SLO COUNTY apcd | Air Pollution Control District
San Luis Obispo County

July 10, 2013

Mr. Phil Jenkins, Chief
OHMVR Division
CA Department of Parks & Recreation
1725 23rd St., Ste. 200
Sacramento, CA 95816

SUBJECT: Conditional Approval of the Oceano Dunes State Recreational Vehicle Area (ODSVRA) Particulate Matter Reduction Plan (PMRP), March 29, 2013 Version

Dear Mr. Jenkins:

Thank you for submitting the ODSVRA Particulate Matter Reduction Plan (PMRP), Third Draft, dated March 29, 2013. APCD staff have reviewed the document and still have concerns regarding some elements of the proposed Plan, as outlined in Attachment 1. Chief among those concerns is the lengthy timeframes proposed before any control measure implementation begins due to State Parks' desire to conduct a comprehensive monitoring program prior to deciding where and what controls will be installed. We believe earlier control measure implementation is essential to enhance the overall effectiveness of the controls and achieve timely reduction of emissions and downwind particulate levels. Thus, Attachment 2 provides a discussion developed by Dr. Chatten Cowherd, of the Midwest Research Institute, describing the typical process used to evaluate and decide on the type, scope and location of appropriate control measures for reducing sand transport and particulate emissions. We hope you will find this helpful.

We believe the concerns raised in Attachment 1 can and should be addressed and resolved as the Coastal Commission permitting process unfolds. In particular, we recommend State Parks seek the input of key oversight agencies and other stakeholders on measures that can reduce sand movement in near shore areas, such as re-establishment of vegetated foredunes in the areas where they have been destroyed by vehicle activity. State Parks own studies show such measures are essential to reduce the energy of the strong onshore winds that impede successful establishment of vegetation further inland to reduce sand transport. Providing upwind surface roughness was also shown in the pilot projects to reduce sand movement and thus reduce the potential for downwind particulate emissions. Based on those studies, we believe implementing near-shore controls could significantly reduce the amount of acreage that may otherwise be needed for control measure installations further inland to achieve the same level of effectiveness.

Nonetheless, the PMRP is State Parks' Plan for complying with Rule 1001, not APCD's. You have the latitude under the Rule to implement the control measure approach you believe will most effectively meet the requirements of the Rule. Ultimately, however, you are responsible for meeting the performance standard in Section C.3 of the rule when it becomes effective on May 31, 2015. If implementation of the PMRP fails to meet that standard, it will further jeopardize the health and welfare of all downwind residents and the ability of APCD to meet state and federal mandates to attain the health-based air quality standards for particulate matter. Thus, the importance of the PMRP control strategies effectively reducing particulate emissions from the dunes in a timely manner cannot be overstated.

With that said, we conditionally approve the March 29, 2013 version of the ODSVRA Rule 1001Draft PMRP subject to the following exceptions and conditions:

1. Comply with the conditionally approved Monitoring Site Selection Plan.
2. Obtain Air Pollution Control Officer (APCO) approval of the PM_{10} monitoring network required by Rule 1001.C.2.a
3. Install and begin operation of the PM10 monitoring network by July 31, 2014.

Please note that Rule 1001 requires Air Pollution Control Officer approval of the final monitoring site locations. Thus, State Parks should not proceed with installing any monitoring equipment required under Rule 1001 prior to obtaining such approval for the site location and measurement methods.

Please call me at (805) 781-5912 if you have any questions or concerns regarding this conditional approval of the PMRP or any other aspect of Rule 1001 implementation.

Sincerely,

Larry R. Allen
Air Pollution Control Officer

cc: Board of Directors, San Luis Obispo County Air Pollution Control District
General Anthony Jackson, California Department of Parks & Recreation
Chris Conlin, California Department of Parks & Recreation, OHMVR Division
Dan Carl, California Coastal Commission
Richard Corey, California Air Resources Board
Deborah Jordan, U.S. EPA Region 9

ATTACHMENT 1

APCD Comments and Concerns Regarding the ODSVRA Particulate Matter Reduction Plan, Third Draft, submitted on March 29, 2013

1. The PMRP still retains as its primary focus the implementation of a comprehensive and lengthy temporary air monitoring program, with the emphasis on gathering significant amounts of data before any control measures are implemented. Given the length of time proposed for monitoring, it does not appear that control measure implementation will likely begin before mid-to-late 2014; this would significantly jeopardize the ability of such control measures to have enough lead time to provide the particulate emission reductions needed to meet the performance standard of the rule. We believe it imperative to begin control measure implementation well before that timeframe to ensure their effectiveness, particularly for revegetation projects that take substantial time to become established and provide the coverage needed to reduce sand transport.

