity to comment on South Coast Air Quality Management District (SCAQMD) Proposed Rule 1109.1 - NOx Emission Reduction for Refinery Equipment. MPC is the parent company of Tesoro Refining & Marketing Company LLC ("Tesoro"), which owns and operates four related facilities with equipment that will be transitioning into Rule 1109.1, and we therefore have great interest in this rulemaking. Following are our comments on concepts presented in the staff presentation during the January 31, 2019 Working Group Meeting #6. Many of these comments were made verbally during the referenced Working Group meeting, but are presented in more detail below, organized with general comments first and the followed by comments on specific slides presented by SCAQMD.

General Comments

- Best Available Retrofit Control Technology (BARCT) must be both technically and economically feasible. The nature of how petroleum refineries are configured, i.e. the number of process heaters and boilers, the specific design configurations of each, equipment spacing, and many other factors, will determine whether achieving a specific BARCT concentration for oxides of nitrogen (NOx) at an individual equipment level is feasible. MPC strongly suggests SCAQMD include a case-by-case review process within Rule 1109.1. If a refiner demonstrates that BARCT is not technically or economically feasible on a case-by-case basis, then that BARCT should not apply.

- Process safety and the safe operation of process heaters and boilers are of paramount importance and must be included in both the technical and economic feasibility analysis. For example, ultra low NOx burners (ULNB) have longer flame lengths and require lower oxygen levels within the heater firebox. Extended flame lengths can cause flame impingement, whereby localized hot spots and mechanical fatigue occur. These conditions increase the potential for a leak and/or explosion. Therefore, the application of ULNB and/or other NOx reducing technology like flue gas recirculation, must be reviewed on a case-by-case basis. Further, automated shutdown systems which include flame scanners, pilot monitoring, automatic shut-off valves, and other instrumentation and controls are required investments to ensure safe operations. The cost of these advanced systems must be factored into the economic feasibility analysis.

- There is not a one-size-fits-all technology that can guarantee same or similar results for all configurations currently in operation within the Refining sector.
- Each process heater and boiler is unique based upon design configuration. NOx formation is a complex reaction for refineries and is dependent upon many factors including refinery fuel gas composition, flame temperature, heater bridgewall temperature, excess oxygen and "tramp air", if air preheat is present, and burner design. Therefore, there is a wide operating window and NOx performance levels are dynamic and in flux. For example, as hydrogen composition increases in refinery fuel gas being burned, so does NOx. Also, as excess oxygen increases within the firebox, so does NOx. The BARCT limits selected to apply to each process heater or boiler must be set at levels that allow the equipment to operate across the full operating range and not at "design" conditions established by the vendor. To ensure consistent compliance with short-term averages (hourly or daily averages), a higher limit is required to cover all of these operating scenarios.
- As SCAQMD reviews individual refinery equipment, it is important to recognize that certain factors (e.g., low firing rate or infrequent use, among others) may warrant categories that do not justify the retrofit of any additional controls. BARCT for those categories should thus reflect current NOx performance.
- The required implementation timeline must include adequate time for engineering and consideration of at least one full turnaround cycle for each process heater and/or boiler.
- SCAQMD must consider the incidental increase in co-pollutants like particulate matter (PM10 and PM2.5) when setting the BARCT levels. Lower NOx performance, such as 10ppm (O2 free), can only be guaranteed across the whole range of operating conditions by using selective catalytic reduction (SCR) technology. Emissions of PM10 and PM2.5 will increase as a result.

Slide 5: Request for Proposal Update

- The consulting firm chosen for the independent third party review of the BARCT technology assessment and cost estimates for refinery equipment must take into account total installed costs as well as the technical feasibility of retrofitting equipment. Each setting and installation is unique even if the basic piece of equipment could be considered to be standard. Total installation costs for a project are significantly higher than the cost of the equipment and will typically range from a factor of 7 to 10 higher than the equipment cost in California refineries. Factors and costs to be considered for each piece of equipment and related project include:

- o Equipment configuration, particularly for heaters and boilers (e.g., vertical cylindrical, box style, forced draft, induced draft, balanced draft, natural draft, radiant / convection section spacing)
- o space constraints (e.g., is plot space available for an SCR, are there ULNB burner space limitations at the heater floor, is room available for extra catalyst beds)
- o appropriate approach temperatures for efficient SCR performance. If the stack temperature is too high or too low, significant heater modifications may be required or additional downstream heat exchange equipment may be required.
- o ammonia storage and related ammonia injection infrastructure
- o power needs (e.g., will new substations be required or will existing ones need to be upgraded)
- o other ancillary equipment (e.g., induced draft fans, temperature control, regeneration)
- o costs unique to California (e.g., seismic requirements, greenhouse gas implications)
- o costs unique to refining in California (e.g., 20%+ increase in labor costs due to California SB 54)

Slide 7: WSPA Comment Letter on 11/6/18

- MPC strongly supports WSPA's recommendation to use a cost index that is more representative of both the refining industry and of California as an operating location than SCAQMD's use of the generic Marshall and Swift (M&S) index.
    - o The cost model CEPCI, which we understand may be used for 1109.1 BARCT analysis, is similar to M&S in that the unique cost factors for refining operations in the state of California are not appropriately captured.

