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Via e-mail at: mmorris@aqmd.gov

Re: SCAQMD Proposed Amended Rule 1178, Further Reductions of VOC Emissions from Storage Tanks at Petroleum Facilities – WSPA Comments on the Cost-Effectiveness Analysis

Dear Mr. Morris,

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 Amended Rule 1178, Further Reductions of VOC Emissions from Storage Tanks at Petroleum Facilities (PAR 1178). WSPA is a non-profit trade association representing companies that explore for, produce, refine, transport, and market petroleum, petroleum products, natural gas, renewable fuels, 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 will be impacted by PAR 1178.

The California Health & Safety Code requires the District, in adopting any Best Available Retrofit Control Technology (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.[1] 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.[2] 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 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 $36,000 per ton of VOC emissions reduced, consistent with the 2022 Air Quality Management Plan (2022 AQMP).[3]

On October 21, 2022, SCAQMD published the presentation slides for PAR 1178 Working Group Meeting (WGM) #6, which was held on October 27, 2022.[4] WSPA offers the following comments on the information presented therein:

[1] California Health & Safety Code §40406, 40440, 40920.6.
[2] California Health & Safety Code §40920.6.
[3] SCAQMD Draft Final 2022 Air Quality Management Plan. Available at: http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan.
[4] Available at: http://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/rule-1178

1. In estimating costs for doming of external floating roof crude oil tanks, the District has not included potential operating and maintenance costs. This is not a complete view of costs, does not align with the Discounted Cash Flow (DCF) method, and results in a significant understatement of the control costs.[5] Operating costs must be considered (along with capital costs) in the calculation of the present value of the proposed controls. Ramboll's cost-effectiveness analysis demonstrates that the proposed doming controls would be above the District's cost-effectiveness threshold when reasonable operating costs are considered.

SCAQMD's cost-effectiveness thresholds presented in the 2022 AQMP are based on the DCF method, in which the present value of control costs over the life of the equipment is calculated by incorporating capital costs, annual operating costs, and other periodic costs over the life of the equipment. [6] For this rule, SCAQMD has stated that they are using the DCF method but has assumed that operations and maintenance costs would be $0.[7] Therefore, costs related to annual operation and maintenance and other periodic costs over the life of the equipment have not been included in SCAQMD's estimate of lifetime costs.

SCAQMD has proposed a 50-year lifetime for the doming of crude oil tanks. While WSPA strongly disagrees with that assumption (see below comment), it is simply not reasonable to assume that such industrial equipment could be operated for such an extended term without incurring operations or maintenance costs. Staff must incorporate reasonable estimates for both operations and maintenance costs, as well as periodic costs, in order to provide a meaningful cost estimate for doming of crude oil tanks.

WSPA's technical consultant, Ramboll US Consulting (Ramboll), considered the impact of including annual operating costs in the analysis and compared estimated costs to the District's presented results. WSPA members had provided the District with cost estimates for doming of crude oil tanks, which were also provided to Ramboll. Separately, SCAQMD provided Ramboll a list of tanks and the District's assumed costs and estimated emission reductions.[8] Ramboll used these data to calculate the cost-effectiveness for three installation cost scenarios. For each scenario, the overall cost-effectiveness was calculated considering the installation-only costs (i.e., initial capital investments), and then using a present weighted value (PWV)-adjusted cost which included operating costs, as prescribed by the Discounted Cash Flow Method prescribed in the SCAQMD Air Quality Management Plan (AQMP). The cost-effectiveness of each scenario was calculated for a 50-year equipment lifetime. Cost calculation methodologies for each scenario were as follows:

- **Scenario 1**: Installation costs and emission reductions were based on the information presented in Slides 27 and 28 of the PAR 1178 WGM #6 presentation, respectively.[9] Staff's "hybrid cost curve" was used to calculate the installation cost for each tank in the list provided by SCAQMD. A PWV-adjusted cost was also calculated for each tank based on the hybrid cost curve, assuming annual operational costs were equivalent to 2% of the total installation cost.

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[5] SCAQMD. Cost-Effectiveness Values and Calculations. Available at: https://www.aqmd.gov/home/permits/bact/cost-effectiveness-values.

