Appendix F

Attainment Demonstration
(Provided by ARB)

2015 Plan for the 1997 PM2.5 Standard
SJVUAPCD

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Appendix F: Attainment Demonstration (Provided by ARB)

F.1 OVERVIEW

The 2008 San Joaquin Valley (SJV or Valley) State Implementation Plan (SIP or Plan) reflected an attainment deadline of April 5, 2015 for the 15 µg/m^3 annual and 65 µg/m^3 24-hour $PM_{2.5}$ standards. Through ongoing implementation of the control strategy contained in the Plan, the Valley met the 65 µg/m^3 24-hour standard in 2010, and only a few locations remained above the 15 µg/m^3 annual standard as of 2012. However, meteorological conditions associated with the current drought resulted in unusually high $PM_{2.5}$ levels during the winter of 2013/2014. Due to nearly two months without rainfall, a majority of days during December 2013 and January 2014 recorded $PM_{2.5}$ concentrations greater than 35 µg/m^3, a nearly threefold increase over the prior winter. These elevated wintertime concentrations affected both 24-hour and annual average design values, especially in the central and southern Valley. As a result, the Valley will not meet the Moderate nonattainment area April 2015 attainment deadline.

This updated attainment demonstration provides for expeditious attainment of the standards under the assumption that these adverse meteorological conditions occur again in the future. The new attainment demonstration uses the fundamental chemistry and associated response of different $PM_{2.5}$ constituents to emission controls reflected in the approved modeling in the 2008 $PM_{2.5}$ SIP. This modeling science is coupled with air quality data reflecting the drought impacts, 2013 design values and $PM_{2.5}$ chemical composition, along with emission reductions expected through 2018 (24-hour standard) and 2020 (annual standard).

The attainment demonstration includes the benefits of ARB and District control programs that provide ongoing emission reductions. Continued implementation of these control programs provides new emission reductions each year, resulting in a forecasted 38 percent decrease in NO_x emissions and a five percent decrease in $PM_{2.5}$ emissions between 2012 and 2020.

The NO_x reductions result from ongoing implementation of both new vehicle standards for passenger and heavy-duty diesel vehicles and equipment, as well as rules accelerating the turnover of legacy diesel fleets. Implementation of stringent requirements for new off-road engines and in-use off road equipment lead to further NO_x reductions, along with District rules addressing stationary source NO_x emissions. $PM_{2.5}$ emission reductions result from ongoing implementation of diesel on- and off-road equipment measures as well as the District's recently strengthened rule for wood-burning fireplaces and heaters. These measures, along with additional reductions from enhancements to the District's commercial charbroiling rule slated for adoption in 2016 provide the necessary control strategy to bring the entire Valley into attainment of the 24-hour standard by 2018, and the annual standard by 2020 (Table 1 in Section D).

F.2 MODELING APPROACH

The attainment demonstration approach for the current SIP is based on modeling conducted for the 2008 $PM_{2.5}$ Plan, which addressed both the annual and 24-hour $PM_{2.5}$ standards. The atmospheric dynamics and associated response to emission reductions represented in this modeling, coupled with 2013 design values (DV) and chemical composition, was used to project future (2020 for the annual standard and 2018 for the 24-hour standard) design values. Photochemical modeling for the 2008 $PM_{2.5}$ SIP was conducted following the U.S. EPA guidance (2007 U.S. EPA)[1] and was approved by U.S. EPA in 2011 (76 FR 69896, 76 FR 41338). While subsequent modeling was conducted for the attainment demonstration for the 2006 24-hour $PM_{2.5}$ standard of 35 $\mu g/m^3$, this effort was based on modeling conducted only for the first and fourth quarters of the year. Thus it was not suitable for addressing the annual average standard as part of the current SIP update.

The 2008 SIP modeling simulations used the Community Multiscale Air Quality (CMAQ) Modeling System, a “one-atmosphere” system that treats major atmospheric and land processes, plus a range of emissions species in a comprehensive framework. The version of CMAQ used in the 2008 Plan included California-specific updates as described in Liang and Kaduwela (2005)[2]. The meteorological inputs to CMAQ were generated using the Pennsylvania State University/National Center for Atmospheric Research Mesoscale Model (MM5). MM5 is designed to simulate or predict atmospheric motions at small scale.

This work included two gridded modeling domains (Figure F-1). The first modeling domain (“CCAQS”) covers the Central Valley and its surroundings with 63 x 63 lateral 12 km grid cells (CCAQS domain) for each vertical layer. This domain extends from the Pacific Ocean in the west to the Mojave Desert and Western Nevada in the East and runs from the northern Sacramento Valley to the Tehachapi Mountains in the south. The second domain (“SJV’) is nested within the CCAQS domain covers the SJV with 80 x 89 lateral 4 km grid cells. Vertically, both domains include 15 layers of varying thicknesses up to the top of the meteorological domain (100 millibar (mb)). The CCAQS domain provided the initial and boundary conditions for the SJV domain.

MM5 was set up for a 14-month simulation (December 1999 - January 2001) with three nested gridded domains. Vertically, the domains included 30 layers and extended up to 100 mb. The two outer domains defined the atmospheric initial and boundary conditions for the area at large scale, while the innermost grid resolved the fine details of atmospheric motions within the SJV domain.

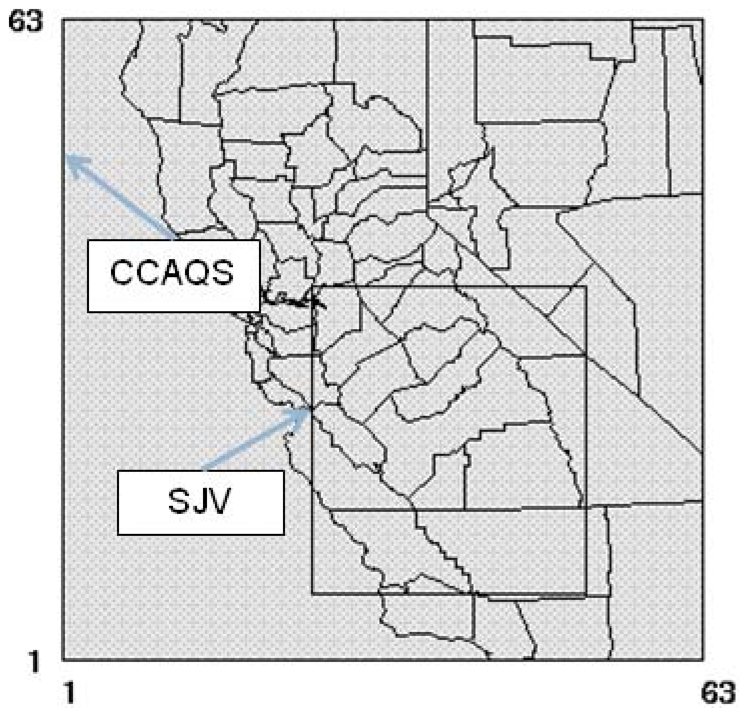
Photochemical modeling was conducted for an entire year. Gridded, hourly, chemically speciated emissions of combined stationary, mobile, area, and biogenic sources were developed as inputs to CMAQ for the 2005 base year and the 2014 future year. The

[1] U.S. EPA, 2007, Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze, EPA-454/B07-002.
[2] Liang, J. and A. Kaduwela, 2005: Microdevelopment of CMAQ for California Regional Particulate-Matter Air Quality Study. Proceedings of the 4th Annual CMAS Models-3 Users’ Conference; September 26-28, 2005, Chapel-Hill, NC.

