

October 20, 2021

Memo: SAG Review of Scripps/UCSD “Interim Report 2021: Preliminary Results from May 2021 Aerosol Measurements”

From: Scientific Advisory Group (SAG)

To: Jon O’Brien, California Department of Parks and Recreation (CDPR)

Cc: Sarah Miggins, California Department of Parks and Recreation (CDPR)
Liz McGuirk, California Department of Parks and Recreation (CDPR)

Summary Statement

The Scientific Advisory Group (SAG) welcomes monitoring campaigns and scientific studies that seek to understand the sources of particulate matter (PM) emissions at and around the Oceano Dunes State Vehicular Recreation Area (ODSVRA) and to inform efforts to reduce ambient PM10 concentrations toward achieving the air quality goals of the Stipulated Order of Abatement (SOA). Here, the SAG reviews the most recent Scripps Institution of Oceanography at the University of California, San Diego (UCSD) study, “Interim Report 2021: Preliminary Results from May 2021 Aerosol Measurements,” which reports new data and findings that build on previous studies conducted by the Scripps/UCSD team.

Scientists of the Scripps/UCSD team have conducted multiple monitoring campaigns and prepared multiple scientific reports with the goal of constraining the importance of PM emitted from the ODSVRA relative to other sources originating outside the ODSVRA. Unfortunately, the SAG finds serious deficiencies within the current Scripps/UCSD report and therefore urges caution in using its reported findings and interpretations to guide management decisions regarding PM mitigation at the ODSVRA.

In particular, the SAG disputes three major aspects of this report: (1) its treatment of health and legal imperatives, (2) its assessment of the effects of off-highway vehicles (OHV) on PM emissions, and (3) the inadequate justification provided for key analyses and interpretations. These three major concerns are described in further detail below. In addition, reviews from individual SAG members (see Appendix 1) address specific aspects of this report that lead to the overall SAG concerns.

SAG Major Concerns regarding Scripps/UCSD Interim Report 2021

1. Health and legal imperatives. The SAG disagrees with assertions within this report that minimize the health and legal importance of PM2.5 and PM10 associated with mineral dust. From a health perspective, PM2.5 and PM10 are known to cause deleterious health impacts regardless of their chemical composition. From a legal perspective (and related to the known health impacts), federal and state PM concentration standards do not distinguish between constituents, nor does the SOA. For these reasons, the SAG argues for the urgent need to

continue to reduce ambient PM_{2.5} and PM₁₀ concentrations at Oceano Dunes regardless of the specific breakdown of PM constituents.

2. Effects of OHV on PM emissions. The SAG disagrees with assertions within this report that minimize the effect of OHV on PM₁₀ emissions at the ODSVRA and PM₁₀ concentrations at receptor sites downwind. By citing a lack of significant difference between weekday and weekend airborne PM₁₀ concentrations as evidence for a lack of OHV impact on PM₁₀, the report perpetuates the misconception that OHVs produce PM emissions primarily through mechanical action at their time of operation. Instead, the primary effect of OHVs is to degrade dune surfaces and to increase the long-term PM emissivity of the dunes. Eventually, removal of OHVs should reduce PM₁₀ emissions and concentrations, but this adjustment would occur over a matter of months, not days. The recent Desert Research Institute (DRI) report, “Examining Dust Emissions and OHV Activity at the ODSVRA,” presents strong evidence, based on years of data collection, for this understanding of effect of OHVs.

3. Analyses and interpretations. The SAG is not convinced by analyses within this report that lead to the conclusion that only a small percentage of overall ambient PM is composed of mineral dust. The SAG does not dispute the raw values reported regarding filter sample gravimetric masses, nor does the SAG question the quality of the X-ray Fluorescence (XRF) analyses used to determine raw elemental compositions. However, the SAG is concerned that the determination of mineral dust contribution rests on a series of untested assumptions regarding the interpretation of XRF analytical results. In addition, there appears to be a wide discrepancy between the dust speciation findings reported in this study as compared to speciation findings from the San Luis Obispo County Air Pollution Control District (APCD). The SAG encourages the authors of this report to coordinate with APCD to share and compare data across studies to identify differences in analyses and interpretations that may be leading to these discrepancies.