[6] SCAQMD Draft Final 2022 Air Quality Management Plan. Available at: http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan.

[7] Personal communication between Yasmine Stutz, Ramboll, and Melissa Gamoning, SCAQMD on 11/9/22

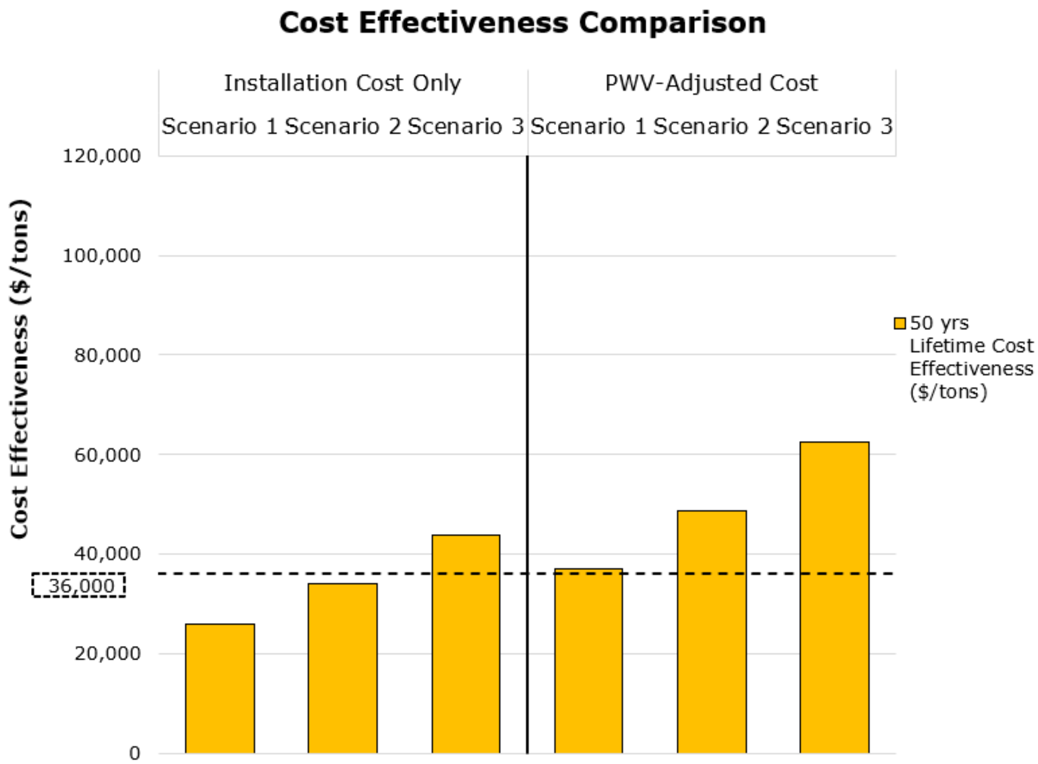
[8] Email communication from James McCreary, SCAQMD, 11/9/22

[9] SCAQMD PAR 1178 Working Group Meeting #6 Presentation. Available at: http://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/1178/par-1178_wgm-6_v9.pdf?sfvrsn=14.

- **Scenario 2**: Installation costs and emission reductions were based on data provided by SCAQMD.[10] A PWV-adjusted cost was then calculated for each tank based on the individual installation cost, assuming annual operational costs were equivalent to 2% of the total installation cost.
- **Scenario 3**: Installation costs were based on the cost data provided by WSPA members. Costs collected from WSPA members were used to create a cost curve based on tank diameter. Emission reductions were based on data provided by SCAQMD.[11] A similar PWV-adjusted cost curve was created assuming annual operational costs were equivalent to 2% of the total installation cost.

Costs for each tank were summed and divided by the total emission reductions for each scenario to calculate the overall cost-effectiveness. The results are summarized in Figure 1 below and compared against the $36,000 cost-effectiveness threshold.