2. The PMRP indicates that sand flux measurements and Pi-Swerl data will provide the primary information base for determining appropriate type, scope and location of control measures to be implemented. APCD has stated on numerous occasions our serious reservations about the viability and reliability of Pi-Swerl technology based on its previous performance in the pilot project and elsewhere. In particular, for Pi-Swerl measurements in non-riding areas, the very act of placing the device on the ground will artificially disturb any stabilized sand surface or fragile crust that may be present, reducing the stability it provides to the underlying sand particles and potentially increasing the emissivity measured by the device. Thus, we view your inclusion of actual sand flux measurements in this version of the Plan as an essential element and welcomed its addition to your monitoring program.

   In his September 24, 2012 paper addressing the previous draft PMRP, Dr. Chatten Cowherd identified the importance of sand flux measurements for quantifying the sand flux rates that must be accommodated by the dust controls so the frequency of control implementation can be projected. Dr. Cowherd's comments in Attachment 2 also describe the "inverse modeling" method as the most effective methodology for identifying the most emissive areas where application of control measures is the highest priority. This method is embodied in USEPA's OTM 30: "*Method to Quantify Particulate Matter Emissions from Windblown Dust*". Both Dr. Cowherd and Dr. Gillies of DRI were part of an independent panel that reviewed OTM 30 and jointly concluded it was the best available approach in dealing with typically non-uniform sources of wind erosion. This method relies on the use of sand catchers and Sensits to provide the sand flux measurements needed to perform the analysis.

   Unfortunately, your recent decision not to conduct the sand flux measurements described in the Plan removes this essential data source from consideration and is inconsistent with the Plan you have submitted for approval. While we will not require the sand flux measurements to be conducted as part of our approval of the plan, we do consider the lack of such data to be a large hole in your monitoring effort that will diminish the ability to draw meaningful conclusions from the other data collected.

3. Section 3 of the PMRP describes potential control measures under consideration and the process to be used in determining what, how and where measures are to be applied. Section 3.1.1 describes potential implementation of vegetation projects, with the caveat that installing vegetation adjacent to existing vegetated areas has a higher incidence of success than planting in open sand areas where increased exposure to wind and sand movement can preclude successful establishment of the plants. You reference the CGS 2007 Vegetation Island Study to support this statement without mentioning another primary and highly relevant conclusion in that same study: that re-establishment and stabilization of foredunes is a critical element for establishing vegetation further inland due the ability of the foredunes to substantially reduce the energy of the winds coming off the ocean and subsequent sand transport further inland. This was successfully demonstrated in reestablishing the foredunes northwest of Oso Flaco Lake and is described in detail in the 2007 CGS study.

As mentioned in our cover letter, we believe re-establishment of vegetated foredunes, particularly in the Le Grande tract area, to be a key dust control strategy that is missing from this PMRP. This important strategy is supported by your own studies and seems to be a critical component for ensuring the success of any dust control measures implemented in the SVRA. We strongly recommend considering this for inclusion in the control measures you implement.

Standard Approach to Characterizing Large Wind Erosion Sources for Purposes of Control Application

Prepared by Chatten Cowherd, Ph.D.
June 26, 2013

Introduction

This analysis of the standard approach to wind erosion source and control characterization is intended to be applicable to a wide range of applications of cases where saltation is the driving force for fine particle emissions during high wind events. The methodology is directly applicable to the Oceano Dunes SVRA Dust Control Project.

Problem Characterization

Wind erosion sources of PM_{10} emissions are particularly difficult to characterize because of the variations in the emission rate in time and space across the source, due to (a) variations in the wind speed and associated shear stress and (b) variations in surface texture and exposure to the wind, taking into account the effects of topography and groundcover. It is well known that the generation of fine particle emissions is driven by saltating (bouncing) sand-sized particles that sandblast the ground surface. Collisions of sand with the ground surface dislodge fine particles that otherwise are bound to larger particles.

