

Frequently Asked Questions: Air Quality and ODSVRA Mitigations

SLO County APCD, February 9, 2024

Q1: What effects have the dust mitigations had on downwind air quality?

A1: The short answer is that we have seen real, significant improvements in air quality downwind of the ODSVRA. The APCD, State Parks, and the ODSVRA Scientific Advisory Group (SAG) have developed several complimentary metrics to track changes in air quality in response to the mitigations deployed on the ODSVRA, and all of them agree that PM₁₀ levels are significantly lower now on the Nipomo Mesa than previously. Below are a few examples.

- **Difference-in-Differences.** The APCD developed a “difference-in-differences” methodology for disentangling the effects of the dust controls from other factors like meteorology, wildfires, and dust transport from the San Joaquin Valley. The analysis is updated annually, and results have been presented on several occasions to the APCD Board of Directors,¹ Hearing Board,² and elsewhere,³ and are documented in our Annual Air Quality Reports.⁴ Table 1, below, summarizes the results for 2016 through 2022 from the last Annual Air Quality Report and adds unofficial results for 2023. The 2023 results are unofficial because these data have not been fully validated yet; however, we do not expect any significant changes.⁵ Final results will be reported in the Annual Quality Report for 2023.

As shown in Table 1, **in 2023, wind-event day PM₁₀ at CDF was 38.1% lower than it was in 2017. At Mesa2, wind-event day PM₁₀ was 22.2% lower in 2023 than in 2017.**

¹ See, for example, the following presentations to the SLO APCD Board of Directors, videos of which are available online at <https://www.slocleanair.org/who/board/meeting-minutes.php>: November 29, 2023, “Item B-2: 2022 Annual Air Quality Report;” November 16, 2022, “Item D-2: Update on Oceano Dunes mitigation efforts;” and November 18, 2020, “Item B-1: 2019 Annual Air Quality Report.”

² See, for example, the following presentation to the SLO APCD Hearing Board, videos of which are available online at <https://www.slocleanair.org/who/board/meeting-minutes.php>: October 13, 2023, “Item 5d: Presentation by SLO County APCD;” June 17, 2022, “Item 5d: Presentation by SLO County APCD;” and October 14, 2021, “Item 5d: Presentation by SLO County APCD.”

³ Tupper, Karl A., “A Difference-in-Differences Approach for Assessing the Effectiveness of Dust Mitigations at the Oceano Dunes,” 2022 National Ambient Air Monitoring Conference, Pittsburgh, August 24, 2022. https://www.epa.gov/system/files/documents/2022-10/Tupper_Karl_NAAMC_2022.pdf

⁴ See SLO APCD Annual Air Quality Reports for 2017 through 2022, available <https://www.slocleanair.org/library/air-quality-reports.php>.

⁵ Since the original version of this FAQ was posted online on February 6, 2024, an error in the preliminary 2023 data set was discovered and corrected. This version of the FAQ updates the difference-in-differences analysis with the corrected data, resulting greater estimated PM₁₀ reductions at CDF and Mesa2 for 2023 than reported previously.

Table 1: Difference-in-differences results, 2016-2023					
Year	Total Dust Mitigation Extent (approx. acres)	Change, vs 2017 baseline, in Event-Day PM ₁₀ Ratio			
		CDF vs Oso Flaco		Mesa2 vs Oso Flaco	
		Percent Change	95% Confidence Interval	Percent Change	95% Confidence Interval
2023	740.1	- 38.1 %	-24.9% to -48.9%	- 22.2%	-6.8% to -35.0%
2022	740.1	- 31.6%	-18.5% to -42.6%	- 13.8%	+1.4% to -26.7%
2021	322.5	- 33.5%	-16.1% to -47.3%	- 7.0%	+11.8% to -22.6%
2020	230.2	- 28.4%	-13.9% to -40.4%	+ 4.6%	+25.4% to -12.9%
2019	137.8	- 7.6%	+23.2% to -30.7%	+ 14.9%	+41.4% to -6.7%
2018	146.9	- 22.4%	-7.4% to -34.9%	- 2.3%	+14.3% to -16.4%
2017	55.3	0 %	n. a.	0 %	n. a.
2016	76.8	- 12.7%	+16.8% to -38.4%	- 4.2%	+17.8% to -22.0%

