SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

PLANNING, RULE DEVELOPMENT, AND AREA SOURCES

ANALYSIS OF EXCEPTIONAL EVENTS CONTRIBUTING TO HIGH PM10 CONCENTRATIONS IN THE SOUTH COAST AIR BASIN ON OCTOBER 21, 2007

Final Report
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ANALYSIS OF EXCEPTIONAL EVENTS CONTRIBUTING TO HIGH PM10 CONCENTRATIONS IN THE SOUTH COAST AIR BASIN ON OCTOBER 21, 2007

1 INTRODUCTION

1.1 Purpose

This document substantiates the request by the South Coast Air Quality Management District (AQMD) to flag violations of the 150 μg/m^3 PM10 24-hour National Ambient Air Quality Standard (NAAQS) in the South Coast Air Basin (Basin) as exceptional events under the U.S. Environmental Protection Agency (EPA) Regulation for the Treatment of Data Influenced by Exceptional Events (40 CFR, sections 50.1 & 51.14)[1]. Natural events caused exceedances of the federal standard at eleven Federal Reference Method (FRM) size-selective inlet (SSI) filter monitors on Sunday, October 21, 2007. The measured PM10 was primarily crustal material from windblown dust due to very strong Santa Ana wind event throughout southern California that started the previous day and continued for several days. The high wind event fanned numerous wildfires throughout southern California that were not fully controlled for nearly three weeks. While the wildfires on October 20 and 21 also contributed smoke and ash to the measured PM10 exceedances, the PM2.5 24-hour NAAQS was not exceeded with the AQMD FRM filter samplers until the days following October 21. The PM2.5 measurements were influenced by smoke for two weeks following October 21; these PM2.5 exceptional events will be addressed in a separate document. The PM10 NAAQS violations on October 21 occurred at the 11 routine air monitoring stations listed below in Table 1-1.

[1] EPA 2007. Treatment of Data Influenced by Exceptional Events; Final Rule. 40 CFR Parts 50 and 51; Federal Register Vol. 72, No. 55; March 22, 2007. http://www.smartpdf.com/register/2007/Mar/22/13560A.pdf

TABLE 1-1

PM10 NAAQS Violations at AQMD Routine FRM PM10 Monitors on October 21, 2007

FRM Monitoring Station	PM10 ($\mu g/m^3$)
Perris	1212
Riverside – Rubidoux	559
Anaheim	489
Norco	332
Fontana	276
Ontario Fire Station	275
North Long Beach	232
San Bernardino	219
Santa Clarita	167
Mira Loma[2]	681
South Long Beach[3]	432

In addition, PM10 NAAQS violations were recorded at several special study Size-Selective Inlet (SSI) filter monitors that were part of the Port of Los Angeles/Long Beach study. While these special study data have not been submitted to AQS to date, they should be flagged if submitted. The exceeding Port Study stations are shown in Table 1-2.

TABLE 1-2

PM10 NAAQS Violations at AQMD Port Study FRM PM10 Monitors on October 21, 2007

Port Study Station	PM10 ($\mu g/m^3$)
Wilmington	207
South Wilmington	262
Long Beach – Anaheim Street	262
Hudson Street School	251
Del Amo	203

[2] The Mira Loma High School station has been replaced by the Mira Loma Van Buren station. The Van Buren PM10 sample was not valid on October 21 due to a power failure after 10 hours of the run. The Mira Loma High School station was operational at this time as a temporary special study site and the PM10 data has not been submitted to AQS to date. It is included in this analysis for completeness and this data should be flagged if it is submitted.

[3] The South Long Beach Station FRM PM10 data was invalidated and has not been submitted to AQS to date. It is included in this analysis for completeness but it will not need to be flagged if not submitted.

To date, AQMD has not submitted PM10 from Beta Attenuation Monitor (BAM) or Tapered Element Oscillating Microbalance (TEOM) instruments to the EPA Air Quality System (AQS) database.[4] Several TEOM and BAM PM10 measurements for the midnight-to-midnight 24-hour averages that exceeded the PM10 NAAQS on October 21, are shown in Table 1-3. If submitted to AQS in the future, these exceedances should also be flagged.

TABLE 1-3

PM10 NAAQS Violations at AQMD Port Study FRM PM10 Monitors on October 21, 2007

Continuous Station	Monitor	PM10 ($\mu g/m^3$)
North Long Beach	TEOM	205
Riverside – Rubidoux	TEOM	559
Mira Loma – Van Buren	TEOM	681
Lake Elsinore	TEOM	382
San Bernardino	TEOM	171

These violations occurred due to particulate matter primarily from high winds occurring on October 21, 2007 throughout the Basin. AQMD has submitted the PM10 data from these monitors on this day to the EPA Air Quality System (AQS) database and has placed the appropriate flags on the data indicating that the data was affected by exceptional events due to high winds. This flagging indicates that the ambient air quality data was influenced by the windblown dust and subsequent wildfire related emissions and insures that the data is properly represented in the regulatory process.

[4] The AQMD has only used the BAM and TEOM PM10 and PM2.5 measurements for forecasting purposes and public notification of PM events. While EPA accepts these measurements as an equivalent federal reference method (FEM), these instruments have not historically been relied upon for determining NAAQS compliance in the South Coast Air Basin or the Coachella Valley.

1.2 Organization of this Document

This document is designed to provide summary information to the public as well as the specific detailed analyses to meet the requirements of Exceptional Events Rule. Section 1, Introduction, describes the purpose, exceptional event criteria, background of the Exceptional Event Rule and background information related to high wind events in the Basin, including:

- the geographic setting;
- the regulatory measures, showing that continuing reasonable controls are in effect in the Basin and that ongoing public education programs and event forecasting and notification plans are in place;
- an overview of high PM10 events in the Basin, including a historical perspective of PM10 exceptional events.

Section 2 describes the analysis of each PM10 NAAQS violation on October 21, 2007 that occurred due to high winds and wildfires. For each exceedance, the Event Summary section summarizes the PM10 measurements and conditions that caused the NAAQS violation and documents how the natural event/episode satisfies the criteria of the Exceptional Events Rule, that is,

- Affects Air Quality; and
- Is Not Reasonable Controllable or Preventable;
- Is either a natural event or an event caused by human activity that is unlikely to recur at a particular location.

Further discussion in the Event Summary includes:

- the causal connection between the high wind/wild fire events and the measured PM10;
- how the measured concentration was in excess of the normal historical fluctuations, including background;
- how there would have been no exceedance “but for” the high wind/wildfire event (the “But For” Test);
- that reasonable measures to control PM10 were in effect on the event day and how a public notification and education process was implemented to warn the public before and during the event through forecasts, advisories and real-time air quality data.

Following the Event Summary section, the Detailed Event Analysis describes the analysis that led to the conclusions presented in the Event Summary section, including:

- a summary of the particulate measurements;
- the meteorological setting;
- conclusions.

Supporting materials for the October 21, 2007 PM10 analysis beyond what is included in the Section 2 are provided in a separate Appendix. This includes: meteorological measurements; National Weather Service (NWS) forecast discussions, nowcasts, wind advisories and significant wind reports; National Climatic Data Center (NCDC) weather event records; satellite smoke text products; news articles and web links; a wildfire summary map and AQMD windblown dust and smoke advisories.

1.3 Exceptional Events Rule Background

Since 1977, EPA has implemented policies to address the treatment of ambient air quality monitoring data that has been affected by exceptional or natural events. In July 1986, EPA issued a document entitled *Guideline on the Identification and Use of Air Quality Data Affected by Exceptional Events*, introducing a flagging system to identify air quality measurements influenced by exceptional events that, if left unidentified, could lead to possible misinterpretation or misuse of the data. In 1996, EPA developed a guidance document entitled *Areas Affected by PM-10 Natural Events*, which provided criteria and procedures for States to request special treatment (i.e., flagging for exclusion from standard compliance consideration) for data affected by natural events (e.g., wildfire, high wind events, and volcanic and seismic activities). EPA approved several requests made by AQMD, through the California Air Resources Board (CARB), to apply the Natural Events Policy in order to flag violations of the 24-Hour PM10 NAAQS in the Coachella Valley for natural events that involved uncontrollable high winds. Air quality has continued to improve through implementation of best available control technologies, required by AQMD rules. AQMD also protects the public through the issuance of area-specific air quality forecasts and episode notifications in the South Coast Air Basin and the portions Riverside County under AQMD jurisdiction in the Salton Sea Air Basin (Coachella Valley) and the Mojave Desert Air Basin.

On March 14, 2007, EPA promulgated a formal rule, entitled: *The Treatment of Data Influenced by Exceptional Events*, known as the Exceptional Events Rule. Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable or preventable using techniques that tribal, state or local air agencies may implement in order to attain and maintain the NAAQS. These events are flagged in the EPA AIR Quality Subsystem (AQS) database as exceptional events. The data remains available to the public but are not counted toward attainment status. The EPA rulemaking:

- ensures that air quality measurements are properly evaluated and characterized with regard to their causes;

- identifies reasonable actions that should be taken to address the air quality and public health impacts caused by these types of events;
- avoids imposing unreasonable planning requirements on state, local and tribal air quality agencies related to violations of the NAAQS due to exceptional events;
- ensures that the use of air quality data, whether afforded special treatment or not, is subject to full public disclosure and review.

The Exceptional Events Rule does not require States to submit formal mitigation plans; however, States must provide public notice, public education, and must provide for implementation of reasonable measures to protect public health when an event occurs. While AQMD had requested flagging of data influenced by natural events in the Coachella Valley, in the Salton Sea Air Basin, AQMD had not previously requested flagging of PM10 data in the South Coast Air Basin, prior to three events in 2007. In addition to this event on October 21, 2007, two other PM10 exceptional events that occurred in the Basin in 2007 are also being submitted: April 12 (high wind) and July 5 (fireworks).

In the preamble of the Exceptional Event Rule, EPA specifically includes both *High Wind Events* and *Wildland Fires* in the list of examples of exceptional events, classified as *Natural Events*. The Rule defines Natural Events as follows:

> *It is important to note that natural events, which are one form of exceptional events according to this definition, may recur, sometimes frequently (e.g., western wildfires). For the purposes of this rule, EPA is defining ''natural event'' as an event in which human activity plays little or no direct causal role to the event in question. We recognize that over time, certain human activities may have had some impact on the conditions which later give rise to a ''natural'' air pollution event. However, we do not believe that small historical human contributions should preclude an event from being deemed ''natural.''*

The Rule defines wildland fires, including wildfire, wildland fire use and prescribed fire, as follows:

> *Federal land managers have afforded recognition to several different types of wildland fires (i.e., wildfire, wildland fire use fire and prescribed fire), depending on their causal circumstances and the role that such fires play in the affected ecosystems. Prescribed fire is addressed more fully in the following section. The question of what is a natural versus an anthropogenic fire has particular significance when considering the impacts of wildland fires (wildfire, wildland fire use fire and prescribed fire) on air quality and how these impacts should be regarded under this rule. A ''wildfire'' is defined as an unplanned, unwanted wildland fire (such as a fire caused by lightning), and include unauthorized human-caused fires (such as arson or acts of carelessness by campers), escaped*

prescribed fire projects (escaped control due to unforeseen circumstances), where the appropriate management response includes the objective to suppress the fire. In contrast, a ''wildland fire use'' fire is the application of the appropriate management response to a naturally ignited (e.g., as the result of lightning) wildland fire to accomplish specific resource management objectives in predefined and designated areas where fire is necessary and outlined in fire management or land management plans. Using these definitions, we believe that both wildfires and wildland fire use fires fall within the meaning of ''natural events'' as that term is used in section 319. Therefore, ambient particulate matter and ozone concentrations due to smoke from a wildland fire will be considered for treatment as an exceptional event if the fire is determined to be either a wildfire or wildland fire use fire.

1.4 Geographic Setting

Southern California's South Coast Air Basin (Basin), shown in Figures 1-1 and 1-2, consists of 10,743 square miles and consists of Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties. The population of the Basin is approximately 16 million people, with approximately 11 million gasoline powered vehicles and 300,000 diesel vehicles. The coastal plain contains most of the most of the population of the Basin, which is surrounded by tall mountains, including the San Gabriels to the north, the San Bernardinos to the northeast, and the San Jacintos to the east. The coastal range of the Santa Ana Mountains separates the inland part of Orange County from Riverside County. The proximity of the Pacific Ocean to the west has a strong influence on the climate, weather patterns and air quality of the Basin. The mountains also have a significant impact on the wind patterns of the Basin. Offshore winds flow down slope and are warmed and dried by compressional heating, gaining momentum through the passes and canyons. Northeasterly winds, known as Santa Ana winds, typically account for the highest wind events in the Basin, occurring several times each year.

Figure 1-3 shows the general locations exceeding the PM10 NAAQS on October 21, 2007. These areas of the Basin are located primarily below canyons and passes where the Santa Ana winds are strongest and windblown dust is generated. Figure 1-4 shows the PM10 monitors in the Basin, including the 24-hour FRM SSI samplers and the continuous Beta Attenuation Monitor (BAM) and Tapered Element Oscillating Microbalance (TEOM) samplers.

