C H A P T E R 2

AIR QUALITY

PM_{10} Air Quality in the Coachella Valley

High-Wind Natural Event

Attainment of Federal PM_{10} Standards

PM_{10} AIR QUALITY IN THE COACHELLA VALLEY

The District currently monitors ambient air quality, including PM_{10} concentrations, at two air monitoring stations in the Coachella Valley. In 1995, the Coachella Valley stations exceeded state and federal standards for ozone and PM_{10}, but did not exceed standards for any other pollutants. The one exceedance of the federal 24-hour PM_{10} standard occurred on a day with high winds and wind-blown dust, and excluding that date in accordance with the newly approved U.S. EPA natural events policy[1], the federal standards were not exceeded. A detailed demonstration of attainment of the federal standards is included in a later section.

Detailed information on air quality in the Coachella Valley through 1993 has been presented previously, including a discussion of trends and detailed tables of statistics covering the period 1976-1993.[2] This discussion covered all of the criteria pollutants, including PM_{10}. Figures 2-1 and 2-2 present a summary of the 24-hour and annual average PM_{10} values based on monitored data. As indicated in Figure 2-1, the 24-hour values peaked in 1989 and have since decreased significantly. Figure 2-2 also shows the declining trend in annual average values.

The following chapter contains an analysis of the most current PM_{10} data available for the Coachella Valley, covering the period 1993-1995. PM_{10} concentrations are compared to both state and federal standards. More detailed air quality information, including an analysis of seasonal, day-of-week, and diurnal variation of PM_{10}, is presented in Appendix G. Tables containing daily PM_{10} measurements and summary statistics for both Coachella Valley stations for each of the years 1993-1995 are also included in Appendix G.

Measurement Method

PM_{10} is sampled by means of size selective inlet high volume (SSI) samplers that collect airborne particles with diameter smaller than approximately 10 micrometers. PM_{10} samples are collected on a quartz fiber filter over a 24-hour period. The filters are returned to the District's laboratory for weighing and chemical analysis. PM_{10} samples are routinely analyzed for sulfate and nitrate. PM_{10} is collected with SSI samplers every sixth day, so that the number of samples is approximately 60 for a given year if data are complete. Accordingly, exceedances of the federal and state PM_{10} standards are usually expressed in terms of percent of days sampled that exceeded.

[1] U.S. EPA, Memorandum from Mary D. Nichols, Assistant Administrator for Air and Radiation to Directors, Subject: Areas Affected by PM-10 Natural Events, May 1996.

[2] Air Quality Management Plan for the Coachella-San Jacinto Planning Area, Appendix I-B, 1994 AQMP, South Coast AQMD, September 1994.