2014 inventory included expected emission reductions from the State and local controls proposed in the 2008 $PM_{2.5}$ SIP. The resulting modeled relative response factors (RRFs) for each $PM_{2.5}$ species between 2005 and 2014 were then used to project 2006 design values and chemical composition to 2014 using U.S. EPA's Speciated Modeled Attainment Test (SMAT).

Further description of the photochemical modeling conducted for the 2008 $PM_{2.5}$ SIP is provided in the "Regional Air Quality Modeling to the 2008 $PM_{2.5}$ Plan" Appendix to the Plan: (http://www.arb.ca.gov/planning/sip/sjvpm25/Appendix%20A-SJV%20Modeling.pdf), and ARB Modeling Documents posted at: http://www.arb.ca.gov/planning/sip/sjvpm25/sjvpm25.htm.

Figure F-1 Modeling Domains



CCAQS domain has 63x63 12 km grid cells and the SJV domain has 80x89 4 km grid cells. Both domains have telescopic vertical grid structure with 15 layers extending to 100 mb.

F.3 MODELING METHODOLOGY

To assess the representativeness of the 2008 SIP modeling for capturing the dynamics and response to emission reductions for the updated attainment demonstration, ARB staff evaluated both the meteorological characteristics, as well as the chemical composition used in the two modeling efforts. The types of meteorological conditions conducive to $PM_{2.5}$ formation in 2013/2014 were similar to the 2000/2001 meteorological conditions simulated in the 2008 SIP. These factors include the presence of persistent ridges that result in warm air aloft and strong stability with limited mixing, cool morning temperatures, and low wind speeds. Although the persistence of these meteorological conditions in 2013/2014 resulted in an increased number of days with high concentrations, the underlying meteorological factors driving elevated $PM_{2.5}$ concentrations were similar to 2000/2001. In addition, as described in Attachment A to this Appendix, the $PM_{2.5}$ chemical composition used in the 2008 $PM_{2.5}$ modeling was very similar to 2013, indicating common atmospheric chemistry regimes. Therefore, the 2008 $PM_{2.5}$ SIP modeling response to emission reduction, applied to 2013 DVs, provides a suitable basis for the updated attainment demonstration.

To ensure consistency with the approved 2008 $PM_{2.5}$ SIP modeling, the current effort uses a single DV representing 2013 based on ambient measurements during 2011-2013. The base emission year is the middle year of 2012, with future emission years of 2020 for the annual standard attainment demonstration, and 2018 for the 24-hour standard demonstration.

Due to the differences in base years (2005 vs. 2012) and future years (2014 vs. 2018 or 2020), the RRFs calculated for the 2008 modeling cannot be used directly in the current Plan. Thus, the updated modeling uses scaled RRFs presented in the following equation.

$$RRF_{12-20} = \left[1 - (1 - RRF_{05-14}) \times \frac{\%\Delta E_{12-20}}{\%\Delta E_{05-14}}\right]$$

Here,

$$\%\Delta E_{12-20} = \frac{E_{12} - E_{20}}{E_{12}} \times 100\% \; and \; \%\Delta E_{05-14} = \frac{E_{05} - E_{14}}{E_{05}} \times 100\%,$$

where, E_j is the total emissions for a given emissions component for year j (= 2005, 2012, 2014, and 2020). That is, quantities in the above equation represent percent emissions changes for the current and 2008 Plans. Similarly, RRF_{i-k} represents RRF values for the current (2012-2020) and 2008 Plans (2005-2014).

In the 2008 $PM_{2.5}$ SIP, 2004-2006 concentrations of ammonium ion, nitrate ion, sulfate ion, organic carbon, elemental carbon, and geologic material were calculated using the Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbonaceous Material Balance Approach (SANDWICH) method. The current plan uses the same SANDWICH method to calculate these components for 2011-2013 speciation measurements made at Bakersfield (California Street), Visalia (North Church Street), Fresno (1st Street and Garland), and Modesto (14th Street). The particle bound water (PBW) was calculated using the e-AIM method that is more accurate than the parameterized equation for PBW. These components (except for PBW) were then projected to the future using the scaled RRFs. PBW is calculated again for the future concentrations.

For those $PM_{2.5}$ monitors that were not collocated with speciation monitors, the composition measured at one of the four speciation sites was assigned (Table F-1). In the 2008 $PM_{2.5}$ SIP, analysis of CRPAQS field study data was used to identifying which sites had similar chemical composition profiles. In the current study, proximity and similarity between sites were also considered. Based on these criteria, the composition at Bakersfield-California was used to represent Bakersfield-Planz. Similarly, Fresno-

Garland composition was used to represent Fresno-Hamilton, Clovis, and Tranquility. Visalia composition was used for Hanford, and Modesto composition was used for sites at Stockton, Manteca, Turlock, and Merced.

Planning inventories were used to calculate the scaling factors for RRFs (viz. $\%\Delta E_{12\text{-}20}/\%\Delta E_{05\text{-}14}$). Nitrate and ammonium ion RRFs were scaled using NO_x emission reductions, and sulfate ion RRFs were scaled using SO_x emission reductions. The justification for using NO_x for both the ammonium and nitrate ions relies on the fact that sulfate ion concentrations are minor and therefore ammonium ion scales mainly with the nitrate ion. Source-level emissions profiles were applied to the PM2.5 planning inventory to calculate the PM2.5 chemical constituents of organic carbon, elemental carbon, and geologic material.

F.4 MODELING RESULTS

Eight of the fifteen sites in the SJV recorded 2013 DVs over the annual $PM_{2.5}$ standard of 15 μg/m^3 (Table F-1). The higher DVs occurred in the Valley's southern region (including the Bakersfield and Visalia as well as Hanford) and the central region (around the Fresno urban area and Madera). Only one site in the northern region (Turlock) measured a 2013 DV over the standard. All sites in the SJV recorded 2013 DVs at or below the 24-hour standard of 65 μg/m^3.

Table F-1 lists the projected 2020 annual and 2018 24-hr DVs determined through the previously described modeling methodology. In 2020, all sites in the Valley are projected to attain the annual standard. For those sites that exceeded the standard, the projected 2020 DVs range from 12.5 μg/m^3 to 15.0 μg/m^3.

The implementation of new reductions from California's on-going emission control programs will provide the major portion of emission reductions needed to attain the annual $PM_{2.5}$ standard by 2020. Further emission reductions from the District's recently tightened residential wood combustion rule coupled with further control from commercial cooking operations slated for adoption in 2016, complement the $PM_{2.5}$ emission reductions needed for the SJV to attain the annual standard in 2020.

As shown on Table F-1, modeling results indicate these control programs will result in 2018 24-hour design values ranging between 24 μg/m^3 and 52 μg/m^3. For sites with 2013 design values over 60 μg/m^3, the modeled 2018 design values range between 46 μg/m^3 and 52 μg/m^3 (71-80 percent of the standard).

F.5 CONSIDERATION OF 2014 AIR QUALITY

The drought-related meteorological conditions that affected PM2.5 concentrations in the San Joaquin Valley during 2013 continued into 2014. Although complete data for 2014 is not yet available, this section provides a preliminary assessment of 2014 air quality data in relation to the attainment demonstration.

Despite the ongoing persistence of the drought, air quality conditions in 2014 generally improved at most locations, particularly in the northern and central portions of the Valley. This is an indication that although drought conditions are continuing, progress is resuming as a result of ongoing emission reductions. However, because 2014 design values will reflect the impact of multiple years of drought, a comparison to the 2013 design values used in the attainment demonstration is expected to be mixed, with some locations recording design values that are slightly lower, and other locations recording design values that are slightly higher. Based on an assessment of the PM2.5 levels predicted for 2020 as well as ongoing trends and analyses, consideration of 2014 design values is expected to remain consistent with the current attainment demonstration. However, ARB and the District will continue to monitor the impacts of the drought and its relationship to future PM2.5 attainment needs.