Figure 1. Results of the Cost-Effectiveness Analysis



As shown in Figure 1, Ramboll's analysis demonstrates that under most cost estimation scenarios, the proposed doming controls would actually exceed the cost-effectiveness threshold of $36,000 per ton of VOC emissions reduced. It is important to note the following:

- SCAQMD costs presented in Working Group Meeting #6 assume no operation and maintenance costs over the lifetime of the equipment. As presented in the bars on the right side of Figure 1, if annual operation and maintenance costs are incorporated, none of the scenarios are cost-effective.
- The data presented in Figure 1 is based on District's estimated emission reductions which assume all materials stored in the tanks have a Reid Vapor Pressure (RVP) of

[10] Email communication from James McCreary, SCAQMD, 11/9/22
[11] Ibid.

8.19. Because SCAQMD has not grouped the tanks based on class and category, it is not possible to know whether doming of the tanks would be cost-effective. Given the potential overstatement of emission reductions discussed in Comment #2, it is likely that doming of tanks would be significantly less cost-effective than presented in Figure 1.

- There will be additional costs associated with tanks being out of service during the retrofitting projects, which were not considered in any of these scenarios.

Given the issues with the cost-effectiveness calculations presented by the District, WSPA believes the SCAQMD needs to reevaluate cost-effectiveness to incorporate operations and maintenance costs and create classes and categories suitable to the materials handled in the tanks.

2. SCAQMD has significantly overstated the potential emission reductions for doming of external floating roof crude oil tanks by assuming an RVP of 8.19 psi across all tanks modeled. Staff needs to consider RVP as a parameter in establishing class and category and revise their emissions modeling to get more accurate estimates.

Under California HSC Section 40406, BARCT is defined as "an emission limitation that is based on the maximum degree of reduction achievable by each class or category of source, taking into account environmental, energy, and economic impacts by each class or category of source".[12] As presented at WGM #6, the District has modeled crude oil tank emissions and estimated potential emission reductions based on an RVP value of 8.19 psi for all tanks. SCAQMD Staff stated that 8.19 was calculated based on RVP data provided in leak reports (Table 1) to calculate the mean, and then added two standard deviations. This approach significantly overstates the amount of emission reductions which could result from the control measure, and would subject all of the tanks to a control measure that is not supportable if the District properly considers class and category.

Refineries in the South Coast are generally oriented towards processing crudes which are heavier (i.e., have a lower API gravity), and sourer (i.e., have a higher sulfur content) than crude stocks in the rest of the United States.[13] Refinery units are configured for these crude stocks.[14] Heavier crudes contain, on average, larger organic molecules and as a result, exhibit lower vapor pressures as compared to lighter crude stocks.[15] Vapor pressure serves as an indirect measure of the evaporation rate of volatile petroleum solvents, with higher vapor pressures indicating greater potential losses from evaporation.[16]

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[12] CA Health & Safety Code § 40406 (2019)
[13] California Energy Commission. Petroleum Watch. February 2020. Available at: https://www.energy.ca.gov/sites/default/files/2020-02/2020-02_Petroleum_Watch_ADA_0.pdf
[14] Ibid.
[15] Chemistry Comes Alive! Vapor Pressure: Molecular Size. Available at: https://www.chemedx.org/JCESoft/jcesoftSubscriber/CCA/CCA2/MAIN/VAPORES5/CD2R1.HTM
[16] Congressional Research Service. Crude Oil Properties Relevant to Rail Transport Safety: In Brief. February 2014. Available at: https://glslcrudeoiltransport.org/wp-content/uploads/2019/01/Andrews_CRS_Crude-Oil-Properties-Relevant-to-Rail-transportation-Safety-in-brief.pdf

As shown in Table 1, all of the crude stock RVP values referenced by SCAQMD were reported to be below 8.19 psi.

Table 1. RVP Values from Leak Reports as provided by SCAQMD[17]

RVP (psi)
1.77
2.17
2.4
2.5
3.2
3.2
3.8
3.93
4.0
5.85
6.15
6.3
6.63
7.33
7.87

To illustrate the degree of potential overstatement associated with the District's RVP assumption, Ramboll used the TankESP program to model emissions for a hypothetical floating roof tank at different RVP values, holding all other model inputs constant.

