DRAFT

Natural Event Documentation
High Winds
Corcoran, California
September 3, 2004

San Joaquin Valley Unified Air Pollution Control District

February 17, 2005

San Joaquin Valley
Air Pollution
Control District

CONTRIBUTORS

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INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has published policies for documenting when exceedances of particulate matter standards result from a natural event. The San Joaquin Valley Air Basin (SJVAB) experienced high levels of particulate matter on September 3, 2004 that fall under the EPA's natural event policies. The purpose of this report is to provide documentation supporting the San Joaquin Valley Unified Air Pollution Control District's (District) determination that the event meets the EPA criteria for a natural event.

The term "particulate matter (PM)" refers to a group of air pollutants suspended in the air as solid particles or liquid droplets and varying in size and composition. The size of PM varies from coarse wind blown dust particles to fine particles; PM can be formed from chemical reactions in the atmosphere or directly emitted. PM10 consists of particles with an aerodynamic diameter of 10 microns or less (human hair has a diameter of about 70 microns). PM10 is a health concern because it is small enough to reach the air spaces deep in the lungs.

The 24-hour National Ambient Air Quality Standard (NAAQS) for PM10 is 150 $\mu g/m^3$. The 24-hour standard for PM10 is attained when the 24-hour average concentration of PM10 does not exceed the NAAQS more than one day per year. The SJVAB has exceeded this standard in the past and is currently classified as a Serious Nonattainment Area for PM10 under federal criteria. Within the SJVAB, a PM10 exceedance occurred in the City of Corcoran on September 3, 2004. The District holds that this exceedance was caused by a natural event of high winds and, as such, should be flagged so that it does not count against the SJVAB's attainment status. An event of strong gusty winds in parts of the Sacramento and northern San Joaquin Valley transported particulates to areas where winds slowed, the particles were deposited near the surface, and high PM10 levels resulted.

This report contains several elements. First, it provides a summary of the federal policy allowing for natural event data flagging. Second, it provides a description of the PM10 problem in the SJVAB. Third, it provides a technical analysis of the conditions that occurred during the exceedance that demonstrates it was caused by a natural event.

Once the District obtains the concurrence of the California Air Resources Board (ARB) and EPA that the data should be flagged, the District will start developing a Natural Events Action Plan (NEAP). The NEAP provides a series of actions to inform the public of future natural events and to mitigate the impacts.

FEDERAL POLICY

There are several federal policies that were published over the years that are relevant to this discussion. The policies have focused on air quality data, PM10 exceedances, and unusual conditions. A discussion of these follows, and a summary is provided in Table 1. This information provides the framework for flagging exceedances as natural events.

The EPA's *Guideline on the Identification and Use of Air Quality Data Affected by Exceptional Events* (1986) introduced a flagging system to help prevent misinterpretation or misuse of air quality data that had resulted from natural or man-made events considered unlikely to reoccur at a given location. Eighteen types of exceptional events were included. One type of event was high winds, defined as conditions in which there is only trace or no precipitation in addition to one of the following conditions: hourly wind speeds averaging at least 40 mph or lower hourly wind speeds with gusts of at least 30 mph. Additionally, these high wind events were to be associated with PM10 samples composed primarily (85%) of natural sources, so dust from industrial sources was not to be flagged (EPA 1986).

Rather than using data flags, Section 188(f) of the 1990 federal Clean Air Act (CAA) amendments waived data if the cause of a PM10 exceedance was shown to be nonanthropogenic. Appendix K to the Code of Federal Regulations Title 40 (*Protection of Environment*), part 50 (2.4), also discounted data from exceptional events rather than applying data flags. Here, exceptional events are uncontrollable natural events and any non-reoccurring event.

A new data flagging system was introduced in the EPA's *Guidelines on the Identification and Handling of Ambient Air Quality Data Affected by Special Events or Special Conditions* (1994). These flags were applied to events happening only once in any five-year period.

Most recent, and of primary concern here, is the EPA memorandum, *Areas Affected by PM10 Natural Events* (1996). When a clear, causal relationship is shown between a PM10 exceedance and one of three categories of natural events (volcanic and seismic activity, unwanted wildland fires, and high wind events), air quality data can be flagged so that it does not count toward an area's attainment status. Since the conditions that create high winds vary from area to area, the State must determine the high wind conditions that are likely to overcome best available control measures (BACM) for dust in each region.

According to this 1996 memorandum, documentation of the causal relationship between the PM10 exceedance and the natural event must be available for public review and comment. Then, it is submitted to the Regional EPA Office within 180 days of the exceedance. The Regional Office will confirm or deny the data flag within 60 days of receiving the documentation. If the data is flagged, a

Table 1 Summary of Federal Policy Related to Natural Events and Exceedances of Federal Ambient Air Quality Standards

POLICY TITLE	DATE	APPLICATION
Guideline on the Identification and Use of Air Quality Data Affected by Exceptional Events	1986	Defined 18 exceptional human and natural events to be flagged
Federal CAA Amendments, Section 188(f)	1990	Waived data from exceedances caused by nonanthropogenic sources
Appendix K to 40 CFR, part 50 (2.4)	revised 2001	Discounted data from uncontrollable natural events or any nonreoccuring event
Guidelines on the Identification and Handling of Ambience Air Quality Data Affected by Special Events or Special Conditions	1994	Flagged data influenced by events that occur once in any five-year period
Memorandum: Areas Affected by PM10 Natural Events	1996	Flags data for exceedances caused by one of three types of natural events so that they do not count against an area's attainment status; requires NEAP

NEAP is to be developed within 18 months of the exceedance date to address pubic health and future events. The NEAP should be reevaluated every five years, at minimum.

PM10 IN THE SAN JOAQUIN VALLEY

The SJVAB is an inter-mountain valley in central California that is approximately 250 miles long, averages 80 miles wide, and is partially enclosed by the Coast Mountain range on the west, the Tehachapi Mountains on the south, and the Sierra Nevada range on the east. Figure 1 shows generalized summer wind patterns in the San Joaquin Valley. The SJVAB includes eight counties: San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and a portion of Kern.

The SJVAB is currently classified as a Serious Nonattainment Area for PM10 under federal criteria. To meet federal requirements, the San Joaquin Valley Air Pollution Control District (District) adopted the *2003 PM10 Plan* on June 19, 2003 and amended the plan on December 18, 2003. The District is currently working on the *2006 PM10 Plan*, which is due to the EPA on March 31, 2006.