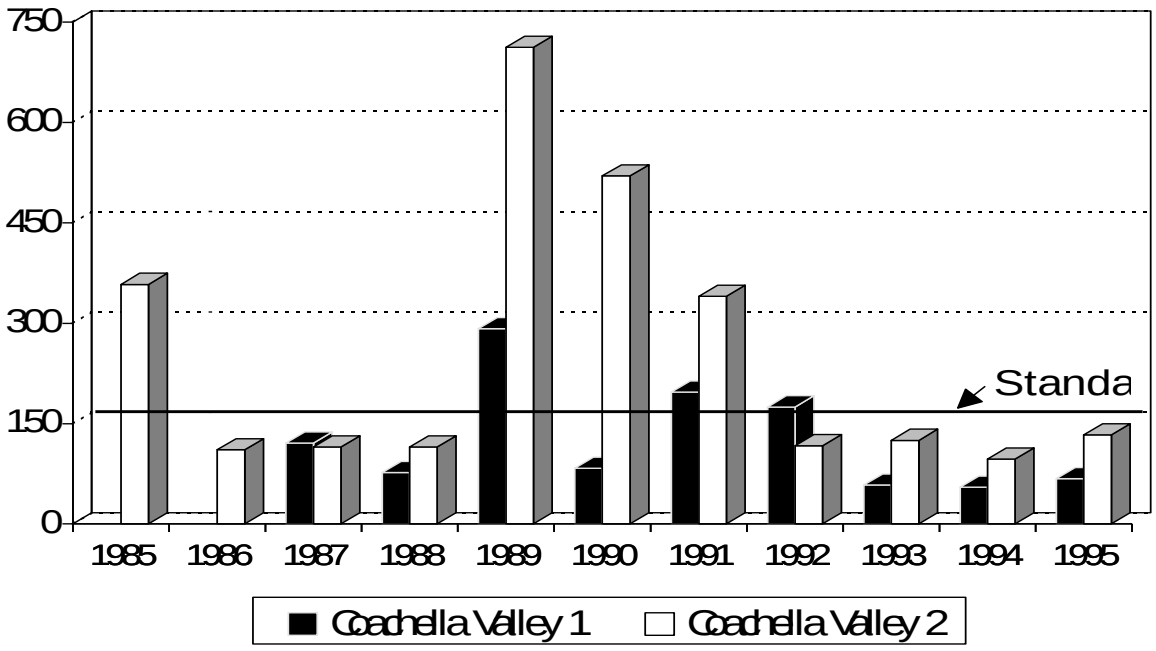

FIGURE 2-1

24-Hour PM_{10}, 1985 - 1995

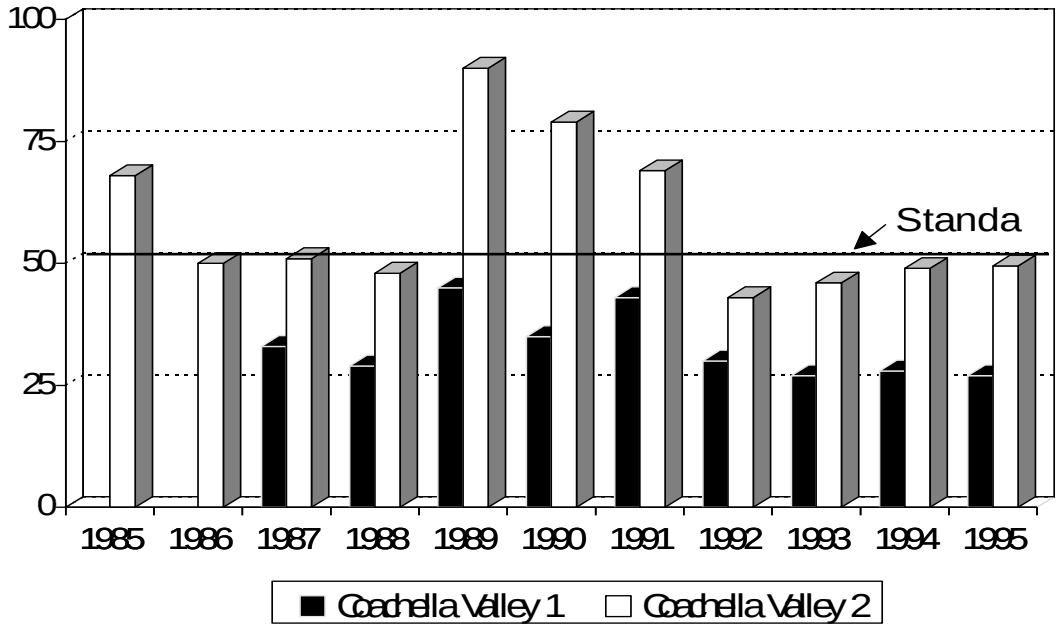

FIGURE 2-2

Annual Average PM_{10}, 1985 - 1995

PM_{10} Air Quality Compared to State and Federal Standards

Table 2-1 shows the number and percent of days exceeding the federal and state 24-hour standards for the years 1993-1995 at the two air monitoring stations in the Coachella Valley. The annual maximum and second highest 24-hour average PM_{10} concentrations are also shown. At Coachella Valley 1 (Palm Springs), which is closest to San Gorgonio Pass and the Basin, there were no exceedances of the federal 24-hour standard during the three year period 1993-1995. The state standard was exceeded on from 1.7 to 3.6% of days sampled during these three years. The maximum concentration recorded at Coachella Valley 1 (68 $\mu g/m^3$) was 45% of the federal standard and 133% of the more stringent state standard.

TABLE 2-1

PM_{10} - Days Exceeding Standards and Maximum 24-Hour Concentrations
(Federal 24-hour standard = 150 $\mu g/m^3$. State 24-hour standard = 50 $\mu g/m^3$.)

Location/Year	Days(% Days) >150 ug/m^3	Days(% Days) >50 ug/m^3	Maximum 24-hr. Avg.	2nd High 24-hr. Avg.	Number of Samples
Coachella Valley 1					
1993	0(0%)	1(1.7%)	58	50	60
1994	0(0%)	2(3.3%)	55	51	60
1995	0(0%)	2(3.6%)	68	56	56
Coachella Valley 2					
1993	0(0%)	25(41.0%)	125	91	61
1994	0(0%)	23(38.3%)	97	84	60
1995	1(1.6%)	27(44.3%)	199	133	61
1995 - June 2*	0(0%) *	26(43.3%) *	133 *	95 *	60

* Statistics for 1995 after deletion of data for June 2, 1995. High winds and windblown dust were recorded on 6/2/95.

At Coachella Valley 2 (Indio), the federal 24-hour PM_{10} standard was not exceeded in 1993 or 1994, but was exceeded on 1.6% of days (or one of the 61 days sampled) in 1995. The maximum concentration recorded in 1995 at Coachella Valley 2 (199 $\mu g/m^3$) was 132% of the federal 24-hour standard, and 390% of the state 24-hour PM_{10} standard. The one day exceeding (June 2, 1995) was a day with high winds and windblown dust. With this day excluded as a "natural event," (see documentation in the next section) there are no violations of the federal standard and the maximum concentration recorded (133 $\mu g/m^3$) is 88% of the federal standard and 261% of the state standard.

Table 2-2 shows annual average PM_{10} concentrations for each of the years 1993-1995. The three averages given are annual arithmetic mean (AAM, used in all historical District reports), annual arithmetic mean of quarterly means (AAMQM, specified for determination of attainment of the federal standard), and annual geometric mean (AGM, used to reduce the effect of extreme values, and specified for comparison to the California state standard).

TABLE 2-2

Annual Average PM_{10} Concentrations

Annual Average PM10 Concentrations

Location/Year	AAM	AAMQM	AGM	Number of Samples
Coachella Valley 1				
1993	27.0	26.8	23.6	60
1994	27.8	27.8	24.0	60
1995	27.0	27.2	24.3	56
Coachella Valley 2				
1993	46.4	46.4	40.6	61
1994	48.7	48.3	45.3	60
1995	52.0	52.0	47.2	61
1995 - June 2*	49.5 *	49.6 *	46.1 *	60

AAM = Annual Arithmetic Mean.
AAMQM = Annual Arithmetic Mean of Quarterly Means. Federal standard = 50 $\mu g/m^3$, AAMQM PM10.
AGM = Annual Geometric Mean. California state standard = 30 $\mu g/m^3$, AGM.
* Statistics for 1995 after deletion of data for June 2, 1995. High winds and windblown dust were recorded on 6/2/95.