In both the pre-dome scenario (i.e., external floating roof design) and the domed scenario (i.e., domed floating roof design), Ramboll utilized TankESP model inputs provided by SCAQMD staff.

Table 2. TankESP Potential Emission Reductions based on Crude RVP[18]

Product	Emissions: Pre-Dome (lb/yr)	Emissions: Domed (lb/yr)	Potential Reductions (lb/yr)
Crude – RVP 8.19	3,747	1,010	2,736
Crude - RVP 6	2,378	755	1,624
Crude - RVP 4	1,458	582	876
Crude - RVP 2	782	455	327

This analysis demonstrates the degree of potential overstatement for emission reductions associated with the District's RVP assumption. Considering tanks that the District analyzed had

[17] Email communication from James McCreary, SCAQMD, 11/9/22.

[18] Based on Ramboll analysis of emissions for a hypothetical tank assumed to have a diameter of 145 ft, annual throughput of approximately 57 million gallons, and an assumed dome roof height of one-sixth the diameter for the "domed" tank emissions, modeled using TankESP.

reported RVPs well below 8.19, the District's estimated emissions reductions from doming (based on an assumed RVP of 8.19) could be overstated by a factor of three to eight times.

RVP is an important criterion in determining the emissions and potential emissions reductions for crude tanks. By failing to accurately consider crude RVP, the District appears to have overstated the potential emission reductions for the proposed rule and failed to fulfill its obligation under HSC to consider class & category in establishing BARCT.

3. **The District's 50 year useful life assumption is arbitrary and unreasonable. This is especially significant given the direct conflict with policy goals presented in the SCAQMD's Air Quality Management Plan (AQMP) and the State of California's Final 2022 Scoping Plan Update. The District must consider a more appropriate time frame for amortizing estimated costs.**

Retrofitting large petroleum tanks with domes for emissions control is a practice that started in the early 2000's, so there is no empirical data to suggest that such retrofitted tanks could remain in service for as long as 50 years. While the District has claimed that one or more vendors suggested 50 years, the District has not demonstrated it would be possible for a facility to obtain a commercial guarantee from a manufacturer for that long a term.

Based on information presented in WGM #6 and reproduced in Figure 2 below, it appears the District arrived at the 50-year assumption by an iterative process. As presented in WGM #6, it was the first useful life length to produced a cost-effectiveness result below the threshold.

Figure 2. SCAQMD Estimates for the Cost-Effectiveness of Doming External Floating Roof Tanks by Dome Useful Life

Dome Useful Life (yrs)	Total Costs ($)	Total Emission Reductions (tons)	Cost-Effectiveness ($/ton)
25	$73,807,300	1,131	$65,300
30		1,357	$54,400
35		1,584	$46,600
40		1,810	$40,800
45		2,036	$36,300
50		2,262	$32,600

While this 50-year assumption raises legitimate engineering feasibility questions, it also conflicts with policy directives issued by the District and State of California. A 50-year life on capital investments in response to PAR 1178 would extend until approximately 2075. But the California Air Resources Board (CARB)'s Final 2022 Scoping Plan for Achieving Carbon Neutrality makes it clear that the level of oil and gas infrastructure in operation today should not be in use by 2075. That plan states "Successfully achieving the outcomes called for in this Scoping Plan would reduce demand for liquid petroleum by 94 percent and total fossil fuel by 86 percent in 2045 relative to 2022".[19] With this projection, it leads to the question: On what basis does the District expect these tanks to be operating for another 50 years?

Ramboll considered cost-effectiveness (as discussed in Comment #1) using the District's more typical 25-year useful life assumption (which would extend to 2048). This was done for the three scenarios discussed above. The results are summarized in Figure 3 below and compared against the $36,000 cost-effectiveness threshold.

[19] CARB. 2022 Scoping Plan for Achieving Carbon Neutrality. November 16, 2022.

Figure 3. Results of the Cost-Effectiveness Analysis – Useful Life Comparison

As shown in Figure 3, none of the scenarios would be below the cost-effectiveness threshold (for PWV-adjusted estimates) using the 25-year useful life assumption. The District needs to re-analyize cost effectiveness considering a more reasonable useful life.