Monitoring Network

The District operates an extensive network of air quality monitoring stations in the SJVAB (see Figure 2). Stations with PM10 monitor locations are indicated with a circled "x". Each PM10 monitor is on a six-day reading cycle, which is maintained for ease of PM10 filter changing while ensuring that samples are not taken on the same day of the week every week. Most of the PM10 monitors are on the same six-day cycle, but one monitor (indicated in the center of Figure 3) is on an alternate six-day cycle. This particular monitor is in the City of Corcoran, part of Kings County, and herein shall be referred to as the alternate Corcoran monitor.

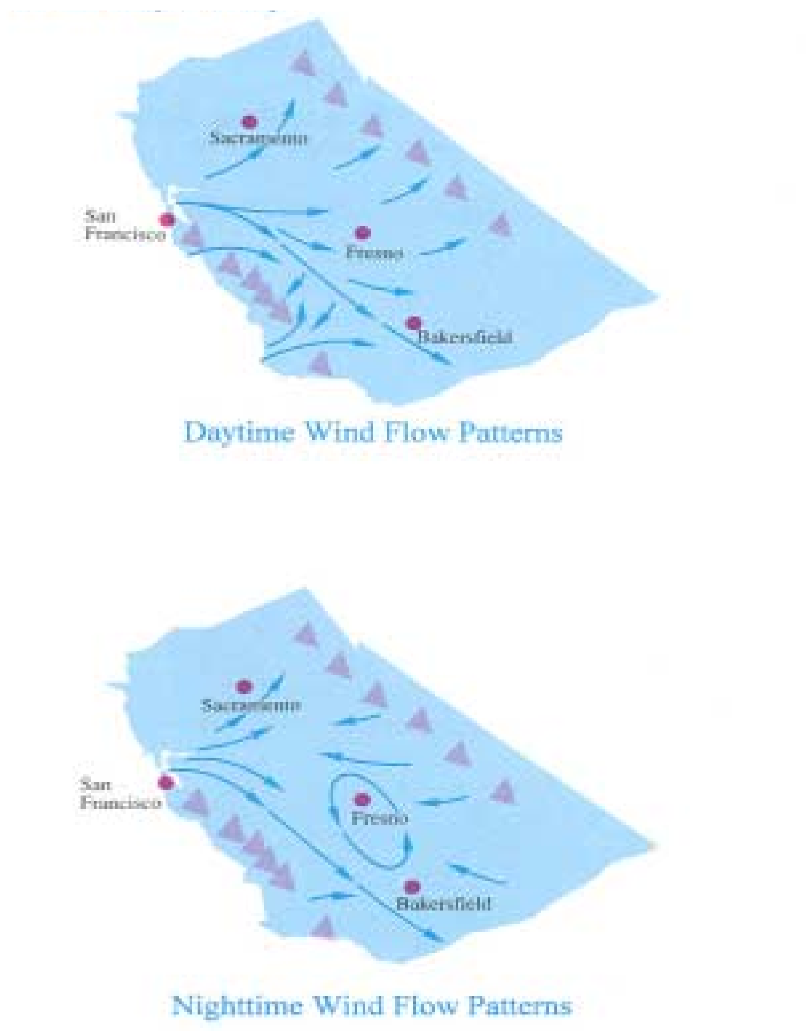


Figure 1 San Joaquin Valley Wind Patterns

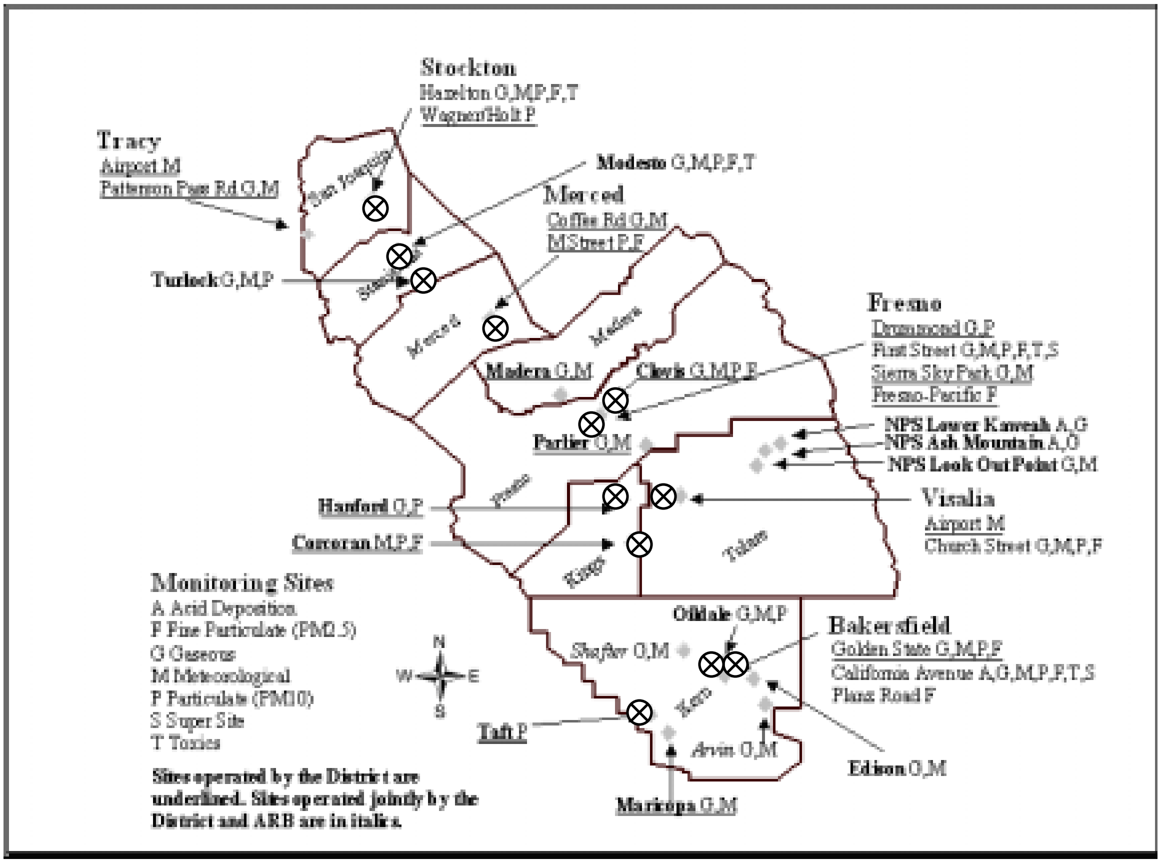


Figure 2 Air Monitoring Sites in the SJVAPCD

Figure 3 Alternate Corcoran monitor location
Source: USGS

The City of Corcoran, which had a 2000 population of 14,458, is part of Kings County, which had a total 2000 population of 129,461 (U.S. Census Bureau 2005). Of the estimated 26.75 tons per day of PM10 emitted in Kings County in 2004, 2.7% came from mobile sources (on-road and off-road), 5.1% came from stationary sources (including industrial processes and fuel combustion), and 92.2% came from area-wide sources (ARB 2005). Area-wide contributions are illustrated in Figure 4.