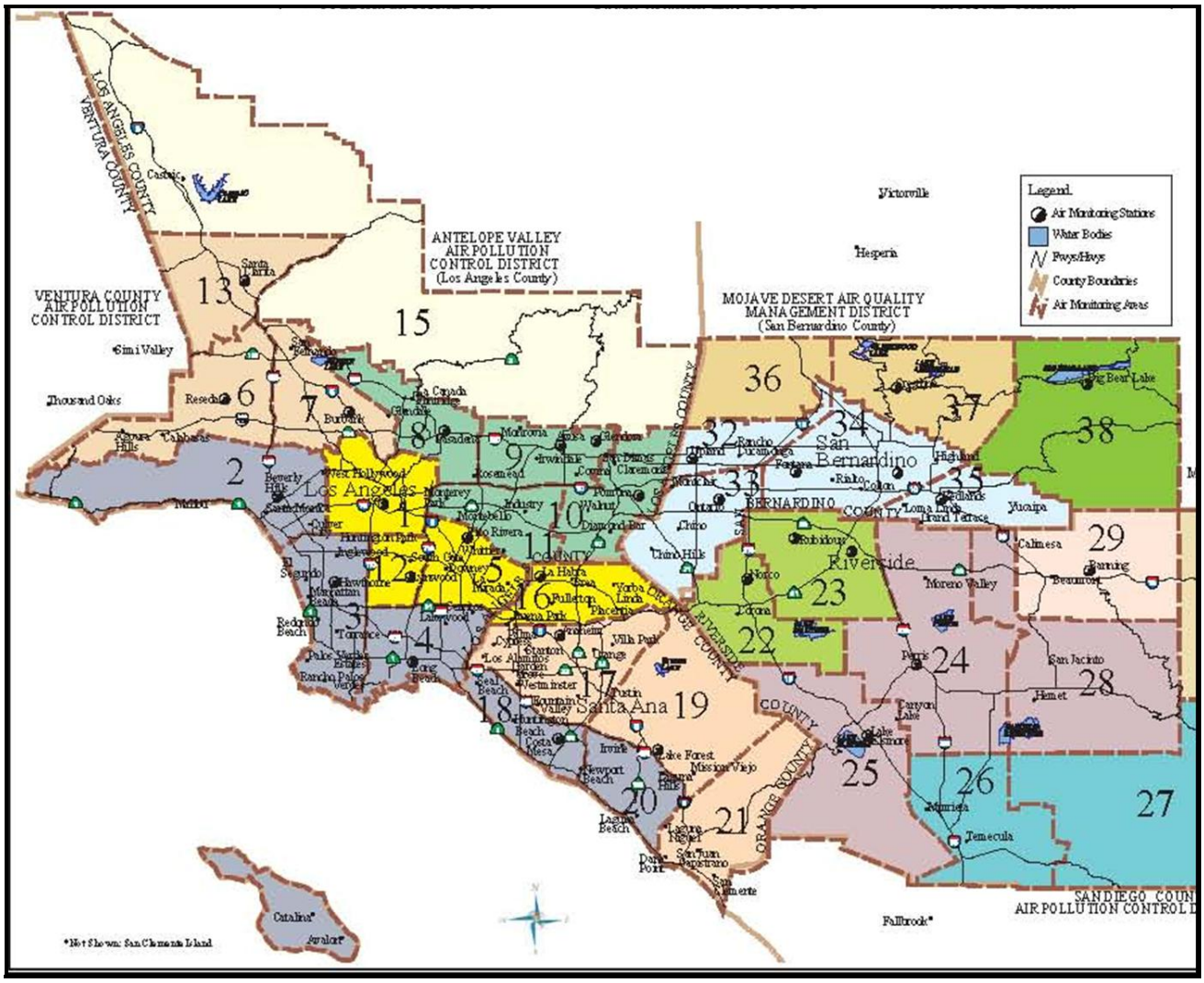


FIGURE 1-1

Map of the South Coast Air Basin Showing Air Monitoring Stations and Forecast Areas

FIGURE 1-2

Map of South Coast Air Basin with Selected Cities and Topography

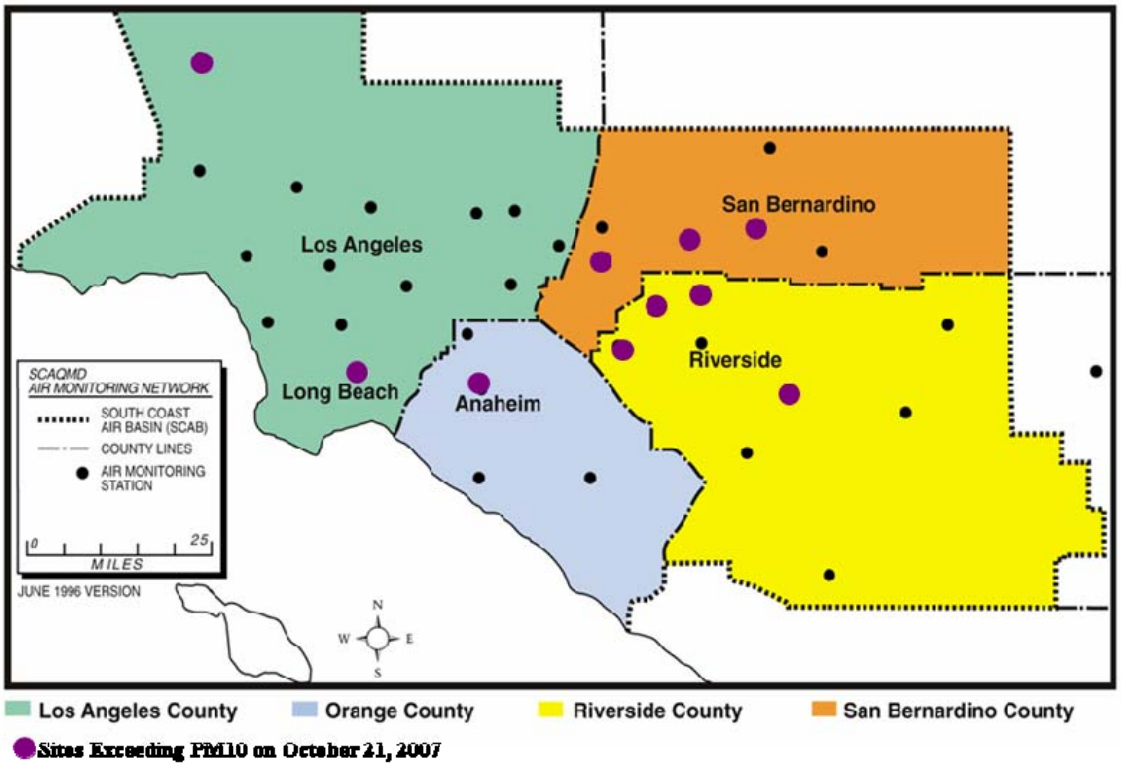


FIGURE 1-3
Map of South Coast Air Basin Monitoring Sites
Showing the Sites Exceeding PM10 on October 21, 2007

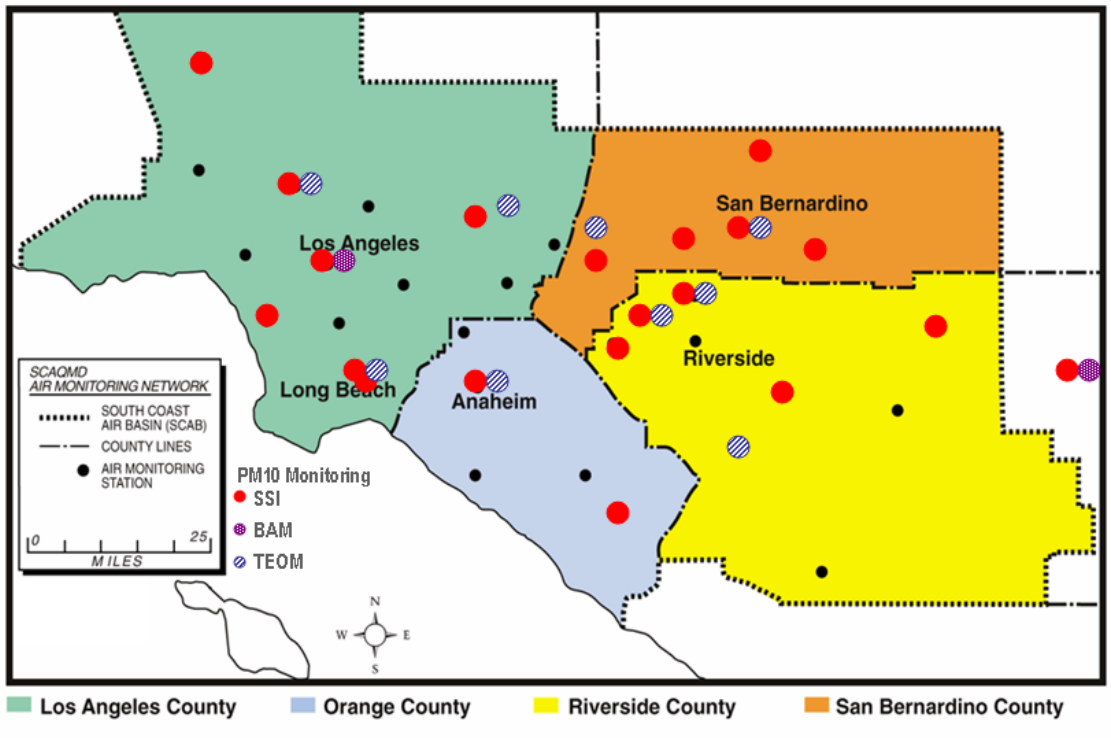


FIGURE 1-4
Map of South Coast Air Basin PM10 Monitors

1.5 Regulatory Measures

AQMD has implemented regulatory measures to control emissions from fugitive dust sources and open burning in the South Coast Air Basin. Implementation of Best Available Control Measures (BACM) in the Basin has been carried out through AQMD Rule 403 (Fugitive Dust), as well as source-specific rules. With its approvals of the South Coast PM10 Attainment Plans in the State Implementation Plan (SIP), EPA has concluded that this control strategy represents BACM and Most Stringent Measures (MSM) for each significant source category, and that the implementation schedule was as expeditious as practicable.

AQMD Rule 403 establishes best available fugitive dust control measures to reduce fugitive dust emissions associated with agricultural operations, construction/demolition activities (including grading, excavation, loading, crushing, cutting, planing, shaping or ground breaking), earth-moving activities, track-out of bulk material onto public paved roadways, and open storage piles or disturbed surface areas.

AQMD Rule 1156, Further Reductions of Particulate Emissions from Cement Manufacturing Facilities, is a source-specific rule that applies to all operations, including material handling, storage and transport at cement manufacturing facilities. It restricts visible emissions from facility operations, open piles, roadways and unpaved areas and requires enclosed systems for loading, unloading and transfer of materials. Other operations must employ wind fencing and wet suppression systems or be enclosed with permitted control equipment.

AQMD Rule 1157, PM10 Emissions Reductions from Aggregate and Related Operations, is a source-specific rule applicable to all permanent and temporary aggregate and related operations that produce sand, gravel, crushed stone or quarried rocks. Like Rule 1156, this rule restricts the discharge of fugitive dust emissions into the atmosphere through plume opacity tests and limiting visible plume travel to within 100 feet of the operation. This rule requires: prompt removal of material spillage; stabilization of piles with dust suppressants; the control of loading, unloading, transferring, conveyors, and crushing or screening activities with dust suppressants or other control methods; stabilization of unpaved roads, parking and staging areas; sweeping of paved roads; and the use of track-out control systems.

AQMD Rule 1158, Storage, Handling, and Transport of Coke, Coal and Sulfur, is a source-specific rule that applies to any facility that produces, stores, handles, transports or uses these materials. This rule restricts visible emissions and requires that piles be maintained in enclosed storage and that unloading operations be conducted in enclosed structures with water spray systems or venting to permitted air pollution control equipment. It also has specific requirements to control emissions from roadways, other facility areas, and conveyors and the loading of materials.

AQMD Rule 1186, PM10 Emissions from Paved and Unpaved Roads and Livestock Operations, requires rapid removal of paved road dust accumulations and establishes a treatment schedule for unpaved roads, street sweeper procurement standards, and design standards for new road construction. AQMD Rule 1186.1, Less-Polluting Sweepers, requires procurement of alternative-fueled equipment when governmental agencies replace street sweepers.

AQMD Rule 444, Open Burning, ensures that open burning is conducted in a manner that minimizes emissions and impacts, and that smoke is managed to protect public health and safety. This rule requires authorization for agricultural and prescribed fire, limited to days that are predicted to be meteorologically conducive to smoke dispersion and that will not contribute to air quality that is unhealthy for sensitive groups or worse. It also restricts residential and waste burning.