4. 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 HSC. HSC Section 40920.6 prescribes two different cost-effectiveness analyses for BARCT rules[20]:

- 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 cost-effectiveness analyses for the different control options under 40920.6(a)(2), SCAQMD has not presented any information concerning the 40920.6(a)(3) analyses. Such incremental cost-effectiveness analyses are necessary 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 analyses in its evaluation of proposed BARCT limits.

The District is proposing both optical gas imaging (OGI) systems and doming as potential emission control technologies. To comply with HSC Section 40920.6, District staff must estimate the cost-effectiveness of each control individually and compare them according to the methodology laid out in the HSC in order to complete the incremental cost-effectiveness evaluation.

5. The District must consider the regulatory and cost implications of 40 CFR Subpart Kb in their cost-effectiveness analysis.

40 CFR Part 60 Subpart Kb contains Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984.[21] Because many of the crude oil storage tanks in the South Coast were constructed prior to the rule's effective date of July 23, 1984, they are not subject to the performance standards. However, these tanks may become subject to it if the retrofits would be deemed a "Reconstruction" under the NSPS regulations. In the context of the subpart, reconstruction means the replacement of components of an existing facility to such an extent that:

- "The fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility"; and
- "It is technologically and economically feasible to meet the applicable standards set forth in this part".[22]

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[20] California Health and Safety Code §40920.6. Available at: https://codes.findlaw.com/ca/health-and-safety-code/hsc-sect-40920-6/.

[21] 40 CFR Part 60 Subpart Kb. Available at: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-60/subpart-Kb.

[22] 40 CFR 60.15 - Reconstruction

Based on the level of capital investment, a project to modify an existing tank might potentially be considered a Reconstruction. In such an event, the tank would be treated as a new source instead of modification. Tanks that become subject to Subpart Kb due to retrofits being classified as reconstructions may have to be further reengineered in order to meet the NSPS. The District must investigate the potential additional costs which might result from 40 CFR Subpart Kb applicability in its cost analysis.

6. **The District's proposal to consider any amount of VOCs detected by an OGI camera as a leak could overestimate the number of leaks exceeding 2,500 ppm. The proposed rule should allow for follow-up investigations following OGI detections and clearly lay out the protocols for conducting such investigations in order to confirm potential leaks.**

OGI systems may not correctly attribute observations to a single emitting source. Depending on observational specifics, VOCs observed in a viewshed might be from several different sources. The rule should not rely on OGIs to determine leaks, because there are no existing reference methods for OGI inspections and different OGI equipment may produce different results. Rather, the rule should make clear what type of follow-up investigations are required based on initial results from OGIs and allow technicians to confirm the presence of leaks.

7. **There are personal and process safety concerns associated with domed floating roof tanks that can result in additional operating costs, which the District must consider in its cost-effectiveness analysis.**

Operating domed floating roof tanks entails additional safety requirements not present with external floating roof tanks. These additional requirements result in costs to ensure the safety of staff working inside of these tanks. For example:

- Accessing domed tanks for inspection and repair, since they are considered confined spaces with limitations under OSHA standards. These include equipment specifications such as limits on the maximum length for supplied air hoses.
- Cleaning tank seals for inspection, which is more difficult with domed tanks, increasing their down time.
- Vapor recovery systems, which cannot be installed on domed floating roof tanks due to explosion hazards. An alternative option to vapor recovery would be a standalone oxidizer, but this would create additional pollutants through the treatment (e.g., nitrogen oxides [NOx] and carbon monoxide [CO]).

The District has not considered operation and maintenance costs in its analysis, including those related to safety. This would result in understated costs and lower cost-effectiveness estimates than would likely be experienced for tank doming as proposed. The District should work with refineries to properly understand these costs and incorporate them into the calculations of cost-effectiveness for the proposed controls.

WSPA appreciates the opportunity to provide these comments related to PAR 1178. We look forward to continued discussion of this important rulemaking. If you have any questions, please contact me at (310) 808-2146 or via e-mail at rcromartie@wspa.org.

Sincerely,

Cc: Wayne Nastri, SCAQMD
Sarah Rees, SCAQMD
Michael Krause, SCAQMD
Rodolfo Chacon, SCAQMD
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