The horizontal movement of saltating sand is confined to an air layer of about 1-m depth above the eroding surface. The mass transport of saltating sand follows a consistent profile from the ground to the top of the saltation layer, so that measurement at a reference height (typically about 15 cm above ground level) can be used to project the total horizontal movement of saltating particles within the saltation layer.

Because wind erosion is typically non-uniform across an eroding area, the source characterization process starts by gathering evidence on the distribution of emissions across the source area, with special attention directed to finding the most emissive subareas. This is initiated by observing visible emissions during high wind events (including videos from elevated vantage points) coupled with analysis of measurements from air quality monitoring stations impacted by wind generated dust plumes. Any patterns of surface disturbance by vehicular activity or other phenomena that disturb the ground surface are also factored into the process. This is followed by inspection of emissive ground areas (between high wind events) for depth of loose sand and for scoured areas that may extend down to a subsurface "hard pan" that is resistant to wind erosion.

The control of wind erosion should focus on the areas (reservoirs) of loose sand that drive the generation of fine dust along downwind trajectories. Near the upwind boundary of the source area, reservoirs of loose sand may be formed by intrusion from upwind sources. Accumulations of loose sand can also be created by deposition of saltating sand on the leeward side of obstacles to the wind, including topographical features and protruding groundcover. In addition, the reservoirs of loose sand can be re-configured by the action of vehicle activity that grinds and pushes sand into furrows along the routes of travel, as would be the case with off-road recreational vehicles traveling over sand dunes.

Establishment of a Recognized Assessment Methodology

Years of debate about the best approaches to this problem have led to wide recognition of the "inverse modeling" method as the most effective methodology for identifying the most emissive areas where application of control measures is the highest priority. This method is embodied into USEPA's OTM 30: "Method to Quantify Particulate Matter Emissions from Windblown Dust." OTM 30 has been the basis for successful dust control on Owens (Dry) Lake, which had been the largest known source of dust emissions in the U.S. It utilizes atmospheric dispersion modeling to assign culpabilities to emitting subareas, such that the observed overall impacts on perimeter air quality monitors during high wind events are best explained.

OTM 30 recognizes the necessity to differentiate among the non-uniformities in the emissivities of sub-areas that comprise a large area of wind-generated dust emissions. The key to this investigative process is deploying monitors that provide an independent measure of emitting activity during a high wind event. Because saltation is the driving force for wind erosion, OTM 30 recommends spatially distributed saltation monitors (e.g., Cox Sand Catchers and Sensits) that track saltation activity across the eroding source area during a high wind event. A series of spatially specific proportionality constants (K-Factors) between saltation rate and PM_{10} emission rate are derived by comparing modeled to observed air quality across the monitoring network. Once the emitting activity is appropriately assigned to source sub-areas, to get the best match between modeled and observed air quality, decisions on the most cost-effective deployment of dust controls can be made. Simply stated, the emitting sub-areas are preferentially controlled in order of emissivity.

OTM 30 has enabled a 90% reduction in PM10 emissions at Owens Lake by controlling emissions across 45 sq. mi. out of the 110 sq. mi. area of the lake bed, but this required a large array of CSCs and Sensits as well as multiple wind instruments that could track shifts in plume direction over large transport distances (up to 20 miles). Because most wind erosion sources are much smaller than found at Owens Lake, most applications of OTM 30 are much more practical to implement as the size of the eroding area decreases. For example, OTM 30 uses an application to the beach areas of Mono Lake to illustrate the recommended methodology.

It should be noted that an independent panel of three recognized wind erosion experts concluded that OTM 30 was the best available approach in dealing with typically non-uniform sources of wind erosion. No changes in the approach were recommended other than adding more coverage of saltation monitors and ambient monitors to complete the last stages of cost-effective emission control, which are always more difficult than earlier stages. Based on endorsements from USEPA and the independent panel of wind erosion experts for Owens Lake, it would seem that area source wind erosion assessment and control should begin with OTM 30 as a benchmark, with detailed justifications provided for any deviations from that approach.