AQMD Rule 445, Wood Burning Devices, reduces pollution from wood-burning fireplaces and other devices through requirements for new construction, curtailment of wintertime wood burning in specified areas when poor air quality is forecast and restriction of the sale of unseasoned firewood. The AQMD Healthy Hearths program provides public education on how to reduce air pollution from wood burning and encourages the conversion to natural gas burning fireplaces through an incentive program.

1.6 Historical Perspective of PM10 in the South Coast Air Basin

Figure 1-5 shows the 2007 time series of maximum 24-hour average FRM SSI PM10 concentrations for the monitoring stations that exceeded the 150 $\mu g/m^3$ NAAQS on October 21, 2007, in the Basin. These sites show a very prominent peak on October 21, overall, even with the peak value of 1212 $\mu g/m^3$ not included in the plot. Two other days in 2007 had PM10 concentrations exceeding the federal standard, April 12 and July 5.

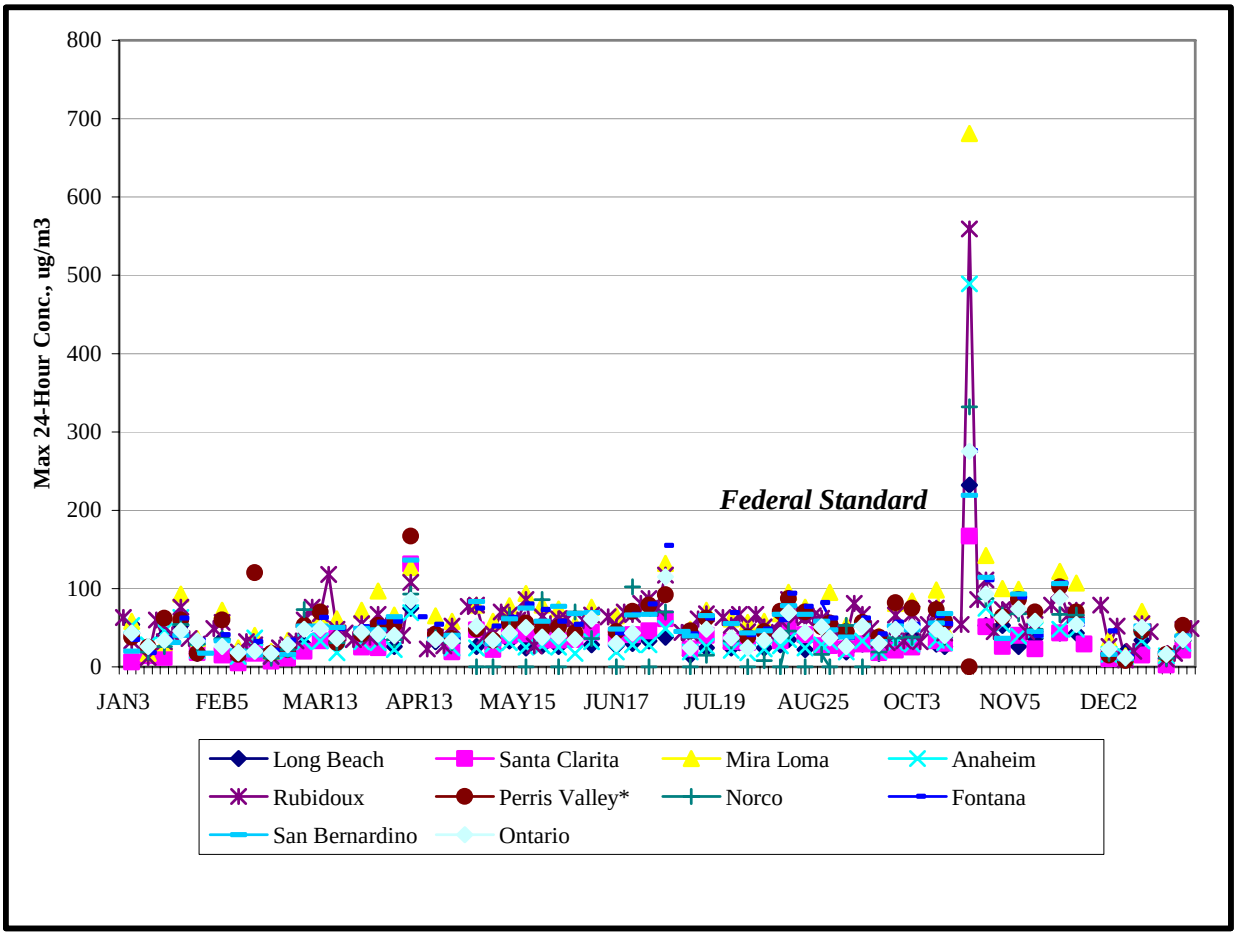


FIGURE 1-5

2007 Time Series of Daily Maximum 24-Hour FRM SSI PM10 (µg/m^3) for South Coast Air Basin Stations Exceeding the PM10 NAAQS on October 21, 2007

Table 1-4 summarizes the days with high PM10 in the South Coast Air Basin, defined as days exceeding 150 µg/m^3, between January 1, 2000 and December 31, 2008. The events prior to 2007 were not flagged for exclusion under the EPA Natural Events Policy, except for August 17, 2001 at Banning Airport which was flagged as a high wind natural event along with the Coachella Valley stations (Indio and Palm Springs) due to thunderstorm winds. All the 24-hour PM10 NAAQS violations that occurred in 2007 have been flagged as requesting exclusion under the EPA Exceptional Events Policy. Since 2000, no 24-hour NAAQS violations occurred in the South Coast Air Basin that

were not associated with strong winds, wildfire or fireworks events. Throughout the nine-year period, seven days exceeded the 150 μg/m^3 NAAQS concentration at air monitoring stations in the Basin, for an overall average of just under 0.8 violations per year basin-wide. Except for the exceedances on July 5, 2003 and July 5, 2007, related to fireworks, all NAAQS violations in the Basin were associated with high wind events, several of which fanned large wildfires.

TABLE 1-4

Historical Summary of South Coast Air Basin FRM SSI PM10 24-HourHigh Concentrations Exceeding 150 μg/m^3 between January 1, 2000 and December 31, 2008 with Primary Causal Event

Event Date*	Station	FRM PM10 (μg/m^3)	Cause
January 2, 2001	Ontario Fire Station	**166**	High Winds
August 17, 2001	Banning Airport	**219**	High Wind Natural Event**
July 5, 2003	Rubidoux	**159**	Fireworks
October 27, 2003	Rubidoux	**164**	High Winds/Wildfire
April 12, 2007	Perris	**167**	High Winds**
July 5, 2007	Azusa	**165**	Fireworks**
July 5, 2007	Fontana	**155**	Fireworks**
October 21, 2007	Perris	**1212**	High Winds/Wildfire**
October 21, 2007	Mira Loma	**681**	High Winds/Wildfire**
October 21, 2007	Rubidoux	**559**	High Winds/Wildfire**
October 21, 2007	Anaheim	**489**	High Winds/Wildfire**
October 21, 2007	South Long Beach	**432**	High Winds/Wildfire**
October 21, 2007	Norco	**332**	High Winds/Wildfire**
October 21, 2007	Fontana	**276**	High Winds/Wildfire**
October 21, 2007	Ontario Fire Station	**275**	High Winds/Wildfire**
October 21, 2007	North Long Beach	**232**	High Winds/Wildfire**
October 21, 2007	San Bernardino	**219**	High Winds/Wildfire**
October 21, 2007	Santa Clarita	**167**	High Winds/Wildfire**

* 1-in-6 day FRM SSI sampling for all stations except 1-in-3 day sampling at Rubidoux.

** All 2007 events have been flagged by AQMD under the Exceptional Events Rule. Prior events in the South Coast Air Basin were not flagged due to ongoing violation of the now-revoked annual PM10 NAAQS, except August 17, 2001 at Banning which was flagged along with Coachella Valley stations during a thunderstorm-related high wind natural event.

Perris recorded the highest PM10 concentration (1212 μg/m^3) on October 21, 2007. This station only exceeded on two days during the period shown in Table 1-4, both in 2007. This was the highest FRM 24-hour PM10 concentration measured anywhere in the Basin since PM10 monitoring started in 1985. In over 21 years since PM10 sampling began at Perris in October 1987, Perris exceeded the PM10 standard on six days, as are shown in Table 1-5. Thus, Perris exceeds the standard once in every 3.5 years on average. However, the first four exceedances occurred in the early years of the PM control program, so in the 18 years starting in 1991, only two exceedances occurred at Perris (one exceedance every 9 years, on average).

TABLE 1-5

Historical Summary of FRM PM10 NAAQS Violations at Perris between October 6, 1987 and December 31, 2008

Event Date	SSI PM10 (μg/m^3)
October 24, 1988	164
October 13, 1989	187
February 28, 1990	180
November 7, 1990	250
April 12, 2007	167
October 21, 2007	1212

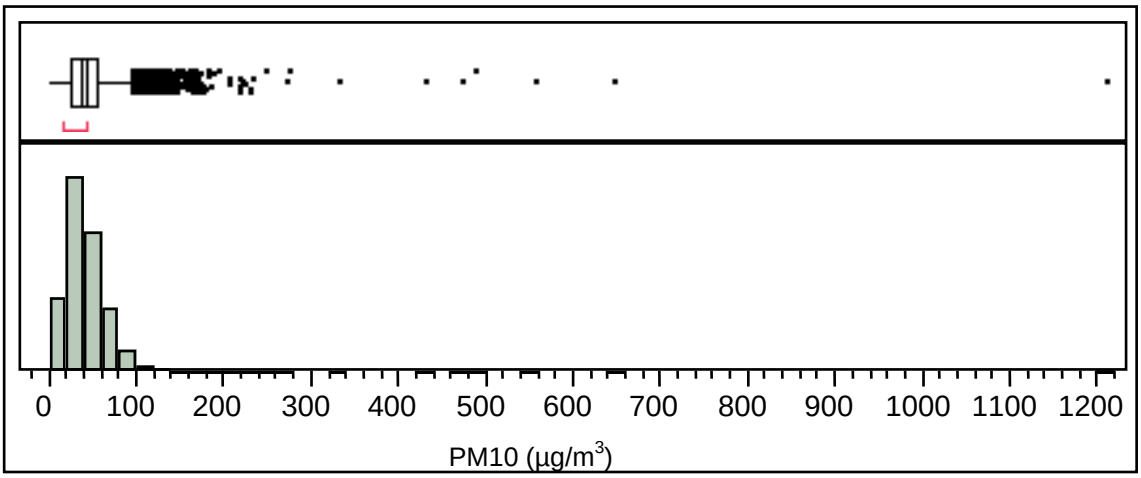
The FRM PM10 measurement recorded at Mira Loma (681 μg/m^3) on October 21, 2007 was the highest on record for this station and this was the only day to exceed the federal standard. This is the second highest concentration ever recorded in the Basin, after the Perris measurement on the same day. The concentration of 559 μg/m^3 measured at Riverside-Rubidoux, historically the Basin maximum station, was the highest recorded at that station. The second highest concentration at Rubidoux was 294 μg/m^3 (10/28/86). Rubidoux exceeded the federal 24-hour standard on 34 days since sampling began in 1985, but only exceeded that standard on three days since 2000. The measured concentration at Anaheim, 489 μg/m^3, was the highest 24-hour PM10 on record for that station and one of only three exceedances since 1985 (158 μg/m^3 on 10/8/90 and 172 μg/m^3 on 12/5/95). The concentration measured at South Long Beach, 432 μg/m^3, was the highest recorded at that station since measurements began in August 2003 and this was the only day to exceed the federal standard.

At Norco the measured 332 μg/m^3 was the highest on record and one of only 5 days exceeding the federal standard since measurements started at that station in 1993 (177 μg/m^3 on 12/5/95, 164 μg/m^3 on 12/9/93, 163 μg/m^3 on 11/23/95 and 158 μg/m^3 on 10/31/97). This was the only exceedance at that station in over 10 years. Since

measurements began at Fontana in October 1985, the concentration of 276 $\mu g/m^3$ measured on October 21, 2007 was the third highest recorded (475 $\mu g/m^3$ on 10/8/90 and 287 $\mu g/m^3$ on 10/24/88). While 17 days exceeded the federal standard at Fontana during the period of record, only two days violated the NAAQS since December 1995, both in 2007 on October 21 (present event) and July 5 (155 $\mu g/m^3$ due to a fireworks exceptional event). The Ontario Fire Station only measured three exceedances of the federal standard since measurements began in December of 1998, the highest of which was October 21, 2007 (275 $\mu g/m^3$). The other two exceedances occurred in May of 1999 (183 $\mu g/m^3$) and January of 2001 (166 $\mu g/m^3$), making this the only exceedance at that station in over 8 years.