Slide 9: Control Manufacturer Meetings

- MPC commends SCAQMD for meeting with the four vendors listed. We suggest meeting with additional major suppliers, such as John Zink and Callidus.
- We request that the performance information and cost estimates (both equipment cost and total installed cost) that vendors have shared with SCAQMD be made available for review.
- We wish to highlight and emphasize the bullet point under Key Topics Discussed relating to "Emission guarantees and performance (conditions)". MPC experience with vendor emission guarantees and nominal performance values provided in general discussions like this is that they reflect a very specific set of operating conditions and configuration. Those operating conditions are typically not reflective

of the full range of performance needed by the heater over the course of normal operation and cannot be achieved under all necessary operating conditions the refinery requires.

Slide 10: Cormetech – Catalyst Manufacturer

- We strongly agree with the statement that "the size, cost and capability of an SCR system are case specific" and with the key variables outlined.

> - **Key Design Inputs:** flue gas flow rate, NOx inlet, flue gas constituents, fuel type, particulate loading, reactor size, geometry, unit type
> - **Performance requirements:** NOx removal efficiency, ammonia slip, pressure drop, SO_2 oxidation limit
> - **Scale up factors:** Maldistribution (Ammonia, temperature, velocity)
> - **Catalyst deactivation and catalyst pitch selection:** Fuel type, unit type, ash characteristics, pressure drop
> - **Catalyst formulation:** Unit type, SO_2 oxidation limit, temperature range, NO/NO_2 ratio, required potential (function of DENOX %, inlet NOx, and slip)
> - **Output:** NOx emission target, end of life slip

In addition, these conditions relate to the design of the actual SCR system itself. However site specific considerations can add significant cost to an SCR installation including:

- Can the SCR be readily located at the heater or will it require significant additional lengths of ductwork or structure for an elevated operation
- Can the additional electrical demands be accommodated within the existing electrical infrastructure or will new substations, etc. be needed.

Slide 11: Peerless – SCR System Manufacturer
Slide 12: Babcock Power/Struthers Wells-TEI

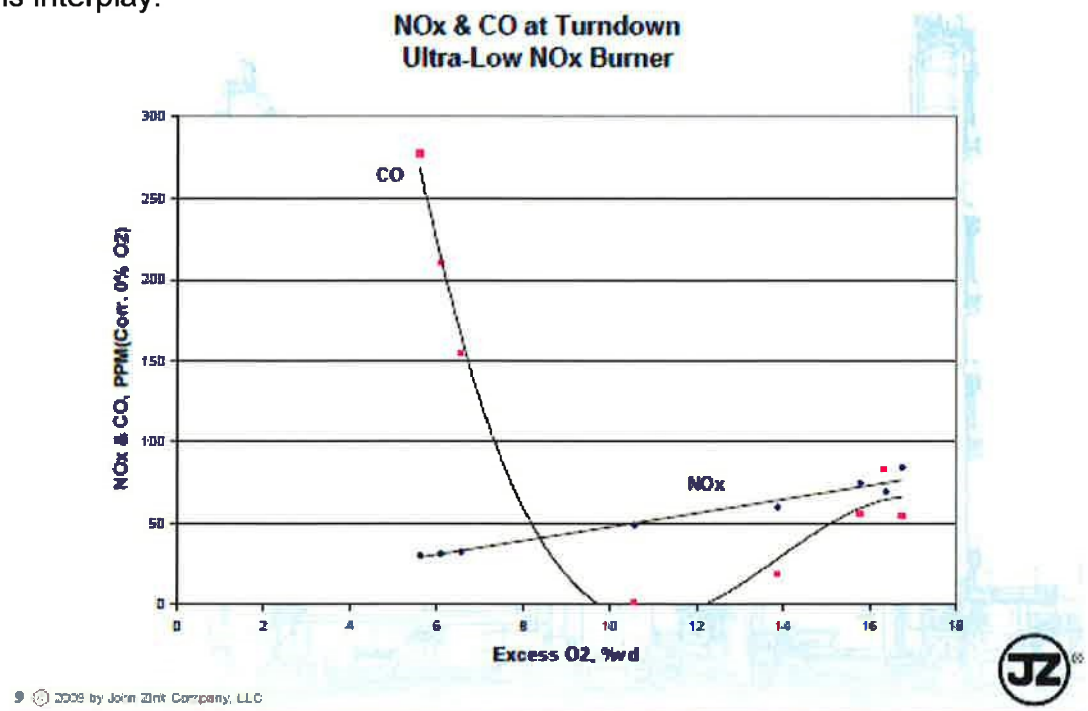
- When SCAQMD meets with SCR manufacturers, it is critical to discuss issues related to refinery fuel gas, such as particulate matter (PM10 and PM2.5) formation from ammonia and sulfur.
- Similar to the key variables listed in the catalyst slide, the evaluation of SCRs in the BARCT analysis will need to review case specific considerations mentioned in Slide 10 (e.g., flue gas temperatures) along with site specific variables, including location and electrical demand.