The highest annual average PM_{10} concentrations at Coachella Valley 1 (27.8 $\mu g/m^3$ AAM or AAMQM, and 24.3 $\mu g/m^3$ AGM) were 55% of the federal standard and 81% of the state standard.

At Coachella Valley 2, which is further downwind from the neighboring South Coast Air Basin (Basin) but more directly affected by the action of winds in the desert, annual average concentrations were higher for all three years. The highest annual average concentrations (52.0 $\mu g/m^3$, AAM or AAMQM, and 47.2 $\mu g/m^3$ AGM) were recorded in 1995 and were 104% of the federal standard, and 157% of the state standard. When the highest 24-hour average PM_{10} of the year at Coachella Valley 2 is excluded, the 1995 annual average concentrations (49.6 $\mu g/m^3$, AAMQM and 46.1 $\mu g/m^3$ AGM) are 99% of the federal standard and 153% of the state standard.

In 1995, the Coachella Valley PM_{10} averaged from 4 to 5% nitrates and from 5 to 8% sulfates. This compares to 22 to 26% nitrates and 6 to 11% sulfates in the Basin. Sulfates and nitrates averaged higher for Coachella Valley 1, which is closest to the Basin with its large urban areas, than for Coachella Valley 2. This is consistent with less transported secondary PM_{10} from the Basin, but a greater contribution from windblown dust at Coachella Valley 2.

HIGH-WIND NATURAL EVENT

U.S. EPA Natural Events Policy

Introduction

In May of 1996 the U.S. EPA released its natural events policy that was intended to provide guidance to air districts regarding the exclusion of ambient air quality data affected by extraordinary natural events (e.g., volcanic and seismic activity, wildland fires, and high-winds). The policy represents the U.S. EPA's most recent interpretation of CAA Section 188(f) and Appendix K to 40 CFR, part 50. Under the policy, air districts may request the redesignation of a nonattainment area to attainment if it can be demonstrated that the area would be meeting the standards if the emissions caused by natural events can be excluded. In order to qualify for the exclusion of ambient air quality data, the policy requires the adoption of a natural events action plan (NEAP) to minimize emissions and to protect public health. The NEAP is included within this submittal (see Chapter 6).

As previously mentioned, the Coachella Valley has had only one day with a 24-hour average PM_{10} concentration above the federal standard of 150 $\mu g/m^3$ during the most recent three year monitoring period (1993-1995). This day, June 2, 1995, resulted in a 24-hour PM_{10} level of 199 $\mu g/m^3$ and can be attributed to a high wind event with windblown dust that can be categorized as a "natural event." Accordingly, the District is proposing that the air quality data documented during this event be removed for purposes of attainment consideration. The following paragraphs provide background information regarding the windblown dust in the Coachella Valley and this information is followed by a case study of the June 2, 1995 event.

Climatic Conditions

To better understand the extreme windblown dust events in the Coachella Valley, the District has initiated a special measurement program in the Whitewater Wash Blowsand Preserve. This site is on the downwind side of a large natural blowsand source and in an unsheltered, high-wind area of the valley, northwest of Palm Springs. Measurements include hourly-averaged winds and peak wind gusts for each hour, as well as PM_{10}

samples. The PM_{10} measurements are made with a sequential SSI, that measures three consecutive 24-hour filter samples. The PM_{10} sampling is initiated during the spring and early summer on a forecast basis, when blowsand events are predicted in the Coachella Valley.

Sustained, high winds are necessary to suspend and transport blowsand to cause high PM_{10} events. While not a rare occurrence in the Coachella Valley, these exceptional wind events occur infrequently and are likely to be associated with unhealthful PM_{10} levels due to windblown dust.

Table 2-3 summarizes the Whitewater Wash and Indio 24-hour PM_{10} concentrations under different wind regimes. Since the every-sixth-day SSI sampling at Indio was not coincident with the forecast-based PM_{10} measurements at the Whitewater Wash, the daily 24-hour averages for Indio on those days are based on hourly measurements from the Beta Attenuation Monitor (BAM) at Indio.

Of the 21 days in 1995 on which PM_{10} and winds were measured at the Whitewater Wash site, six days had wind gusts of 50 mph, or higher, for five or more consecutive hours. The Whitewater Wash 24-hour PM_{10} mass on those high wind days ranged from 79 $\mu g/m^3$ to 206 $\mu g/m^3$, with a mean of 126 $\mu g/m^3$. Since there are no other significant upwind sources, these readings are a measure of the intensity of wind-originated PM_{10} in the natural, undisturbed portions of the desert. For comparison, the Indio 24-hour PM_{10} mass on those six days ranged from 40 to 155 $\mu g/m^3$, with a mean of 92 $\mu g/m^3$. This provides an indication of the difference in PM_{10} levels between the immediate source area (Whitewater Wash) and further downwind (Indio).

Seven of the PM_{10} sampling days had wind gusts that did not exceed 50 mph for five or more hours of the day, but did have wind gusts that exceeded 40 mph for five or more hours. While the speed of the gusts were only marginally lower than the top category, the impact to blowsand generation from the reduced gust strength is clearly demonstrated by a reduction of the measured mean 24-hour PM_{10} concentrations at both Whitewater Wash and Indio by nearly one-half.