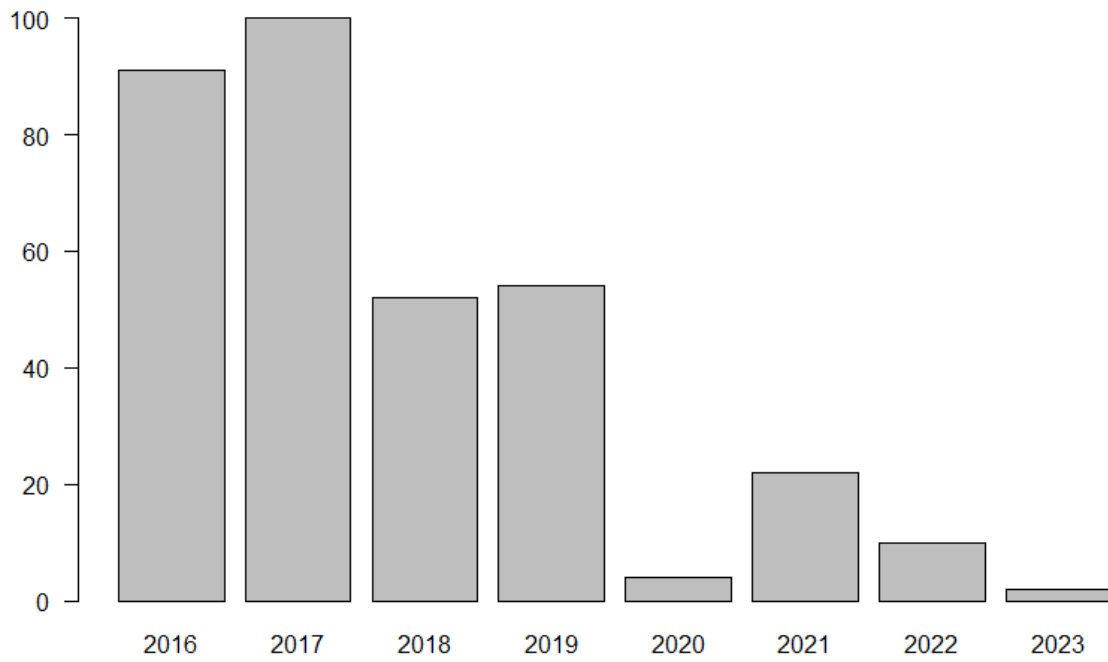
This analysis uses 2017 as the baseline year to compare other years against. This is because the data required for the analysis are only available back to 2016, and of the available years, 2017 had the least amount of dust controls in place, with only 55.3 acres. The original Stipulated Order of Abatement (SOA) required emissions to be cut in half from 2013 levels, when there were less than 5 acres of controls. While the difference-in-differences methodology cannot determine the change in PM₁₀ levels from 2013 to 2023, it's likely that the reductions have been larger than the 38.1% and 22.2% reductions seen for CDF and Mesa2 for 2023 vs 2017, since there were 50 fewer acres of dust controls in 2013 than 2017.

It is interesting to note that even though the footprint of the dust control did not increase in 2023 (i.e., there were 740.1 acres of controls in 2022 and 2023, as noted in Table 1), the analysis nonetheless shows incremental improvement in PM₁₀ levels at both CDF and Mesa2. This is likely due to the continued growth and maturation of previously installed dune restoration projects and the conversion of wind fencing and straw treatments to permanent dust controls.