F.6 UNMONITORED AREAS

A screening analysis designed to assess the possibility of unmonitored violations of the annual $PM_{2.5}$ NAAQS was presented in the 2008 $PM_{2.5}$ Plan. An annual-averaged modeled $PM_{2.5}$ field was generated for the entire modeling domain. This field was then scrutinized to see if there would be gradients in the field that would give rise to higher values away from monitors if this field were to be used to adjust the interpolated annual-averaged design value field. The analysis found there are no areas with steep gradients that would result in higher design values than those measured at monitors.

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Table F-1 Projected 2020 Annual and 2018 24-hour Design Values

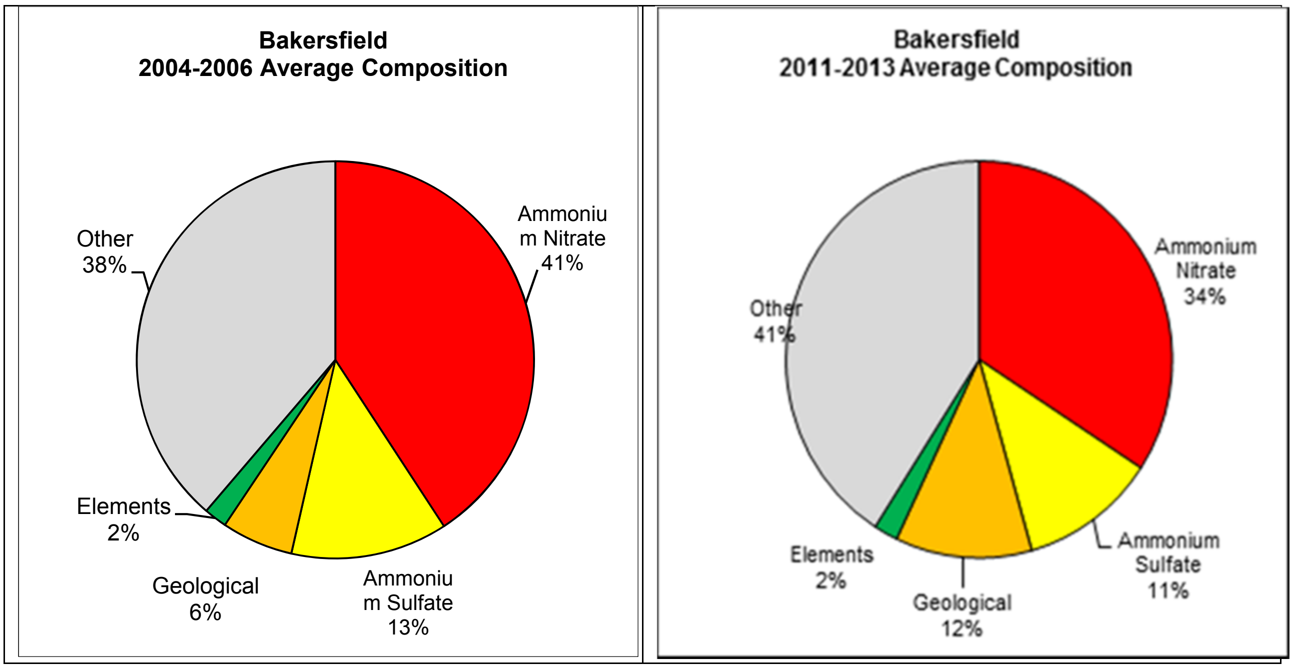
Monitoring Site	AQS Site ID	Type	Speciation	2013 Ann. DV[3]	2020 Ann. DV with Rules[4]	2013 24-hr DV[5]	2018 24-hr DV with Rules[6]
Bakersfield - California Street	060290014	FRM	Bakersfield-California	16.4	13.7	64.6	51.6
Bakersfield - 410 E Planz	060290016	FRM	Bakersfield-California	17.0[3]	14.3	55.8[3]	44.9
Clovis - N Villa Avenue	060195001	FRM	Fresno-1st	16.4[4]	13.3	57.6[4]	45.3
Fresno - 1st Street/Garland[7]		FRM	Fresno-1st	15.4[5]	12.5	62.0[5]	49.3
Fresno - Hamilton and Winery	060195025	FRM	Fresno-1st	14.7	12.0	63.5	50.3
Hanford-S Irwin Street	060311004	FEM-BAM	Visalia - N Church	17.0	13.9	60.2	45.8
Madera	060392010	FEM-BAM	Fresno-1st	18.1	15.0	52.3	41.4
Manteca-530 Fishback Rd	060772010	FEM-BAM	Modesto 14th	10.2	8.7	36.7	32.1
Merced - 2334 M Street	060472510	FRM	Modesto 14th	11.1	9.2	49.2	40.3
Merced – S Coffee Ave	060470003	FEM	Modesto 14th	13.3	11.0	41.8	34.8
Modesto - 14th Street	060990005	FRM	Modesto 14th	13.6	11.5	50.6	42.2
Stockton - Hazelton Street	060771002	FRM	Modesto 14th	13.8	12.0	45.0	39.0
Tranquility	060192009	FEM-BAM	Fresno-1st	7.9	6.6	30.0	23.9
Turlock-S Minaret Street	060990006	FEM-BAM	Modesto 14th	15.7	13.2	52.7	43.8
Visalia - N Church Street	061072002	FRM	Visalia - N Church	16.6	13.5	55.7	42.5

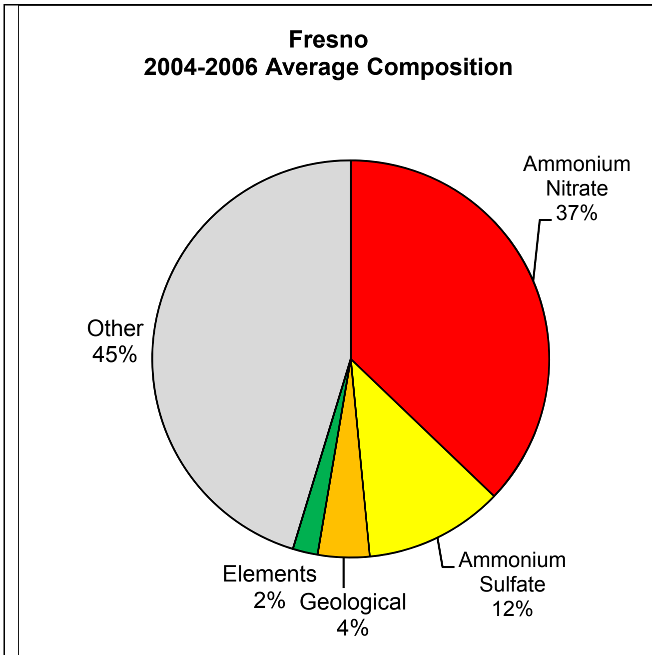
[3] Design values equal to or less than 15.0 µg/m³ attain the annual $PM_{2.5}$ standard
[4] Design values equal to or less than 65.4 µg/m³ attain the 24-hour $PM_{2.5}$ standard
[5] Does not include 167.3 µg/m³ measured on May 05, 2013 (supporting documentation provided in Attachment B)
[6] Clovis 2013 DV is based on combined FRM/FEM BAM data
[7] 2013 DV is based on 2011 data for Fresno-1st (060190011) and 2012/2013 data for Fresno-Garland (060190008)

