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February 16, 2021

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Via e-mail at: mkrause@aqmd.gov

Re: SCAQMD Proposed Rule 1109.1, NO_X Emission Reduction for Refinery Equipment
WSPA Comments on Preliminary Proposed BARCT for Boiler and Heater Categories

Dear Mr. Krause,

Western States Petroleum Association (WSPA) appreciates the opportunity to participate in the Working Group Meetings (WGMs) for South Coast Air Quality Management District (SCAQMD or District) Proposed Rule 1109.1, NO_X Emission Reduction for Refinery Equipment (PR1109.1). This proposed rulemaking is part of the District's larger project to transition facilities in the Regional Clean Air Incentives Market (RECLAIM) program for NO_X emissions to a command-and-control structure (i.e., the "RECLAIM Transition Project"). WSPA is a non-profit trade association representing companies that explore for, produce, refine, transport, and market petroleum, petroleum products, natural gas, and other energy supplies in five western states including California. WSPA has been an active participant in air quality planning issues for over 30 years. WSPA-member companies operate petroleum refineries and other facilities in the South Coast Air Basin that are within the purview of the RECLAIM Program administered by the SCAQMD will be impacted by PR1109.1.

On October 23, 2020, SCAQMD released a first draft of rule language for PR1109.1.[1] The draft language included preliminary NO_x Best Available Retrofit Control Technology (BARCT) levels (or "endpoints"). And on December 24, 2020, SCAQMD released a second draft.[2] There are significant shortcomings with the District's preliminary BARCT proposal for PR1109.1. Specific to the refinery heaters and refinery boilers categories, the District has failed to demonstrate technical feasibility for certain categories of refinery equipment. For other categories, the District has not demonstrated that its proposals are cost-effective. These problems are discussed below.

General Comments

The California Health & Safety Code requires the District, in adopting any BARCT standard, to ensure the standard is technologically feasible, and take into account "environmental, energy, and economic impacts" and to assess the cost-effectiveness of the proposed control options.[3] Cost-effectiveness is defined as the cost, in dollars, of the control alternative, divided by the emission reduction benefits, in tons, of the control alternative.[4] If the cost per ton of emissions reduced is less than the established cost-effectiveness threshold, then the control method is considered to be cost-effective. Cost-effectiveness evaluations need to consider both capital

[1] Proposed Rule 1109.1. Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries. Rev. October 23, 2020. (Initial Draft for Discussion Purposes).
[2] Proposed Rule 1109.1. Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries. Rev. December 24, 2020. (Second Draft for Discussion Purposes).
[3] California Health & Safety Code §40406, 40440, 40920.6.
[4] California Health & Safety Code §40920.6.

costs (e.g., equipment procurement, shipping, engineering, construction and installation) and operating (including expenditures associated with utilities, labor, and replacement) costs. Currently, the District is applying a cost-effectiveness threshold of $50,000 per ton of NO_X emissions reduced for BARCT rules. This threshold is consistent with what was applied in the 2016 Air Quality Management Plan (2016 AQMP).[5]

1. **The District's third-party consultants identified significant limitations with the technical feasibility of Staff's proposed BARCT endpoints. Those issues appear to materially impact the technical feasibility and/or cost-effectiveness of the proposed BARCT endpoints. The District's preliminary analysis fails to fully consider these issues in its assessment.**

As part of the PR1109.1 rule development, SCAQMD contracted two third-party consultants to review the preliminary BARCT assessment. The assignments for each consultant were defined as follows:[6]

- Norton Engineering Consultants (NEC):
  - Perform a BARCT feasibility assessment which includes commercially viable NO_X control technologies and emission reduction levels that each technology can achieve and any caveats associated with achieving NOx reductions; and
  - Review and verify cost analysis including the use of the U.S. Environmental Protection Agency (EPA) SCR Cost Model, model input assumptions, local labor costs, and other factors that affect the cost-effectiveness evaluation.
- Fossil Energy Research Corporation (FERCo):
  - Conduct facility visits to make detailed on-site observations and engineering evaluations of affected equipment;
  - Review the feasibility of installation, including feasibility of installation of new control technologies;
  - Consider challenges associated with installation of control technologies such as space constraints, and burner technology; and
  - Determine if further optimization can be performed on currently installed NO_X control systems to help achieve further emission reductions.

In the December 4, 2020 report, NEC reviewed the available NO_X control technologies proposed for each PR1109.1 equipment category and concluded that heaters and boilers with heat input rating >40 MMBtu/hr would require ultra-low NO_X burner (ULNB) technology in combination with selective catalytic reduction (SCR) to meet the District's proposed NO_X BARCT limit of 2 ppm.[7,8] NEC also concluded that meeting a 2 ppm limit would require SCR systems able to achieve 95% control efficiency for NO_X (assuming the concentration of NO_X entering the SCR system doesn't exceed 40 ppm with ULNB installed).[9]

In WGM #17, the District stated that "Staff consulted with Norton, FERCo , and SCR catalyst vendors regarding the feasibility of installing ULNB and achieving 2 ppmv NOx for units with sub optimal conditions" and that the "consultants stated that regardless of ULNB NOx performance, the proposed 2 ppm endpoint is feasible by installing multiple catalyst reactors or a two stage

[5] SCAQMD Final 2016 Air Quality Management Plan, Approved March 3, 2017.
[6] Execute Contracts for Engineering Consultant to Review the BARCT Assessment for Proposed Rule 1109.1 – NOx Emission Reductions for Refinery Equipment. SCAQMD Governing Board Meeting. May 3, 2019.
[7] Unless explicitly noted otherwise, all references to "ppm" concentration levels are parts per million by volume, dry, and referenced to 3% oxygen.
[8] Norton Engineering Consultants NOx BARCT Analysis Review, December 4, 2020, (NEC Report).
[9] Ibid, page 30.

SCR.[10] This would require installation of ammonia injection grids (AIG) between each reactor, a reactor designed to achieve proper distribution and missing, or a static mixer in between each bed or SCR reactor.

NEC cited several limitations with ULNB and SCR that are critical in determining technical feasibility. With the 95% NO_X control efficiency requirement, NEC concluded that the technical feasibility of the proposed 2 ppm NOx endpoint would require the following SCR design features:

a. Low superficial velocity (<10 ft/s);
b. SCR system operating in the optimum temperature window based on the selected catalyst formulation, or be "over-treated" with ammonia;
c. Multiple SCR catalyst beds;
d. Provision for an AIG for one or more downstream SCR catalyst bed(s);
e. Ammonia destruction catalyst bed to meet the requirement for low NOx and low ammonia slip concentrations; and
f. Even distribution of ammonia in the flue gas entering the SCR catalyst beds.

NEC notes that the above requirements would involve additional capital costs for the SCR system, additional ammonia usage, additional power consumption, and likely an additional fan.

FERCo presented its report to SCAQMD in November 2020.[11] FERCo concluded that refineries may be space-challenged to install SCR on some devices, and that the U.S. EPA SCR Cost Model could be improved to better reflect refinery SCR systems, including the methodology to estimate required catalyst volumes. They also noted that existing refinery systems would need to be evaluated on a case-by-case basis to see how they can be upgraded to meet the new BARCT limit, or if major modifications are necessary.