The primary land use for many miles upwind of the site is farming. The San Joaquin Valley has the most productive farmland in the world with over 4.4 million harvested acres in 2002. The high temperatures and normal summer drought in the region add to the productivity of the crops, but these conditions can create low soil moisture conditions after harvest is complete and irrigation is discontinued. September is peak harvest season for many crops. In the absence of best available control methods (BACM), certain soil types may be subject to wind entrainment during the period after being disturbed by harvest activities and until the soil is prepared for the next crop. However, the infrequency of high winds in the area limits the occasions when this condition causes a problem. After the first substantial rain of the season, which usually occurs in late September or early October, the potential for windblown dust is greatly reduced.

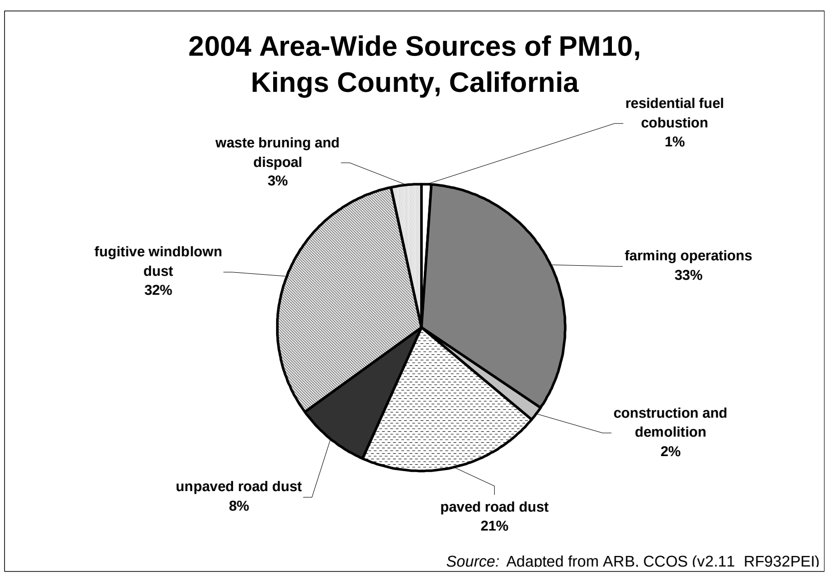
The District has adopted BACMs in the San Joaquin Valley that control the significant sources of PM10 in the air basin, including Corcoran. The two most important controls of fugitive dust are Regulation VIII (Fugitive PM10 Prohibitions) and Rule 4550 (Conservation Management Practices). EPA has approved the control strategy in the 2003 PM10 Plan as BACM. The rules are discussed at length in the 2003 PM10 Plan and are available at <http://www.valleyair.org/rules/1ruleslist.htm>.

<u>Exceedance on September 3, 2004</u>

Corcoran has a total of three PM10 monitors. Two of the monitors are on the same cycle to allow checks of monitor accuracy. The third monitor, the alternate Corcoran monitor, allows for more data to be taken. This alternate Corcoran monitor recorded a PM10 exceedance on September 3, 2004. This monitor was functioning properly when the exceedance was recorded (see Figures 5 and 6).

On September 3, 2004, the alternate-cycle monitor collected a PM10 sample reflecting a PM10 concentration of 217µg/m^3 (see Figure 7), which is well above the 150µg/m^3 standard. This exceedance was likely due to a combination of several factors, but the exceedance would not have occurred in the absence of regional high winds.

Figure 4 PM10 in Kings County



District staff examined other potential sources of the high readings that day. Fires were taking place in the Sierra Nevada area on the afternoon of the exceedance. A 400-acre, 70% contained wildfire burned near Mariposa, and active wildland fire use was taking place in Sequoia and Kings Canyon National Park (SEKI), which is approximately 60 miles from Corcoran. The largest SEKI fire was 74 acres. Northwest winds observed this day would not have transported smoke from the fire into the Corcoran area, so several agricultural burns were initially permitted as well. However, the District subsequently set burn allocations to zero when stronger winds set in. Additionally, the PM2.5 reading for Corcoran was low, at 25µg/m^3. A low PM2.5 level occurring with high PM10 levels typically indicates that wind-blown dust, not fire, is the source.

VOLUMETRIC PM 10
24-HOUR AIR SAMPLE REPORT
MLD-13A (REV. 8/01)

SAMPLE NO. (FILTER PAPER NO.) 3018455 LAB. NO.

STATION NAME: Corcoran-Patterson #3 ELEVATION: 296'
STATION ADDRESS: 1520 Patterson
REPORTING AGENCY: SJVUAPCD

COUNTY: 16 SITE: 00719 AGENCY: 1 PROJECT: 11
INSTRUMENT NO.: 04645

SAMPLING CONDITIONS: A

LOCAL CONDITION CODES (ENTER APPROPRIATE CODE IN BOX AT LEFT)
A: NO UNUSUAL CONDITIONS
B: WIND-BLOWN SAND/DUST
C: CONSTRUCTION NEARBY
D: FARMING OPERATION NEARBY
E: FIRE NEARBY
F: SAMPLER MALFUNCTION (Explain Below)
H: RAIN
Z: OTHER (Explain in Remarks)

DATE OF LAST CALIBRATION: YEAR 04 MONTH 08 DAY 09

SAMPLE COLLECTION DATA

	DATE YEAR	DATE MONTH	DATE DAY	TIME HOURS	TIME MIN.	ELAPSED TIME METER (MIN.)	FILTER PAPER WEIGHT (GRAMS)
FINISH	04	09	03	24	00	1440.0	
START	04	09	03			0.0	4.4798
INDICATED FLOW RATE						NET: 1440.0	NET:

AVERAGE STD FLOW (SCFM): 39.0
AVERAGE IND. FLOW RATE: 38.8
35.0

Pd(I) 22.0 in. Pd(F) 24.0 in. Ta 19.7 °C Pa 752 mmHg

TO BE COMPLETED BY SAMPLER OPERATORS:

[X] Inspection of sampler and filter indicates that sample collected is in compliance with quality control standards for sampling. Filter and Dickson recorder chart enclosed.

