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To: Daphne Greene and Phil Jenkins, Off-Highway Motor Vehicle Recreation Division

From: Chris Dugan

Date: November 2, 2011

Re: New Information on Oceano Dunes SVRA Vehicle Activity and downwind PM10 that affects Rule 1001

## Introduction

The San Luis Obispo County Air Pollution Control District (APCD) is proposing Rule 1001, Coastal Dune Dust Control Requirements, which requires the operator of a coastal dune vehicle activity area to minimize emissions of inhalable, coarse particulate matter (PM) with an aerodynamic diameter between 2.5 and 10 microns, or PM10, from the area under its control. The presumed need for this rulemaking activity is primarily based on findings published by the APCD in its South County Phase 2 Particulate Study (APCD 2010, hereafter referred to as Phase 2 Study).

This memo summarizes new information for the California State Parks Off-Highway Motor Vehicle Recreation Division (CSP) to consider regarding vehicle activity at Oceano Dunes State Vehicular Recreation Area (Oceano Dunes SVRA) and PM10 concentrations measured downwind and in the vicinity of Oceano Dunes SVRA. This information includes data and information that affects the purpose and need for, and feasibility of, Rule 1001, particularly the proposed Air Pollution Control Officer-approved PM10 monitoring network contained in this rule.

## New Data and Evidence

New data demonstrates there was no direct correlation between Oceano Dunes SVRA vehicle activity and measured PM10 concentrations on the Nipomo Mesa from April 1, 2009 to June 30, 2011; new information recently supplied by the APCD, suggests Figure 3.54 of the Phase 2 study depicts uncorrected EBAM PM10 concentrations for the Oso south control site, thereby under-reporting PM10 concentrations at this control site by approximately 30 percent. This information is summarized below.