Together, NEC and FERCo have identified several important limitations to technical feasibility of the proposed 2 ppm endpoint which have yet to be fully considered by the District. We call attention to four of them:

1. NEC's expert opinion was that the proposed BARCT endpoint would require secondary ammonia injection grids (AIG) for downstream SCR catalyst bed(s). Neither the district nor FERCo has done a feasibility assessment for installation of secondary ammonia injection grids, nor have they considered such costs in the cost-effectiveness evaluation.

   While District staff have previously suggested that multiple catalyst beds may be required to meet a 2 ppm endpoint, the NEC report was the first indication that multiple AIGs could also be needed. This design requirement effectively requires two SCR systems in series, which is significantly different than a single SCR with double the catalyst.

   The FERCo report stated that the physical spaces around the refinery heater units are typically very congested, significantly limiting the distance available between the AIG and the SCR catalyst. The report notes that achieving the high level of NOx removal necessary requires exceptionally good mixing of ammonia into the flue gas stream ahead of the catalyst, which could require two reactors.[12] While FERCo offered some ideas concerning the location of one AIG relative to the SCR catalyst grid, it does not appear that FERCo considered spatial requirements for accommodating multiple AIG which would be more complicated.

[10] PR1109.1 WGM #17 presentation, slide 6.

[11] FERCo South Coast Air Quality Management District Rule 1109.1 Study Final Report, November 2020, (FERCo Report).

[12] FERCo report, page 5-3.

In summary, it does not appear that the District has addressed the technical feasibility of this requirement for existing equipment or the additional costs. And given the spatial limitations identified by FERCo, it seems likely there could be situations where the required space is simply unavailable.

2. The District previously stated that achieving a 2 ppm BARCT endpoint will generally require installation of ULNB. We recognize the District is now suggesting a control technology option for achieving the proposed endpoint without ULNB, namely two SCR reactors in series (i.e., multiple AIGs). But as discussed above, this option has not been demonstrated to be technically feasible.

   There are several design criteria necessary for safe and effective operation of ULNB in refinery heaters. District staff has not considered these criteria in its assessment of technical feasibility, nor included additional costs for the potential rebuilds or replacements which may be needed to meet the proposed BARCT endpoints.

   The NEC report notes that in order to achieve a 2 ppm BARCT endpoint, ULNB technology must be installed upstream of the SCR. NEC states several design criteria required by the API 560 standard (Fired Heaters for General Refinery Service) which must be followed to avoid flame impingement in refinery heaters. These include:

   a. Radiant section geometry – due to higher flame lengths generated by ULNB, the radiant section of the heater fire box needs to be long enough to avoid flame impingement on internal services.
   b. Burner spacing – in order to take advantage of internal flue gas recirculation (IFGR) patterns to lower NOx, both burner to burner spacing, and the spacing between burners and heater internals must be appropriate to avoid flame impingement.

   Flame impingement is a significant safety concern, particularly when retrofitting ULNB into existing refinery heater geometries. Refinery heaters and boilers have fixed radiant section geometries, tube configurations, and other internal surfaces that in many cases limit the unit's ability to accommodate additional spacing demands needed for newer ULNB products. Flame impingement can cause tube rupture of radiant tubes which contain flammable material, resulting in a potentially catastrophic explosion event, making it impossible to safely retrofit ULNB in many existing refinery heaters and boilers. Options to avoid flame impingement would include significant rebuild of the unit's geometry (if feasible), or complete replacement of the refinery heater or boiler.

   Typical refinery heaters also have fixed burner-spacing designs based on the original burners. These designs tend to be tightly spaced to reduce the overall dimension of the firebox. More recently, ULNB designs have used internal flue gas recirculation, which typically requires greater spacing to avoid potential burner FGR interferences. As a result, installation of newer ULNB designs may require reengineering of the firebox.

   By not collecting specific refinery heater/boiler design information, the District's third party experts and the District staff have not considered safety constraints in the analysis of technical feasibility, nor included additional costs of potential rebuild or replacement required to meet the proposed BARCT endpoint in the cost-effectiveness analysis. If certain heaters would need to be rebuilt or replaced to meet proposed BARCT endpoints, these additional costs must be considered in the cost-effectiveness analysis.

3. Achieving a 2 ppm BARCT endpoint will require an SCR design with low superficial velocity (<10 ft/s). Neither the District staff nor its third-party experts has determined how many, if any, of the devices can meet this requirement. Without this assessment, SCAQMD cannot confirm that the BARCT endpoint is technically feasible or cost-effective.

   NEC's expert opinion was that low superficial velocity will be necessary to meet the proposed 2 ppm NO_X endpoint. As a critical design requirement, FERCo should have considered whether existing SCR installations could be retrofit to meet the requirement during their on-site reviews. While FERCo noted spatial constraints, FERCo did not give any apparent consideration to the possible need to re-engineer gas paths to meet the superficial velocity limitation identified by NEC.

   At WGM #17 Staff reported that Norton had recommended "increasing the catalyst volume by 30% to address units that may require additional cross sectional area to slow the flue gas velocity."[13] However, no basis for the 30% catalyst volume increase was provided. It is reasonable to expect that accommodating this design specification would require further modification (if not wholesale replacement) of existing emission control and gas path systems. That would cause material impacts to compliance costs and technical feasibility due to spatial constraints. These would not be resolved by simply adding an additional 30% to catalyst costs. District staff acknowledged that they have not examined whether any of the equipment which would be subject to the proposed 2 ppm endpoint would meet the low superficial velocity design requirement. Staff further indicated they have not obtained the technical information necessary to do so. Without an understanding of whether the control equipment can be retrofit to meet the low superficial velocity requirement, SCAQMD cannot demonstrate that the proposed BARCT endpoint is technically feasible or cost-effective.

4. The NEC report states that an ammonia destruction catalyst will likely be needed to maintain low ammonia slip. It does not appear that SCAQMD has incorporated the impact of the ammonia destruction catalyst in the evaluation of technical feasibility or cost-effectiveness.

   The NEC report states, "The combination of both low NOx (2 ppmv) and low NH_3 slip (5 ppmv) will likely necessitate an NH_3 destruction bed for most refinery applications."[14] The report also notes that "a trade-off is required between low NH_3 slip and high NOx reduction."[15] In order to get to a 2 ppm BARCT endpoint, a large amount of ammonia must be introduced into the system. An ammonia destruction catalyst will oxidize a significant fraction of the ammonia slip to NOx. Ammonia oxidation mechanisms are shown below:

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_20$$

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 3O_2$$

   Staff must consider the impact of an ammonia destruction bed on the technical feasibility of reaching the 2 ppm proposed BARCT endpoint. Additionally, the costs associated with the ammonia destruction bed must be incorporated into the District's cost-effectiveness analysis.

[13] PR1109.1 WGM #17 presentation, slide 10.
[14] NEC report, page 31
[15] NEC report, page 23

The NEC and FERCo reports also identified items that need would need to be considered in assessing the cost and cost effectiveness of NO_X control technologies.

1. Higher costs for SCR catalyst

   FERCo commented that the annualized cost to achieve the lowest NOx level is 60% greater than the projected cost by the EPA SCR Cost Model, and that the method for estimating catalyst volume could be altered to ensure that correct variable operating cost are used.[16] It is unclear whether this factor was considered in the District's analysis.