Conclusion

The SAG expresses major concerns with the current Scripps/UCSD study and cautions against its use to inform air quality management decisions at the ODSVRA. Despite these concerns, the SAG acknowledges the potential value of data from the May 2021 aerosol measurements along with data from previous Scripps/UCSD studies. The SAG encourages the authors of this study to coordinate with APCD staff to share and compare data across studies toward developing a robust and scientifically-justified understanding of PM₁₀ sources that is consistent across studies.

Respectfully,
The Scientific Advisory Group

Dr. Raleigh Martin (Acting chair of SAG); Dr. William Nickling; Dr. Ian Walker; Ms. Carla Scheidlinger; Mr. Earl Withycombe; Mr. Mike Bush, Dr. John A. Gillies

Appendix 1: Reviews from Individual SAG Members

Reviewer 1

(p. 2, Background, 1st paragraph, 5th sentence) The fact that there is a lack of difference between weekday and weekend coarse particle emissions does not support the hypothesis that “natural” sources predominate over “anthropogenic” sources. Instead, it suggests that windblown sources predominate over mechanically-generated sources of dust emissions. Windblown sources include those that are entirely natural, such as undisturbed sand dunes outside the riding area at ODSVRA, and those that are anthropogenic, such as sand dunes disturbed by riding activities. DRI emissivity testing demonstrates that riding-disturbed dunes produce twice as much windblown dust as undisturbed dunes.

(p. 2, Background, 1st paragraph, 6th sentence) Supermicron particulate matter between 2.5 and 10 microns in size has been identified by U.S. EPA in assessments of health effects studies to contribute to increases in thoracic flow resistance and heart rate variability, among other impacts, regardless of elemental or chemical composition. It is on the basis of such studies that U.S. EPA maintains the PM₁₀ ambient air quality standard to protect public health. Statements to the effect that windblown sand particles in the coarse particulate size range do not contribute to chronic respiratory effects are erroneous.

(p. 3, last paragraph, 1st sentence) U.S. EPA has designated PM_{2.5} to be an air pollutant harmful to public health, regardless of elemental or chemical composition. To suggest that the association of PM_{2.5} with detrimental health effects may be without foundation is erroneous.

(p. 4, first partial paragraph, last sentence) Assessing the portions of PM_{2.5} deriving from windblown dust or combustion emissions is irrelevant as to whether PM_{2.5} is responsible for adverse health effects. U.S. EPA’s several assessments of health effects resulting from PM_{2.5} exposure – regardless of elemental or chemical composition – are comprehensive and consistent.

(p. 8, first paragraph) The mineral dust component of filter samples collected on high-PM₁₀ days is reported to range from 2% to 32%, and average 14% with a standard deviation of 14%. In 2020, the SLOAPCD collected eight filter PM₁₀ samples at the CDF monitoring site on windy days between April 23 and September 24, which were analyzed by XRF by the Desert Research Institute. Using the IMPROVE protocol for isolating the geological component of mass ($2.2 \times \text{Al} + 2.49 \times \text{Si} + 1.63 \times \text{Ca} + 2.42 \times \text{Fe} + 1.94 \times \text{Ti}$), the average geological component was found to be 43.5% with a standard deviation of 10.2%. Because of these significantly different results, it would be useful for Scripps and SLOAPCD to exchange raw data in an attempt to resolve these differences in analytical results.

(p. 9, first paragraph) The mineral dust component of PM_{2.5} filters collected on high-PM₁₀ days is reported to average 27% by VSCC inlet and 19% by SCC inlet. Typically, the geologic component is predominately higher in PM₁₀ samples than in PM_{2.5} samples as the mean particle size of windblown dust is about 4 microns. These results suggesting that the geologic component is higher in the PM_{2.5} fraction than in the PM₁₀ fraction at the CDF monitoring station are unusual and warrant an explanation.