[ ] Sample does not meet quality control standards for sampling and should be invalidated. Dickson recorder chart and filter enclosed. Makeup sample scheduled for ________.

Reasons:
__ Filter Contaminated or Damaged
__ Power Outage
__ Other
__ High/Low Flowrate
__ Dickson Chart Recorder Problem
__ Erratic Flowrate
__ Timer Problem

OPERATOR: Mike Smith PHONE NO. 559-230-5862

State of California
CALIFORNIA AIR RESOURCES BOARD
1927 13th St.
Sacramento, CA 95814

REMARKS:

PRE-ANA. 9/4/04 | POST-ANA.

Figure 5 Documentation of sample collection in compliance with quality control standards for sampling for the September 3, 2004 PM10 sample collected at Corcoran. Monitors are calibrated every four months.

SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT
VOLUMETRIC FLOW CONTROL
PM10 CALIBRATION DATA SHEET

Date: 8/9/2004

Calibration: AS-IS ______ Final X

Site Name:	Corcoran-Patterson #3	Site Elevation:	286
Site Number:	16-719	Ambient Temp C: (Ta)	38.5
Log Number:	NA	Ambient press. mmHg: (Pa)	753

Calibration Standards

Orifice Std. Make/Model:	GMW VAR. ORFICE
Property Number	9253
Date Certified	1/8/2004
P Std. Property Number:	DELTA CAL 9219
P Date Certified:	1/14/2004

Sampler Being Calibrated

Make and Model:	Sierra -Anderson
VFC Serial Number:	P4894
Property Number:	4645
Last Cal. Date:	4/8/2004
Flow During Last Cal Date:	39.2
Sampler Magnehelic Zero:	0
Dickson Chart reading:	36.0

Single-Point Calibration Verification

True Volumetric Flow (Qt)

GMW Magnehelic Pg "H₂O" 3.2
Qt CFM 39.74

Qt= K1 Sqrt (ΔP Pa/Tk) + K2
Tk= Ta+273

Sampler Volumetric Flow (Qv)

Pf Std Abs Pres mmHg 42.0
Magnehelic Pf "H₂O" 22.0
Po/Pa 0.9454
Qv CFM 39.95

$$P_o/P_a = 1 - \frac{Pf\ "H2O"}{P_a * 0.535}$$

% Diff from True $\frac{Qv - Qt}{Qt}$ x 100 = 0.53 %

% Diff from previous cal $\frac{Qt - Qt\ Prev}{Qt\ Prev}$ x 100 = 1.38 %

Magnehelic % Accuracy $\frac{|(Pf_m\ "H_2O" \times 1.867) - (Pa - Pf_{std})|}{(Pa - Pf_{std})}$ x 100 = 2.1 %

* Pfstd = PmmHg measured at stagnation tap by pressure standard (clean filter in calibrated orifice) while sampler is running
**QvCFM = m3m (chart look up value)(35.3146667215)

Comments: Motor brushes failed- reconditioned motor installed, calibration checked. Operates normal.

Figure 6 Documentation of normal operation for Corcoran PM10 monitor

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
AIR QUALITY SYSTEM
RAW DATA MAX VALUES REPORT

Jan. 25, 2005

(81102) PM10 Total 0-10um STP

SITE ID: 06-031-0004 POC: 4
COUNTY: (031) Kings
CITY: (16224) Corcoran
SITE ADDRESS: 1520 PATTERSON AV., CORCORAN
SITE COMMENTS: SITE IS PARALLEL MONITOR TO 06-031-0003 WHICH IS TO BE CLOSED MID 97
MONITOR COMMENTS: GMW HI-VOL SSI SIERRA ANDERSON ALTERNATE 6 DAY SAMPLING

STATE: (06) California
AQCR: (031) SAN JOAQUIN VALLEY
URBANIZED AREA: (0000) NOT IN AN URBAN AREA
LAND USE: RESIDENTIAL
LOCATION SETTING: SUBURBAN

CAS NUMBER:
LATITUDE: 36.101389
LONGITUDE: -119.565833
UTM ZONE: 11
UTM NORTHING: 3998073
UTM EASTING: 269015
ELEVATION-MSL: 0
PROBE HEIGHT:

SUPPORT AGENCY: (0945) San Joaquin Valley Unified Air Pollution Control Dist
MONITOR TYPE: OTHER
COLLECTION AND ANALYSIS METHOD: (063) HI-VOL SA/GMW-1200 GRAVIMETRIC
REPORTING ORG: (0145) California Air Resources Board

REPORT FOR: 2004

DURATION: 24 HOURS
UNITS: UG/CU METER (25 C)
MIN DETECTABLE: 2

Day	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1												
2												
3									P 217			
4												
5												
6												
7												
8												
9									138			
10												
11												
12												
13												
14												
15									85			
16												
17												
18												
19												
20												
21									60			
22												
23												
24												
25												
26												
27									71			
28												
29												
30												
31												
NO.:	0	0	0	0	0	0	0	0	5	0	0	0
MAX:									217.			
MEAN:									114.2			

ANNUAL OBSERVATIONS: 5 ANNUAL MEAN: 114.2 ANNUAL MAX: 217.

1 Values marked with 'P' exceed the PRIMARY STANDARD of: 155
1 Values marked with 'S' exceed the SECONDARY STANDARD of: 155

Note: A plus sign ("+") following a value indicates that the computed average includes one or more raw data values effected by a special event.

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Figure 7 Raw Data Maximum Values Report for the Corcoran Monitoring Site measuring a PM10 level of 217 μg/m^3 in Corcoran on September 3, 2004

SYNOPTIC METEOROLOGY FOR THE SEPTEMBER 2 AND 3, 2004 EPISODE

The last measurable precipitation had occurred 98 days before the start of this episode. During this episode, the average hourly wind speed in Corcoran was 10 mph, and wind gusts reached 14 mph. In contrast, the average hourly wind speed for the area for September 2004 was only 5 mph. Windy conditions are rare in the Corcoran area. According to CART, a statistically based computer model that stands for “Classification and Regression Trees,” and modeling of climate data from Corcoran from 1988 to 2000, “[high] wind speeds [at Corcoran] make little difference in [PM] concentrations in Corcoran” (SJVAPCD 2003, p L18).