The PM10 concentration of 232 $\mu g/m^3$ measured on October 21 was the only 24-hour PM10 NAAQS exceedance at the North Long Beach station since measurements began in January 1985. The measured value of 219 $\mu g/m^3$ from San Bernardino was the sixth highest concentration since measurements started on May of 1986, with a peak concentration of 289 $\mu g/m^3$ measured on October 24, 1988. The exceedance on October 21, 2007 was the only NAAQS violation at San Bernardino since November 1991. The PM10 concentration measured at Santa Clarita on October 21, 2007, 167 $\mu g/m^3$, was the only PM10 24-hour NAAQS violation at that station since measurement began in April of 2001.

Figure 1-6 shows the distribution of all Federal Reference Method (FRM) Size-Selective Inlet (SSI) PM10 measurements for South Coast Air Basin air monitoring stations from January 1990 through June 2008. The plotted values (black squares) are considered statistical outliers. Concentrations above the 97.5 percentile value (101 $\mu g/m^3$ and above) are above the normal range of data for the Basin. Therefore, any value that exceeds the 24-hour federal PM10 standard of 150 $\mu g/m^3$ is well outside the normal range of data and is above the 99.5 percentile value (139.5 $\mu g/m^3$).



Quantiles		PM10 (µg/m^3)
100.0%	maximum	1212.0
99.5%		139.5
97.5%		101.0
90.0%		73.0
75.0%	quartile	54.0
50.0%	median	38.0
25.0%	quartile	26.0
10.0%		16.0
2.5%		10.0
0.5%		5.0
0.0%	minimum	0.0

Moments	PM10 (µg/m^3)
Mean	42.472396
Std Dev	26.819924
Std Err Mean	0.1930991
upper 95% Mean	42.850887
lower 95% Mean	42.093905
N	19291

FIGURE 1-6

Distribution of SSI PM10 Concentrations throughout the South Coast Air Basin from January 1990 through June 2008

(Square symbols show statistically outlying PM10 concentrations)

2 HIGH WIND AND WILDFIRE EXCEPTIONAL EVENT ANALYSIS

2.1 Event Summary: October 21, 2007

Violations of the PM10 NAAQS were recorded at the South Coast Air Basin monitoring stations on October 21, 2007, due to high wind and wildfire. The 24-hour mass concentration at each site was measured with a federal reference method (FRM) size-selective inlet (SSI) filter-based PM10 sampler. The PM10 NAAQS violations occurred at the following 11 air monitoring stations: Perris (1212 $\mu g/m^3$), Mira Loma (681 $\mu g/m^3$), Riverside-Rubidoux (559 $\mu g/m^3$), Anaheim (489 $\mu g/m^3$), South Long Beach (432 $\mu g/m^3$), Norco (332 $\mu g/m^3$), Fontana (276 $\mu g/m^3$), Ontario Fire Station (275 $\mu g/m^3$), North Long Beach (232 $\mu g/m^3$), San Bernardino (219 $\mu g/m^3$), and Santa Clarita (167 $\mu g/m^3$). In addition, PM10 NAAQS violations were recorded at five temporary special study FRM filter samplers that were part of the Port of Los Angeles/Long Beach study and at five TEOM monitors that have not been submitted to AQS at this time. This event meets the criteria for high wind natural events as defined in the EPA Exceptional Events Rule.

A strong Santa Ana wind event developed on October 21, causing extremely high northerly through easterly winds in the mountains and deserts, especially through and below the wind-favored passes and canyons in the Basin. National Weather Service (NWS) weather stations measured extremely high peak wind gusts throughout the day in areas near or upwind of the high AQMD PM10 stations, including: 108 mph by in the mountains areas of Los Angeles County, 85 mph in the Santa Ana Mountains of Orange County; 78 mph near Santa Clarita, 74 mph in Rancho Cucamonga; 67 mph in Rialto; 64 mph in Malibu, 63 mph at Ontario, 49 mph in Corona; and 40 mph in Van Nuys.

Due to the widespread winds, sources of the windblown dust were both natural areas, particularly in the mountains and deserts, and BACM-controlled anthropogenic sources. The timing of the this event is verified with the high wind observations and reports of reduced visibility and blowing sand and dust, in conjunction with the hourly TEOM PM10 measurements data from nearby monitors in the Basin, when available. With the weight of evidence provided, AQMD concludes that the PM10 exceedances would not have occurred without the high winds and wind-entrained dust.

Flagging of Data

AQMD has submitted the PM10 data from this monitor to the EPA AQS database and has placed the appropriate flags on the data indicating that the data was affected by exceptional events due to high winds (Flag RJ, requesting exclusion due to high winds). While wildfires also contributed to these exceedances, windblown dust was the primary

contributor to the measured PM10. Since only one flag can be submitted for each station exceedance, this is most appropriate for the PM10 on this day. Such flagging ensures that the air quality data is properly represented in the overall air quality planning process.

Exceptional Event Criteria Summary

40 CFR 50.1(j) of the Exceptional Events Regulation defines an exceptional event as an event that:

- affects air quality;
- is not reasonably controllable or preventable;
- is either an event caused by human activity that is unlikely to recur at a particular location or a natural event; and
- is determined by the EPA Administrator in accordance with the Exceptional Events Rule to be an exceptional event.

The following sections describe how the first three criteria are met for the October 21, 2007 high wind and wildfire natural events.

Affects Air Quality

For an event to qualify as an exceptional event, it is necessary to show that the event affected air quality. This criterion can be met by establishing that the event is associated with a measured exceedance in excess of normal historical fluctuations, including background. The demonstration of a clear causal relationship is necessary to establish that the event affected air quality and is also a separate requirement.

The documentation provided herein for the October 21, 2007 natural event provides the required information to establish a causal connection between the high winds throughout southern California and the high PM10 concentrations measured throughout the Basin. The exceptionally high 24-hour PM10 concentrations in the Basin, to 1212 μg/m3 at Perris, show that air quality was affected. As shown in Table 2-2, the 24-hour PM10 concentrations were relatively low on the days before and after the high wind event. The hourly PM10 concentrations in the Basin increased rapidly as the winds spiked in the morning, as is shown in Figure 2-1 and the wind observation tables (Appendix, A.1). As was shown previously in Section 1.6, in 18 years of analyzed data, high PM10 concentrations exceeding the 24-hour NAAQS do not often occur in the Basin and fall into less than the top 0.5 percent of the data. In the past 7 years, all seven days with PM10 24-hour NAAQS violations in the Basin were due to exceptional events, including strong winds, wildfire and fireworks displays. The PM10 measured at Perris on October 21 was the highest ever recorded at that station and in the entire south Coast Air Basin. The other exceeding stations

measured the highest concentrations ever recorded at that station except a couple locations that had not measured PM10 that high in many years.

Section 2.2, Detailed Event Analysis, includes meteorological data showing a clear correlation between strong, gusty winds and increased hourly PM10 in the Basin. The supporting documentation also includes a National Weather Service (NWS) forecasts and advisories of high winds and windblown dust, as well as National Climatic Data Center (NCDC) storm damage reports and newspaper accounts. The measured exceedances on October 21, 2007 are in excess of normal fluctuations, as is discussed further below.

Is Not Reasonably Controllable or Preventable

This requirement is met by demonstrating that despite reasonable and appropriate measures in place, the October 21, 2007 wind and wildfire event caused the NAAQS violation. During this event, there were no other unusual PM10-producing activities occurring in the Basin and anthropogenic emissions were approximately constant before, during and after the event. In addition, reasonable and appropriate measures were in place, as has been described in Section 1.5, Regulatory Measures. A Rule 403.1 High Wind Day forecast was issued by AQMD on October 21, requiring curtailment of dust-producing agricultural and construction activities and the use of mitigation measures on disturbed soil in the Coachella Valley. On October 21, PM2.5 measurements, as well as PM10 sulfate and nitrate measurements in the Basin, were relatively low, indicating primarily crustal material comprising the PM10 mass and not transported or locally generated urban pollution or combustion sources.

A survey of the AQMD complaint records and inspection reports for the Riverside and San Bernardino County portions of the Basin indicated no evidence of unusual particulate emissions on October 21, 2007, other than related to the windblown dust event. The complaints are summarized in Table 2-10 from the AQMD CLean Air Support System (CLASS) database for complaints and compliance actions. Due to the windy conditions, AQMD Compliance staff responded to 17 complaints related to windblown dust. Most were in San Bernardino and Riverside Counties and many were in the same two areas (Mira Loma and Beaumont). No Notices of Violation or Notices to Comply were issued in the Basin for fugitive dust violations on this day. The control methods were generally effective throughout the Basin, but were apparently overwhelmed in several instances by the strong, gusty winds, causing windblown dust and sand to be entrained in the atmosphere and to cross property lines.

Twelve wildfires were reported in the southern California on October 21, fanned by the strong, dry Santa Ana winds. Seven of these were within the Basin and the rest were in San Diego, Ventura and Santa Barbara Counties. The smoke and ash from

wildfires contributed to a small fraction of the PM10 measured, with Santa Clarita and Anaheim experiencing the greatest fire impacts on this day. Crustal material from windblown dust was the primary component of the measured PM10, as confirmed by comparing the PM2.5, sulfate, nitrate and potassium analyses, as well as microscopy analyses of several filters from this day. Prescribed, agricultural or residential burning did not appear to have added any significant amount of PM10 to the concentrations recorded in the Basin; these activities were not permitted on this day. The PM2.5 portion of PM10, which would indicate combustion, was very small throughout the Basin. PM10 was emitted from some BACM-controlled sources (mainly agricultural and construction activities) as BACM controls were locally overwhelmed by the high winds. Natural particulate source areas also contributed to the measured PM10, particularly the upwind mountain and desert areas.

Was a Natural Event

Ambient particulate matter concentrations due to dust being raised by unusually high winds will be treated as due to uncontrollable natural events where (1) the dust originated from non-anthropogenic sources, or (2) the dust originated from anthropogenic sources within the State that are determined to be reasonable well controlled at the time the event occurred, or from anthropogenic sources outside the State. Based on previous analyses of windblown dust in the Coachella Valley and the Basin, wind gusts over 22 mph are sufficient to entrain windblown dust in the atmosphere. In the preamble to the Exceptional Events Rule, EPA also explains states must provide appropriate documentation to substantiate why the level of wind speed associated with the event in question should be considered unusual for the affected area during the time of year that the event occurred. On average, the strong wind conditions that lead to PM10 exceedances due to high wind natural events occur less than three times per year, for the entire South Coast Air Basin. EPA also notes in the Exceptional Event Rule that natural events (e.g., high winds, wildfires, etc.) may recur, sometimes frequently. The event on October 21, 2007 was a natural event in which human activity played little or no direct causal role. A portion of the wind-entrained dust originated from anthropogenic sources, including some agricultural operations and construction activities, that are well controlled in the Basin as described in Section 1.5, Regulatory Measures.

The analysis of the meteorological setting, including weather charts, pressure gradients and satellite imagery, indicates the potential for extremely strong winds in the Basin on October 21, 2007. Wind speeds in Los Angeles, Orange, San Bernardino and Riverside Counties, especially in the mountains and through the passes and canyons were very high on this day. Wind speeds upwind of the Perris, Mira Loma, Rubidoux, Anaheim, Long Beach, Norco, Fontana and Ontario air monitoring stations were particularly strong, causing very high PM10 concentrations, peaking at 1212 at Perris. The exceeding stations are all downwind of the geographic

corridors for Santa Ana wind events, were windblown particulates are most likely. This first Santa Ana wind event of the season brought unusually strong winds. Soil moisture was very dry due to rainfall well below normal for the year, providing dust to blow and contributing to the wildfire potential. Sustained high wind speeds that were recorded at National Weather Service (NWS) weather stations reached: 48 mph at Sandberg in the Los Angeles County mountains; 34 mph at Chino Airport; 41 mph at Ontario Airport; 29 mph at Van Nuys Airport Riverside Municipal Airport and March ARB; 26 mph at Long Beach Airport and Santa Ana/John Wayne Airport. Significantly higher wind gusts were also measured through the day with peak gusts to over 100 mph recorded in the mountains and to near 80 mph in the Basin. The weather observations support the presence of windblown dust through the day with blowing dust and visibilities as low as 1.5 miles reported. In addition, NWS forecast discussions and wind warnings, NCDC storm event record reports and newspaper articles also describe strong winds and blowing dust in southern California, providing substantial weight-of-evidence for the sequence of events.

Causal Connection

This documentation shows a clear causal connection between the PM10 measured at the AQMD air monitoring stations and the high winds throughout southern California upwind of those stations on October 21, 2007. The winds in the Basin increased in the morning, causing increased hourly PM10, as measured with the available TEOM PM10 monitors. The causal connection is demonstrated by the dramatic increase in hourly PM10 concentrations that coincided with the transport of dust entrained by strong, gusty winds.