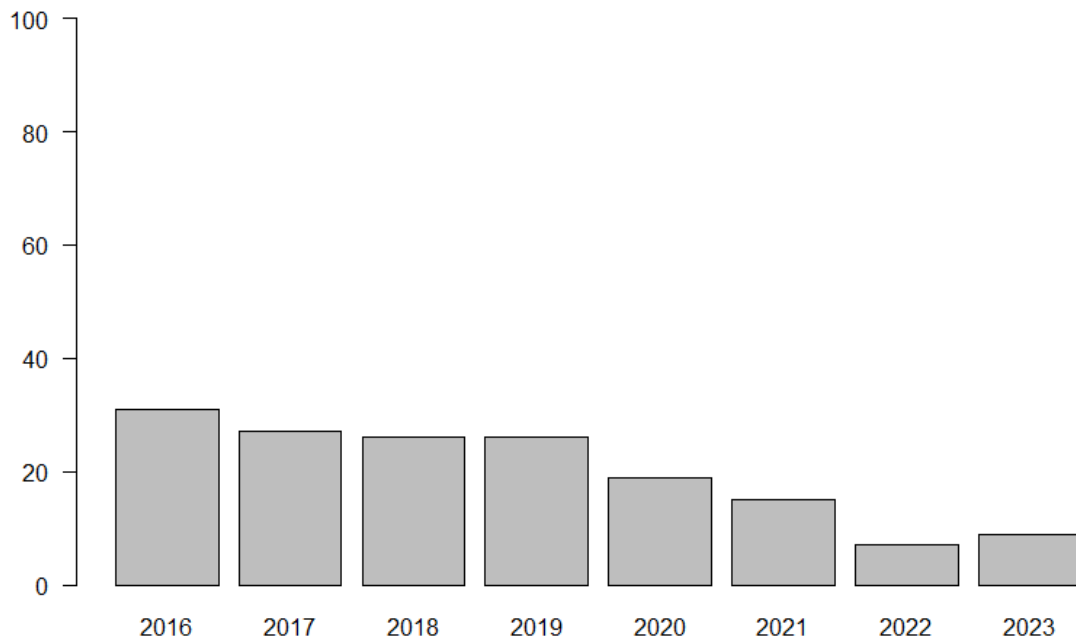
- Hours over 300 $\mu\text{g}/\text{m}^3$.** Another metric that APCD tracks to assess the effectiveness of the dust controls is the number of hours at CDF and Mesa2 over 300 $\mu\text{g}/\text{m}^3$. In contrast to the difference-in-differences analysis, this metric does not account for the impact of wildfires and non-ODSVRA dust source. The figures below show the results for CDF and Mesa2 for 2016 through 2023; as with the difference-in-differences analysis discussed above, the data for 2023 is unofficial. At both sites there is a clear downward trend in the number of hours over 300 $\mu\text{g}/\text{m}^3$. For CDF, 2023 had the fewest such hours ever. At Mesa2, 2023 was on track to have the fewest such hours,⁶ but a storm in November resulted in 2023 having slightly more hours than 2022. The winds associated with the November storm were from the southeast, so the source of the elevated PM₁₀ was likely not the OSDVRA.

⁶ See the November 29, 2023, presentation to the SLO APCD Board of Directors noted in Reference 1.

Number of Hours at CDF with PM10 Over 300 ug/m3



Number of Hours at Mesa2 with PM10 Over 300 ug/m3



- TPM₁₀:TWPD Ratio.** The ratio of total PM₁₀ to total wind power density, or “TPM₁₀:TWPD ratio,” is a metric that was developed by Desert Research Institute for tracking progress in reducing PM₁₀ levels. The figures below, which are from State Parks’ Annual Report and Work Plan (ARWP) for 2023,⁷ demonstrate that this ratio has decreased at both CDF and Mesa2 as the scale of mitigation measures on the ODSVRA has increased.

According to the report, the “metric indicates that the PM₁₀ originating from the ODSVRA has been reduced by the dust controls by approximately 41% at CDF in 2022 for equivalent [wind] conditions compared with the baseline year of 2011. For Mesa2, the ... metric indicates that the PM₁₀ originating from the ODSVRA has been reduced by the dust controls by approximately 32% for equivalent [wind] conditions compared with the value for 2018 when there were few acres of dust control upwind of the Mesa2 station.” These estimates are very close to the estimates from the Difference-in-differences analysis noted above; their concurrence is impressive considering that differences between how these estimates are calculated and their underlying assumptions.