The high wind event must therefore be viewed regionally. Since September 3 was the sampling day for the alternate Corcoran monitor, no other monitors gave official readings for that day. A TEOM (Tapered Element Oscillating Monitor) in Stockton recorded a PM10 concentration of 176 $\mu g/m^3$, which would have also constituted an exceedance; however, the Stockton TEOM is not certified as data for record.

The September 2 and 3, 2004 PM10 episode in the SJVAB was exceptional in that wind speeds were much higher than normal throughout the San Joaquin Valley. In addition, the high winds persisted for many hours, which is also atypical. For the San Joaquin Valley and some areas of Sacramento Valley, 18 out of 42 sites recorded daily average wind speeds far out of historical range (more than 3 standard deviations). The high wind event resulted in entrainment of dust followed by deposition as the plume moved further down the San Joaquin Valley from Stockton to Bakersfield. The winds slowed in the Corcoran, PM10 that had been entrained north of the site was deposited, and the result was higher PM10 levels.

September 2, 2004

A wind blown dust event began across parts of Sacramento and San Joaquin Valley late in the day on September 2, 2004. The alternate Corcoran monitor measured a 24-hour PM10 concentration of 119 $\mu g/m^3$ on that day. Table 2 outlines the peak and daily average particulate matter measurements at Stockton, Modesto, Bakersfield-California, Corcoran, Clovis, and Fresno-1st. In order to understand the variability of these measurements, District staff conducted an in-depth examination of the synoptic pattern and surface winds and observations, aircraft soundings, and lower air profiler measurements leading to the episode.

The meteorological synoptic analysis showed that an unseasonably deep trough developed near Vancouver Island on the morning of the September 1, 2004. The

Table 2 Peak and Daily Average Particulate Matter Measurements for sites across the SJV for September 2, 2004

	10-TEOM[1]		10-BAM[2]		2.5-BAM		FRM-10[3]
Site Name	Peak	24-Avg.	Peak	24-Avg.	Peak	24-Avg.	24-Avg.
Stockton	173	40	*	*	*	*	*
Modesto	*	*	*	*	21	9	*
Corcoran	111	55	380	119	21	15	*
Clovis	60	41	*	*	*	*	*
Fresno-1st	*	*	73	50	*	*	*
Bak-Cal	*	*	*	*	22	12	*

Units in µg/m^3, *-N/A

trough slowly pushed southeastward toward California. The upper level system reached northern California on the morning of September 2, 2004 and pushed southeastward into the Great Basin by the September 3, 2004. The afternoon surface charts depicted a surface high pressure ridge draped across central California to Tonopah, with a thermal low near Kingman, Arizona. The 0Z[4] (17:00 PDT) surface pressure gradient was +10.9 millibars (MB) from San Francisco (SFO) to Las Vegas (LAS). A +10.9 MB pressure gradient means onshore or up-valley (from low elevations to high elevations on the Valley floor) flow, which results in strong northwesterly winds across the San Joaquin Valley. A moderately strong dry cold front curved westward from Tonopah, Nevada toward Redding. The morning temperature soundings over Fresno showed a strong inversion of 12 degrees Fahrenheit from the surface up to 1,500 feet. At Bakersfield the temperature sounding showed a moderate inversion of 7 degrees Fahrenheit from the surface up to 1,000 feet.

Upper level charts indicated a strong low over the Intermountain Region, with a trough digging south-southwestward across extreme northeastern California. A strong temperature gradient (packing) at 850 MB and an intense upper level (300 MB) jet were evident across northwestern California on the 05:00 PDT (12 Z) analysis maps. The moderate temperature gradient aloft, along with a strong upper level jet, manifested the surface pressure gradient and resulted in strong gusty winds measured at several hourly-surface meteorological monitoring sites during the evening hours on September 2. Table 3 shows the 24-hour daily average wind speeds at SJVAPCD air monitoring, ASOS (Automated Surface Observing System), and CIMIS (California Irrigation Management Information System) sites for September 2, 2004. *Italicized* sites recorded wind speeds

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[1] Tapered Element Oscillating Monitor (TEOM)
[2] Beta Attenuation Monitor (BAM)
[3] Federal Reference Method (FRM)
[4] 0Z is midnight Zulu time. The National Oceanic and Atmospheric Association (NOAA) satellites use Zulu time. 0Z is equivalent to midnight Universal Coordinated Time (UTC, formerly referred to as Greenwich Mean Time). 0Z is also equivalent to 017:00 Pacific Daylight Savings Time (PDT). 12Z is equivalent to 5:00 PDT.

Table 3 24-hour average wind speeds (WS) at SJVAPCD air monitoring, ASOS, and CIMIS sites for September 02, 2004.

SJVAPCD Air Monitor		ASOS		CIMIS			
	WS mph		WS mph		WS mph		WS mph
Visalia LAP	5.0	BFLD Meadows	7.3	FivePoints	7.3	Famoso	2.8
Clovis	7.0	Fresno YI	10.4	Shafter/USDA	3.3	Orange Cove	6.7
Fresno SSP	3.0	Hanford	9.0	Firebaugh/Telles	5.8	Madera	6.2
Madera Pump	15.0	Madera-AP	9.1	Stratford	7.1	Belridge	3.8
Maricopa	6.0	Merced-AP	7.9	Kettleman	*6.4*	Merced	5.4
Merced-Coffee	5.0			Visalia/Americas	3.9	Patterson	**9.3**
Parlier	6.0			Parlier	*5.0*	Lodi West	3.0
Turlock	6.0			Blackwells Corner	5.6	Tracy	*7.6*
				Los Banos	7.5	Porterville	3.7
				Manteca	5.7	Arvin-Edison	4.5
				Modesto	5.8	Delano	3.6
				Fresno State	6.5	Westlands	**9.1**
				Lindcove	2.8	Panoche	5.6
				Kesterson	5.9		

moderately out of normal range and **bolded** sites recorded wind speeds far out of normal range.

Lower air profiler data from Chowchilla showed that with solar insolation (heating), the inversion present in the morning began to mix out by 11:00-12:00 PDT (18 -19Z), resulting in winds aloft mixing to the surface (Figure 8, Figures 9 and 10 show later observations). The ASOS hourly observations showed northwesterly wind flow across the San Joaquin Valley (down-valley). As the upper level trough and strong jet-stream aloft began to move over the region by the late afternoon hours, northwesterly winds strengthened over the San Joaquin Valley resulting in blowing dust conditions. As the winds upwind of Corcoran intensified to 15 to 25 mph, particulate levels became elevated in Corcoran on September 3. The monitor showed slower wind speeds between 5 to 10 mph in Corcoran, illustrating a down-wind deposition of particulate material from a distant source site.