Concentration was in Excess of Normal Historical Fluctuations

The 1212 $\mu g/m^3$ 24-hour PM10 concentration measured at Perris and the high values at 10 other stations on October 21, 2007 are all higher that the 99.5 percentile value of 139.5 $\mu g/m^3$ for all South Coast Air Basin FRM measurements since 1990, as shown previously in Section 1.6, Figure 1-6. Concentrations above the 97.5 percentile value (101.0 $\mu g/m^3$ and above) are outside the normal range of the data. Therefore any value that exceeds the 24-hour federal PM10 standard of 150 $\mu g/m^3$ is clearly in excess of the normal historical fluctuations of data for the Basin. All concentrations exceeding the federal 24-hour PM10 standard in the Basin since at least January 1, 2000 can be attributed to events that would quality as exceptional events, as was shown previously in Table 1-4. The Perris concentration measured on October 21, 2007 is the highest valid PM10 measured at Perris and in the entire Basin since monitoring began. With the exception of the sample from the April 12, 2007 high wind event, no other days

exceeded the PM10 24-hour NAAQS at Perris since November 7, 1990. Of the other stations that exceeded the PM10 NAAQS on October 21, this day had the station maximum PM10 concentration ever recorded at Mira Loma, Rubidoux, Norco, Ontario, Anaheim, Santa Clarita, South Long Beach and North Long Beach. For many of these stations, this was the only NAAQS PM10 exceedance on record. Fontana had three higher concentrations in the past, two of which occurred prior to 1991. The only recent accidence occurred on July 5, 2007 and has been submitted as an exceptional event due to fireworks. While October 21 had the sixth highest measurement ever recorded at San Bernardino, this was the only exceedance at that station since November 1991.

The "But For" Test

To qualify as an exceptional event, it is necessary to demonstrate that there would have been no exceedance "but for" the event. To meet this "but for" requirement, it must first be shown that no unusual anthropogenic activities occurred in the affected area that could have resulted in the exceedances, besides the high wind event. Activities that generate anthropogenic PM10 were approximately constant in the Basin immediately preceding, during and after the event. Activity levels in the Basin were typical for the time of year and PM10 emissions control programs were being implemented, not only for fugitive dust-generating activities, but also for agricultural burning in the Basin. Furthermore, due to the forecast for high winds on October 21, the AQMD compliance teams were ready to act quickly to fugitive dust complaints to minimize emissions and to enforce mitigation methods like watering and soil stabilization.

Vehicular traffic, cooking and residential fires do not directly cause PM10 24-hour NAAQS violations in the Basin. Activity levels in the Basin were typical for the time of year and PM10 emissions control programs were being implemented, for fugitive dust-generating activities, as well as open burning. With the unsettled conditions on October 21, such emissions would not contribute significantly to the PM10 measured. There were reasonable and appropriate measures in place to control PM10 in the Basin on October 21, 2007, including AQMD Rules 403, 444, 445, 1156, 1157, 1158 and 1186. Moreover, EPA has approved AQMD's BACM demonstration for all significant sources of PM10 in the Basin.

Examining the make-up of the PM10 in the Basin on this day using FRM PM2.5 data, the coarse particles (PM10-2.5), which are associated with windblown dust, represent over 75% of the total PM10 mass collected in Los Angeles County and over 90% of the mass in Orange, Riverside and San Bernardino Counties. The wildfires that were burning in southern California, most of which started on October 21, were not the primary cause of the high PM10, even at Santa Clarita and Anaheim where the potential for smoke and ash impact was greatest. PM2.5 remained relatively low throughout the

Basin on this day. Laboratory analyses of the PM10 filters for soluble potassium, an indicator of wood smoke, also support the conclusion that while there was likely some contribution from the wildfires, it was relatively small. PM10 sulfate and nitrate components were also low on the FRM filters throughout the Basin, again indicating primarily crustal material in the sample. PM10 chloride was also low, although the concentrations increased with the winds.

Based on the data provided in this report, AQMD concludes that there would not have been exceedances of the PM10 NAAQS in the Basin on October 21, 2007 if high winds were not present. Even if the extreme 99.5 percentile concentration for the Basin, 139.5 $\mu g/m^3$, were used as the background concentration to compare to the measured PM10 concentrations, the particulate contribution from the high wind event clearly caused these exceedances. The causal connection of the measured PM10 and the strong winds in the Basin, and throughout southern California, along with the high contribution of fugitive dust to the PM10 mass indicate that but for the high wind event this NAAQS violation would not have occurred.

Reasonable Measures

AQMD issued daily air quality forecasts on October 20 and 21, 2007, each valid for the following day, with same-day updates. These warned the public of the air quality in the Basin and the Coachella Valley that was predicted to reach the high Moderate range, due to increased particulates in association with the windblown dust at the time the forecast was issued. Good ventilation and deep mixing were predicted for the Basin and, given the time of year, air quality would be expected to be in the Good range, except for the wind event.

AQMD issued an air quality advisory(Appendix, A.11) on October 21 for the windblown dust and wildfires and similar advisories were issued through the next week as the ongoing winds and increasing wildfire smoke impacted the Basin. AQMD encourages public awareness of the health impacts of particulate matter through the AQMD website, informational brochures, public meetings and conferences, and press releases. Real-time air quality data and daily air quality forecasts and episode notifications are available through the AQMD website (http://www.aqmd.gov) and through the Interactive Voice Response (IVR) telephone system (1-800-CUT-SMOG). Forecasts and air quality notifications can be received by email (http://www.aqmd.gov/smog/ForecastEmails.html) or by FAX and many schools, recreational facilities, sports organizations and individuals subscribe to these services. AQMD forecasts and current data are also available through the EPA AirNow system (http://www.airnow.gov) and data is available through the CARB website (http://www.arb.ca.gov/aqd/aqdpage.htm).

Public Notification

The South Coast Air Quality Management District (AQMD) has prepared this documentation to demonstrate that this exceedance was due to high-wind natural events, in accordance with the EPA Exceptional Event Rule. Upon transmittal of this document to the California Air Resources Board (ARB), this document will be posted on the AQMD website for public hearings, notices and meetings (http://www.aqmd.gov/pubinfo/public_notices.htm), requesting review and comment by the public for a minimum of 30 days. Public comments should be directed to: Mr. Kevin Durkee, Senior Meteorologist, South Coast Air Quality Management District, 21865 Copley Drive, Diamond Bar, CA 91765; email: kdurkee@aqmd.gov.

Checklist of Exceptional Event Requirements

AQMD Flagging of Data	✓
Exceptional Event Criteria Summary:	
Affects Air Quality	✓
Is Not Reasonably Controllable or Preventable	✓
Was a Natural Event	✓
Causal Connection	✓
Concentration in Excess of Normal Historical Fluctuations	✓
The "But For" Test	✓
Reasonable Measures	✓
Public Notification	✓*

* This document will be posted on the AQMD website for a 30 days public comment period, when received by CARB

2.2 Detailed Event Analysis

PM Summary

On October 21, 2007, the FRM samplers at eleven air monitoring stations in the Basin listed below measured exceptionally high 24-hour PM10 mass concentrations, to the extreme concentration of as 1212 μg/m^3 at Perris. Routine chemical analysis of PM10 mass shows that sulfate, nitrate and chloride components of PM10 mass on October 21, were below the yearly average at most sites exceeding PM10 on this day, indicating that the PM10 mass was primarily crustal material. Soluble potassium, analyzed from the PM10 filters on October 21 as a potential tracer of wildfire smoke, also remained relatively low on October 21. PM2.5 concentrations at the monitoring stations exceeding the PM10 NAAQS with collocated PM2.5 samplers were low, in the range of 5.0 to 29.4 μg/m^3, within the PM2.5 24-hour federal standard of 35 μg/m^3. The low FRM PM2.5 concentrations on October 21 also indicate that windblown dust contributed to the high PM10 and was the primary components of the measured PM10. Table 2-1 summarizes the FRM PM10 mass and the sulfate, nitrate, chloride and potassium components from the PM10 filters on October 21, along with the available FRM PM2.5 data for the sites exceeding PM10 federal standard.

TABLE 2-1

24-hour FRM PM10 Mass, Sulfate, Nitrate, Chloride and Potassium and FRM PM2.5 Measurements (μg/m^3) for October 21, 2007

(concentrations exceeding 150 μg/m^3 are highlighted in bold type)

FRM Monitoring Station	PM10 (μg/m^3)	Sulfate (μg/m^3)	Nitrate (μg/m^3)	Chloride (μg/m^3)	Potassium (μg/m^3)	PM2.5 (μg/m^3)
Perris	**1212**	4.4	6.2	1.67	1.94	--
Mira Loma (H.S.)	**681**	3.5	3.3	1.20	0.78	--
Riverside – Rubidoux	**559**	2.7	3	1.18	0.56	11.1
Anaheim	**489**	4.4	4	2.85	3.44	29.4
South Long Beach	**432**				2.34	18.4
Norco	**332**	2.6	1.7	0.92	0.62	--
Fontana	**276**	2.2	1.2	0.59	0.28	8
Ontario Fire Station	**275**	2.9	4.5	0.27	0.19	16.7
North Long Beach	**232**	3.0	4.7	0.91	0.77	--
San Bernardino	**219**	1.9	1.7	0.49	0.21	5
Santa Clarita	**167**	2.7	1.5	0.89	1.52	--

Table 2-2 shows the daily 24-hour averaged PM10 concentrations from the available FRM (SSI), and the hourly BAM and TEOM continuous measurements for air monitoring stations in the Basin with available data between October 15 and 27, 2007. The AQMD FRM PM10 filter samples are collected on a 1-in-6 day schedule, except at Riverside-Rubidoux and Indio where 1-in-3 day data is collected. Extremely high SSI and TEOM PM10 concentrations were measured on October 21 at the Riverside County stations in the Basin and at the other Basin stations in San Bernardino, Orange and Los Angeles Counties. This demonstrates that the high wind event was widespread throughout the Basin.

The Coachella Valley area in the farthest eastern portion of the Riverside County (in the Salton Sea Air Basin) was not affected by this event and recorded the lowest PM10 concentrations of all AQMD stations, well below the federal standard. The Central portion of Los Angeles County, the coastal area of Orange County and the eastern portion of the San Bernardino valley and the San Bernardino mountain areas were not as affected by the winds and wildfires on October 21. PM10 concentrations remained relatively low, below the federal standard, in these areas. The FRM PM10 concentrations on October 20 at Perris and the Metropolitan area of Riverside County were up to 20 times that measured on the sampling days before and after that day. Central Orange County and South Coastal Los Angeles County areas were up to 16 times higher than the surrounding days. Other areas exceeding were from 1.5 to 10 times higher than the sampling days before and after. This indicates the impact of the natural event on the October 21 PM10 air quality, resulting in the higher than typical PM10 concentrations above the federal standard level in over half of the Basin.

TABLE 2-2

24-hour FRM and TEOM PM10 Measurements (μg/m^3)
October 15 through October 27, 2007

(concentrations exceeding 150 μg/m^3 are highlighted in bold type)

Monitoring Site		24-Hour PM10 (μg/m^3)												
		Date (2007)												
Location	Type	Oct. 15	Oct. 16	Oct. 17	Oct. 18	Oct. 19	Oct. 20	**Oct. 21**	Oct. 22	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 27
Central Los Angeles	FRM	45						63						58
Central Los Angeles	BAM	29	24	31	39	35	36	50	108	69	51	56	77	49
Los Angeles Airport	FRM	16						128						55
Burbank	TEOM	26	22	28	41	35	45	34	93	58	56	64	81	41
Azusa	FRM	42						--						68
Glendora	TEOM	20	18	18	18	20	29	43	61	39	28	57	78	50
Santa Clarita	FRM	30						**167**						51
North Long Beach	FRM	26						**232**						53
North Long Beach	TEOM	19	19	22	37	40	32	**205**	138	69	63	74	50	41
South Long Beach	FRM	30						**432**						65
Port Study: Wilmington	FRM	24						**207**						53
Port Study: S. Wilmington	FRM	20						**262**						55
Port Study: Long Beach	FRM	28						**262**						61
Port Study: Hudson	FRM	27						**251**						61
Port Study: Del Amo	FRM	21						**203**						54
Anaheim	FRM	31						**489**						75
Mission Viejo	FRM	22						74						52
Norco	FRM	38						**332**						87
Rubidoux	FRM	43			54			**559**			86			111
Rubidoux	TEOM	22	21	21	45	58	69	**275**	107	68	79	116	145	96
Mira Loma (H.S.)	FRM	47						**681**						--
Mira Loma (V.B.)	FRM	49						--						142
Mira Loma (V.B)	TEOM	18	20	19	36	55	48	**581**	145	55	82	108	118	81
Perris	FRM	58						**1212**						113
Lake Elsinore	TEOM	25	18	16	35	54	45	**382**	**579**	55	51	136	130	69
Banning Airport	FRM	40						--						64
Ontario Fire Station	FRM	40						**275**						93
Fontana	FRM	55						**276**						111
Upland	TEOM	19	19	17	25	29	31	70	82	55	45	73	91	57
San Bernardino	FRM	68						**219**						114
San Bernardino	TEOM	31	22	24	34	40	44	**171**	**152**	99	114	89	109	88
Redlands	FRM	63						97						85
Crestline	FRM	23						--						--

Table 2-3 shows the hourly PM10 concentrations from the TEOM measurements at Long Beach, Mira Loma, Riverside-Rubidoux, Lake Elsinore and San Bernardino from 1200 PST on October 20 through October 22. Figure 2-1 shows this data graphically for from 1200 PST on October 20 through October 21. The 24-hour averaged daily TEOM measurements indicate that PM10 concentrations were relatively low through the late evening on October 20. All stations except Long Beach show an increase in hourly

PM10 concentrations at midnight on October 21. PM10 concentrations in the inland valley areas continued to increase throughout the early morning hours on October 21, reaching the peak concentrations in the late morning hours in the Riverside areas of the Basin and extending to the San Bernardino county valley areas. PM10 concentrations at the Long Beach site increased later at 1000 PST in the morning. PM10 concentrations began to rise in the western portions of the Basin in Orange County and Los Angeles County reaching the peak PM10 concentrations in the early afternoon. PM10 concentrations remained high at most areas through midnight and in the early morning hours of October 22. The PM10 concentrations then gradually became lower the following day. Relatively low concentrations were measured throughout the day on October 23.