2. Additional costs for multibed SCR systems

   While the District has mentioned the need for multiple catalyst beds during previous working group meetings, the quantity of catalyst appears to have been estimated by the District using EPA SCR Cost Model "default" values. The District presented in WGM #16 that costs were adjusted for catalyst volume but did not provide information on how such adjustments were made, or to which subcategories this cost adjustment applied. It is also unclear if or how the District included the cost of ammonia destruction beds in its cost analysis. NEC has repeatedly noted that such ammonia destruction beds would be needed to meet ammonia slip requirements with such a low NO_X limit.[17]

   At WGM #17 the District presented an estimated cost increase for a multiple stage reactor as 25% of the total installed cost (TIC), and stated that this cost increase addresses potential cost increase of additional catalyst, reactor, and installation.[18] Stakeholders noted that the cost for a multiple bed SCR system are significantly higher than presented with additional costs result from the need for a larger horizontal and vertical footprint, new transformers, larger induced draft fans, additional power to run the fans, upgraded ducting, support systems and analyzers, etc. These potential costs must be incorporated into the cost-effectiveness analysis in order to determine the appropriate BARCT endpoint.

3. Additional costs for multiple AIGs

   Both NEC and FERCo indicated that multiple AIG may be required to meet the proposed BARCT endpoint. The District presented in WGM #17 that the additional cost of a multiple stage reactor with additional AIG or static mixer as 25% of the total installed cost. But multiple AIGs would effectively create two SCR in series, with potential costs closer to double the cost of a single SCR.

4. Additional costs for on-site electric power supplies

   FERCo also noted that some facilities may need to upgrade the on-site electric power infrastructure to satisfy the additional power demand caused of SCR reactors. It is unclear if or how the District consider this factor in its cost analysis.

5. Additional costs for existing subsurface conditions

   FERCo also noted that there may be legacy underground barriers, such as process water or power lines, that would complicate installation of foundations. FERCo stated that there could be substantial foundation work necessary due to the nature of the soil for refineries located at the coast. It is unclear if or how the District considered this energy impact, as required pursuant to Health and Safety Code §40406, or whether this is considered in its cost analysis.

[16] FERCo report, page 4-5.

[17] NEC report, page 30.

[18] PR1109.1 WGM #17 presentation, slide 8.

In summary, while the District has incorporated a small increase in its total installed cost estimate, this increase does not fully address the costs associated with multibed and multi-AIG systems, nor has it addressed the other costs identified by its third-party experts. Additionally, the District has not fully evaluated the impacts of the issues identified by the third-party experts on the technical feasibility of the control options. The District must consider these issues when determining technical feasibility of a control technology, and associated costs must be incorporated into the cost-effectiveness analysis. Without these analyses, the District cannot make a BARCT determination for these classes/categories of equipment.

2. The District has not completed all of the cost-effectiveness analyses required under the California Health and Safety Code. Incremental cost-effectiveness of each technology must be analyzed and compared to the cost-effectiveness threshold.

The District has not completed all of the cost-effectiveness analyses required under the California Health & Safety Code. H&SC 40920.6 prescribes two different cost-effectiveness analyses for BARCT rules.

- 40920.6(a)(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." AND
- 40920.6(a)(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."

While the District has presented the stakeholders with 40920.6(a)(2) analyses for the different landing rules, stakeholders have not been presented any information concerning the 40920.6(a)(3) analyses. This is interesting given that the revised RECLAIM Transition Plan outlines the methodology for calculating incremental cost-effectiveness. Such incremental cost-effectiveness analyses are intended to evaluate the cost per emission reduction for each progressively more stringent control option as compared to the next less expensive control option. Since the District is required to perform both cost-effectiveness evaluations to determine to establish a BARCT standard, the District must include both in its evaluation of proposed BARCT limits.

3. For equipment categories where the District's BARCT proposal relies on an emerging burner technology, PR1109.1 needs to include a District-led technology review process that ensures the emerging technologies being prescribed by the District's BARCT standard are available before they are required.

The District is proposing BARCT endpoints for certain equipment categories which would rely on "emerging" burner technologies becoming commercially available. This includes the following PR1109.1 category:

- Refinery heaters with heat input ratings of <40 MMBtu/hr and not equipped with an existing SCR

At WGM #10, the District reported there are a total of 53 units in this category. The District's initial rule language for these categories proposed a BARCT endpoint of 9 ppm NO_X, to become effective ten years after rule adoption when 50 percent or more of the unit's burners have been

replaced.[19] The District and its third-party experts have acknowledged that burner technology to meet a 9 ppm endpoint is still in development and not commercially available. The District also acknowledged a number of significant technical issues with the emerging burner technologies that must be addressed before they might be considered technically feasible. These included burner/heater compatibility issues such as burner design requirements (e.g., induced draft vs. forced draft technology) and burner/flame geometries. Also, as presented at WGM #7, one of the technologies is currently only designed for vertical fire configurations.[20] So in addition to the product development uncertainties (e.g., when will the technology actually be commercially available), the District needs to recognize that such technical issues could ultimately render one or more of the burner products being infeasible for one or more types of refinery heaters.

The District's initial BARCT proposal for these categories fails to address these concerns and does not provide a process to ensure the needed emerging technologies would actually be commercially available before being required. If the District decides to continue with the technology-forcing BARCT, the rule must include a District-led technology review to be completed before the earliest possible compliance deadline to allow time for District adjustment of PR1109.1 compliance deadlines in the event the required technologies do not develop as quickly as assumed by the District. The rule must also include contingencies if the District is unable to demonstrate during the technology review that the emerging technology is commercially ready. Such contingencies could include delayed compliance milestones, or alternative control measures.

4. The District's cost-effectiveness analysis is based on a flawed methodology. These methodology issues result in a significant understatement of the compliance costs for proposed BARCT. These must be remedied.

The District's BARCT assessment for further controlling NO_X emissions from refinery heaters and boilers has largely focused on the use of SCR technology. And the District's evaluation of cost and cost effectiveness for SCR technology has generally relied on the EPA SCR Cost Model.[21] WSPA previously submitted two comment letters on the EPA SCR Cost Model. The first letter concerned the use of a non-refining sector index for cost estimation.[22] The second letter detailed inadequacies of the EPA SCR Cost Model for estimating costs associated with installation of SCR systems on refinery equipment.[23] WSPA maintains that the EPA SCR Cost Model continues to be insufficient for this purpose, and does not reflect costs for installation of SCR systems at refineries.

Note: The discussion in Sections (a)–(d) below addresses costs associated with proposed BARCT endpoints but does not address potential secondary costs for refinery fuel gas (RFG) desulfurization. The latter issue is addressed separately in Section 6.

[19] PR 1109.1 Rev. December 24, 2020.
[20] SCAQMD Proposed Rule 1109.1 Working Group Meeting #7 Presentation, April 30, 2019.
[21] US EPA SCR Cost Calculation Spreadsheet. Available at: https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution. Accessed: October 2020.
[22] WSPA Letter: Estimation of Future Costs for Equipment Covered by SCAQMD Proposed Rule 1109.1 Refinery Equipment, November 6, 2018. Available at: http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/comment-letter---western-states-petroleum-assoc-11062018.pdf?sfvrsn=8. Accessed: December 2020.
[23] WSPA Letter: Use of EPA SCR Cost Model to Estimate Refinery Heater and Boiler Control Costs and Cost Effectiveness under SCAQMD Proposed Rule 1109.1, Refinery Equipment. Available at: http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/wspa-epa-cost-model-comment-letter-final-111819.pdf?sfvrsn=6. Accessed: December 2020.

a. The EPA SCR Cost Model was not intended for use on refinery equipment and does not address costs for non-SCR control technologies such as ULNB. WSPA has alerted the District that the model is not suited for refinery applications, and has demonstrated that it is understating estimated compliance costs for those categories of the rule where SCR technology would be prescribed.