The wind event on September 2, 2004 began in the afternoon hours and continued into the early evening. Northwesterly winds led to a regional transport of particulates with local deposition occurring where winds speeds decreased. The highest 24-hour average PM10 measurement was 119 $\mu g/m^3$ at Corcoran. A majority of the PM10 fraction was coarse, as approximately 13% of the PM10 sample was PM2.5 or smaller. A violation of the PM10 NAAQS did not occur on September 2 because the wind event only lasted eight to nine hours (and the standard of interest for this report is a 24-hour standard). During the overnight

Figure 8 Chowchilla Lower Air Profiler image for September 1 through September 2, 2004.

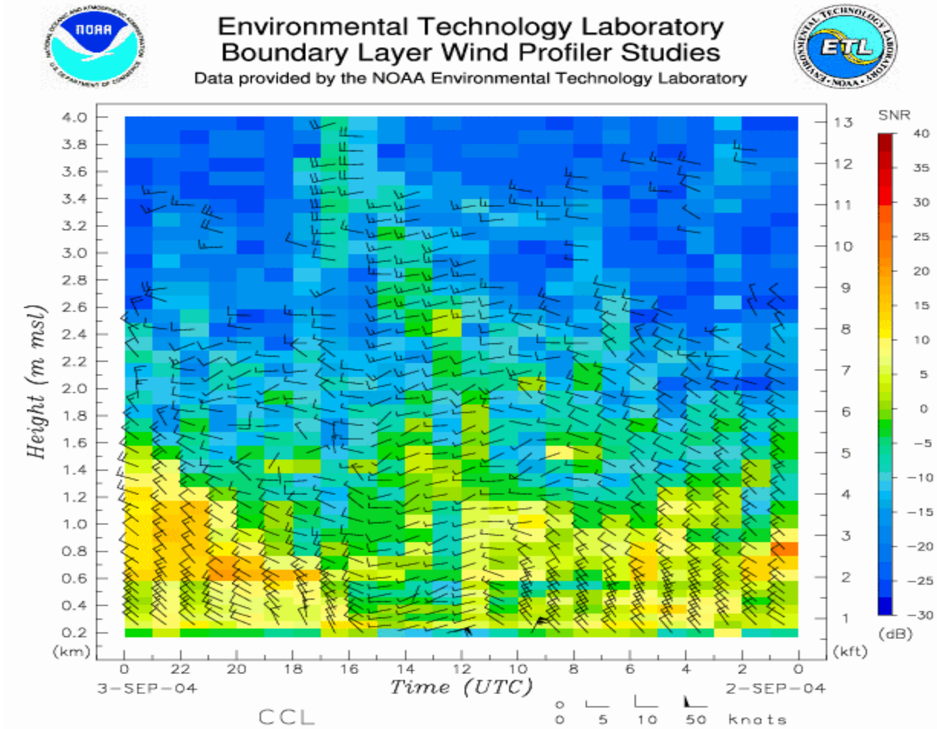


Figure 9 Chowchilla Lower Air Profiler image for September 2 through September 3, 2004.

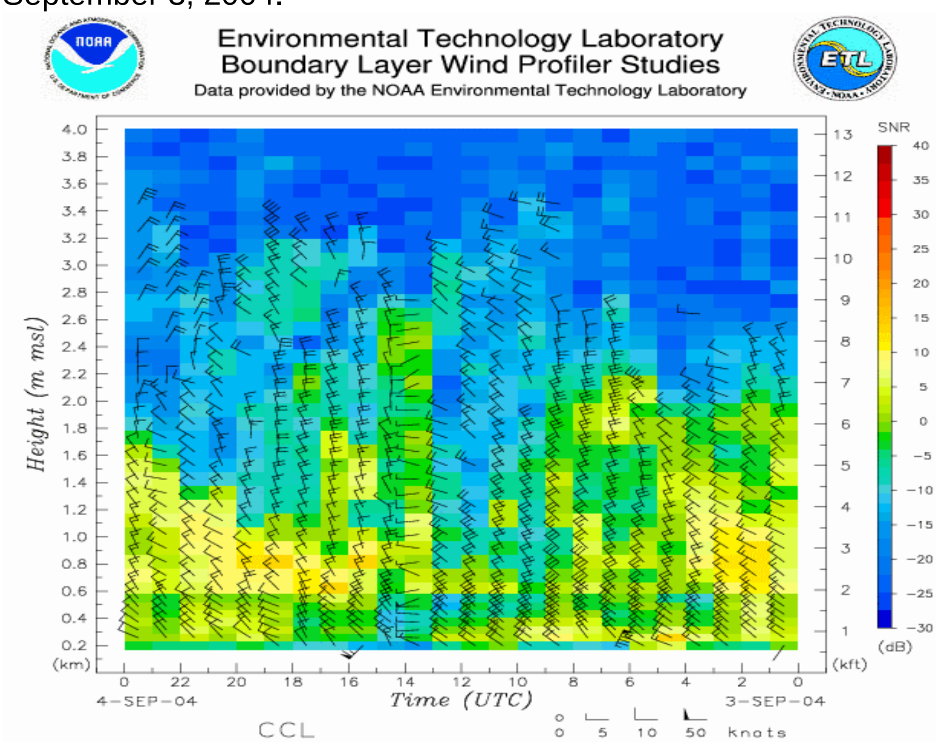
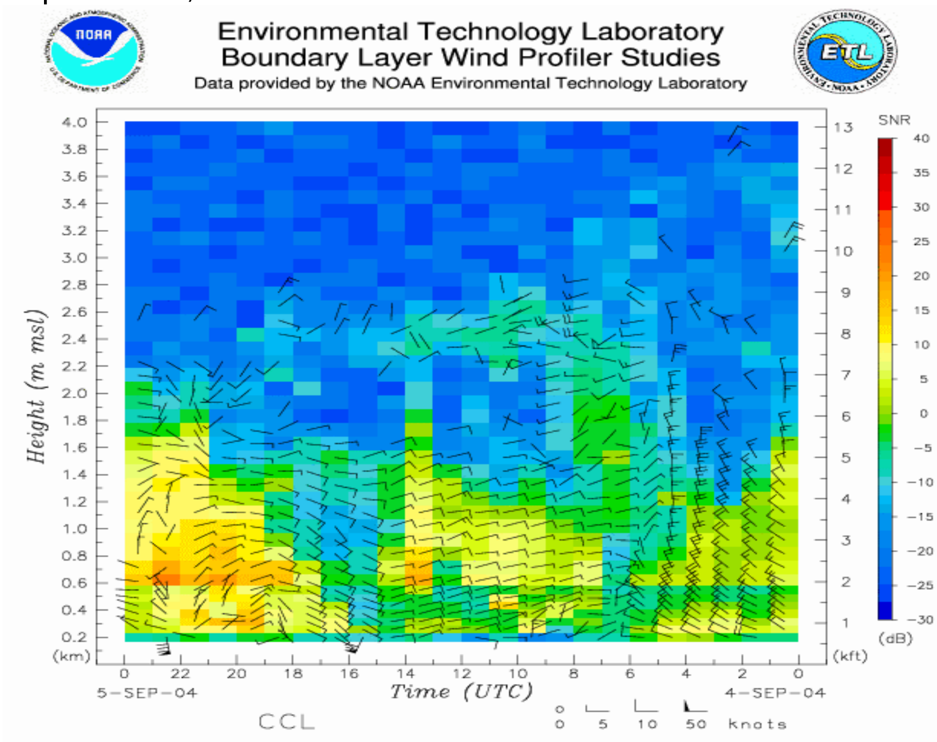