TABLE 2-3
Hourly TEOM PM10 Measurements, 1200 PST October 20 through October 22, 2007
(concentrations exceeding 150 μg/m^3 are highlighted in bold type)

DATE	HOUR (PST)	Hourly PM10 (μg/m^3)				
		North Long Beach	Rubidoux	Mira Loma (V.B.)	Lake Elsinore	San Bernardino
10/20/07	1200	38	53	33	41	28
	1300	38	45	31	36	27
	1400	24	45	37	45	30
	1500	31	47	38	41	40
	1600	27	53	34	46	44
	1700	30	46	37	43	54
	1800	33	41	51	38	49
	1900	59	49	37	30	47
	2000	41	50	41	37	51
	2100	34	53	60	36	50
	2200	31	57	42	45	62
	2300	29	408	133	28	117
10/21/07	0000	27	**637**	**883**	128	107
	0100	34	**680**	**744**	**345**	104
	0200	24		**879**	**296**	**247**
	0300	25		**581**	**306**	**328**
	0400	27		**929**	**349**	81
	0500	26	**493**	**970**	**450**	82
	0600	51	**447**	**974**	**321**	**414**
	0700	39	**522**	**999**	**435**	**288**
	0800	60	**695**	**999**	**324**	**180**
	0900	72	**312**	**999**	**522**	150
	1000	135	**444**	**596**	99	**181**
	1100	**343**	**349**	**741**	**682**	**529**
	1200	**297**	**293**	**997**	**417**	**247**
	1300	**486**	**170**	**552**	**544**	**175**
	1400	**319**	**187**	**333**	**517**	134
	1500	**205**	124	**556**	**257**	88
	1600	139	75	**338**	**249**	65
	1700	**170**	53	134	**194**	**237**
	1800	**622**	65	137	**425**	65
	1900	**415**	59	90	**355**	**193**
	2000	**358**	70	90	**447**	98
	2100	**388**	44	**154**	**590**	42
	2200	**348**	33	**216**	**824**	29
	2300	**313**	19	46	99	37
10/22/07	0000	**272**	47	57	**999**	51
	0100	**186**	51	47	**999**	38
	0200	**206**	40	84	**999**	58
	0300	**180**	26	142	**999**	74
	0400	**198**	55	**276**	**999**	49
	0500	**214**	82	**187**	**999**	67
	0600	**211**	**154**	**295**	**999**	83
	0700	**231**	112	**259**	**999**	77
	0800	**200**	101	**209**	**999**	119
	0900	**182**	**341**	**191**	**999**	120
	1000	134	**335**	**318**	**861**	**170**
	1100	92	**187**	**376**	**360**	**546**

TABLE 2-3 (CONTINUED)

DATE	HOUR (PST)	Hourly PM10 (µg/m^3)				
		North Long Beach	Rubidoux	Mira Loma (V.B.)	Lake Elsinore	San Bernardino
10/22/07	1200	85	**248**	141	**252**	**626**
	1300	121	**173**	95	**355**	**391**
	1400	**174**	75	72	**205**	**234**
	1500	89	58	69	**282**	**251**
	1600	106	45	62	**383**	114
	1700	94	36	48	**314**	143
	1800	34	70	35	**321**	55
	1900	39	47	43	**158**	41
	2000	45	44	137	82	63
	2100	72	66	83	**171**	106
	2200	76	85	97	95	99
	2300	60	81	**153**	70	84

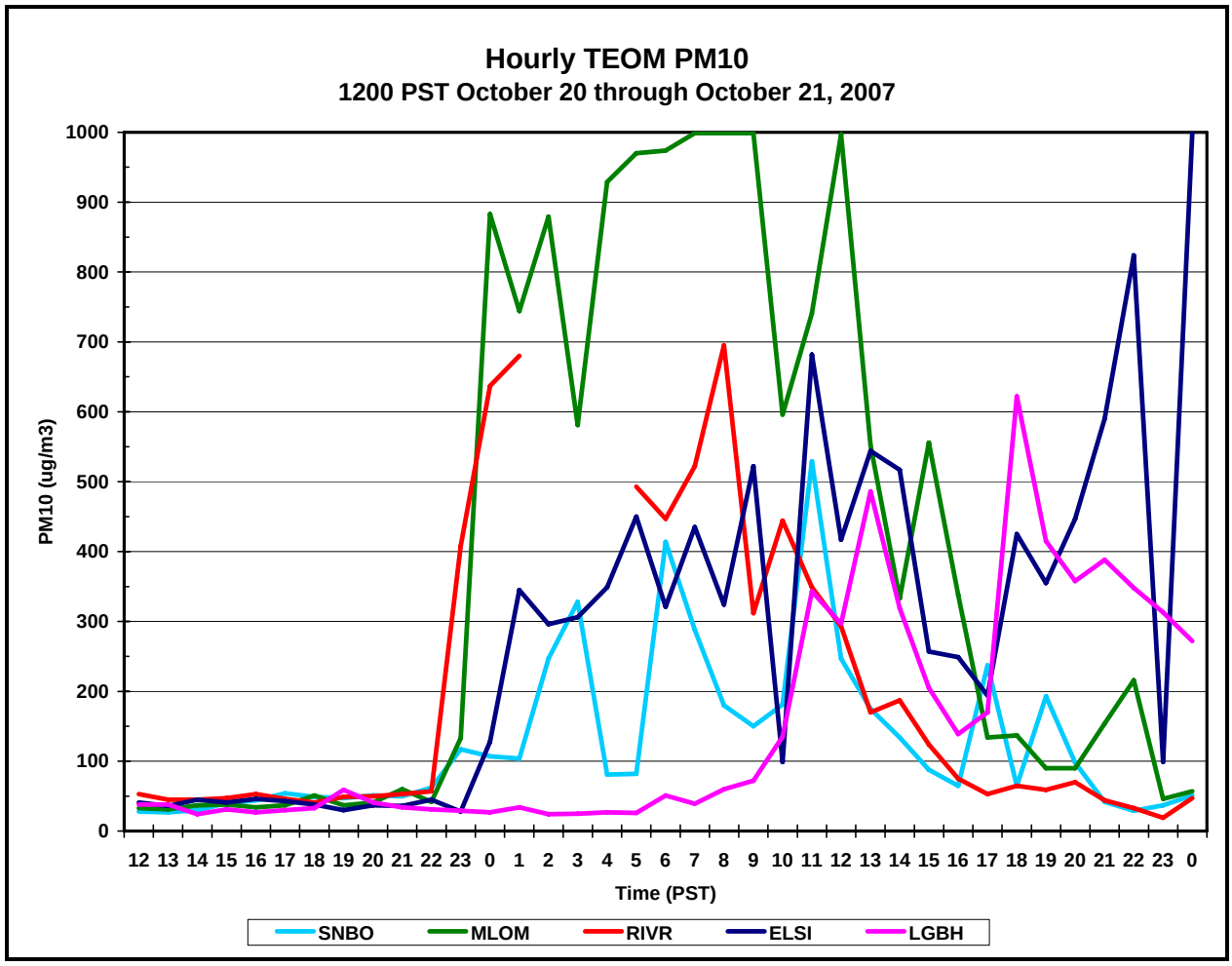


FIGURE 2-1

Time Series of Hourly TEOM PM10 (µg/m^3) from 1200 PST October 20 through October 21, 2007

Table 2-4 shows 24-hour sulfate, nitrate and chloride species from the PM10 FRM SSI filters for the days surrounding October 21. The average sulfate concentration at Perris, the site with the highest PM10 on the record, for the year 2007 was 3.2 $\mu g/m^3$ and sulfates accounted for an average of 5.8% of the PM10 mass for the year. The sulfate concentration measured at Perris on October 21, 4.4 $\mu g/m^3$, accounts for only 0.4% of the PM10 mass on that day. The average nitrate concentration at Perris for the year 2007 was 3.8 $\mu g/m^3$ and accounted for an average of 6.9% of the PM10 mass that year. The nitrate concentration measured at Perris on October 21, 6.2 $\mu g/m^3$, accounts for 0.5% of the PM10 mass on that day. The average chloride concentration at Perris for the year 2007 was 0.20 $\mu g/m^3$ and accounted for an average of 0.5% of the PM10 mass that year. The chloride concentration measured at Perris on October 21, 1.67 $\mu g/m^3$, accounts for 0.1% of the PM10 mass on that day. The below-average PM10 sulfate, nitrate and chloride concentration indicate that windblown crustal material was the primary contributor to PM10 on October 21. Similarly, all the other sites exceeding showed a low PM10 sulfate, nitrate and chloride concentration of the PM10 mass (less than 6%) on October 21.

TABLE 2-4

24-hour Sulfate, Nitrate and Chloride from PM10 FRM Measurements from Basin Air Monitoring Stations Between October 15 and 27, 2007

Monitoring Site		24-Hour PM10 Sulfate ($\mu g/m^3$)												
		Date (2007)												
Location	Type	Oct. 15	Oct. 16	Oct. 17	Oct. 18	Oct. 19	Oct. 20	**Oct. 21**	Oct. 22	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 27
Central Los Angeles	FRM	8.4						2.4						3.9
Los Angeles Airport	FRM	5.6						3.1						5.8
Azusa	FRM	6.5						--						4.1
Santa Clarita	FRM	3.6						2.7						3.4
North Long Beach	FRM	6.6						3.0						4.8
Anaheim	FRM	8.6						4.4						5.6
Mission Viejo	FRM	5.1						1.7						4.7
Norco	FRM	7.0						2.6						5.1
Riverside-Rubidoux	FRM	6.1			2.7			2.7			0.8			3.8
Mira Loma (H.S.)	FRM	6.8						3.5						--
Mira Loma (V.B.)	FRM	6.6						--						4.5
Perris	FRM	6.5						4.4						
Banning Airport	FRM	3.6						--						2.1
Ontario Fire Station	FRM	4.5						2.9						3.8
Fontana	FRM	6.7						2.2						3.6
San Bernardino	FRM	2.7						1.9						3.2
Redlands	FRM	6.0						2.1						2.9
Crestline	FRM	2.7						--						

TABLE 2-4 (continued)

Monitoring Site		24-Hour PM10 Nitrate (μg/m^3)												
		Date (2007)												
Location	**Type**	Oct. 15	Oct. 16	Oct. 17	Oct. 18	Oct. 19	Oct. 20	**Oct. 21**	Oct. 22	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 27
Central Los Angeles	FRM	7.9						3.5						5.5
Los Angeles Airport	FRM	1.0						3.6						10.3
Azusa	FRM	7.9						--						8.7
Santa Clarita	FRM	5.9						1.5						2.7
North Long Beach	FRM	2.8						4.7						8.5
Anaheim	FRM	5.0						4.0						14.0
Mission Viejo	FRM	2.3						1.2						6.4
Norco	FRM	10.1						1.7						9.6
Riverside-Rubidoux	FRM	11.7			5.3			3.0			3.9			10.6
Mira Loma (H.S.)	FRM	11.9						3.3						--
Mira Loma (V.B.)	FRM	11.9						--						12.2
Perris	FRM	16.6						6.2						--
Banning Airport	FRM	10.8						--						2.3
Ontario Fire Station	FRM	2.1						4.5						10.6
Fontana	FRM	13.3						1.2						9.6
San Bernardino	FRM	18.0						1.7						9.3
Redlands	FRM	19.3						1.6						3.8
Crestline	FRM	1.6						--						--