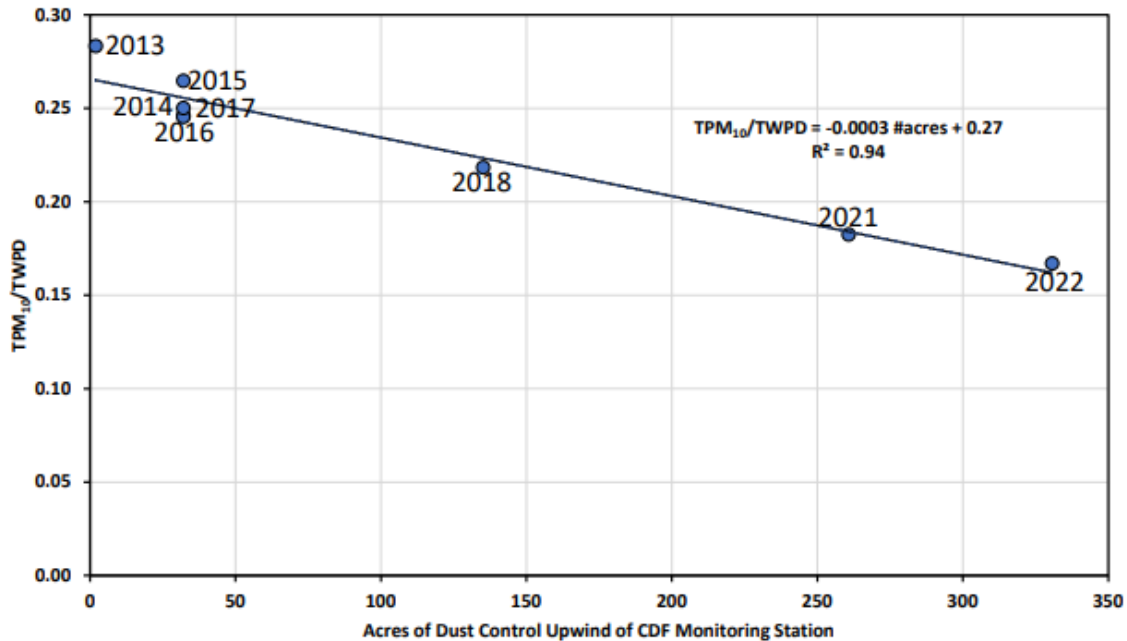


Figure 4. The relation between TPM₁₀:TWPD ratio value measured at CDF and the acres of dust control from 2013 through to 2022 placed upwind of CDF in the directional range 270° to 325°. Data from 2019 and 2020 were excluded as discussed elsewhere. Note 2014 and 2017 data align on top of each other.

⁷ California State Parks, “Provisional Final 2023 Annual Report and Work Plan, Attachment 4: Increments of Progress Towards Air Quality Objectives - ODSVRA Dust Controls 2022 Update.” Available online at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/SAG%20Edits%20to%20DRI%20Report%20-%20Increments_of_progress_02-07-2023_V1_dri_revised_09-05-2023_accept_all%20FINAL.pdf

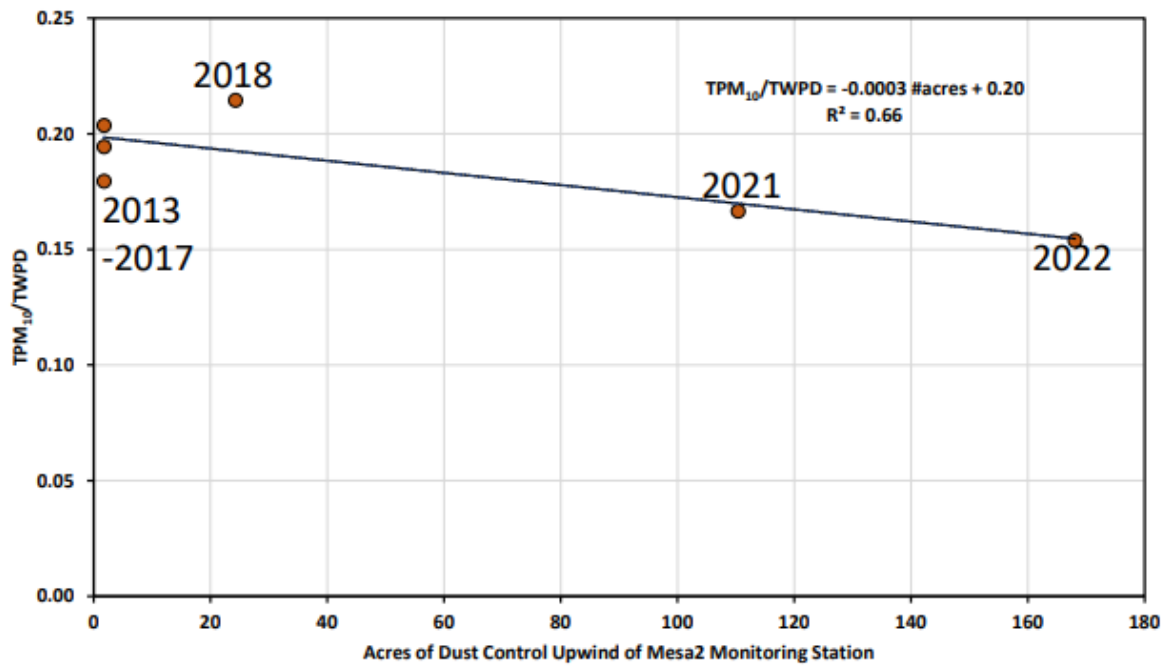


Figure 5. The relation between TPM₁₀:TWPD ratio value measured at Mesa2 and the acres of dust control from 2013 through to 2022 placed upwind of Mesa2 in the directional range 270° to 305°. Data from 2019 and 2020 were excluded as discussed elsewhere. Note for the 2013-2017 data points some years are aligned on top of one another.