Figure 10 Chowchilla Lower Air Profiler image for September 3 through September 4, 2004



hours, the upper level jet-stream moved out of the area and a weak inversion formed over the San Joaquin Valley, resulting in lower wind speeds and particulate levels.

September 3, 2004

A regional wind blown dust event occurred across the San Joaquin Valley on September 3, 2004. This regional event extended from the Sacramento Valley southward into the San Joaquin Valley. The Stockton-Hazleton and Corcoran-Patterson stations measured 24-hour PM10 concentrations of 176 and 217 $\mu g/m^3$, respectively. Table 4 outlines the peak and daily average particulate matter measurements at Stockton, Modesto, Bakersfield-California, Corcoran, Clovis, and Fresno-1st. In order to understand the variability of these measurements, District staff conducted an in depth examination of the synoptic pattern, surface winds and observations, aircraft soundings, and lower air profiler measurements leading to the episode.

The meteorological synoptic analysis showed the jet-stream re-intensified over central California on the morning of September 3, 2004. The morning surface charts depicted a strong, dry surface cold front that stretched westward across central California from Las Vegas to Monterey. The 05:00 PDT (12Z) surface pressure gradient was +10.5 millibars from San Francisco (SFO) to Las Vegas

Table 4 Peak and Daily Average Particulate Matter Measurements for sites across the SJV for September 3, 2004
units in $\mu g/m^3$, *-N/A

	10-Teom		10-BAM		2.5-BAM		FRM-10
Site Name	Peak	24-Avg.	Peak	24-Avg.	Peak	24-Avg.	24-Avg.
Stockton	341	***176***	*	*	*	*	*
Modesto	*	*	*	*	20	10	*
Corcoran	262	120	542	***217***	41	25	***217***
Clovis	144	88	*	*	*	*	*
Fresno-1st	*	*	145	92	*	*	*
Bak-Cal	*	*	*	*	23	14	*

(LAS). A +10.5 millibars pressure gradient means onshore or up-valley flow (from low elevations to high elevations on the Valley floor). The morning temperature sounding over Fresno showed a moderate inversion of 7 degrees Fahrenheit from the surface up to 2,500 feet turning unstable above. At Bakersfield the temperature sounding showed a slightly unstable atmosphere.

Upper level charts indicated a deep trough across the Great Basin, the vast area of valleys and narrow mountain ranges centered on Nevada and extending to the Sierra Nevada Range in California on the west and to the Rockies in Utah on the east. A strong high located 900 NM (nautical miles) west of Eureka, and a ridge was building northeastward into British Columbia. A moderate temperature gradient at 850 MB and an intense upper level (300 MB) jet were evident across northern California on the 05:00 PDT (12Z) analysis maps. With afternoon heating, the inversion rapidly dissipated. With strong upper-level mixing in the afternoon, northwesterly winds were mixed to the ground. Table 5 shows the 24-hour daily average wind speeds at SJVAPCD air monitoring, ASOS, and CIMIS sites for September 03, 2004. *Italicized* sites recorded wind speeds moderately out of normal range and **bolded** sites recorded wind speeds far out of normal range.

Lower air profiler data from Chowchilla indicated that with solar heating, the weak morning inversion rapidly mixed out by 09:00 – 10:00 PDT (16 - 17Z), resulting in strong winds aloft mixing to the surface (Figure 9). Madera had higher wind speeds on September 2, 2004 compared to September 3 whereas Stockton had higher wind speeds on September 3, 2004 compared to September 2. Figures 11 and 12 show that on the September 2, 2004, wind characteristics at Madera and Stockton were marked by a short duration event of elevated winds. On the other hand, September 3 was marked by gusty, strong winds occurring for most of the day. Peak one-hour average wind speed measurements at Madera measured 19 mph from 12:00 – 15:00 PDT (19 – 22Z), with a 20 mph wind speed measurement recorded at 15:00 – 16:00 (22 – 23Z) and 17:00 –18:00 PDT (0 – 1Z).

In summary, the regional wind event on the September 3, 2004 across the Sacramento and San Joaquin Valley resulted in a PM10 measurements of 176 and 217 $\mu g/m^3$ in Stockton and Corcoran respectively; these levels exceeded the federal 24-hour PM10 standard. Many sites recorded daily average wind speeds that were more than 3 standard deviations from the normal, resulting in a natural wind-blown dust event occurring on September 3, as is evident with the widespread elevated PM10 measurements. Strong to gusty winds in parts of the Sacramento and San Joaquin Valley transported particulates to areas where winds slowed, the particles were deposited near the surface, and high PM10 levels resulted. Local sources may have contributed to the samples, but the large regional transport component overwhelmed their contribution.