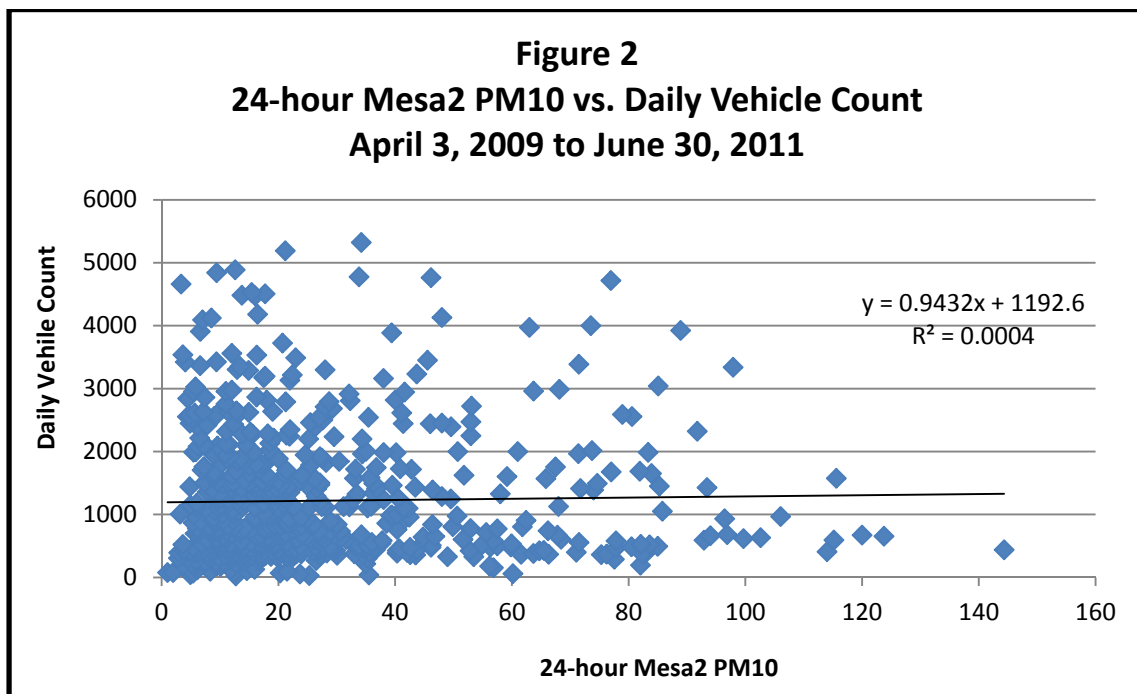
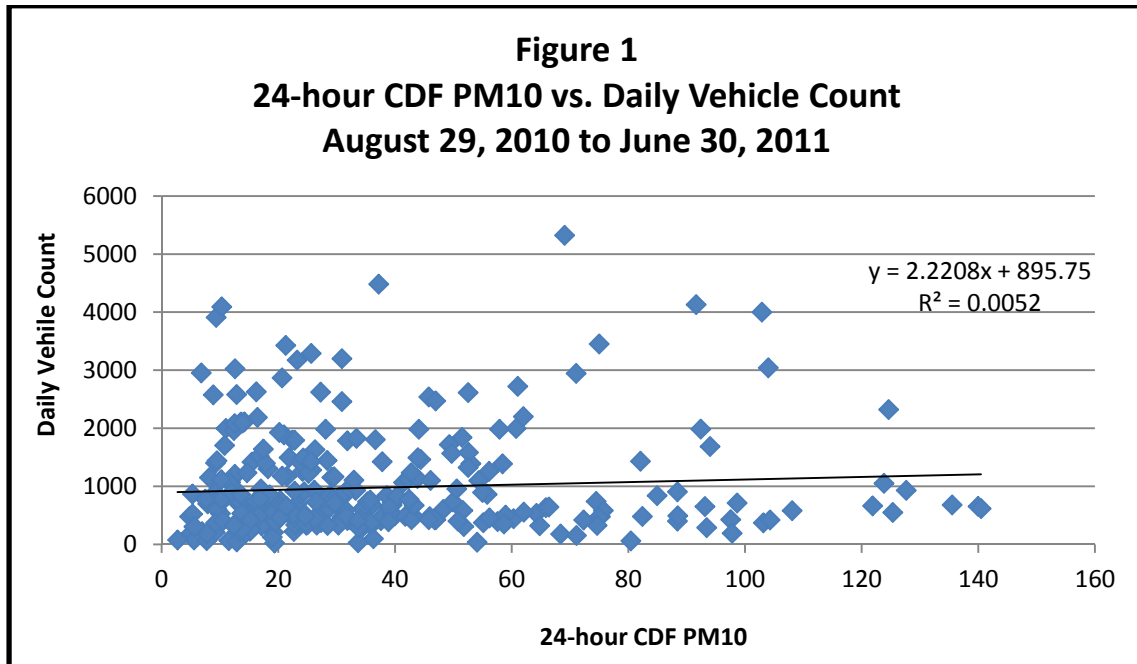
### **1. New data from April 1, 2009 to June 30, 2011 demonstrates there was no direct correlation between Oceano Dunes SVRA vehicle activity and measured downwind PM10 concentrations during this time.**

Notably, the Phase 2 Study did not find a strong direct association between Oceano Dunes SVRA vehicle activity and downwind PM10 concentrations during the April 1, 2008 – March 31, 2009 study time period (APCD 2010 3-52, 53). New data for the time period April 1, 2009 to June 30, 2011 continues to demonstrate that there is no direct association between Oceano Dunes SVRA vehicle activity and downwind PM10 violations.

Although the time period April 1, 2009 to June 30, 2011 represents an 820-day timeframe, gaps in the monitoring data collected at the APCD's CDF and Mesa2 monitoring stations reduce the amount of publicly available data coverage for this time period to approximately 300 days at CDF and 640 days at Mesa2. All PM10 data was obtained through the California Air Resources Board's Air Quality and

*Conservation Planning and Implementation* ○ *Environmental Impact Analysis*  
*Geographic Information Systems* ○ *Wetland Delineation* ○ *Biological Surveys*

Meteorological Information System, AIRS Nos. 060792007 (CDF) and 060792004 (Mesa2) (ARB 2011a and 2011b). Figures 1 and 2 compare daily Oceano Dunes SVRA vehicle counts versus the 24-hour average PM10 measurements made at CDF and Mesa2 during this time. The R-squared value, or the magnitude of the variation in one variable that is proportional to the variation in another variable, for the CDF and Mesa2 data is approximately 0.5 and 0.04 percent, respectively, meaning vehicle activity cannot be used to accurately predict downwind PM10 concentration because its effect on downwind concentrations is miniscule (R-squared values approaching -1 and 1 indicate a stronger correlation between actual and predicted measurements).