This correlation between extreme gusts and blowsand events is further demonstrated by the eight days that had wind gusts under 40 mph for nearly all hours of the day. The 24-hour PM_{10} mass at the Whitewater Wash site on these lighter wind days ranged from 10 $\mu g/m^3$ to 98 $\mu g/m^3$, with a mean 24-hour PM_{10} concentration of 47 $\mu g/m^3$. This is approximately equal to the 1995 annual geometric mean (AGM) concentration of PM_{10} (47.2 $\mu g/m^3$) observed in the Coachella Valley. The mean 24-hour PM_{10} at Indio measured 28 $\mu g/m^3$ on these lighter wind days, indicating that the transport of blowsand was not a significant factor for wind gusts under 40 mph.

TABLE 2-3

Summary of 24-Hour Average PM_{10} Measured at the Whitewater Wash Blowsand Site and Indio (daily average from hourly BAM) in 1995 Under Various Wind Gust Regimes

Days With Whitewater Wind Gusts:	**# Days Whitewater PM_{10} & Winds Sampled**	**Mean of Whitewater Wind Gusts on Sampled Days**	**Mean Whitewater 24-hr. PM_{10} (Min-Max)**	**Mean Indio 24-hr. PM_{10} (Min-Max)**
> 50 mph for 5+ Hours	6	48 mph	126 $\mu g/m^3$ (79-206 $\mu g/m^3$)	92 $\mu g/m^3$ (40-155 $\mu g/m^3$)
> 40 mph, but under 5 hours of Gusts > 50	7	40 mph	69 $\mu g/m^3$ (26-135 $\mu g/m^3$)	42 $\mu g/m^3$ (18-75 $\mu g/m^3$)
≤ 40 mph for 20+ Hours	8	27 mph	47 $\mu g/m^3$ (10-98 $\mu g/m^3$)	28 $\mu g/m^3$ (12-69 $\mu g/m^3$)
All Days	21	37 mph	77 $\mu g/m^3$ (10-206 $\mu g/m^3$)	51 $\mu g/m^3$ (12-155 $\mu g/m^3$)

To further evaluate the dust producing wind events in the Coachella Valley, Figure 2-3 shows the 24-hour average wind speed from the Whitewater Wash site plotted against the 24-hour average PM_{10} concentration from the BAM at the Indio site for 1995. The best-fit curve illustrates that the wind starts to contribute to the downwind PM_{10} level at approximately 22 to 25 mph, after which the PM_{10} increases exponentially with increasing wind speed. This is consistent with studies in the Coachella Valley that have indicated a starting threshold of 22 mph for the PM_{10} dust to be picked up by the wind. The flat part of the curve at low wind speeds indicates a background level of approximately 45 $\mu g/m^3$ at Indio that is not caused by the winds at the large PM_{10} source at the Whitewater Wash Blowsand Preserve.

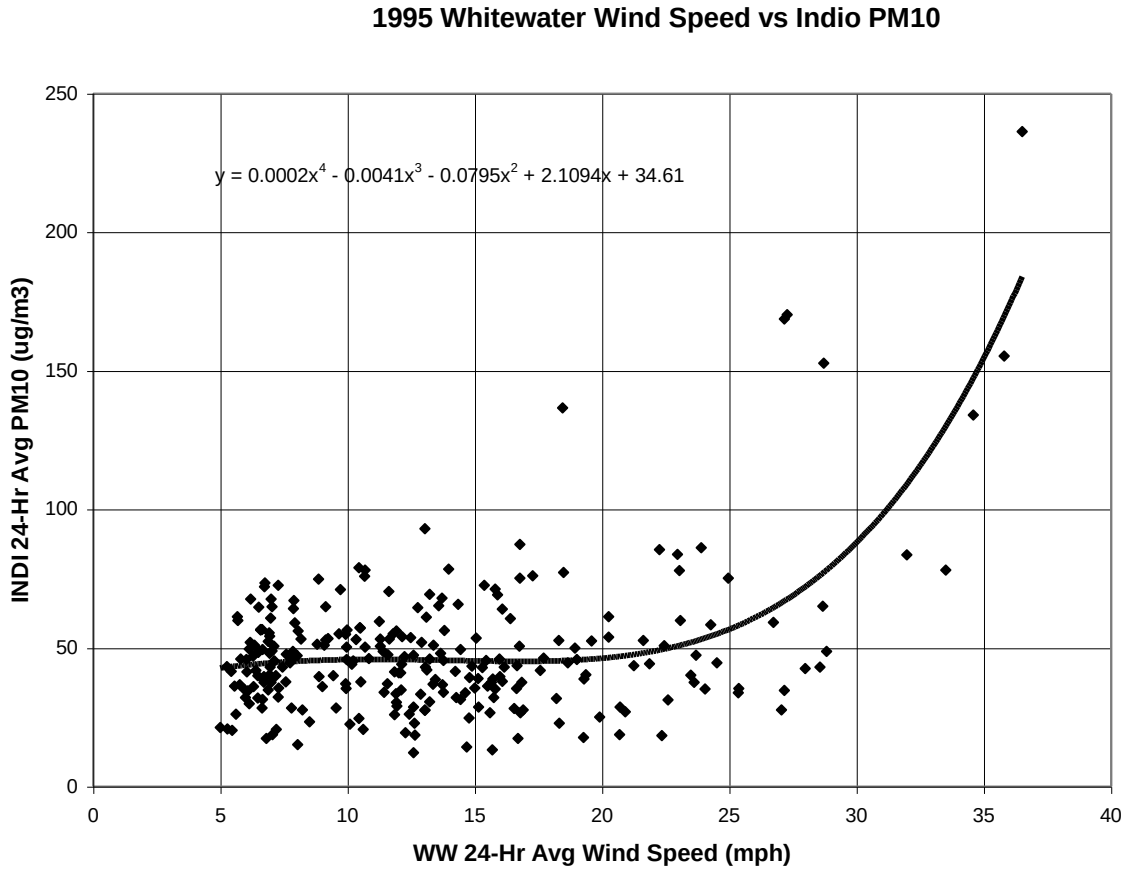

FIGURE 2-3

Plot of Paired Whitewater Wash 24-Hour Average Wind Speeds Versus Indio 24-Hour Average PM_{10} Concentrations from Hourly BAM Monitoring for 1995
(curve is best fit polynomial to data)