(p. 13, Figure 3) The labeling of the difference between BAM and PM₁₀ filter measurements as “Semivolatile” is speculative in the absence of further testing. The positive identification of only 18% of PM₁₀ mass results in very limited information with respect to the composition of PM₁₀ measured at the CDF monitoring station.

(p. 13, Conclusions, first paragraph, last sentence) The statement that results of this study were consistent with the chemical composition reported by the SLOCAPCD in its Nipomo Mesa Particulate Study (Phase 1) is misleading in that the Phase 1 study analyzed only total mass, sulfate, nitrate, and chloride values in PM₁₀ samples collected at the CDF monitoring site. As the Scripps study did not analyze sulfate, nitrate, and chloride contributions at CDF, there is almost no overlap in the constituents measured in the two studies with respect to samples collected at CDF.

(p. 14, first paragraph, first sentence) The statement that dune-derived mineral dust is more likely to be primarily caused by natural forces (i.e., wind) rather than human activities ignores the results of dune emissivity testing conducted almost annually since 2013 by the Desert Research Institute which shows riding-disturbed dunes are twice emissive as non-disturbed dunes at ODSVRA. These results demonstrate that human activity on the dunes is responsible for roughly 50% of windblown emissions of PM₁₀ from the riding area.

(p. 14, second sentence, second paragraph) The statement that a substantial fraction of PM_{2.5} was not associated with fossil-fuel combustion emissions ignores the failure in the paper to identify the composition and sources of 63.6% of total mass on PM_{2.5} samples collected on high PM₁₀ days.

Reviewer 2

(p. 2, Background, first paragraph, 6th sentence, “as well as by source areas”) Not clear what this means. How the source area increase emission?

(p. 2, Background, first paragraph, 7th sentence) But they have been associated with negative impacts on human health. See literature cited by SAG in review of last report.

(p. 3, first partial paragraph, first full sentence) Where is this in reference to?

(p. 3, last partial paragraph, first sentence) What about research that links mineral particle inhalation with an asthmatic response?

(p. 4, first partial paragraph, last sentence) The opinion stated (still) does not mean that under current laws, that standards are not to be met. In addition, the focus on PM_{2.5} does not allow for the setting aside of the SOA's intent to control PM₁₀.

(p. 7, bullet 1a) What does SIO stand for?

(p. 13, Figure 3 caption) No analytical measurements were carried out other than XRF. So doesn't that make the apportionment rather " cursory"?

(p. 13, Conclusions, first paragraph, last full sentence) On high PM days with winds from the west (292-ish degrees), what are the likely sources for the cited sources that cannot originate from the Ocean environment (ammonium nitrate, non-sea salt sulphate, other semi-volatile species)?

(p. 14, second full paragraph) There has been no recent debate on the source of the PM10 being generated by saltation processes driven by the wind. The recent analysis and reporting of DRI we suggest (the SAG) provide compelling data that demonstrates the OHV activity augments the emissivity of the dunes (PI-SWERL data). DRI and APCD data show that cessation of OHV activity in 2020 resulted in lower PM10 for the same wind conditions, suggesting that the dunes are becoming less emissive following the removal of OHV activity.

(p. 14, third full paragraph) This final paragraph again sets aside that the fact that the SOA is in place to lower PM10 and does not address the toxicity of the particles, regardless of the size.

Reviewer 3

I am not qualified to review the methods and some of the conclusions, but one of the conclusions stood out to me. Namely this:

"The association of high PM10 and PM2.5 with high wind conditions, even when recreational vehicles were limited at Oceano Dunes compared to prior years, indicates that dune-derived mineral dust is more likely to be primarily caused by natural forces (i.e. wind) rather than human activities."

It seems to me that the results of the DRI study conducted on riding vs. non-riding areas would cast a lot of doubt on this conclusion. The DRI work demonstrated that the riding activity itself MODIFIED the sand surfaces in such a way as to make them more emissive, even when vehicles were not present. I don't think we dispute that it is wind that mobilizes dust. But it seems clear from the DRI work that the vehicles make surfaces more emissive of dust when those surfaces have been worked by vehicle activity.

Whatever other conclusions the paper promotes, this one should be flagged as not supported by the data.