The Phase 2 Study also examined potential differences in 24-hour average PM10 concentrations during high and low vehicle activity days, finding statistically significant results for mean Mesa2 PM10 concentrations only. TRA Environmental Sciences (TRA) submitted comments to the APCD for consideration on May 18, 2010 that demonstrated this analysis was based on unpublished, incorrect data that contained substantial formulaic errors and misuse of statistical tests for significance (TRA 2010). To date, we are not aware the APCD has responded to these comments. TRA is unclear as to whether the lack of a response signifies APCD staff has accepted these comments as correct. Regardless, TRA is providing additional, new information as an update to our previous comments.

Lumping and comparing high and low vehicle activity days, as was done in the Phase 2 Study, ignores the majority of the daily vehicle activity data that has the least variability from the sample mean and that also contributes to the overall association, or lack thereof, with downwind PM10 concentrations. Even assuming this type of analysis could be used to look for an association, as Table 1 shows, a Student T-Test performed on the data from April 1, 2009 to June 30, 2011 demonstrates that the difference between the mean downwind PM10 concentrations at CDF (n=74) and Mesa2 (n=161) for the highest and lowest 25 percent of Oceano Dunes SVRA daily vehicle counts is not statistically significant at the P=.05 level.

**Table 1**  
**Average PM10 Concentration for Highest and Lowest 25% of Vehicle Activity Days**

Scenario	Number of Days above PM10 Standard / Daily Average Vehicle Count		24-Hour Average PM10 Concentration	
	CDF	Mesa2	CDF	Mesa2
Highest 25%	17 days / 2,215 vehicles	23 days / 2,698 vehicles	37.6	27.2
Lowest 25%	21 days / 285 vehicles	20 days / 326 vehicles	32.4	24.2
Difference	-4 days / 1,930 vehicles	3 days / 2,372 vehicles	5.2	3.0
Statistical Confidence (1-P)			88.6%	88.4%

Table 1 indicates the number of days where the 24-hour average PM10 concentration exceeded 50 µg/m<sup>3</sup> at CDF was lower for high vehicle activity days than for low vehicle activity days. The converse is true for Mesa2. Table 1 also indicates that differences in the PM10 concentrations between high and low vehicle activity days presented in Table 1 have a less than 95 percent chance that they are not the result random variation in measurements. The fact that this biased test demonstrates the lack of a statistically significant difference between high and low visitation days provides evidence that measured downwind PM10 levels are not directly related to daily Oceano Dunes SVRA vehicle activity.

To further emphasize this point, Table 2 ranks and compares, by day, the average vehicle activity and downwind PM10 data for the 282 days since April 1, 2009 when both CDF and Mesa2 were concurrently operating.

**Table 2**  
**Average PM10 Concentration for Highest and Lowest 25% of Vehicle Activity Days**

Day	Average Vehicle Count	24-Hour Average PM10 Measurement	
		CDF	Mesa2
Tuesday	539	34.5	24.5
Wednesday	590	37.6	27.7
Monday	619	38.5	26.4
Thursday	733	37.9	27.1
Sunday	1,268	33.7	22.4
Friday	1,343	39.6	29.7
Saturday	1,945	30.5	21.1

Note that Table 2 indicates the lowest 24-hour average PM10 measurements from more than 275 days worth of data were observed on Saturday, the day with most vehicle activity data.

**2. New information suggests Figure 3.54 of the Phase 2 Study depicts uncorrected EBAM PM10 concentrations for the Oso south control site, thereby under-reporting PM10 concentrations by 33 percent.**

The Phase 2 Study discloses that APCD staff made two corrections to wind speed data and PM10 measurements recorded at the Oso south control site. First, using the power law to correct for differences in recorded wind speed heights, two-meter Oso wind speeds were multiplied by 1.259 to approximate ten-meter wind speeds (APCD 2010 3-22). Second, to ensure PM10 measurements made at Oso with a non-Federal Reference Method (FRM) EBAM monitor would be comparable to PM10 measurements made at Mesa2 with a FRM TEOM monitor, Oso EBAM PM10 monitors were collocated with the Mesa2 TEOM PM10 monitor, resulting in the application of a single correction factor to all EBAM data when winds were greater than 10 miles per hour (mph) (APCD 2010 3-21, A-5).