Figure 2-4 shows a similar plot for the winds measured at the Indio site with PM_{10} concentrations at Indio. The Indio wind speeds are clearly lighter than those at the Whitewater Wash site. In fact, the 22 mph starting threshold for windblown dust is never attained in the daily average. This indicates that the wind events at the upwind Whitewater Wash Blowsand Preserve source area are the main contributor to high windblown dust events measured at the Indio monitoring site.

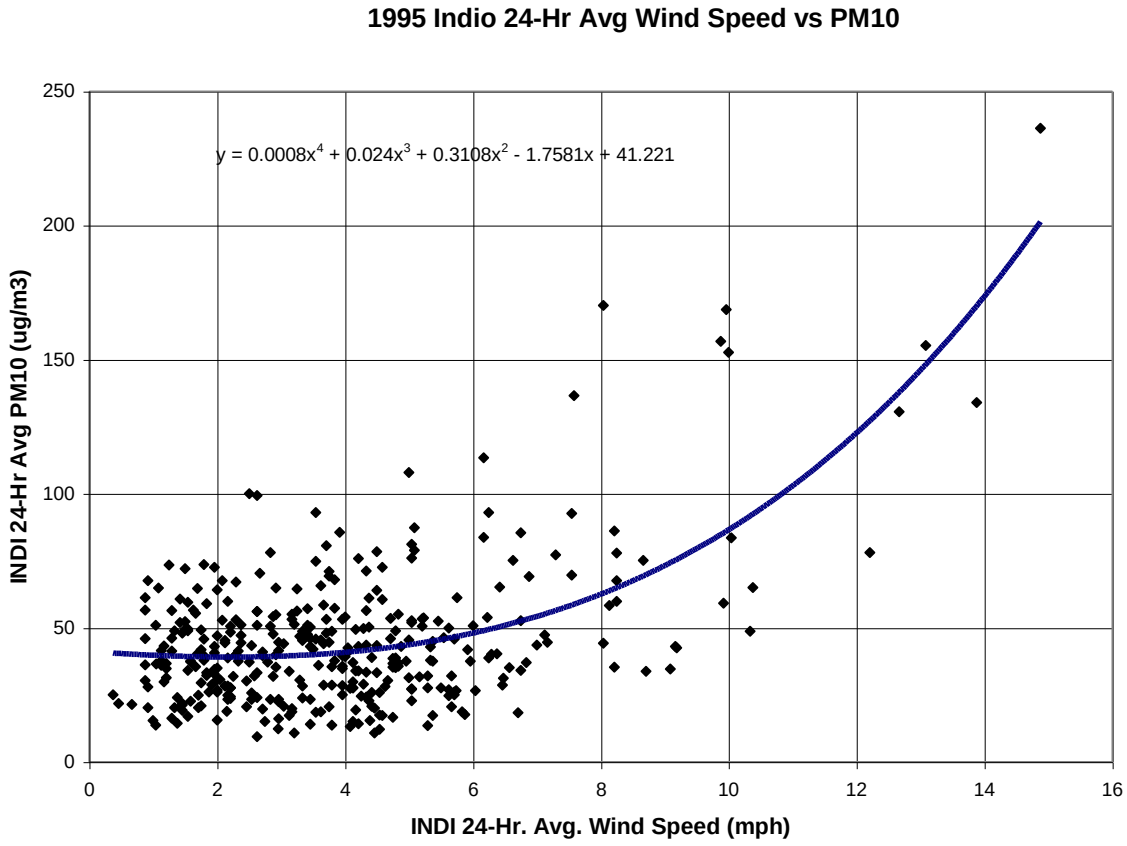

FIGURE 2-4

Plot of Paired Indio 24-Hour Average Wind Speeds Versus Indio 24-Hour Average PM_{10} Concentrations from Hourly BAM Monitoring for 1995
(curve is best-fit polynomial to data)

Case Study:June 2, 1995

The meteorological conditions on June 2, 1995 are characterized by an upper level trough of low pressure over Southern California. This is shown in Figure 2-5, the height analysis of the 500 millibar upper air pressure surface from the National Weather Service for June 2 at 0400 PST. The upper level trough helped to lift the inversion base and strengthened the onshore surface pressure gradient. The surface winds in the Coachella Valley were reinforced by the northwesterly winds aloft. Over the Basin, the marine layer on the morning of June 2 was over 4000 feet deep, causing morning low clouds, fog and local drizzle with only partial clearing in the afternoon. Skies in the Coachella Valley were clear, except for some afternoon strato-cumulus clouds that developed over the mountains.