Slide 13: Zeeco – Burner Manufacturer

- As noted on this slide, burner guarantees are dependent on heater duty and operating conditions. In our experience, the range of operating conditions for the guarantee is very tight and not always representative of the full range of operation required by any individual process heater or boiler within a refinery considering both variations in duty demand and fuel gas composition. It is critical for SCAQMD's BARCT analysis to evaluate performance under all operating conditions and establish both NOx and CO emission limits that can be met under the full range of operation variability as discussed further below in comments for Slide 15.

Slide 15: Burner Technology Revised

- The guaranteed NOx limit (15 ppm) provided by burner manufacturers is footnoted to say "over specific operating conditions". Those operating conditions should be identified and must accommodate the full range of expected normal operation with an appropriate NOx limit established as such.
- Turndown conditions are when a process heater is operating below its normal design rating. The interaction among excess O2, NOx and CO should be considered as part of the BARCT analysis. The following John Zink graph illustrates this interplay.



- Vendors should be asked what the NOx and CO guarantees would be under the following condition, which is typical for how a refinery would need to operate:
  - o 3.5% excess O2 wet mole basis
  - o 4:1 turndown
  - o at a given combustion air preheat temperature
  - o at the anticipated fuel gas composition operating range
- BARCT must be set for safe, normal operation at various turndown ratios acknowledging the variations that each heater/boiler will have. No flame impingement on radiant or convention tubes or on the arch refractory can be tolerated. Ultra low NOx burners in particular may not be able to be retrofit into a heater due to flame length.

- Other costs that are likely to be incurred to achieve a 15ppm guaranteed limit include:
  - Sophisticated air to fuel ratio controllers
  - Expansion of floor spacing to accommodate burners
  - Flame scanners and other safety equipment to avoid any unsafe conditions
  - Fuel gas coalescers to ensure proper burner performance

Slide 28: Primary Heaters Summary

- SCAQMD totals **196** primary heaters. However, 5ppm NOx/5ppm ammonia performance observations are based on only **4 heaters** (per the information provided in Slides 26 and 27):
  - Observation: "New install units (<25 years old) with burner control technology and SCR combination achieve the lowest NOx emissions (<5ppm NOx and 5ppm ammonia slip)"
    - Based on 2 units (1.02% of primary heaters)
  - Observation: "Retrofit units can also achieve low NOx emissions with burner control technology and SCR combination (<5ppm NOx and 5ppm ammonia slip)"
    - Based on 1 unit (0.51% of primary heaters)
  - Observation: "Units with SCR control only are also capable of achieving low NOx emissions (<5ppm NOx and 5ppm ammonia slip)"
    - Based on 1 unit (0.51% of primary heaters)
- We request that the information in Slides 26 and 27 be provided for the total universe of primary heaters.
- We also request that CO emissions and CO permit limits be added to this table.
  - For instance, the boiler in the 20-40MMBtuhr category at 20% capacity may have significant CO emissions. Heaters with low NOx burners operating at a high turndown will result in cold firebox temperatures and potentially elevated CO emissions.
- SCAQMD's analysis should include the expected levels of PM across the entire range of the process heater operating window.

Slide 29: Hydrogen Reformer Heaters

- The slide says all hydrogen reformer heaters are fueled by PSA off-gas. However, secondary fuel information (RFG and NG) should also be included.

Slide 32: Boilers Summary

- SCAQMD observes that boilers greater than 110 MMBtu/hr achieve low NOx due to burner control. However, a different observation could be made based on data in Slide 31: that low NOx is due to SCRs with high ammonia slip (20ppm) for 2 units and low utilization rates (32% to 60%) for the other 4 units.

- SCAQMD's analysis should include the expected levels of other pollutants across the entire range of the boiler operating window, particularly PM and CO.

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

Sincerely,

Susan R. Stark
Regulatory Affairs Manager

cc: Dr. Philip Fine
Susan Nakamura
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