Monitoring Site		24-Hour PM10 Chloride (μg/m^3)												
		Date (2007)												
Location	**Type**	Oct. 15	Oct. 16	Oct. 17	Oct. 18	Oct. 19	Oct. 20	**Oct. 21**	Oct. 22	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 27
Central Los Angeles	FRM	0.06						0.26						0.02
Los Angeles Airport	FRM	0.05						4.67						0.14
Azusa	FRM	0.04						--						0.05
Santa Clarita	FRM	0.04						0.89						0.06
North Long Beach	FRM	0.04						0.91						0.07
Anaheim	FRM	0.05						2.85						0.09
Mission Viejo	FRM	0.04						0.34						0.08
Norco	FRM	0.09						0.92						0.11
Riverside-Rubidoux	FRM	0.05			0.16			1.18			0.14			0.15
Mira Loma (H.S.)	FRM	0.05						1.20						--
Mira Loma (V.B.)	FRM	0.04						--						0.12
Perris	FRM	0.06						1.67						--
Banning Airport	FRM	0.05						--						0.08
Ontario Fire Station	FRM	0.00						0.27						0.07
Fontana	FRM	0.07						0.59						0.21
San Bernardino	FRM	0.04						0.49						0.09
Redlands	FRM	0.04						0.17						0.08
Crestline	FRM	0.05						--						--

Table 2-5 shows 24-hour PM2.5 concentrations from October 21 through 27, 2007, at stations throughout the Basin. PM2.5 is not measured at Perris, so the nearest stations provide an indication of the contribution from PM2.5. PM2.5 is measured with FRM filter samplers at Riverside-Rubidoux, Mira Loma and Indio in Riverside County and at Ontario, Fontana and San Bernardino in San Bernardino County. Anaheim, Central Los Angeles and S. Long Beach show the PM2.5 in the coastal counties. Where 24-hour averaged BAM measurements were available, these have been included to supplement the FRM measurements. The Lake Elsinore BAM PM2.5 instrument is particularly supportive in this case, since that station is relatively close to Perris. The PM2.5 concentrations were relatively low on October 21, with Anaheim measuring the highest FRM PM2.5 concentration, 29.4 $\mu g/m^3$. All FRM PM2.5 measurements on October 21 were well below the 24-hour PM2.5 NAAQS of 35 $\mu g/m^3$. There are high BAM PM2.5 measurements at Banning and Anaheim on October 21 for the period shown in Table 2-5 that do not match collocated FRM instruments. The BAM data is suspect in these cases and it has not undergone a rigorous quality control process and it is not submitted to AQS to date. The validated FRM PM2.5 concentration at Anaheim on October 21, for example, is 29.4 $\mu g/m^3$ compared to the same day BAM measurement of 45.3 $\mu g/m^3$.

TABLE 2-5
24-hour FRM and BAM PM2.5 Measurements Surrounding the Azusa and Fontana Air Monitoring Stations Between October 15 and October 27, 2007

(concentrations exceeding 35 μg/m^3 are highlighted in bold type)

Monitoring Site		24-Hour PM2.5 (μg/m^3)												
		Date (2007)												
Location	Type	Oct. 15	Oct. 16	Oct. 17	Oct. 18	Oct. 19	Oct. 20	**Oct. 21**	Oct. 22	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 27
Central Los Angeles	FRM	**44.3**	10.4	10.7	15.1	11.1	12.6	12.0	19.3	20.7	19.1		**53.8**	27.9
Central Los Angeles	BAM	**42.5**	20.3	18.8	22.6	16.0	21.8	19.4	27.1	27.8	26.3	**39.7**	**68.0**	**43.5**
Compton	FRM	23.5			13.5			15.5			29.2			29.2
Pico Rivera	FRM	31.6			12.5			10.9			26.9			32.9
Burbank	FRM	**36.2**			12.0			6.9			20.2			---
Burbank	BAM										28.8	**71.4**	**40.7**	**40.4**
Pasadena	FRM	**31.4**			9.0			9.4			16.7			21.4
Azusa	FRM	31.0	21.0	10.0	9.0	7.1	13.5	7.2	9.8					
Glendora	BAM	31.5	22.2	12.9	7.4	3.9	9.6	6.9	9.1	19.4	9.4	**36.3**	**67.4**	**38.5**
North Long Beach	FRM	18.4	9.1	8.8								33.5	**36.1**	23.6
South Long Beach	FRM	17.0	9.0	8.0	15.7	16.7	10.9	18.4	32.7	29.7	32.5	33.7	29.4	22.0
Anaheim	FRM	23.5	9.4	9.9	14.2	15.4	14.5	29.4	28.1	27.8	28.6		**50.9**	33.1
Anaheim	BAM	34.2	17.0	12.0	18.3	17.8	18.3	**45.3**	**45.3**	32.4	32.8	**46.9**	**62.5**	**47.5**
Mission Viejo	FRM	17.4			8.5			6.7						
Riverside-Rubidoux	FRM	**38.8**	26.1	10.5	11.6	13.0	17.6	11.1	7.7	14.9	25.6	**50.4**	**75.7**	**42.0**
Riverside-Rubidoux	BAM	**46.0**	32.0	12.8	17.7	14.4	21.5	26.4	10.9	19.9	29.2	**44.5**	**90.5**	**48.1**
Riverside-Magnolia	FRM	**35.2**			14.9			14.0			18.8			31.5
Mira Loma (H.S.)	FRM	33.3			15.1						25.7			**47.7**
Mira Loma (V.B)	BAM	**48.2**	**36.2**	21.4	29.4	24.1	31.4		**78.0**	**94.3**	34.1	**66.4**	**93.8**	**59.8**
Lake Elsinore	BAM	**38.5**	13.0	7.3	10.7	11.4	13.4	25.3	**104.4**	7.9	8.5	**58.0**	**113.0**	27.4
Banning Airport	BAM	**38.0**	19.3	12.1	14.2	9.6	15.6	**238.9**	**50.5**	6.0	5.0	**44.4**	**68.7**	**42.1**
Ontario Fire Station	FRM	31.8			12.3			16.7			25.9			**46.9**
Fontana	FRM	**39.4**			16.5			8.0			23.7			34.4
San Bernardino	FRM	**46.6**			11.6			5.0			**72.1**			**44.9**
Big Bear	FRM							3.2						**45.4**

By comparing the 24-hour PM10 and PM2.5 mass from the same stations, the percentage of PM10 attributed to PM-Coarse (PM10-2.5) is high at all locations on October 21, as is shown in Table 2-6. In Riverside, San Bernardino and Orange Counties, the PM-Coarse was over 90 percent of the PM10. In Los Angeles county the PM-Coarse was near 80 percent of more. This indicates that the source of the high PM10 throughout the Basin on October 21, was primarily crustal material due to windblown dust. Table 2-7 shows the hourly BAM PM2.5 concentrations in the Basin. The hourly PM2.5 values increased in the early morning of October 21 when the windblown dust increased the PM10, but PM2.5 remained a small fraction of the hourly PM10 throughout the day. The extremely high PM2.5 data from Banning Airport is suspect. The Mira Loma-Van Buren BAM stopped working after ten hours due to a power outage at that site. Smoke from the fire in Orange County that started in the afternoon of October 21, is evident in the Anaheim BAM data in the evening of October 21. The Basin PM2.5 measurements were influenced by smoke for two weeks following October 21; these PM2.5 exceptional events will be addressed in a separate document.

TABLE 2-6

Percentage of 24-Hour PM10 Attributed to PM-Coarse (PM10-2.5) from Collocated Measurements between October 15 and October 27, 2007

Monitoring Site		24-Hour PM-Coarse (PM10-PM2.5)/PM10 (%)												
		Date (2007)												
Location	**Type**	Oct. 15	Oct. 16	Oct. 17	Oct. 18	Oct. 19	Oct. 20	**Oct. 21**	Oct. 22	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 27
Central Los Angeles	FRM	1.6						81.0						51.9
Central Los Angeles	BAM	-46.6	15.4	39.4	42.1	54.3	39.4	61.2	74.9	59.7	48.4	29.1	11.7	11.2
Burbank	BAM	-39.2			70.7			79.7			48.6	-11.6	49.8	1.5
Azusa	FRM	26.2						---						---
Glendora	BAM	-57.5	-23.3	28.3	58.9	80.5	66.9	84.0	85.1	50.3	66.4	36.3	13.6	23.0
North Long Beach	FRM	29.2						---						55.5
South Long Beach	FRM	43.3						95.7						66.2
Anaheim	FRM	24.2						94.0						55.9
Mission Viejo	FRM	20.9						90.9						---
Riverside-Rubidoux	FRM	9.8			78.5			98.0			70.2			62.2
Riverside-Rubidoux	BAM	-109.1	-52.4	39.0	60.7	75.2	68.8	90.4	89.8	70.7	63.0	61.6	37.6	49.9
Mira Loma (H.S.)	FRM	29.1						---						66.4
Mira Loma (V.B)	BAM	-167.8	-81.0	-12.6	18.3	56.2	34.6	---	46.2	-71.5	58.4	38.5	20.5	26.2
Lake Elsinore	BAM	-54.0	27.8	54.4	69.4	78.9	70.2	93.4	82.0	85.6	83.3	57.4	13.1	60.3
Banning Airport	BAM	5.0						---						34.2
Ontario Fire Station	FRM	20.5						93.9						49.6
Fontana	FRM	28.4						97.1						69.0
San Bernardino	FRM	31.5						97.7						60.6

TABLE 2-7

Hourly BAM PM2.5 Measurements on October 20 and 21, 2007

(concentrations exceeding 35 μg/m^3 are highlighted in bold type)

DATE	HOUR (PST)	Hourly BAM PM2.5 (μg/m^3)						
		Central Los Angeles	Glendora	Anaheim	Riverside-Rubidoux	Mira Loma (V.B.)	Lake Elsinore	Banning Airport
10/20/07	0000	20	7	16	17	24	17	15
	0100	20	5	9	13	24	15	15
	0200	19	5	9	12	21	14	15
	0300	22	3	9	12	20	13	25
	0400	11	2	11	12	18	14	14
	0500	11	2	19	11	22	15	21
	0600	19	4	21	15	29	20	17
	0700	23	2	17	26	31	20	13
	0800	28	6	12	29	29	19	9
	0900	27	7	20	23	25	10	12
	1000	21	7	11	19	**41**	9	12
	1100	20	10	20	26	**36**	11	8
	1200	34	9	32	32	34	12	9
	1300	33	9	31	21	35	11	12
	1400	26	9	27	17	31	14	14
	1500	26	11	21	19	31	15	23
	1600	22	15	23	21	32	13	13
	1700	20	18	18	24	31	9	16
	1800	17	14	18	28	**38**	19	18
	1900	22	15	18	27	32	5	13
	2000	19	20	17	26	**43**	8	11
	2100	22	16	19	31	**37**	10	20
	2200	20	16	21	31	**43**	11	23
	2300	21	18	19	25	**46**	17	26
10/21/07	0000	20	11	19	24	**113**	12	33
	0100	23	16	21	**36**	**156**	23	23
	0200	22	14	17	**72**	**115**	20	20
	0300	27	8	15	**67**	**85**	21	17
	0400	20	9	11	**61**	**64**	21	17
	0500	15	11	19	**48**	**68**	25	**183**
	0600	20	11	15	26	**79**	18	**401**
	0700	26	11	25	33	**53**	24	**943**
	0800	26	12	35	**46**	**61**	20	**759**
	0900	29	13	**43**	**42**	**58**	21	**821**
	1000	21	12	32	**37**	**58**	26	**614**
	1100	15	11	28	24		25	**337**
	1200	10	4	**42**	23		18	**252**
	1300	5	2	**46**	30		31	**119**
	1400	9	8	21	24		27	**143**
	1500	16	5	28	17		14	**118**
	1600	12	0	30	9		10	**98**
	1700	12	0	29	2		6	**111**
	1800	14	0	**39**	0		21	**111**
	1900	25	0	**91**	0		16	**295**
	2000	21	0	**141**	2		21	**88**
	2100	22	0	**134**	5		**37**	**51**
	2200	27	3	**131**	4		**42**	**87**
	2300	28	4	**75**	1		**108**	**92**

Soluble potassium is used as a tracer of the combustion of biomass, especially of wood smoke. Table 2-8 shows the 24-hour soluble potassium concentrations from October 21 through 27, 2007, at stations throughout the Basin. The soluble potassium concentrations increased on October 21 from that taken from the previous sampling run, when most concentrations were near zero. On October 21, the potassium ranged from 0.11 $\mu g/m^3$ at Burbank and Redlands to 3.44 $\mu g/m^3$ at Anaheim, the station most impacted by wildfires at the end of the day. These concentrations accounted for between 0.1% and 0.2% of PM10 mass at most stations and 0.9% of the mass at Santa Clarita. AQMD does not routinely perform the soluble potassium analysis on the PM10 filters. However, these values can be compared to the PM2.5 total potassium measured during the AQMD Multiple Air Toxics Study (MATES III), sampled every three days between April 3, 2004 and February 19, 2006 throughout the Basin. Potassium is mostly in the PM2.5 size range, so the difference between PM10 and PM2.5 potassium is small. Also, the soluble potassium would not be greater than the total potassium. During the MATES III period, the average potassium was 0.10 $\mu g/m^3$ and the 99^{th} percentile value was 0.75 $\mu g/m^3$. In contrast, the soluble potassium measured from the PM10 filters for the July 5, 2007 fireworks exceptional event was 26.0 $\mu g/m^3$ (15.8% of PM10 mass) at Azusa 11.1 $\mu g/m^3$ (7.2% of PM10 mass) at Fontana. The potassium content of the PM10 mass at the sites exceeding PM10 federal standard on October 21, indicates that the fires had some influence on the PM10 measured, but that the primary contribution was from crustal material due to windblown dust.