Q2: Why hasn't air quality improved as much at Mesa2 as at CDF?

A2: PM₁₀ levels have always been higher at CDF than at Mesa2, so larger reductions are needed at CDF than at Mesa2 to achieve pre-disturbance levels. While the observed percent reduction in PM₁₀ has been larger at CDF than at Mesa2, CDF still exceeds the PM₁₀ standard more frequently and has a higher annual average than Mesa2, as shown in the figures below, which are from the most recent Annual Air Quality Report.

Initially, dust control projects were focused upwind of CDF because PM₁₀ levels were higher there, as shown in the figures below. Focusing efforts there brought relief to those most impacted and also provided the best opportunity to test dust control strategies to see if they performed as expected in reducing PM₁₀ levels downwind. In addition, early controls were focused on the parts of the riding area that were the most emissive as determined by PI-SWERL studies. These areas tended to be in the northern section of the ODSVRA, more upwind of CDF than of Mesa2. In recent years, though, mitigation efforts have focused on areas upwind of Mesa2, and as shown in Table 1, above, for the last few years there has been year-over-year improvements in air quality at Mesa2. Improving air quality at Mesa2 is critical as the area near it is much more populated than the area around CDF.

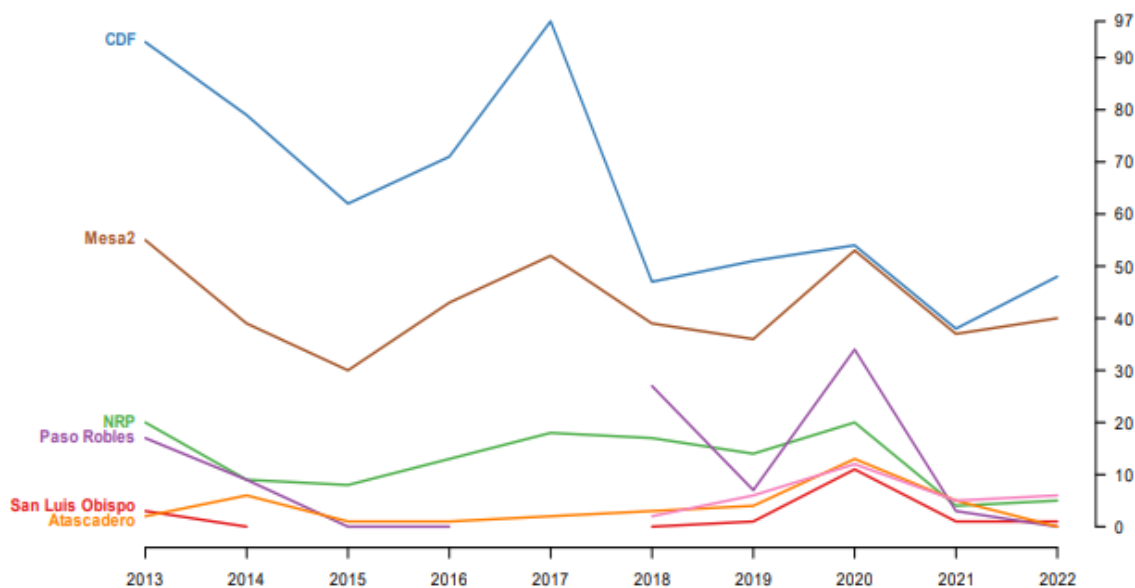


Figure 10: Exceedances of the California 24-hour PM₁₀ Standard, 2013–2022

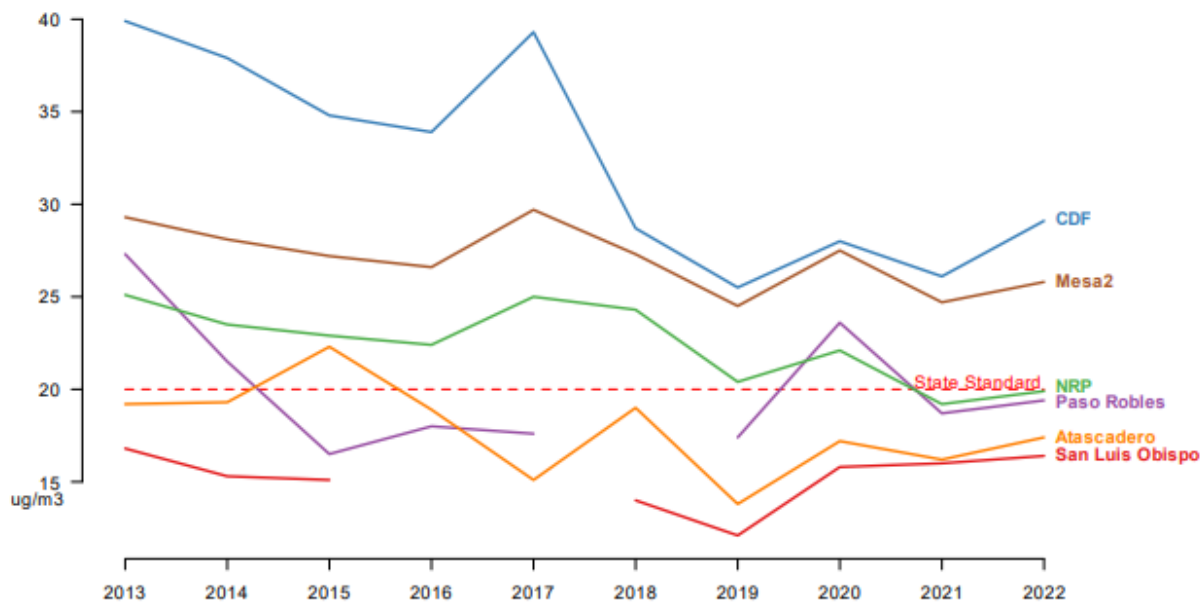


Figure 12: PM₁₀ Annual Averages, 2013-2022

Q3: Have PM₁₀ levels been reduced enough?

A3: It is clear that the dust controls are working and PM₁₀ levels are being reduced downwind, but the question remains: Have they been reduced enough? The goal of the SOA is to eliminate PM₁₀ emissions from the ODSVRA that are associated with off-roading; the goal is not to eliminate all standard exceedances on the Nipomo Mesa.⁸ State Parks, with guidance from the SAG, is in the process of proving to the hearing board that the goal has been or will be achieved shortly. We should have a final answer in the coming months. More mitigations will be required if the goal has not been achieved. In October, the Hearing Board will make the final determination as to whether to accept the excess emissions goal identified by State Parks' modeling.