To date, the District's PR1109.1 cost analysis has largely relied on the EPA SCR Cost Model. That model was not intended for application to the basic equipment types covered by PR1109.1 nor does it address costs for non-SCR control technologies such as ULNB. The model was based on the EPA Clean Air Markets Division Integrated Planning Model (IPM) (version 5.13), and intended to analyze the projected impact of environmental policies on the electric power sector.[24] EPA developed the SCR Cost Model to allow users to estimate capital and annualized operating costs for SCR devices for such electric power boiler projects.[25] The calculation methodologies in the model are described in the EPA's Air Pollution Control Cost Manual.[26]

> *"The equations for utility boilers are identical to those used in the IPM. However, the equations for industrial boilers were developed based on the IPM equations for utility boilers. This approach provides study-level estimates (±30%) of SCR capital and annual costs… The actual costs may vary from those calculated here due to site-specific conditions."*

EPA notes that the model was intended for the following types of combustion units:

- Coal-fired utility boilers with full load capacities greater than or equal to 25 MW.
- Fuel oil- and natural gas-fired utility boilers with full load capacities greater than or equal to 25 MW.
- Coal-fired industrial boilers with maximum heat input capacities greater than or equal to 250 MMBtu/hour.
- Fuel oil- and natural gas-fired industrial boilers with maximum heat input capacities greater than or equal to 250 MMBtu/hour.

Clearly the cost model was not intended for refinery equipment, or any equipment with heat input ratings less than 250 MMBtu/hour.

b. The EPA SCR Cost Model further understates potential PR1109.1 costs by utilizing a cost index which is not representative of costs at California refineries. The District should revise its analysis to incorporate a more appropriate cost index.

The EPA SCR Cost Model estimates future costs using the Chemical Engineering Plant Cost Index (CEPCI). The CEPCI is published by Chemical Engineering magazine and is used to evaluate equipment and plant costs for the chemical and process industries. It consists of a composite index assembled from a set of four sub-indices: equipment, construction labor, buildings, and engineering and supervision. The sub-indices are the weighted sum of components primarily corresponding to Producer Prices Indexes (PPIs) published by the U.S. Department of Labor's Bureau of Labor Statistics. The PPIs used as inputs to the CEPCI cover products important to chemical plant construction, not the refining industry.

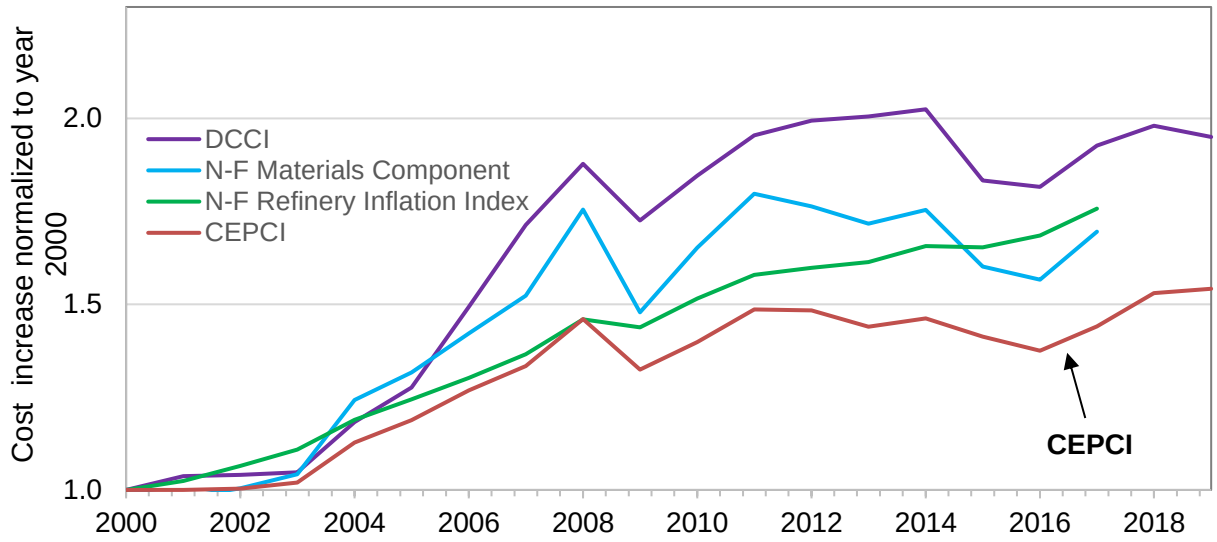
[24] US EPA Clean Air Markets – Power Sector Modeling. Available at: https://www.epa.gov/airmarkets/clean-air-markets-power-sector-modeling. Accessed: October 2020.
[25] US EPA SCR Cost Calculation Spreadsheet. Accessed: October 2020.
[26] US EPA Air Pollution Control Cost Manual, Section 4, Chapter 2: Selective Catalytic Reduction. Available at: https://www.epa.gov/sites/production/files/2017-12/documents/scrcostmanualchapter7thedition_2016revisions2017.pdf. Accessed: October 2020.

There are several alternative cost indices that would be more appropriate for estimating emission control equipment costs at California refineries. These include:

- IHS Markit Downstream Capital Costs Index (DCCI): The DCCI tracks "the costs of equipment, facilities, materials and personnel (both skilled and unskilled) used in the construction of a geographically diversified portfolio of 40 refining and petrochemical construction projects."[27]
- Nelson Farrar (N-F) Cost Index: The N-F cost index was established in 1946, and was published in the Oil and Gas Journal through 2017. It has since been discontinued. The N-F cost index was heavily weighted towards the petroleum and petrochemical industries, and included individual indices for construction costs of pumps and compressors, electrical machinery, internal combustion engines, instruments, heat exchangers, miscellaneous equipment, materials component, labor component, as well as a refinery inflation index.

To understand how the cost projections of these indices differ, Ramboll on behalf of WSPA, gathered data for each of them for the period from 2000 to 2019.[28] Because the cost indices were established in different years, data was normalized to the year 2000. Results of the index comparisons are presented in Figure 1.

Figure 1: Comparison of Industrial Project Cost Indices, Normalized to Year 2000[28]



As shown in Figure 1, the CEPCI significantly understates costs when compared to the DCCI and N-F cost indices. This is important because the DCCI and N-F cost indices were actually constructed for application to the U.S. refining/petrochemical industries, whereas the CEPCI is not designed for the refining/petrochemical industries. Given that the N-F index was recently

[27] IHS Markit: Cost and Technology Indexes. Available at: https://ihsmarkit.com/Info/cera/ihsindexes/index.html. Accessed: October 2020.