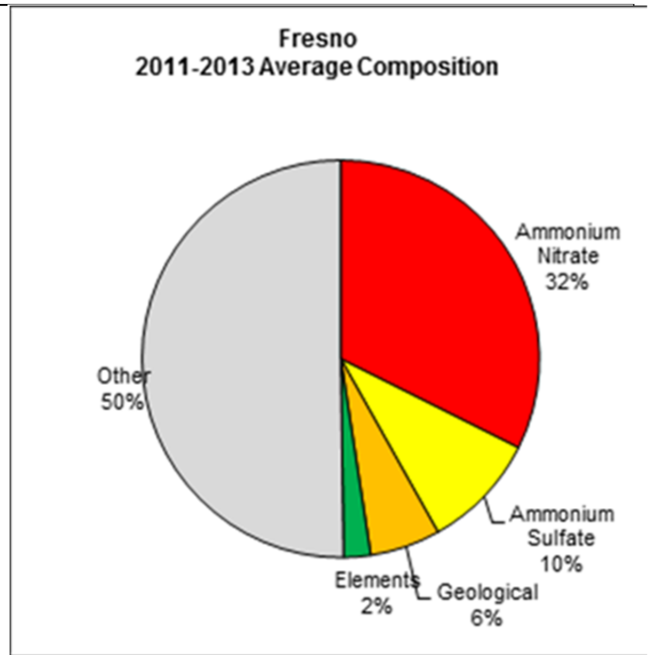
Attachment A: Trends in PM2.5 Composition

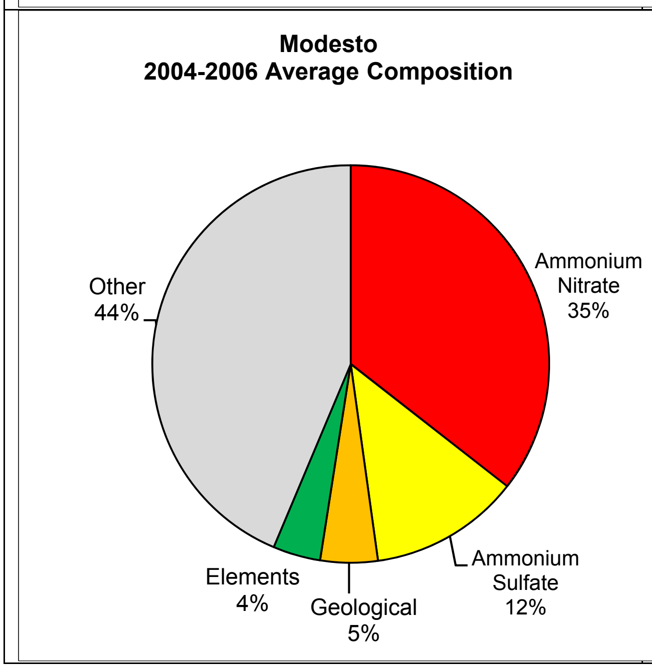
To assess the representativeness of the atmospheric chemistry regime included in the 2008 SIP modeling for simulating conditions experienced in 2013, ARB staff compared the chemical composition of ambient PM2.5 collected during the periods represented by the two SIPs. The 2008 modeling reflected speciation for 2004-2006 while the current plan reflects 2011-2013. Speciation data is available for four sites in the Valley: Bakersfield, Fresno, Modesto, and Visalia. In this analysis, organic and elemental carbon are combined with “other” because the measurement technique for the organic and elemental carbon components have changed between the two three-year windows. The relative composition for each site during these two periods is shown in Figure F-2 below.

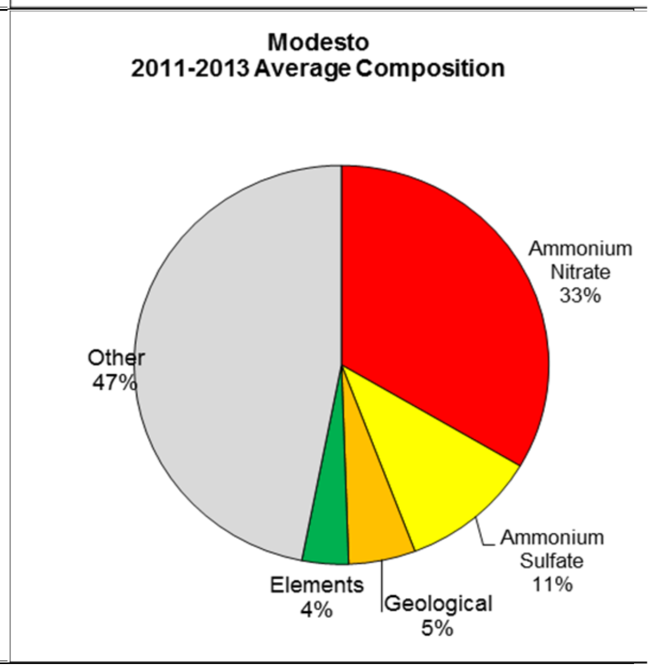
Figure F-2 Average PM2.5 Percent Composition During 2004-2006 Compared to 2011-2013

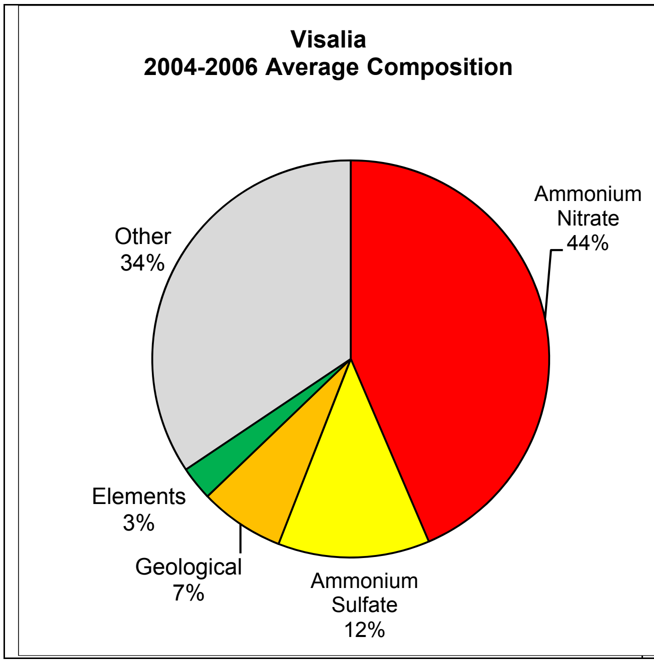


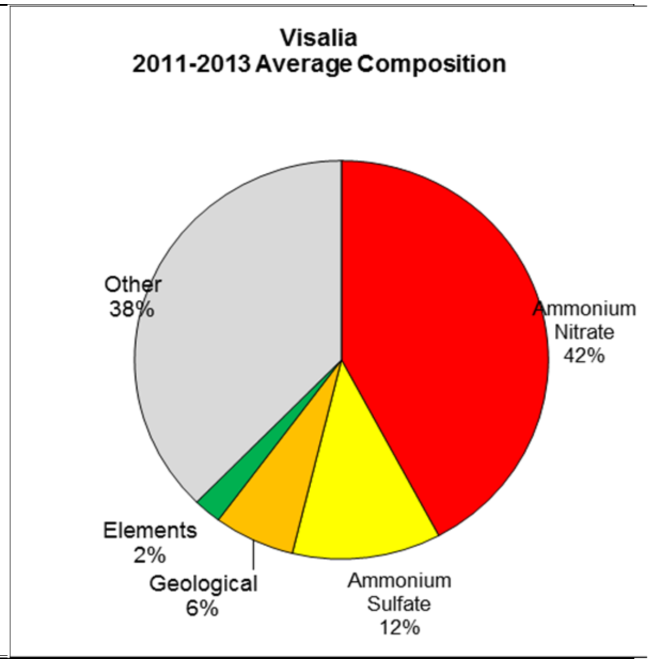

Fresno
2004-2006 Average Composition
Ammonium Nitrate 37%
Other 45%
Elements 2%
Geological 4%
Ammonium Sulfate 12%