As discussed in the 2023 ARWP,⁹ State Parks has modelled emissions from the Park as currently configured and under an assumed "pre-disturbance" scenario based on aerial photographs of the Park from the 1930s. Using emissivity data collected in 2013, the modeling estimates that emissions today are less than pre-disturbance emissions, and thus no additional dust controls are needed. In

⁸ The ODSVRA is located within the Callender Dunes complex, which is a natural coastal dune system. Dust is generated when strong winds blow across sand dunes, so it is expected that even in the absence of off-roading, PM₁₀ levels downwind of the dunes would be higher than typical levels elsewhere. For example, The Oso Flaco monitoring station is within the ODSVRA but downwind of an area where off-roading has been banned for decades, and where dunes have been revegetated to unnaturally dense state. Here, the California PM₁₀ standard was exceeded 6 times in 2022, which more times than at the inland sites of NRP, San Luis Obispo, Atascadero, and Paso Robles.

⁹ California State Parks, "Provisional Final 2023 Annual Report and Work Plan," October 4, 2023. Available online at https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2023ARWP_ProvFinal_20231004_lowres.pdf.

contrast, using 2019 data, the model estimates that current emissions still exceed pre-disturbance emissions, and thus more controls are needed. To resolve this issue, State Parks was tasked with working with the SAG come up with a final recommendation for what emissivity data to use in the modeling.¹⁰ These assumptions were recently submitted to the APCD for approval.¹¹ The results of revised modeling using Districted-approved modeling assumption will be used to determine compliance with the SOA's emissions reduction goal.

¹⁰ Gary Willey, "Conditional Approval of California Department of Parks and Recreation's 2023 Annual Report and Work Plan in Response to Stipulated Order of Abatement Number 17-01," October 18, 2023. Available online at <https://storage.googleapis.com/slocleanair-org/images/cms/upload/files/2023-10-18%20Conditional%20Approval.pdf>.

¹¹ See documents in the "Winter 2023 Update" section of the APCD's "Oceano Dunes Particulate Emissions Reduction Efforts" webpage at <https://www.slocleanair.org/air-quality/oceano-dunes-efforts.php>.