[28] DCCI data source: IHS Markit: Cost and Technology Indexes. Available at: https://ihsmarkit.com/Info/cera/ihsindexes/index.html. Accessed: October 2020.
N-F data source: Oil and Gas Journal. Volume 110, Issue 1a. Available by subscription only:https://www.ogj.com/index.html https://www.ogj.com/articles/print/vol-110/issue-1a/processing/annual-refinery-construction.html. Accessed: October 2020.
CEPCI data source: Chemical Engineering. Available by subscription only: https://www.chemengonline.com/pci-home. Accessed: November 2020. Note: The N-F cost index was not published post-2017.

discontinued, WSPA again recommends the DCCI should be used as a more representative index for cost escalation to estimate PR1109.1 compliance costs (and cost effectiveness). Further, because the DCCI is based on a geographically diverse selection of projects, the results of the DCCI model should be adjusted to account for the higher labor costs in California associated with additional training and qualifications requirements imposed by SB 54.

c. The District cost analysis has not considered additional costs identified by NEC or FERCo; costs which the third-party experts deemed necessary to meet proposed BARCT endpoints.

As discussed in Section 1, NEC and FERCo evaluated technical feasibility and costs associated with reaching proposed BARCT endpoints. NEC concluded that technical feasibility of the proposed 2 ppm endpoint was contingent on several design criteria. Separately, FERCo identified a number of issues which carry potential additional costs. While the District provided updated costs in WGM #16 and 17, stakeholders noted that the provided cost estimates address only a fraction of what would be necessary to implement control equipment and meet the technical criteria identified in the NEC report. The District's cost-effectiveness analysis is therefore incomplete and must be revised to fully address all issues identified by NEC and FERCo.

d. While the District has attempted to augment its' PR1109.1 cost analysis by incorporating a limited amount of cost data from facilities, the resulting cost analysis continues to understate PR1109.1 compliance costs.

At WGM #9 meeting, the District presented cost data for 58 SCR projects at refineries; data which was reportedly obtained by the District from certain unidentified refineries.[29] While that data was not provided to the working group, the District's version of the cost estimates for the 58 projects was graphically presented.[30] The District also provided a cost model which was reportedly applied in the EPA SCR Cost Model spreadsheet.[31] Unfortunately, this power factor fit (i.e., capital costs as a function of heater/boiler size) significantly understates costs when compared to the District's raw data for the 58 SCR projects. This is shown below in Figure 2 (i.e., SCAQMD WGM#9 EPA 58 SCR Projects Line Fit versus SCAQMD WGM#9 EPA 58 SCR Projects).

As noted in our letter dated November 18, 2019, Ramboll on behalf of WSPA conducted a confidential survey of WSPA members (which was de-identified and aggregated), to obtain their estimated costs for complying with the District-proposed BARCT endpoints.[32] This letter discusses the results of that analysis as they relate to the refinery heater and boiler categories. Ramboll aggregated and deidentified heater and boiler cost data to create industry-specific models for estimating emission control costs for refinery heaters and boilers categories. As shown in Figure 2 below, the estimated control costs from the Ramboll confidential cost survey

[29] SCAQMD, presented to PR1109.1 Working Group Meeting #9, December 12, 2019, slide 18.

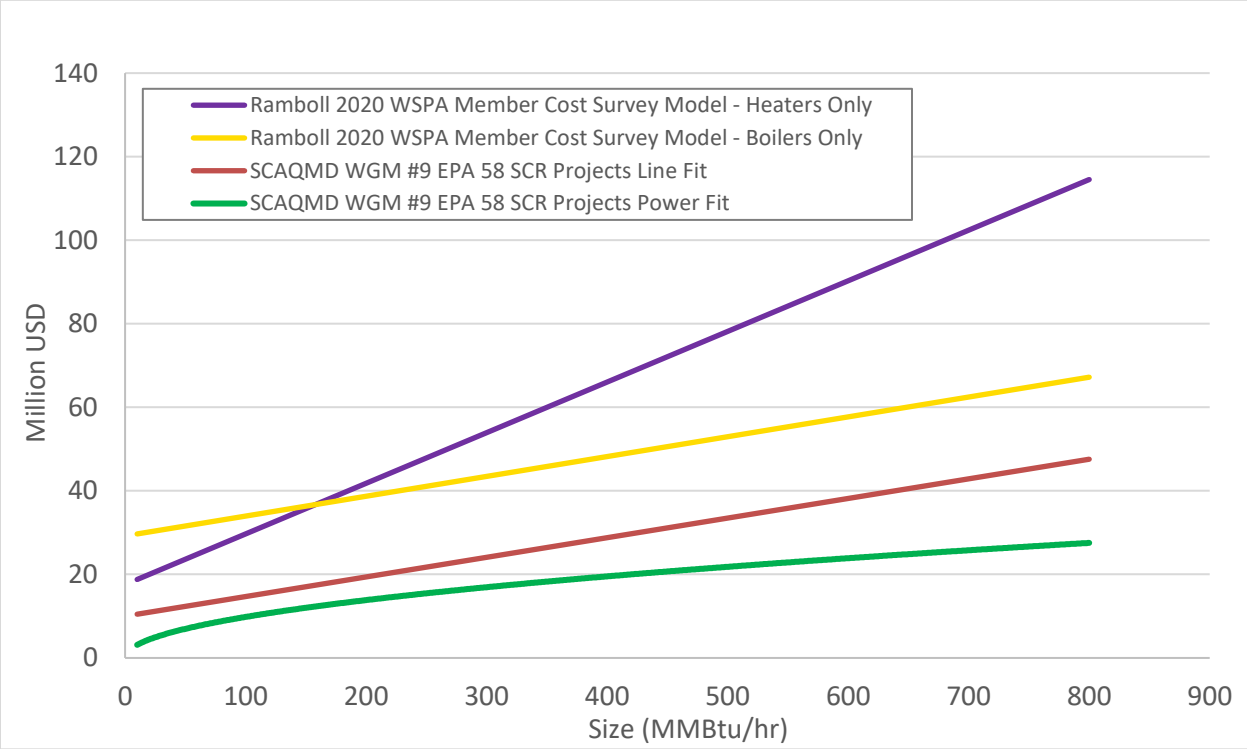
[30] PR1109.1 WGM#9 slide 19, the District reportedly "conditioned" the cost information for certain factors, some of which were described. The impact of these conditioning factors on the companies' original cost estimates was not explained.

[31] PR1109.1 WGM #9 slide 21.

[32] Under a confidential Ramboll survey conducted on behalf of WSPA, WSPA members provided their current cost estimates for installation and operation of emission control equipment which might be needed to comply with PR1109.1 at each of their Southern California refineries. Most of these estimates were reported as "intermediate" or "preliminary" stage cost estimates. Such estimates would be based on an early project scope definition and, due to their being early stage, will be more approximate than later stage project cost estimates once detailed engineering and/or procurement activities have been undertaken. These estimates were initially submitted in 2019 and updated in 2020.

demonstrate that compliance costs for PR1109.1 are significantly higher than the District's estimates.

Figure 2: Comparison of Ramboll Cost Models (done for WSPA) for Boilers and Heaters to District SCR Costs Line Fit (Based on Data from Facilities) and Power Fit (Based on EPA SCR Cost Model, Adjusted to Reflect Total Cost[33]) as presented at WGM #9



While SCAQMD updated the cost model curve used to calculate capital cost in the EPA SCR Cost Model, it still fails to fully account for compliance costs for the refinery heaters and boilers categories. The EPA SCR Cost Model is not fit for purpose. The model simply does not consider burner technology costs, and is not equipped to consider most of the other costs and considerations identified by the NEC and FERCo reports (see above).