Fresno
2011-2013 Average Composition
Ammonium Nitrate 32%
Other 50%
Ammonium Sulfate 10%
Elements 2%
Geological 6%


Modesto
2004-2006 Average Composition
Ammonium Nitrate 35%
Other 44%
Elements 4%
Geological 5%
Ammonium Sulfate 12%


Modesto
2011-2013 Average Composition
Ammonium Nitrate 33%
Other 47%
Ammonium Sulfate 11%
Elements 4%
Geological 5%





At all sites, ammonium nitrate and organic/elemental carbon as represented in the “other” category are the largest constituents in both periods. For Modesto and Visalia, the relative composition is nearly identical for the two three-year periods shown. At Bakersfield and Fresno, ammonium nitrate has decreased slightly, with a corresponding increase in other and geological. However, at both sites, the overall composition between the two three-year periods is very similar and therefore supports a conclusion that there have not been any major shifts in atmospheric chemistry regimes in SJV.

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Attachment B: Assessment of the Representativeness of the PM2.5 Value Recorded at the Bakersfield-Planz Monitoring Site on May 5, 2013

A. Overview

On May 5, 2013, a $PM_{2.5}$ concentration of 167.3 µg/m^3 was measured at the Bakersfield-Planz monitoring site. A concentration of this magnitude is extremely unusual, especially during the spring/summer when $PM_{2.5}$ concentrations are typically low. Further, all other Bakersfield $PM_{2.5}$ monitors recorded concentrations that were substantially lower, consistent with levels typical for the Valley during this time of year. Meteorological analysis shows that high winds on May 5, 2013 may have resulted in microscale $PM_{2.5}$ impacts at Bakersfield-Planz that are atypical from measured concentrations at the Bakersfield-Planz site and other nearby sites during similar events. Elemental analysis of particulates collected on the filter indicated an extraordinarily high concentration of elements associated with windblown dust. This unusual measured concentration indicates that the sample collected on May 5, 2013 was not representative of the broader spatial scale the Bakersfield-Planz monitor is intended to capture.

Based on the following analysis, ARB staff is therefore excluding the value of 167.3 µg/m^3 from use in the modeling analysis for the SJV 2015 $PM_{2.5}$ Plan. ARB and the District are also pursuing further analysis of this event by engaging the Department of Public Health to conduct a more thorough examination of the filter media. The results of this analysis will be closely evaluated and aide in future planning efforts.

B. Representativeness of Bakersfield-Planz $PM_{2.5}$ Data

Air quality planning begins with evaluating pollutant concentrations measured at air monitoring stations and comparing those measurements to established air quality standards. In practice, monitors are only capable of sampling a relatively small portion of the atmosphere in the immediate vicinity around the inlet. However, the samples are intended to be representative of concentrations over a larger area as defined by the spatial scale of the monitoring site.

The Bakersfield-Planz monitoring site is identified as neighborhood scale, meaning that $PM_{2.5}$ measurements are expected to be representative of air quality within an area that has relatively homogenous land use ranging from 0.5 to 4.0 kilometers around the monitor. If measurements at the site are overwhelmed by local dust sources and driven by unusual meteorological events atypical of the area, the measurements may no longer be considered representative of air quality within the broader area around the monitor.

San Joaquin Valley Seasonal $PM_{2.5}$ Concentrations

$PM_{2.5}$ concentrations throughout the Valley follow the same seasonal pattern. During the low concentration season (primarily April through September), concentrations are generally below 25 to 30 µg/m^3 Valley-wide. A measured concentration of 167.3 µg/m^3

in May is therefore extraordinarily unusual. Evaluating days where wind speeds were similar in magnitude shows that PM2.5 values measured during those days were much lower than the 167.3 µg/m^3 measured on May 5, 2013.

Data presented in Table 1 illustrates the typical observed pattern and shows the highest $PM_{2.5}$ concentrations recorded between April and September in the Valley over the last 14 years. Apart from the May 5, 2013 value, flagged data, and an anomalous reading in April 2010, other recorded $PM_{2.5}$ values are consistently low during the April to September time period.

Table 1 Highest SJV $PM_{2.5}$ Concentrations - April thru September 2000-2013 (µg/m^3)

Year	April	May	June	July	August	September
2000	31.4	20	27.1	28.1	23	33
2001	27.3	21.6	19.3	43	17.3	18.5
2002	40	20.7	25.4	25.5	49	19.6
2003	15	18	20.3	25.3	23.2	31.5
2004	28	18.6	15.4	**63.1**	19	20.7
2005	30.6	18	21.7	31	24	19.4
2006	23	23.7	23.7	32	22.6	42.5
2007	28	30.5	21.3	**103.8**	20.5	52
2008	32.3	36	99.3	**60.8**	28.3	36.5
2009	31.3	24.4	26.5	25.8	31.9	28
2010	**107.8***	21	23.2	**92.2**	25.8	37.8
2011	33.2	23.6	38.4	33.2	20	29.3
2012	29.7	21.9	23.4	31	19.7	29.4
2013	24.9	**167.3**	28.3	40.1	39.1	26.8

**Bakersfield-California BAM recorded a 26.9 µg/m^3 daily average; FRM value not available*

(dark hatched)	Fireworks (Data flagged in AQS)
(light grey)	Fires (Data flagged in AQS)
(light dotted)	Highest Concentrations at Planz

On May 5, 2013 all other monitoring sites in the Valley measured $PM_{2.5}$ typical of the low concentration season. Measurements ranged from 9.9 µg/m^3 to 24 µg/m^3 (Table 2). The Bakersfield-California monitoring site recorded 24, 23, and 26 µg/m^3 on the $PM_{2.5}$ Federal Reference Method monitor, and primary and collocated Beta Attenuation Monitors, respectively. As seen in Table 2, the Bakersfield-Planz site recorded the highest 24-hour average $PM_{2.5}$ concentration in the Valley on May 5, 2013, with levels an order of magnitude higher than any other site.