Optimization of Wind Erosion Control

The objective for cost-effective wind erosion control is to stop the movement of saltating sand. In fact, the effectiveness of candidate wind erosion controls is typically measured in terms of reduction in saltation rate. Generally it is impractical to achieve control by covering large areas of loose sand with a woodmulch or other non-erodible material, because of the size of such areas. In addition there is a strong risk that such protection could be rendered useless because of the likelihood of sand deposition from missed upwind sources of saltating sand during a high wind event. It is far more practical and effective to build barriers (e.g., 6-ft high berms) that capture saltating sand immediately downwind of known source areas. When such barriers fill with sand on the windward side, they can be rolled directly onto the sand accumulations, thereby forming a larger barrier with even greater capacity. This eliminates the need for recovering and transporting large quantities of captured sand to other locations. Once the movement of saltating sand is contained, programs to re-vegetate protected bare ground areas can be pursued with much greater promise of success as a long-term control measure.

In deploying sand barriers most effectively, the goal is to control the largest sources of saltating sand in order of reservoir size. Another consideration is to configure the barriers so that they do not impede desired activities such as vehicle movement as in the case of recreational vehicles in sand dune areas. This requires a detailed analysis of traffic patterns (routes and volumes). Such considerations regarding vehicular traffic are found in many other wind erosion source applications as well (e.g., construction and agriculture).

Enhancements from Transect Analysis

Regarding the emission characterization of open sources such as wind erosion, the use of transect analysis as an investigative tool has become recognized as much more cost-effective than dealing strictly with fixed-point monitoring. Typically, the high cost of fixed point monitoring limits the deployment of monitors in relation to the desired coverage, making it difficult to characterize source impacts and culpabilities.

Transect analysis uses continuous mobile monitoring (along with area-wide wind monitoring) to characterize plume structure by moving roughly at right-angles to the wind direction at a relatively consistent travel speed. A monitoring intake height of 2 m above the test vehicle avoids the impacts of dust generated by the vehicle itself. Moreover, it is not necessary to utilize reference-method samplers in transect monitoring, because the typically large observed variations in PM_{10} concentration across dust plumes are not masked by modest inaccuracies in the less expensive and more rugged continuous monitors used for this purpose. Mobile monitoring provides crosswind characterization of plume structure that is very revealing with regard to identifying the most emissive source areas. In addition, repeated transects will reveal the trends in emissions and potential shifts in emissive hot-spots during a high wind event. More refined sampling and monitoring analyses targeting the most emissive areas can then be performed.

Typical Path to Air Pollution Control

In dealing with open (non-ducted) source problems, as with many other scientific investigations, the most productive path typically proceeds from the general to the specific. Typically in air pollution control, the assessment process begins by focusing on directly observable source characteristics and associated macro-features that characterize the most emissive areas (hot-spot analysis). In the case of wind erosion sources, this would include obvious differences in surface texture, ground cover, topography and activities such as traffic that mechanically disturb the surface. If gross features can be used to inform source characterization, there is little value in proceeding to detailed scientific analysis of sub-features that require extensive time and effort in data collection and analysis. In other words, it makes sense to move from the general to the specific, and find what can be learned most quickly and inexpensively. Historically this is what has been done in addressing fugitive dust sources, focusing on development of emission factors that relate source activity to emission rate and enable the development of emission inventories based on emission factors and source activity analysis. In turn, the emission inventory is input into dispersion modeling to assess the source impacts on air quality and to determine the most cost-effective application of emission controls necessary to meet ambient air quality standards.

Summary

This above analysis of wind erosion source and control characterization is applicable to a wide range of cases where saltation is the driving force for fine particle emissions during high wind events. Such is the case for the Oceano Dunes SVRA Dust Control Project. The recommended methodology is based on OTM 30, which was developed and demonstrated over many years as the best approach in identifying the most emissive areas where application of control measures is the highest priority. In the early stages of investigation, direct observation of plumes and eroding surfaces, coupled with transect analysis, are productive in identifying the most emissive areas and the factors that contribute to emissivity including ground disturbances from vehicular traffic. This information is critical to informing the process for deploying ambient air and saltation monitors for a more detailed analysis of emissivity variations and optimal locations of control measures. Finally, the most cost-effective controls consist of small footprint berms of biodegradable materials that contain the movement of saltating sand and require the lowest level of maintenance activity until longer term surface stabilization by vegetation can be accomplished.