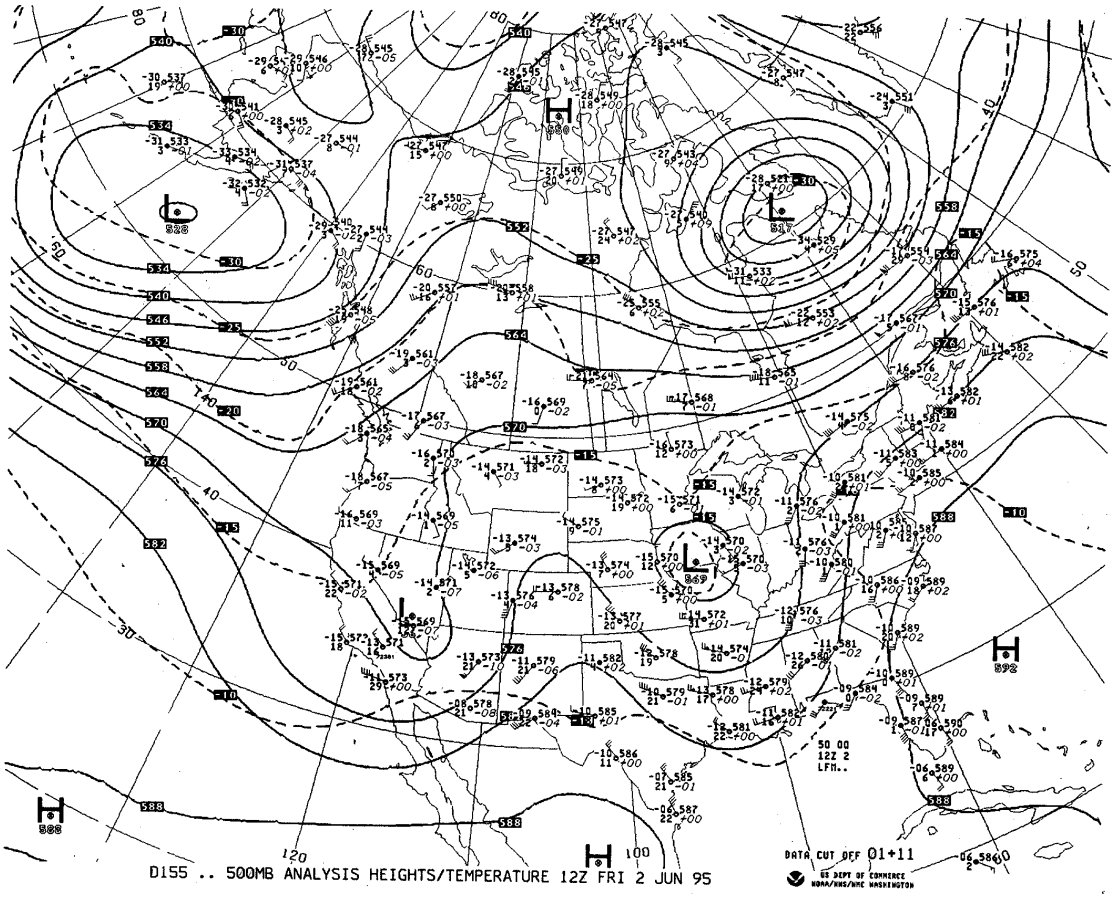

FIGURE 2-5

National Weather Service Height Analysis (Solid Contours in Tens of Meters)
of the 500 Millibar Pressure Surface for 12Z (0400 PST) Friday, June 2, 1995

A 24-hour PM_{10} concentration of 199 $\mu g/m^3$ was measured at Indio on June 2. The City of Palm Springs is sheltered by the San Jacinto Mountains during these west through northwest wind regimes that blow along the Coachella Valley, leading to a low PM_{10} concentration of only 39 $\mu g/m^3$ at the Palm Springs air monitoring station on this day.

This case is a good example of one of the main causes of widespread wind conditions in the Coachella Valley; that is, strong pressure and air mass density differences between the desert air mass and the marine-modified coastal air mass. Surface low pressure in the desert caused cooler and denser marine air to move through the Banning Pass and into the Coachella Valley. On June 2, this was reinforced by the synoptic (large scale) upper level trough of low pressure over Southern California and the strong surface pressure gradient, resulting in widespread, high west-northwest winds throughout the

valley. The high winds persisted for most of the day to produce windblown dust and the exceptional PM_{10} event.

The criteria used by the District to forecast high winds and windblown dust events in the Coachella Valley require:

(1) 0700 PST Pressure Gradient Index (PGI) > 17 millibars,
where PGI = the 0700 PST Summation Pressure Gradient [SPG = (SAN-LAS)[3] + (LGB-DAG)[4] + (RIV-DAG)[5]] + its 24-hour change from the previous day, and

(2) 0400 PST Coastal Temperature Inversion Base ≥ 1500 feet.

On the morning of June 2, 1995, the 0700 PST Summation Pressure Gradient (SPG) was 19.9 millibars. The 24-hour change in the SPG was 3.1, giving a Pressure Gradient Index (PGI) of 23.0 millibars. The coastal inversion base at 0400 PST was over 4000 feet. Thus, a strong onshore wind push was indicated on this day.

In addition, the pressure gradient at 0700 PST between San Francisco and Thermal (SFO-TRM) was 7.7 millibars, indicating moderately strong wind forcing through the Banning Pass and along the Coachella Valley.