Table 2 $PM_{2.5}$ FRM and FEM Concentrations in the San Joaquin Valley on May 5, 2013

Site Name	***Avg. 24-Hr $PM_{2.5}$ Concentration ($\mu g/m^3$)***
Fresno-Garland	10.3
Tranquility-32650 West Adams Avenue	10.3
Clovis-North Villa Avenue	10.8
Bakersfield-410 E Planz Road	***167.3***
Bakersfield-5558 California Avenue	24
Hanford-South Irwin Street	9.9
Madera-28261 Avenue 14	16.2
Merced-South Coffee Avenue	10
Manteca-530 Fishback Road	12.7
Stockton-Hazelton Street	15.9
Turlock-South Minaret Street	10.4
Modesto-14th Street	11.4

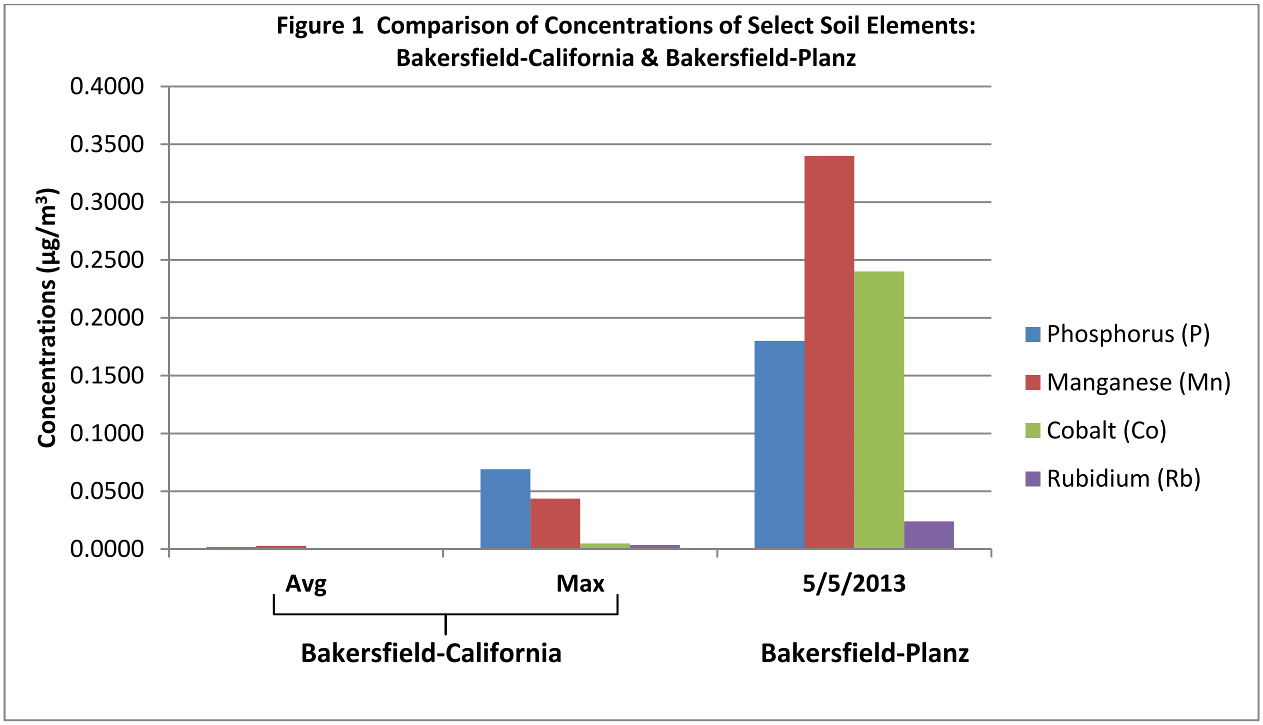
<u>Elemental Species Composition</u>

To further evaluate the representativeness of the May 5, 2013 sample, ARB's Monitoring and Laboratory Division analyzed the FRM filter using X-Ray Fluorescent Spectroscopy (XRF). The analysis revealed that the $PM_{2.5}$ mass was heavily dominated by fugitive dust. In order to estimate the fugitive dust contribution to the total $PM_{2.5}$ mass, ARB staff used the IMPROVE formula:

$$(2.2 \times Al) + (2.49 \times Si) + (1.63 \times Ca) + (2.42 \times Fe) + (1.94 \times Ti)$$

The fugitive dust concentration, estimated at 107.7 $\mu g/m^3$, far exceeded the values typically seen in the $PM_{2.5}$ size fraction. The recorded value of 107.7 $\mu g/m^3$ was over four times higher than the next highest value of 26.2 $\mu g/m^3$ observed in the entire California network based on 14 years of available data. The PM2.5 fraction of fugitive dust is generally low, and PM2.5 concentrations during high wind events are thus typically not nearly as high as the May 5, 2013 reading.

Concentrations of total elemental species were also unusually high, about 6.6 $\mu g/m^3$. Some of these species, such as cobalt, manganese, phosphorus, and rubidium, reached levels not previously measured in the State. These unusual concentration levels suggest that, along with fugitive dust, elemental species in the soil, combined with other chemical species, were deposited onto the filter. Figure 1 below compares average and maximum concentrations for select species historically measured at Bakersfield-California to what was measured at Bakersfield-Planz on May 5, 2013.



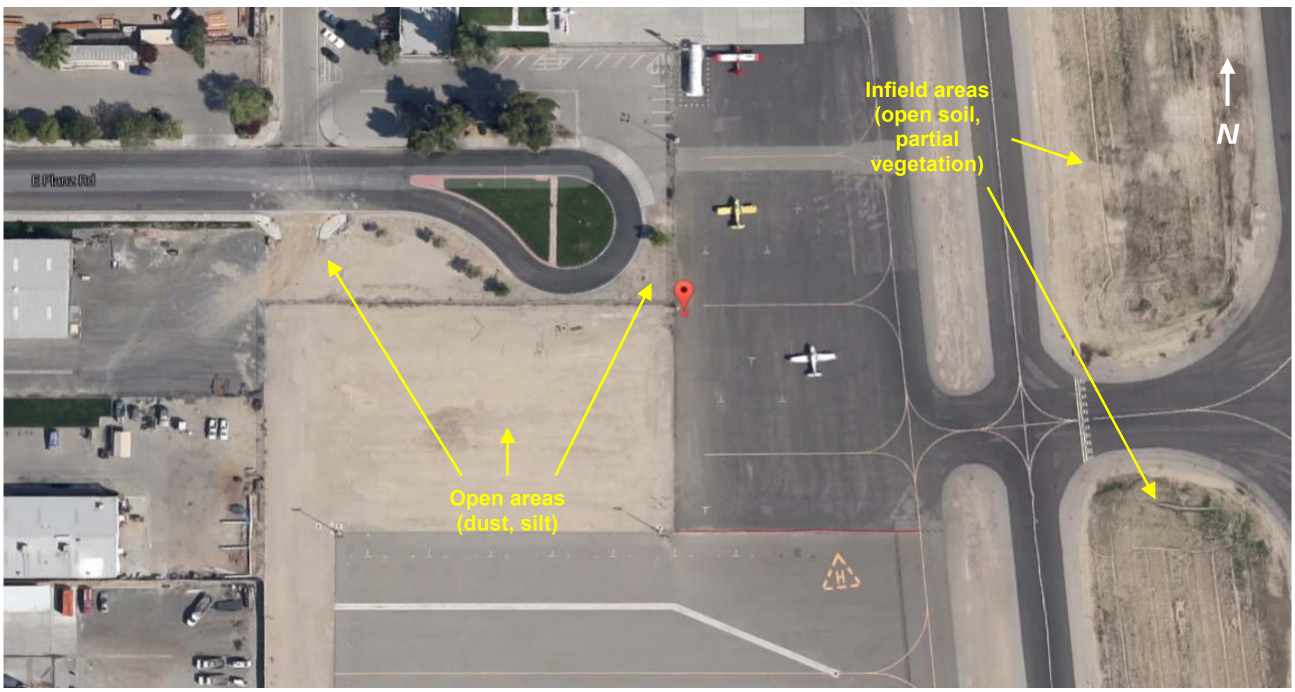
C. Potential Fugitive Dust Sources Impacting the Bakersfield-Planz Site

To evaluate the potential influence of local fugitive dust sources on the Bakersfield-Planz monitor on May 5, 2013, the location of open soil areas, stationary sources, and known dust-generating activities were reviewed relative to the monitoring site. This information, coupled with observations of potential dust sources made by District enforcement staff on December 18, 2014, is summarized below.