These correction factors affect the data the APCD published as part of its Phase 2 Study. We are only able to provide this analysis now, however, given APCD only provided the requested raw data files from the Phase 2 Study containing the wind speed and PM correction factors on October 17, 2011. (File ~9361228.xlsx)

The applied correction factors most notably affect Figure 3.54 of the Phase 2 Study, which is reproduced below (APCD 2010 3-43). Note that average Oso PM10 concentration is approximately 90  $\mu\text{g}/\text{m}^3$ , but clearly below 100  $\mu\text{g}/\text{m}^3$ .

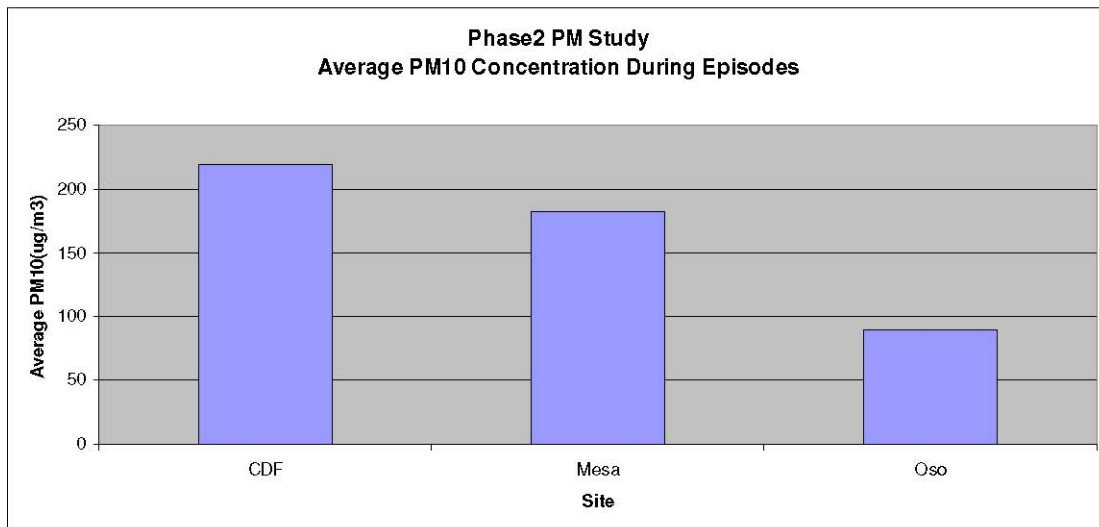
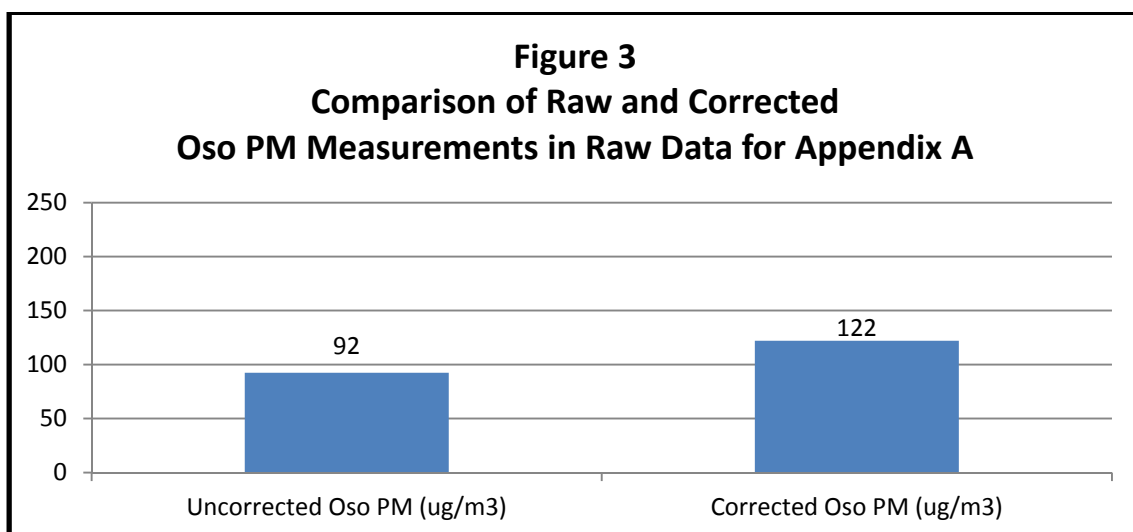