Table 2-4 shows the wind directions, wind speeds with gusts and the highest 1-minute average wind speed for each hour on June 2 from the District's meteorological monitoring stations in the Coachella Valley. The wind monitor at the Whitewater Wash Blowsand Preserve measured hourly-average wind speeds exceeding 32 miles per hour throughout the day, with the maximum hourly measurement of 42 mph. The wind direction was consistently from about 300 degrees (west-northwest), or along the Coachella Valley corridor. Peak instantaneous gusts exceeded 50 mph for 23 hours of the day, with a maximum gust of 66 mph recorded. The District stations at Indio and Palm Springs also recorded relatively high hourly resultant average winds and high maximum 1-minute average speeds, which have been used since instantaneous gusts are not available from some District instrumentation. Since the Indio and Palm Springs stations are more sheltered or removed from the main wind corridor of the Valley below the Banning Pass, those sites measured lighter winds than the Whitewater Wash site. The 24-hour average wind speed at Indio was 15 mph, compared to 37 mph at Whitewater.

[3] Difference between San Diego and Las Vegas
[4] Difference between Long Beach and Daggett
[5] Difference between Riverside and Daggett

TABLE 2-4

Hourly and 24-Hour-Average Wind Directions (degrees),
Wind Speeds with Peak Gusts (mph, with gusts indicated by G when reported)
and the Highest 1-Minute Average for the Hour (mph)
for District Monitoring Stations in the Coachella Valley on June 2, 1995

	Whitewater Wash Blowsand Site			**Palm Springs Monitoring Station**			**Indio Monitoring Station**		
HOUR (PST)	**WD (deg)**	**WS (mph)**	**Maximum 1-Minute Avg. (mph)**	**WD (deg)**	**WS (mph)**	**Maximum 1-Minute Avg. (mph)**	**WD (deg)**	**WS (mph)**	**Maximum 1-Minute Avg. (mph)**
0000	306	39G59	49	308	13	20	326	16	26
0100	304	38G62	48	310	14	21	328	15	25
0200	304	33G52	40	303	12	19	323	15	23
0300	300	39G60	47	305	16	24	324	16	23
0400	297	42G66	52	305	17	23	326	17	23
0500	296	37G57	45	304	16	23	329	15	21
0600	297	35G53	43	303	14	22	324	15	23
0700	299	32G49	40	309	12	17	327	15	24
0800	301	34G51	40	308	13	19	330	15	21
0900	296	36G56	45	306	15	20	325	13	18
1000	296	40G60	49	312	15	21	329	16	22
1100	301	36G54	42	313	15	22	329	15	21
1200	298	35G52	42	312	14	21	328	13	18
1300	296	39G62	46	310	16	23	330	13	19
1400	298	38G59	46	311	16	22	335	15	22
1500	298	34G58	43	311	15	20	329	13	19
1600	296	33G56	43	308	14	20	332	12	19
1700	295	36G57	44	312	13	20	339	13	18
1800	290	33G54	44	307	11	19	335	15	21
1900	300	37G57	46	305	12	17	328	16	21
2000	303	38G56	44	305	15	22	324	17	27
2100	297	39G60	48	308	16	22	328	17	25
2200	300	37G54	45	307	16	23	326	16	23
2300	297	36G59	45	304	15	21	326	14	19
AVG	**298**	**37G57**	**45**	**308**	**14**	**21**	**328**	**15**	**22**

Table 2-5 shows the wind directions, wind speeds with gusts and visibilities for each hour on June 2 from the National Weather Service (NWS) stations in the vicinity of the Coachella Valley. Measurements from Palm Springs Airport and Thermal Airport showed gusty winds, but speeds were again lower than those seen at the Whitewater Wash monitor. The NWS site at Imperial, southeast of the Coachella Valley, exhibited lighter winds. While visibility degradation was associated with this event, visibilities at the NWS sites remained relatively good throughout the day on June 2 with minimum visual ranges of 10 miles observed.

TABLE 2-5

Hourly and 24-Hour-Average Wind Directions (degrees),
Wind Speeds with Peak Gusts (mph, with gusts indicated by G when reported) and
Visibilities (miles, when reported) for National Weather Service Stations on June 2, 1995

	Palm Springs Airport			**Thermal Airport**			**Imperial**		
HOUR (PST)	**WD (deg)**	**WS (mph)**	**VIS (miles)**	**WD (deg)**	**WS (mph)**	**VIS (miles)**	**WD (deg)**	**WS (mph)**	**VIS (miles)**
0000				310	14G26	10	260	28G33	20
0100				330	12G21	15	260	23	20
0200				320	14G24	15	290	7	20
0300				320	13G22	15	320	8	20
0400				330	12G22	15	0	0	20
0500	280	17	15	320	10G20	15			
0600	280	17	15	320	13G25	15	260	14	30
0700	0	0	15	320	13G24	15	290	10	30
0800	300	23	15	310	12G26	15	270	12	30
0900	300	17	20	300	10G23	15	310	8	30
1000	310	18	20	330	13G21	15	320	6	30
1100	300	35	20	330	10G17	15	250	9	30
1200	300	23	20	330	9	12	240	12	30
1300	320	23	20	340	8	12	250	18	30
1400	300	33	20	320	14	12	250	17	30
1500	290	23G35	20	340	12	10	240	21	30
1600	300	23G35	20	330	10	10	240	22	30
1700	310	29	20	320	10G20	12	250	23	30
1800	300	23	20	330	9	15	250	22	30
1900	310	21	20	320	13G22	15	260	20	30
2000	290	29	20	330	14G24	12	250	23	20
2100	310	29	10	330	13G22	12	260	16	20
2200	310	12	10	320	12G18	15	250	17	20
2300				320	14G24	15	260	18	20
AVG	**284**	**22**	**18**	**324**	**12**	**14**	**253**	**15**	**26**