Table 5 24-hour average wind speeds at SJVAPCD air monitoring, ASOS, and CIMIS sites for September 3, 2004

SJVAPCD Air Monitor		**ASOS**		**CIMIS**			
	WS mph		**WS mph**		**WS mph**		**WS mph**
Visalia LAP	5.0	BFLD Meadows	5.8	FivePoints	*9.4*	Famoso	3.5
Clovis	6.0	Fresno YI	8.9	Shafter/USDA	3.2	Orange Cove	4.4
Fresno SSP	3.0	Hanford	9.3	Firebaugh/Telles	**9.3**	Madera	6.3
Madera Pump	15.0	Madera-AP	7.9	Stratford	**10.0**	Belridge	3.9
Maricopa	7.0	Merced-AP	11.5	Kettleman	*6.4*	Merced	6.8
Merced-Coffee	7.0			Visalia/Americas	2.9	Patterson	**18.8**
Parlier	5.0			Parlier	3.7	Lodi West	*5.8*
Turlock	11.0			Blackwells Corner	6.5	Tracy	**11.4**
				Los Banos	**13.3**	Porterville	3.1
				Manteca	*7.7*	Arvin-Edison	4.5
				Modesto	**10.1**	Delano	4.4
				Fresno State	5.4	Westlands	**10.5**
				Lindcove	2.9	Panoche	**9.1**
				Kesterson	**14.4**		

Figure 11: Hourly Average Wind Speeds at Madera on September 2, and 3, 2004

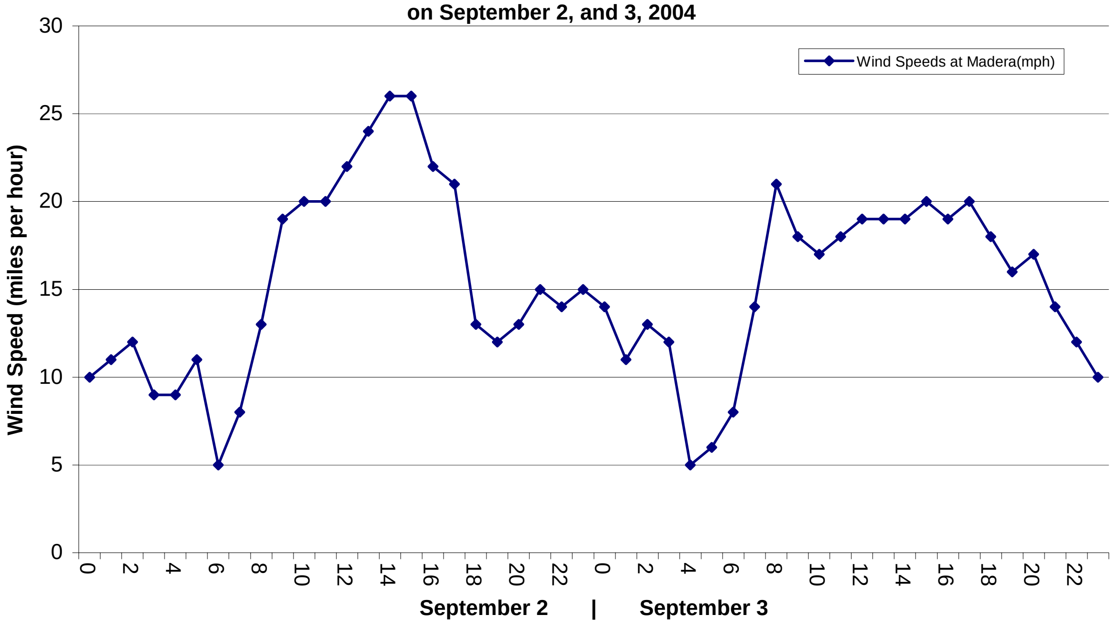
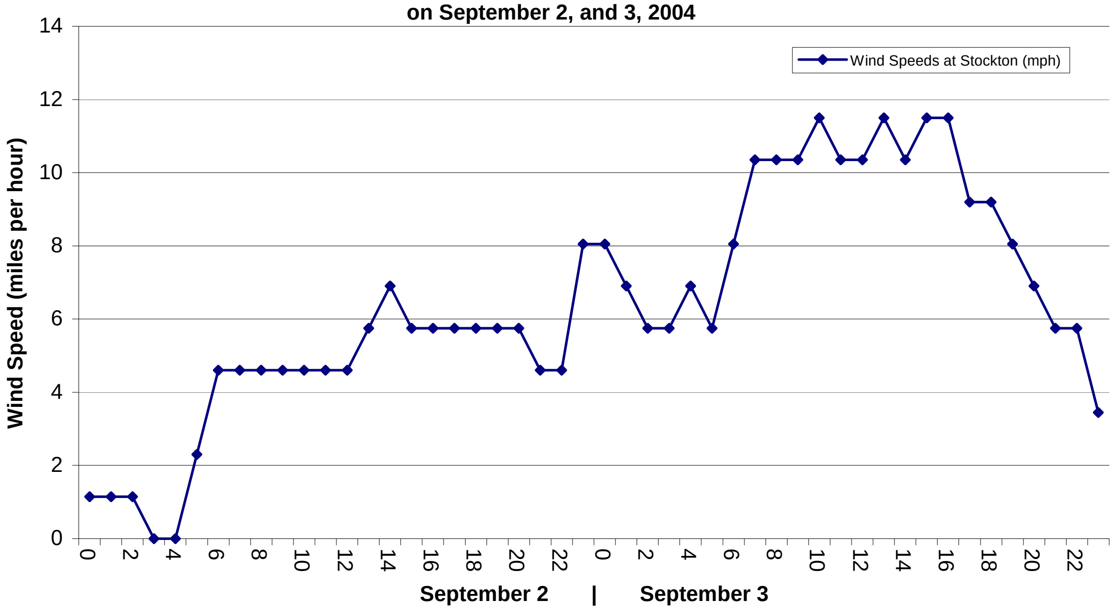


Figure 12: Hourly Average Wind Speeds at Stockton on September 2, and 3, 2004



SUMMARY

The 1996 EPA memorandum, *Areas Affected by PM10 Natural Events*, allows areas to define the natural, high wind events that will overcome the best available control measures (BACM) for fugitive dust. When documentation shows that a natural high wind event caused a PM10 exceedance, then the air quality data from that event will be flagged so that it does not count towards attainment status.

The PM10 exceedance recorded in Corcoran, California on September 3, 2004 was the result of high winds throughout the Central Valley that affected the Corcoran area by upwind transport. This documentation is to be submitted to the ARB and the EPA by March 3, 2005, and if the flag request is approved, the District will prepare a NEAP (Natural Events Action Plan) and submit it to the EPA by March 3, 2006.

<u>Resources</u>

California Air Resources Board (ARB). *Forecast Emissions by Summary Category Reports: CCOS (v2.11_RF932PEI)*. February 3, 2005, <www.arb.ca.gov/emsinv/ccos>.

San Joaquin Air Pollution Control District. *2003 PM10 Plan*. Amended December 18, 2003.

U.S. Census Bureau. *Census Bureau Home Page*. February 3, 2005, <http://www.census.gov>.