As shown in Figure 2, the estimated compliance costs for heaters tend to be significantly higher than boilers of comparative heat input rating. We believe this is due to several factors, including higher burner counts, higher flue gas temperature of heaters, and the need to install an induced draft fan. The NEC report stated "For heaters and boilers with rated firing rates > 40 MMBtu/hr, a NOx BARCT limit of 2 ppmv will require a combination of ULNB and SCR."[34] In WGM #17, the District presented that two SCR in series could also be used to achieve a 2 ppm endpoint.

[33] Slide 21 in SCAQMD Proposed Rule 1109.1 Working Group Meeting #9 presents a trend line for unit size on the x-axis and cost per MMBTU/hr on the y-axis. The plot here has been adjusted to display a y-axis of total cost (rather than cost per MMBTU/hr) by multiplying the y-axis values by their respective unit sizes.
[34] NEC Report, page 29.

ULNB costs are sensitive to the burner count (as opposed to the aggregate rating), burner spacing constraints, and geometry space constraints, so heaters with more burners will cost more than boilers with fewer burners (for comparable heat input rating). Additionally, there are different equipment requirements for heaters compared to boilers (i.e., external flue gas recirculation, and steam injection). Refinery heater flue gas temperatures are typically much higher (i.e., 800F range), compared to boilers because boiler flue gas temperature is based on steam temperatures. Refinery heater typically will have a convection section to reduce the flue gas temperature to save energy with an exhaust temperature target typically in the range of 300-400F. That temperature range is too low for efficient operation of an SCR system, which typically require 500-900 deg F. The convection section of an existing heater would normally need to be altered to fit an SCR, which is a significant cost due to the redesign/rebuild of the heater. Finally, the majority of older heaters are natural draft designs, and would require installation of an induced draft fan after the SCR bed. Because of the significant differences between refinery boilers and heaters, the District should prepare its cost effectiveness analysis for boiler categories separately from the refinery heater categories and include all relevant costs.

The EPA SCR cost model is not built to incorporate the cost of two SCR in series. Costs for a larger horizontal and vertical footprint, new transformers, larger induced draft fans, additional power to run the fans, upgraded ducting, support systems and analyzers, etc. will all impact the overall cost for this control technology.

In summary, cost estimates for equipment upgrades should not be based on the SCR cost model alone. The cost estimate must also include electrical infrastructure modifications, installation of new (and potentially secondary) ammonia injection grids and SCR catalyst beds, ammonia destruction catalyst beds, stack and gas path modifications, new installation of fans and convection systems, and other costs associated with operating the control equipment.

5. The District is basing its cost-effectiveness analysis on a 25-year useful life assumption. This is an unreasonable assumption and contributes to an understatement of compliance costs for the District's proposed PR1109.1 BARCT endpoints.

The District's cost-effectiveness of proposed BARCT endpoints has been based on an assumed useful life term of 25 years for each piece of equipment. This assumption is clearly inconsistent with current State of California climate policy. The District must reconsider the appropriateness of the assumption or risk of creating stranded assets.

The proposed useful life of 25 years is inappropriate because District rulemaking has been far more frequent, with the prior major NO_X RECLAIM rulemaking occurring just over 5 years ago. Use of a 25-year useful life assumption makes the rule costs appear lower than they actually are by diluting the significant capital costs of required projects over a much longer time table than is likely to occur.

As the District is well aware, Governor Newsom signed an executive order on September 23, 2020 requiring that all new cars and passenger trucks sold in California be zero-emission vehicles by 2035. Additionally, the executive order sets the goal that all drayage trucks and off-road vehicles and equipment be zero emission by 2035 and all medium- and heavy-duty vehicles be zero emissions by 2045 where feasible.[35] If implemented, this executive order and strategies outlined under the CARB draft 2020 Mobile Source Strategy would obviously reduce in-state

[35] California Executive Order N-79-20. Available at: https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf. Accessed: October 2020.

demand for transportation fuels over the coming decades. Given current California policy, the District needs to come up with a more reasonable useful life assumption for determining cost-effectiveness of BARCT under PR1109.1.

6. **The District's cost analysis has failed to account for additional costs of refinery fuel gas (RFG) desulfurization which could be a direct result of PR1109.1. While the District has been working with US EPA and CARB on varying approaches to address co-pollutant emissions, this issue is not resolved. Projected costs for RFG desulfurization could significantly increase the cost of PR1109.1, thereby reducing cost-effectiveness. That would render several of the District's initial BARCT proposals as not cost-effective.**

SCAQMD Rule 1303 requires implementation of Best Available Control Technology (BACT) for any new or modified source that results in an emission increase of any nonattainment air contaminant. In order to meet some of the proposed BARCT endpoints, SCR would need to be installed on equipment. Unreacted ammonia from SCR systems can react with SO_3 formed in the gas path to form ammonium sulfate, which is emitted as particulate matter. The District has suggested these particulate matter emissions could trigger BACT, potentially requiring additional desulfurization for existing RFG systems fueling the units.

The District has reportedly been working with US EPA and CARB on different approaches to resolve this issue. But there is currently no resolution to the BACT issue. If RFG desulfurization was required, those costs would be significant. Based on the SCAQMD's 2020 Fuel Gas Treatment Survey (2020 FGT Survey), the projected costs for WSPA member facilities alone were estimated to be **at least $1.4 billion**.[36]

If triggered, these costs must be included when determining whether the proposed BARCT are cost effective. The PR1109.1 BARCT endpoints cannot be finalized for the equipment categories impacted by this issue until the BACT issue has been settled.

Comments for Specific PR1109.1 Categories

WSPA also has specific concerns with a number of BARCT endpoints proposed by the District for various subcategories of equipment.

7. **Category: Refinery boilers with a heat input >40 MMBtu/hr without existing SCR:**

   The District's BARCT analysis for this category fails to fully account for compliance costs identified by the District's third-party experts. Additionally, the BARCT proposal is not cost-effective when RFG desulfurization costs are included. Therefore, the initial proposal cannot be considered BARCT.

   The District has proposed a BARCT endpoint of 2 ppm for refinery boilers with a heat input rating >40 MMBtu/hr without existing SCR.[37] As noted above, the District has not fully considered the technical issues or costs identified by its third-party experts for meeting the proposed BARCT endpoints. Ramboll, acting for WSPA, conducted a confidential projected cost survey of WSPA members to understand the companies' projected costs for complying with potential PR1109.1 BARCT endpoints.[38] Ramboll aggregated and deidentified the

[36] In 2020, District Staff surveyed companies subject to PR1109.1 to provide estimated costs for desulfurization of their fuel gas systems. Afterwards, Ramboll acting for WSPA, surveyed WSPA members to provide those District survey responses, confidentially, to Ramboll. The aggregated sum of those cost estimates is presented above.
[37] SCAQMD Proposed Rule 1109.1 Working Group Meeting #14 Presentation, August 27, 2020.
[38] WSPA Letter to SCAQMD Re: Use of EPA SCR Cost Model to Estimate Refinery Heater and Boiler Control Costs and Cost-effectiveness under SCAQMD Proposed Rule 1109.1, Refinery Equipment, November 18, 2019.

heater/boiler cost data for installation of control equipment to create industry cost models for these equipment. Separate cost models were created for SCR control and ULNB control costs. These cost models were then applied to each subcategory, as applicable. The models were then used to estimate compliance costs for each piece of equipment that did not already meet the proposed BARCT levels. These costs were totaled for each subcategory, and then divided by the expected emission reductions over the District's assumed useful life of 25 years[39] to evaluate the cost-effectiveness.