The statistical model presented earlier in Figure 2-3 further illustrates that the June 2 PM_{10} exceedance at Indio was a natural event, resulting mainly from the natural PM_{10} source area of the Whitewater Wash Blowsand Preserve. From the best-fit curve of Whitewater 24-hour averaged wind speed versus Indio 24-hour averaged PM_{10} (Figure 2-3), the predicted 24-hour average PM_{10} at Indio from the June 2 24-hour average wind speed of 37 mph at Whitewater Wash would be 185 $\mu g/m^3$. By subtracting the local background PM_{10} of 45 $\mu g/m^3$, predicted by the model even at low wind speeds, we can estimate that approximately 140 $\mu g/m^3$ of the PM_{10} measured at Indio resulted from the Whitewater Wash blowsand. The winds at Indio averaged 15 mph on June 2 with no hourly wind speeds exceeding the 22 mph blowsand generation threshold, although the maximum 1-minute averages indicate that this threshold was reached for shorter periods of time. Thus, the local winds at Indio were not high enough to significantly contribute blowsand from the immediate Indio area, producing only an estimated 14 $\mu g/m^3$ of locally windblown dust. The estimated PM_{10} source influence at Indio on June 2, 1995 is summarized in Table 2-6.

TABLE 2-6

Estimated PM_{10} Source Influence at Indio on June 2, 1995

PM_{10} Origin	**PM_{10} Contribution ($\mu g/m^3$)**
Local Background	45
Natural Source (Whitewater Wash area)	140
Local Windblown	14
TOTAL:	**199**

ATTAINMENT OF FEDERAL PM_{10} STANDARDS

For the purposes of determining attainment of the federal 24-hour and annual PM_{10} standards, the EPA has specified that an expected annual number of exceedances and an expected annual arithmetic mean must be calculated. The details of the computation are outlined in the Federal Register.[6]

Table 2-7 shows the estimated number of exceedances of the federal 24-hour PM_{10} standard by quarter for each of the years 1993-1995. Table 2-7 also shows the expected annual number of exceedances based on the 1993-1995 data for the two Coachella Valley Stations. PM_{10} is normally measured every sixth day, so if one day exceeding is recorded in a given quarter or year, it is estimated that there were six exceedances[7]. The

[6] Federal Register, Vol. 82, No. 126, Wednesday July 1, 1987. Appendix K, p 24667.

[7] This number may not be exactly six since the number of days in a calendar quarter may not be exactly divisible by six.

expected annual number of exceedances is defined as the average of the estimated number of exceedances for three (or more) consecutive years. Coachella Valley 1, at the western end of the valley closest to the South Coast Air Basin, recorded no exceedances of the federal 24-hour PM_{10} standard during the three year period 1993-1995, and therefore has an expected annual number of exceedances of zero.

Coachella Valley 2, further east in the valley and further from the Basin, recorded one day exceeding in 1995 and none in 1993-1994. This results in an expected number of exceedances of 2 (Table 2-7). However the one day exceeding (June 2) occurred during a period of high winds which generated windblown dust. When this day is excluded from the data as a natural event day, the expected number of exceedances is zero.

TABLE 2-7

Expected Exceedances of Federal 24-Hour PM_{10} Standard

	Estimated Quarterly/Annual Exceedances					Expected Annual
Site/Year	Q1	Q2	Q3	Q4	Annual	Exceedances
Coachella Valley 1						
93	0	0	0	0	0	
94	0	0	0	0	0	
95	0	0	0	0	0	0
Coachella Valley 2						
93	0	0	0	0	0	
94	0	0	0	0	0	
95	0	6.1	0	0	6.1	2.0
95	0	0*	0	0	0*	0*

* Values for 1995 after deletion of a natural event, the high wind day 6/2/95.

Qn = estimated exceedances for quarter n = observed exceedances x (days in Qn/days sampled)

Annual = annual estimated exceedances = sum of quarterly exceedances for all 4 quarters.

Expected annual exceedances = 1/3 (sum annual estimated exceedances).

Table 2-8 shows the expected annual arithmetic mean for the Coachella Valley stations. The expected annual average is computed from the estimated annual arithmetic mean for three consecutive years. The estimated annual arithmetic mean for each year is the average of the four calendar quarter means. Coachella Valley 1 has an expected annual arithmetic mean of 27 $\mu g/m^3$ based on data for 1993-1995. Coachella Valley 2 has an expected annual arithmetic mean of 49 $\mu g/m^3$ with the high wind day included and an annual arithmetic mean of 48 $\mu g/m^3$ without it.

TABLE 2-8

Expected Annual Arithmetic Mean

Site/Year	Arithmetic Mean PM10 Concentration µg/m3					Expected
	Q1	Q2	Q3	Q4	AAMQM	AAM
Coachella Valley 1						
93	18.0	32.4	35.9	21.1	26.8	
94	17.0	35.1	38.1	20.9	27.8	
95	17.6	30.8	29.8	30.6	27.2	27
Coachella Valley 2						
93	31.3	42.4	64.1	48.0	46.4	
94	38.8	42.9	65.6	45.7	48.3	
95	45.7	60.9	50.0	51.4	52.0	49
95	45.7	51.1*	50.0	51.4	49.6*	48*

* Values for 1995 after deletion of 24-hour average for high wind day (6/2/95).

Qn = arithmetic mean PM10 for nth calendar quarter.

AAMQM = annual arithmetic mean of quarterly means.

Expected AAM = expected annual arithmetic mean = average of three years AAMQM.