The Bakersfield-Planz monitor is located on the grounds of the Bakersfield Municipal Airport, a city-owned airport used for private, civil aviation. The airport also includes a helicopter landing area near the monitor and helicopters are known to periodically use the airport. As shown in Figures 2 and 3 below, the monitor is closely surrounded on several sides by open areas with the potential of emitting dust during high wind events. These open parcels of land are located to the east, west, and south of the monitor and include the airport infield areas between taxiways and runways. Dust sources located nearest to the monitor have the greatest potential impact because dust particles do not remain suspended and deposit quickly. Additionally, as discussed above, the PM2.5 fraction of fugitive dust is generally low; therefore, the abnormally high value of 167.3 µg/m^3 measured on May 5, 2013 is unusual. ARB and the District are pursuing further analysis of this value through a more thorough examination of the filter media.

Figure 2 Bakersfield-Planz $PM_{2.5}$ FRM Monitor[8]

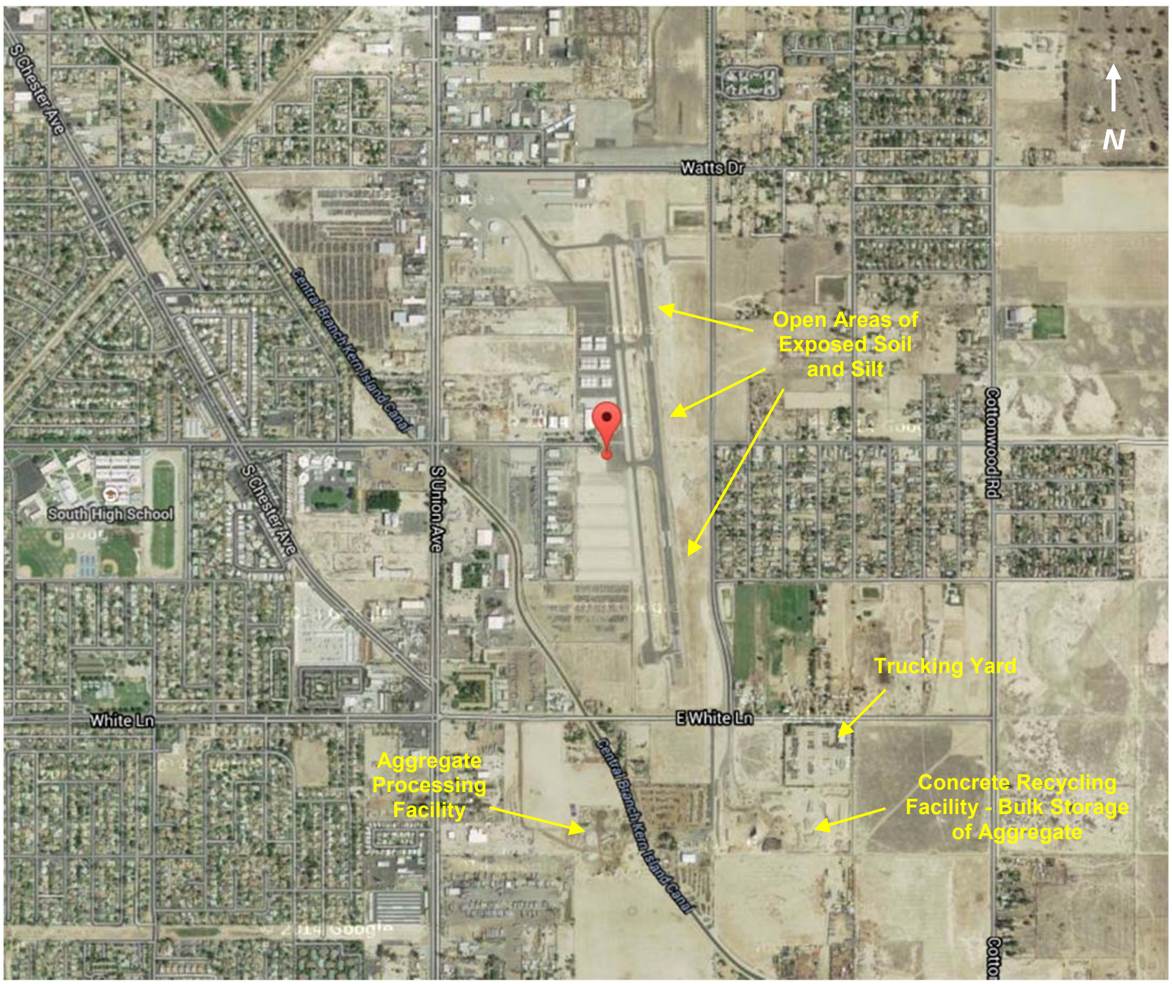
Figure 3 Aerial Photo of Bakersfield Municipal Airport[9]



[8] Photo taken looking west
[9] Red marker indicates monitor location

Additional potential sources of fugitive dust in the broader area surrounding the airport were also evaluated through field investigation by District enforcement staff. A review of aerial photos, combined with field investigations, indicate that additional potential dust-emitting sources in the area are present to the east and southeast of the Bakersfield Municipal Airport (Figure 4). These sources are subject to District rules for controlling fugitive dust from construction and demolition activities; handling, storage and transport of storage of bulk materials; disturbed open areas; paved and unpaved roads; and off-field agricultural sources.

Figure 4.
Aerial Photo of Bakersfield Municipal Airport - Potential nearby Fugitive Dust Sources*
(Red marker indicates monitor location)



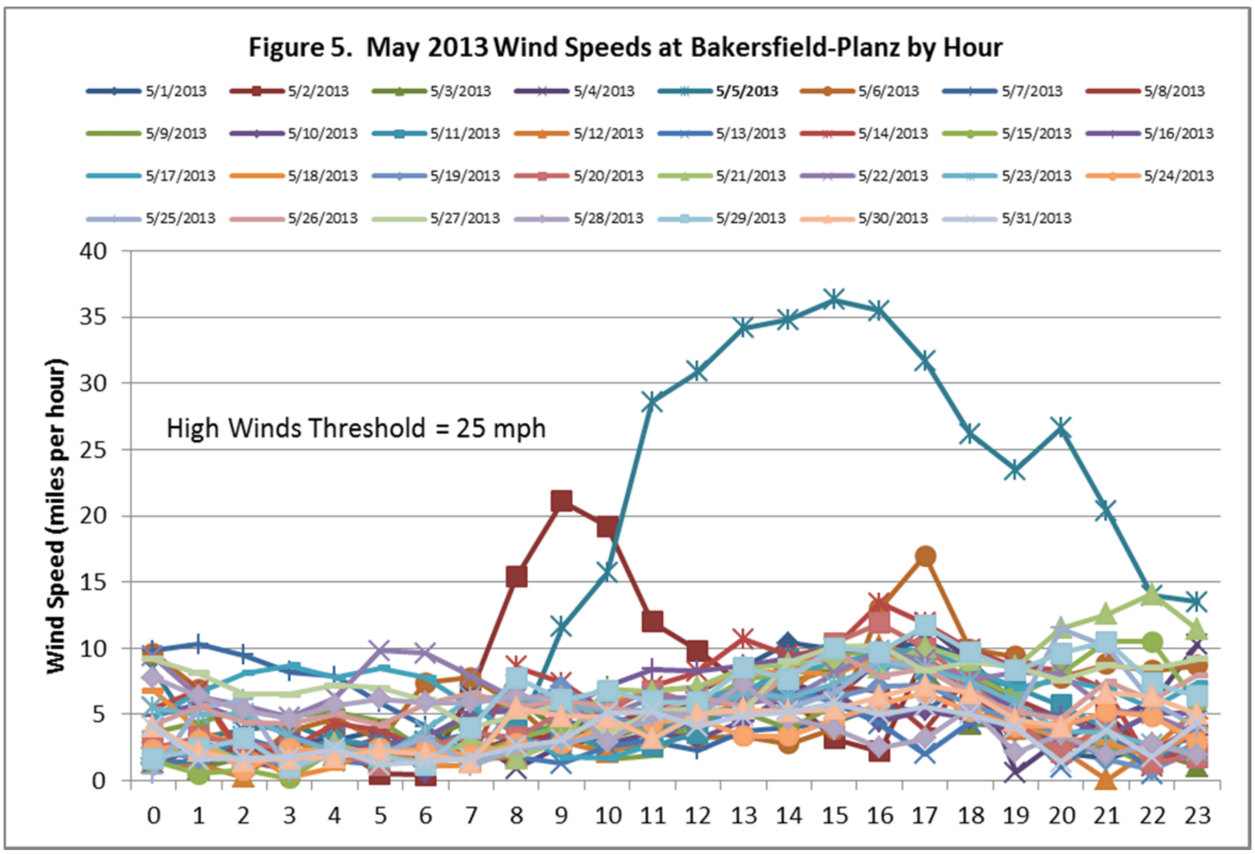
**For reference, the distance from the monitor to the Trucking Yard is approximately 1 kilometer*