A further refinement was done to understand the impact on cost-effectiveness from the District requiring RFG desulfurization as a direct outcome of the proposed BARCT endpoints. Present Weight Value (PWV) of RFG desulfurization was calculated based on projected installation and operation costs provided to the District under the 2020 FGT Survey. These costs were then applied to those equipment categories for which new SCRs would be needed to achieve the proposed BARCT level. Adding those RFG desulfurization costs more than doubled the projected compliance costs for this category, rendering the cost effectiveness well above the $50,000/ton threshold. Since it is not cost-effective, the District's initial proposal for this category cannot be considered BARCT.

8. **Category: Refinery boilers with heat input rating 20-40 MMBtu/hr input without existing SCR operating on refinery fuel gas:**

   The District has not presented a cost analysis for this category. A BARCT determination cannot be reached for the category without demonstrating cost effectiveness.

   Per the response to SCAQMD's 2018 Survey Questionnaire for NO_X Emission-Producing Equipment at Refinery Facilities (2018 Survey),[40] some of the boilers in this subcategory were reported as operating on refinery fuel gas. To our knowledge, the District has not examined a cost effectiveness evaluation for boilers in this category operating with refinery fuel gas. The District cannot make a BARCT determination for this category without first demonstrating cost-effectiveness.

9. **Category: Refinery boilers with heat input rating <20 MMBtu/hr without existing SCR:**

   The District has not presented a technology or cost-effectiveness analysis for this category. A BARCT determination cannot be made for category before demonstrating cost effectiveness.

   The District has stated that available burner technology can currently achieve 5 ppm on natural gas,**Error! Bookmark not defined.** but this technology has not been presented to the WGM stakeholders. At WGM #10, the District stated that there will be "potential additional cost" for this subcategory, but no cost information was been presented to stakeholders. At WGM #17 the District presented cost effectiveness results of $36,000 per ton of NOx reduced if the requirement for burner replacement within 10 years of rule adoption is removed. However, no information was provided on how the District arrived at this cost-effectiveness estimate. It appears that the District has only incorporated burner costs into this cost-effectiveness analysis and has not fully addressed costs associated with retrofit. The District cannot make a BARCT determination for this category without first demonstrating cost-effectiveness.

[39] Per our earlier comment, the 25-year useful life assumption is inappropriate and needs to be reconsidered.

[40] WSPA member companies provided copies of the 2018 Survey responses for their PR1109.1 facilities to Ramboll.

10. Category: Refinery boilers with heat input rating >40 MMBtu/hr with existing SCR:

Based on the Ramboll cost survey done for WSPA, the compliance costs for the category's proposed endpoint will exceed the District's threshold. The District's initial proposal for this category cannot be considered BARCT.

The District has proposed a BARCT endpoint of 2 ppm for Boilers >40 MMBtu/hr with existing SCR.[41] Based on the methodology described above, the Ramboll analysis done for WSPA found that the compliance costs for this equipment category will exceed the District's cost-effectiveness threshold.

11. Category: Refinery heaters with heat input rating >110 MMBtu/hr without existing SCR:

Based on the Ramboll cost survey done for WSPA, the compliance costs for the proposed endpoint will exceed the District's cost-effectiveness threshold. And when including RFG desulfurization costs, both the Ramboll and District cost analyses will exceed the cost-effectiveness threshold. Thus, the District's initial proposal for this category cannot be considered BARCT.

The District has proposed a BARCT endpoint of 2 ppm for Heaters >110 MMBtu/hr without existing SCR.[42] The District has not considered the technical issues or costs identified by its third-party experts for meeting the proposed 2 ppm endpoint. Additionally, the Ramboll analysis found that the compliance costs for this equipment category will exceed the District's cost-effectiveness threshold. If RFG desulfurization costs are included, Ramboll also found that the cost-effectiveness result for this category increased by at least 40%; a result that is even further above the cost-effectiveness threshold. Furthermore, Ramboll found that the proposed BARCT fails to be cost-effective when RFG desulfurization costs are included. The District's initial proposal for this category cannot be considered BARCT.

12. Category: Refinery heaters with heat input rating >40-110 MMBtu/hr without existing SCR:

The District's cost-effectiveness result for this category, as presented to the Working Group, exceeds the cost-effectiveness threshold. In addition, the Ramboll analysis done for WSPA also found that this category is above the cost-effectiveness threshold. And when including RFG desulfurization costs, both the Ramboll and District cost analyses exceed the cost-effectiveness threshold by an even greater margin. Thus, the District's initial proposal for this category cannot be considered BARCT.

The District proposed a BARCT endpoint of 2 ppm for refinery heaters >40-110 MMBtu/hr without existing SCR.[43] As noted above, the District presented the cost-effectiveness for this proposed endpoint at $56,366,**Error! Bookmark not defined.Error! Bookmark not defined.** which is above the cost-effectiveness threshold of $50,000 per ton NOx reduced. And when RFG desulfurization costs are included, Ramboll found that the District's cost-effectiveness is even less cost-

[41] SCAQMD Proposed Rule 1109.1 Working Group Meeting #14 Presentation, August 27, 2020.

[42] SCAQMD Proposed Rule 1109.1 Working Group Meeting #14 Presentation, August 27, 2020.

[43] Ibid.

effective.

The Ramboll analysis also found that the projected compliance costs for the proposed endpoint will exceed the District's cost-effectiveness threshold. The addition of RFG desulfurization costs increased the cost-effectiveness result for this category by 35%; a result that is even further above the threshold (i.e., the endpoint is even less cost-effective). Thus, the District's initial proposal for this category cannot be considered BARCT.

13. Category: Refinery heaters with a heat input rating 20-40 MMBtu/hr without existing SCR:

The District has now proposed a BARCT endpoint of 40 ppm, stating that this will only impact three heaters. Staff have not provided a technical demonstration to support this assertion, and the baseline technical data does not support it. For these reasons, the District's initial proposal for this category cannot be considered BARCT.

The District has proposed a BARCT endpoint of 40 ppm for Heaters 20-40 MMBtu/hr, to be based on a 24-hour averaging period.[44] The District reported evaluating a total of 37 units in this subcategory, and suggested that this endpoint would impact only three heaters. The District has not provided a technical analysis to support this conclusion. On behalf of WSPA, Ramboll reviewed the baseline technical data for these equipment and does not believe the Staff's conclusion is supported by the data.

Since the units in this category are not equipped with CEMS, hourly NO_X emissions data was not available. But based on the reported annual emissions for these equipment, approximately one third of them had annualized NO_X emissions for the representative year that were above 40 ppm. If the annual average emissions from these units are greater than 40 ppm, one cannot expect the units could comply with the proposed 40 ppm limit to be enforced on a 24-hour average basis. Furthermore, Ramboll on a confidential, de-identified basis, reviewed the category units present at the WSPA member facilities. At least three units were found to have current SCAQMD permit limits for NO_X greater than 40 ppm. Given this information, it is reasonable to conclude that some of these units would require additional compliance costs and/or permit modifications to comply with the Staff proposal. The District analysis has not examined these costs, or the impact on cost-effectiveness.