Figure 3.54 – Comparison of Average Downwind PM10 Concentration During Episodes

The Phase 2 Study identifies four steps that were taken to focus comparisons of downwind PM10 concentrations and produce Figure 3.54 above: 1) Days where the 24-hour average PM10 concentration at Mesa2 exceeded 50  $\mu\text{g}/\text{m}^3$  were identified as “episode” days; 2) data from episode days was manually examined to exclude hours where the PM10 concentration was below 50  $\mu\text{g}/\text{m}^3$ ; 3) data from episode days was manually examined to exclude hours when winds were calm; and 4) data from episode days was manually examined to exclude hours when winds did not pass over open sand sheets.

A review of the raw data file provided by the APCD on October 17, 2011 suggests that Figure 3.54 incorrectly depicts Oso average PM10 concentrations. By following the four steps listed above, the raw Appendix A data provided by the ACPD yields Figure 3 as follows:



Since the Phase 2 data does not explicitly list all of its assumptions, the above graph assumes “calm” winds are winds less than two mph and winds from the west-northwest and northwest pass over open sand sheets (280 – 320 degrees). Changing these underlying assumptions slightly (i.e., winds from 270 – 330 degrees or 300 – 330 degrees) does not change the fact that the raw data for Appendix A of the

Phase 2 Study provided by the APCD indicates that only uncorrected, Oso PM10 values averaged less than 100  $\mu\text{g}/\text{m}^3$  during Mesa2 episode days. Corrected Oso PM10 values averaged more than 100  $\mu\text{g}/\text{m}^3$  during these times. As shown in Figure 3 above, the difference between uncorrected and corrected Oso PM10 values is as much as 30  $\mu\text{g}/\text{m}^3$ , or approximately 30 percent of the Oso PM10 values reported in the Phase 2 Study. While this value is still lower than the CDF and Mesa2 PM10 values presented in Figure 3.54 of the Phase 2 study, it does indicate that the Phase 2 Study may have erroneously presented Oso PM10 concentrations, which directly affects the ability to monitor potential differences in PM10 downwind of sand sheets that are and are not open to vehicle activity.

## Conclusions

The Phase 2 study concluded that “open sand sheets disturbed by OHV activity emit significantly greater amounts of particulates than undisturbed sand sheets under the same wind conditions.” The APCD has used this finding to develop draft Rule 1001, at the heart of which is a Particulate Matter Reduction Plan (PMRP) and a PM10 monitoring program. Rule 1001 presumes this PM10 monitoring program will be able to detect differences in PM10 concentrations downwind of sand sheets open to vehicle activity and sand sheets that are not open to vehicle activity and thus guide the successful implementation of the PMRP. The new data and evidence summarized above, however, suggests this assumption is not true. PM10 concentrations downwind of sand sheets not open to vehicle activity may be higher than previously estimated, and there is no direct relationship between vehicle activity and downwind PM10 concentrations, making any monitoring program subject to natural or other yet unidentified phenomena that cannot be attributed to Oceano Dunes SVRA vehicle activity. We are concerned about using such a monitoring program as a basis for rulemaking activity.

## References

- APCD 2010. San Luis Obispo County Air Pollution Control District (ACPD). *South County Phase 2 Particulate Study*. San Luis Obispo, CA. February 2010.
- ARB 2011a. California Air Resources Board (ARB). “Air Quality Data Query Tool.” *Air Quality and Meteorological Information System*. ARB. April 30, 2010. Web. October 2011.  
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