No violations of District fugitive dust rules were documented at any nearby dust emitting facilities in Figure 4 on May 5, 2013. Based on this assessment of fugitive dust sources surrounding the monitor, the likely source of total particulate mass is from the open areas immediately adjacent to the monitor, reflecting a localized microscale impact.

However, due to the significance difference in readings from nearby monitors, other factors may have contributed to the unusually high reading at Planz.

D. Meteorology at the Bakersfield-Planz Monitoring Site

An evaluation of Bakersfield area meteorology indicates that high winds measured at the airport are the expected cause of the localized dust impact on May 5. Wind speed data for the Bakersfield-Municipal Airport monitoring site was used to assess winds at Bakersfield-Planz. The Bakersfield-Municipal Airport meteorological site is located on the northern edge of the airport property, approximately one-half mile from the Bakersfield-Planz monitor. Strong winds on May 5, 2013 included 9 hours (including eight consecutive hours) exceeding 25 miles per hour (mph), in excess of U.S. EPA's Interim Exceptional Events Guidelines threshold of 25 mph,[10] and far in excess of the San Joaquin Valley's Exceptional Event threshold of 17 mph as established in prior EPA-approved Exceptional Event submissions. Figure 5 illustrates the difference between wind speeds on May 5, 2013 and a typical day in May of 2013.
By contrast, wind speeds were notably lower at the Bakersfield-California monitoring station, located about 4 miles from Bakersfield-Planz.

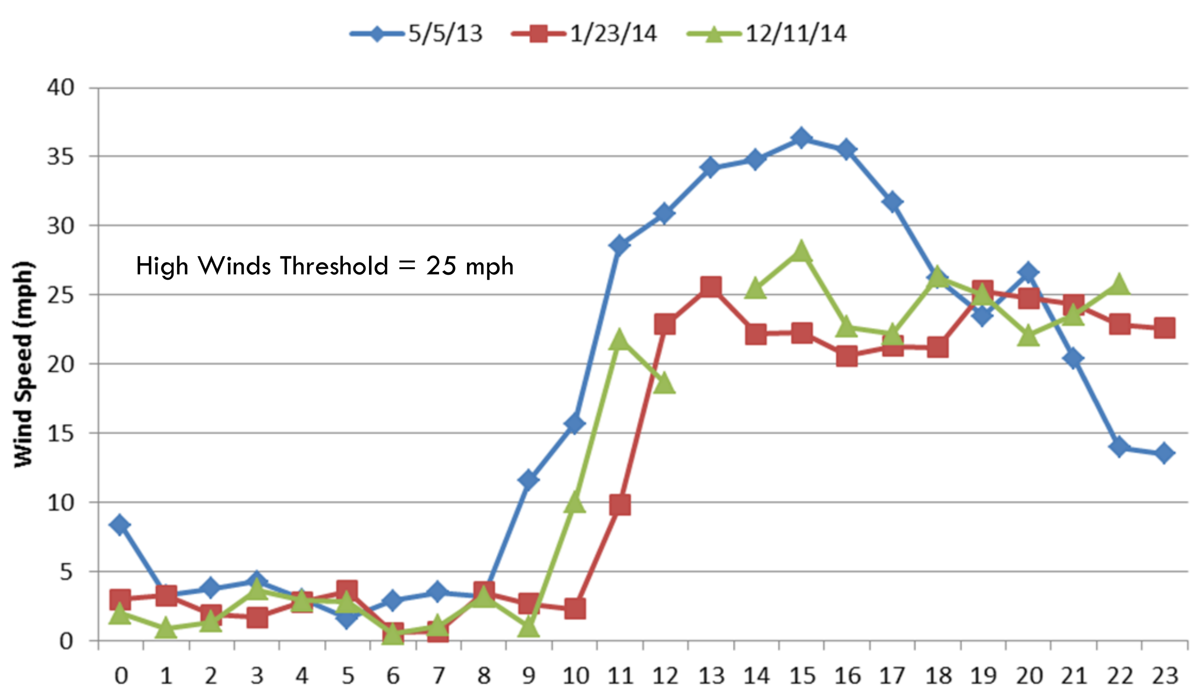


[10] Page, Stephen D. (May 10, 2013). *Interim Guidance to Implement Requirements for the Treatment of Air Quality Monitoring Data Influenced by Exceptional Events* [Memorandum]. Research Triangle Park, North Carolina: U.S. Environmental Protection Agency.

To evaluate wind speeds on May 5, 2013, relative to other significant wind event days at Bakersfield-Planz, wind speed data were reviewed from the first day meteorological data were collected at the Bakersfield-Municipal Airport site on September 11, 2012, through December 31, 2014. During that 2 year and 3 month period, there were 3 days that included sustained winds over 25 mph (Figure 7). Among these high wind days, May 5, 2013, had over 8 hours with winds in excess of 25 mph, a significantly greater amount of time than the next highest day of December 11, 2014, with about 4 hours of sustained winds over 25 mph.

It should be noted that May 5, 2013 was the only high wind day during the dry season in the San Joaquin Valley. The other high wind days occurred during winter months, when moisture in the ground would minimize the potential for fugitive dust to become airborne. $PM_{2.5}$ concentrations were measured only on one of these winter days, January 23, 2014, and reached 49.7 µg/m^3, which is fairly typical for PM2.5 concentrations during winter in the Valley.

Figure 7. Days with High Wind Speeds at Bakersfield-Planz by Hour



The available meteorological data indicate that May 5, 2013 was highly unusual in terms of wind speed and the duration of high winds as compared with other days in which wind speed was measured at the airport.

E. Conclusion

In summary, comparison of the 167.3 µg/m^3 concentration measured on May 5, 2013, to values typical for this season as well as comparison to values measured throughout the Valley on the same day, combined with the record high fugitive dust and elemental species concentrations, indicate that the monitor was impacted by microscale sources that are not representative of the neighborhood spatial scale the monitor is intended to represent. Therefore, this value is not included in modeling analysis for the San Joaquin Valley 2015 $PM_{2.5}$ Plan. ARB and the District are pursuing further analysis of this event in order to conduct a more thorough examination of the filter media. The results of this analysis will be closely evaluated and aide in future planning efforts.

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