For these reasons, WSPA does not believe the District has demonstrated cost-effectiveness. The initial proposal for this category cannot be considered BARCT.

[44] Proposed Rule 1109.1. Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries. Rev. October 23, 2020. (Initial Draft for Discussion Purposes). Available at: http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1109.1/pr1109-1-rule-language-10-23-20.pdf?sfvrsn=12. Accessed: October 2020.

14. Category: Refinery heaters with heat input rating <20 MMBtu/hr without existing SCR:

The District has proposed a BARCT endpoint of 40 ppm with no cost analysis for this subcategory, and the District has not provided a technical basis to support the assertion units in the category would be able to achieve 40 ppm without any additional compliance costs. Additionally, the Ramboll analysis done for WSPA, found that the proposal for this category is not cost-effective.

The District has proposed a BARCT endpoint of 40 ppm for refinery heaters with a heat input <20 MMBtu/hr to be based on a 2-hour average.**Error! Bookmark not defined.**[45] At the working group, the District stated there will be "no additional costs" for units in the category to achieve 40 ppm. To date, the District has offered no technical support for this assertion; one which appears to be inconsistent with baseline emissions data.

At WGM #9, the District noted that the existing units in this category currently operate with NO_X emissions in the range of 3-58 ppm. Separately, Ramboll has confirmed at least two existing units in the category have current permit limits >80 ppm NO_X. This suggests that at least some of the equipment in this category would require additional investments and/or permit modifications to comply with the proposed endpoint. The District must re-analyze this category to ensure the compliance costs for the proposed endpoint are fully considered before establishing BARCT. Additionally, Ramboll found, based on the confidential, de-identified survey done for WSPA, that estimated compliance costs for the proposed 40 ppm NO_X endpoint would exceed the District's cost-effectiveness threshold.

15. Category: Refinery heaters with heat input rating >40 MMBtu/hr with existing SCR:

The Ramboll analysis done for WSPA found that, based on WSPA member estimates, the proposed endpoint for this category exceeds the District's cost-effectiveness threshold.

The District has proposed a BARCT endpoint of 2 ppm for refinery heaters with heat input >40 MMBtu/hr with an existing SCR, with the exception of units with a permit limit of less than or equal to 5 ppm NO_X. The District has not fully considered the technical issues or costs identified by its third-party experts for meeting the proposed 2 ppm endpoint. Additionally, the Ramboll analysis found that compliance costs, as reported by WSPA member companies, would exceed the District's cost-effectiveness threshold. For this reason, WSPA does not believe the District's initial proposal for this category can be considered BARCT.

16. Category: Steam Methane Reformer Heaters:

The Ramboll analysis done for WSPA found that, based on WSPA member estimates, the proposed endpoint for this category exceeds the District's cost-effectiveness threshold.

The District has proposed a BARCT endpoint of 5 ppm for steam methane reformer (SMR) heaters.[46] The Ramboll analysis found that the compliance costs, as reported by the member companies, would exceed the District's cost-effectiveness threshold. For this reason, WSPA does not believe the District's initial proposal for this category can be considered BARCT.

[45] Ibid.

[46] SCAQMD Proposed Rule 1109.1 Working Group Meeting #14 Presentation, August 27, 2020.

17. The implementation schedule for transition to command-and-control BARCT can materially affect what is achievable, and whether it is cost-effective.

Due to RECLAIM program design, facilities within the refining sector (and other sectors) have pursued varied strategies for compliance under the RECLAIM market cap. As such, these facilities now find themselves in widely varied situations with respect to their basic equipment, currently installed emissions controls, and the investments and construction that may be needed to achieve future command-and-control BARCT limits. Given these varied starting points, the implementation schedule for command-and-control BARCT rules will be an important factor in determining what is achievable or cost-effective as BARCT.

Proposed BARCT scenarios need to include reasonable compliance schedules. These schedules must take into account the time needed for the planning, engineering, and design required for each unit, as well as procurement of funds and materials, preparation of permit applications, construction, and testing/tuning of new control devices on a refinery-by-refinery basis. These activities will be required on multiple units at each refinery sector facility and must be coordinated with turnaround schedules to ensure safe and effective installation. Additionally, the labor pool for such projects may be limited by the requirement to meet the "skilled and trained workforce" requirements of SB 54. It is anticipated that the projects will take years from the start of planning to final testing of new/modified equipment. Planning cannot begin before final rule adoption because BARCT endpoints are still being determined.

WSPA appreciates the revisions to the proposed implementation schedule presented in WGM #16 and the revised rule language.[47] However, issues still remain regarding the implementation timing. As stated above, upgrades must be timed with each refinery's turnaround schedule(s). It takes 3-5 years to plan a turnaround, and multiple units must come down in order to meet safety considerations. Additionally, multiple units subject to one phase may span different turnaround schedules. Compressing these requirements to meet a rule deadline could potentially create off-cycle turnarounds that can lead to process and personnel safety incidents. It is critical that the District work with individual refiners to find reasonable and attainable implementation schedule(s).

18. The draft rule language continues to include carbon monoxide (CO) emission limits.[48] The District has not provided any information to demonstrate such limits are necessary, technically feasible or cost effective. If CO limits are imposed in conjunction with the new NOx BARCT limits, the associated costs must be addressed in the cost-effectiveness analysis for PR1109.1.

CO emission limits have been included in Table 1 of the initial draft of PR1109.1. The District stated in WGM #16 that the intent of the proposed CO limits in PR 1109.1 was not to impose more stringent CO requirements, but maintain existing requirements and corresponding emissions. Staff proposed to add a provision allowing facilities with existing CO permit limits at the time of rule adoption to keep their permit limits. Units with no CO limit on the permit would be subject to the rule limit.

Since early 2018, the PR1109.1 WGMs have focused on NO_X BARCT with limited side discussions of ammonia (NH_3) slip emissions and $PM_{2.5}$ co-pollutant emissions potentially

[47] Proposed Rule 1109.1. Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries. Rev. December 24, 2020. (Second Draft for Discussion Purposes).
[48] Ibid.

associated with the SCR technology. There has been no technical discussion or analysis of CO emissions or CO emissions control technologies. We appreciate the District's stated intent to prevent an increase in CO emissions. However, the District has not presented stakeholders with any information to demonstrate that proposed CO limits presented in the PR1109.1 are technically feasible or cost-effective for existing equipment without permitted CO limits. A very cursory examination of District rules Indicates that the limits suggested in Table 1 would conflict with current District rules applicable to PR1109.1 equipment. How widespread a problem that would be is unclear because there has been no analysis of CO emissions performance for units without existing CO limits. If it is ultimately determined that there is a supportable basis for imposing CO limits, then the cost-effectiveness analysis for PR1109.1 needs to reflect any costs associated with meeting the proposed CO limits.

WSPA appreciates the opportunity to provide these comments related to PR1109.1. We look forward to continued discussion of this important rulemaking. If you have any questions, please contact me at (310) 808-2144 or via e-mail at psenecal@wspa.org.

Sincerely,

Cathy Senecal

Cc: Wayne Nastri, SCAQMD
Susan Nakamura, SCAQMD
Cathy Reheis-Boyd, WSPA