TABLE 2-8

24-hour Potassium Analyzed from PM10 FRM SSI Measurements from Basin Air Monitoring Stations between October 15 and 27, 2007

Monitoring Site		24-Hour PM10 Potassium (μg/m^3)												
		Date (2007)												
Location	Type	Oct. 15	Oct. 16	Oct. 17	Oct. 18	Oct. 19	Oct. 20	**Oct. 21**	Oct. 22	Oct. 23	Oct. 24	Oct. 25	Oct. 26	Oct. 27
Central Los Angeles	FRM	0.00						0.18						--
Los Angeles Airport	FRM	0.03						0.50						0.23
Azusa	FRM	0.00						0.09						0.23
Burbank	FRM	--						0.11						0.26
Santa Clarita	FRM	0.07						1.52						0.30
Long Beach	FRM	0.00						0.77						0.18
South Long Beach	FRM	0.01						2.34						0.25
Anaheim	FRM	0.00						3.44						0.27
Mission Viejo	FRM	0.03						0.12						0.27
Norco	FRM	0.00						0.62						0.63
Rubidoux	FRM	0.00			0.15			0.56			0.30			0.62
Mira Loma (H.S.)	FRM	0.00						0.78						--
Mira Loma New	FRM	0.00						0.81						0.99
Perris	FRM	0.00						1.94						0.59
Banning Airport	FRM	0.00						--						0.42
Ontario Fire Station	FRM	0.05						0.19						0.53
Fontana	FRM	0.00						0.28						0.69
San Bernardino	FRM	0.00						0.21						0.75
Redlands	FRM	0.00						0.11						0.66

Meteorological Setting

An upper level trough of low pressure moved through California in the morning of Saturday, October 20, 2007 and developed further on Sunday, October 21, centered over New Mexico. Ridging occurred behind the trough from the west. The strong pressure gradients that developed between the high and low pressure aloft created strong winds. The National Weather Service (NWS) 500 millibar (MB) analyses every 12 hours between 0400 PST on October 20 and 0400 PST on October 22 are shown in the Appendix, Section A.13. The winds over California at the 500 MB pressure level started out westerly in the morning of October 20, then became northwesterly in the afternoon with speeds increasing to 86 mph (75knots). On October 21, the upper level winds became northerly, weakening somewhat as the area of high pressure to the southwest edged into California. The northerly flow aloft provided upper level support to the north and northeasterly winds at the surface on this day.

The passage of the low pressure trough aloft brought the first strong cold front of the season at the surface. Section A.14 in the Appendix shows the NWS surface analyses, every three hours between 0400 PST on October 20 and 0400 PST on October 22. The low pressure center and cold front moved through southern California on October 20, creating some gusty northwesterly winds on that day. High pressure started building over southern Oregon on October 20, expanding to the east over the Great Basin on October 21. This is the classic Santa Ana wind pattern that brings strong winds to southern California. High pressure builds over the Great Basin in the cold air behind the front with lower pressure off the southern California coast. This pressure gradient creates strong north through northeasterly winds, enhanced by thermal gradients due denser cold air over the Great Basin. The relatively cool air from the Great Basin deserts flows over the southern California mountains, gaining momentum on the lee side. The downslope flow causes compressional warming and drying of the air in the Basin. This combination of strong wind, high temperatures and low relative humidities make these Santa Ana conditions highly conducive to wildfires in southern California.

The surface winds on October 21 started out northerly in the morning, shifting to the northeast through the day and more easterly by the following day as the surface high pressure shifted eastward behind the trough. Temperatures in southern California on October 21 were warm for this time of year, reaching the upper 80˚F range even along the coast. The air was very dry, especially in the windy areas; relative humidities in the Basin fell into the teens even in coastal areas. One wildfire started on October 20 and several more started throughout the day on October 21. The winds continued for the next few days, with hot, dry conditions contributing to the growth of these wildfires and many new ones over the next several days.

The AQMD Meteorology Section routinely analyzes pressure gradients in southern California to assess winds and air pollution potential. The Summation Pressure Gradient

(SPG) is a good indicator of the strength of the flow and whether it is onshore (positive) or offshore (negative), where

$$SPG = (SAN\text{-}LAS)^5 + (LGB\text{-}DAG)^6 + (RIV\text{-}DAG)^7$$

In the morning of October 20, the 0700 PST SPG was 15.3 millibars (MB), indicating moderate onshore flow. At the same time in the morning of October 21, the SPG was high and negative, at -27.6 MB, indicating very strong offshore flow and an extreme shift from 24-hours earlier. The strong offshore gradient continued through the day and the SPG was -28.8 at 0700 PST in the morning of October 22.

The AQMD Meteorology Section predicted high winds on October 20 in the Coachella Valley for AQMD Rule 403.1, which requires specific actions in this area when wind gusts exceed 25 mph. While there are no other AQMD rule requirements to forecast winds in the Basin, the daily forecast discussion by AQMD issued on October 19 for Saturday, October 20, predicted the onset of strong winds, stating:

> *Moderately strong northwest winds will start in the afternoon [Saturday], becoming northerly in the evening and northeasterly on Sunday. The strongest wind gusts will be through and below the passes and canyons, especially in the mountains and desert areas, with areas of blowing dust and sand likely.*

PM10 predictions were increased throughout the Basin for October 20 and agricultural and prescribed burning was prohibited with a No-Burn prediction for the entire Basin. The AQMD forecast issued October 20 for Sunday, October 21 continued the prediction of strong winds, stating:

> *Sunday will be mostly sunny and several degrees warmer with strong offshore flow. Gusty winds are likely throughout the Basin, with strongest gusts through and below passes and canyons. Areas of blowing dust and sand are likely, especially in the deserts and mountain areas.*

PM10 predictions were increased further and agricultural and prescribed burning was again prohibited. A Coachella Valley Rule 403.1 High Wind Day was also declared for October 21. Morning soundings through this period indicate surface-based temperature inversions, which are common with offshore wind events. This allowed winds aloft to more readily mix to the surface.

The Appendix to this document (Sections A.2 through A.6) contains the forecast discussions, short-term forecasts (nowcasts), fire weather forecasts, warnings and significant wind reports, as available from the NWS Los Angeles/Oxnard and San Diego

[5] Sea Level Pressure difference between San Diego and Las Vegas
[6] Sea Level Pressure difference between Long Beach and Daggett
[7] Sea Level Pressure difference between Riverside and Daggett

Forecast Offices, whose areas of responsibility cover the Basin and much of southern California. These show that the strong Santa Ana wind event was well predicted in advance, warning the public of potentially damaging winds and windblown dust and sand, along with reduced visibilities.

NWS warnings for high winds (Appendix, Section A.5) were already in place on October 20, extending through Monday, October 22, or longer. A Wind Advisory is issued by NWS when sustained winds of 30 to 39 mph are expected for 1 hour or longer. A High Wind Warning is issued when sustained winds of 40 mph or more are expected for 1 hour or longer, or for wind gusts of 58 mph or more with no time limit. NWS Oxnard issued High Wind Warnings on October 20, extending through the period for: the Los Angeles and Ventura County Mountains; the Santa Monica Mountains; the Antelope Valley; the Ventura and Los Angeles County Coasts, including Downtown Los Angeles; the Ventura and Los Angeles County Valleys, including the Santa Clarita Valley; and the Santa Barbara County Mountains and Coastal areas. NWS San Diego issued High Wind Warnings for: the Orange County Coastal Areas; the Inland Empire, including the San Bernardino and Riverside County Valleys; the San Bernardino and Riverside County Mountains; the Santa Ana Mountains and Foothills; and the San Diego County Valleys, Mountains and Coastal Areas. A Wind Advisory was also in effect for the Coachella Valley. In short, High Wind Warnings were in place for the entire South Coast Air Basin and most of southern California to warn the public of this high wind event. Northeasterly winds with sustained speeds in the 25 to 50 mph range were predicted throughout the region, along with damaging gusts to 80 mph, especially in the mountains, with some isolated gusts to 100 mph. Hazardous driving conditions were predicted, especially through and below canyons and passes, as well as blowing dust and sand with reduced visibility, broken tree limbs and downed power lines.

Wildfire Analysis

A total of 23 wildfires burned in Southern California between October 20 and November 10, 2007, when all were completely contained. There were 10 confirmed fire-related fatalities, 139 people injured, 3,204 structures destroyed (2,233 homes, 5 businesses and 966 outbuildings). An estimated 517,267 acres were burned. The fires resulted in the largest evacuation in California history, with more than 321,500 mandatory evacuees[8]. Section A.10 of the Appendix shows a map of the southern California wildfires during this period, created by the California Governor's Office of Emergency Services (OES). Section A.10 also contains a reproduction of the California Joint Incident Briefing issued by OES and CalFire at 0900 PST in the morning of October 22. The Ranch Fire started in the evening of October 20, near Castaic in the mountains of northern Los Angeles County. Ten fires started in southern California on October 21. The fires on these two days are listed chronologically in Table 2-9.

TABLE 2-9

Southern California Wildfires on October 20 and 21, 2007

Fire Name	Location	Estimated Start Date/Time (PST)	Declared Full-Control Date	Estimated Final Size (Acres)
Ranch Fire	Northern Los Angeles County Mountains, 6 miles north of Castaic	10/20/07 2042 PST	10/30/07	58,401
Canyon Fire	Malibu Canyon, south of Pacific Coast Hwy.	12/21/07 0355 PST	10/27/07 1100 PST	4,500
Sedgewick Fire	Santa Barbara County	10/21/07 0500 PST	10/24/07 0600 PST	710
Harris Fire	Southern San Diego County	10/21/07 0830 PST	11/10/07 1700 PST	90,440
Nightsky Fire	Ventura County	10/21/07 0935 PST	10/22/07	30
October Fire	Angeles National Forests	10/21/07 (time unknown)	10/23/07	25
Witch Fire	East of Ramona in Central San Diego County	10/21/07 1135 PST	10/31/07	197,900
Buckweed Fire	Agua Dulce and Canyon Country, north of Santa Clarita	10/21/07 1155 PST	10/26/07	38,356
Roca Fire	Aguanga, east of Temecula in Riverside County	10/21/07 1452 PST	10/23/07 1700 PST	270
Santiago Fire	Santa Ana Mountains in Orange County, east of the City of Orange, north of Irvine	10/21/07 1655 PST	11/9/07 0500 PST	28,400
McCoy Fire	Central San Diego County	10/21/07 2237 PST	10/26/07 1700 PST	353
Cajon Fire	Cajon Pass, near Devore and Glen Helen	10/22/07 2300 PST	10/24/07 (est.)	250

[8] Source California Office of Emergency Services, Quick Facts for Southern California Wildfires: http://www.oes.ca.gov/Operational/OESHome.nsf/ALL/8A7A41878BC9B726882573A20069BF4D?OpenDocument

The fires burned hot initially, sending smoke high into the atmosphere to be blown offshore by the strong northeasterly Santa Ana winds. While the Ranch Fire that had started on October 20 was burning close to Castaic on October 21, its smoke impact to the Santa Clarita monitor, about 10 miles to the south, was relatively small. The northeasterly winds primarily blew this smoke offshore across Ventura County. The October Fire in the mountains of the Angeles National Forest was small, reported at only 25 acres. The start time and exact location were not reported, and little smoke impact was evident. Smoke impacts to the Santa Clarita monitor were more likely from the Buckweed fire that was estimated to have started around 1155 PST. The soluble potassium analyzed from the Santa Clarita filter did increase on October 21, to 1.52 $\mu g/m^3$ from essentially zero on the previous sampling day. This is still a low concentration, indicating that the smoke was a small portion of the PM10 measured at Santa Clarita on this day.

The smoke from the Canyon Fire in Malibu that started in the early morning of October 21 also blew over the ocean with the strong winds in that area and did not significantly impact the AQMD monitoring stations on October 21. Smoke from the Sedgewick Fire in Santa Barbara County and the Harris Fire in Southern San Diego County blew offshore and did not impact the Basin. The Nightsky Fire in Ventura county was very small, 30 acres, with smoke transport across Ventura County and offshore on this day. Again, this smoke did not impact Basin stations. Likewise, smoke from the McCoy Fire that started near the end of the day in central San Diego County would have had little impact to the Basin PM10 monitors.

The Witch Fire created smoke that started around 1135 PST east of Ramona in the mountains of central San Diego County and was also transported to the west on October 21 out over the ocean. Smoke impacts from this fire did not impact Riverside or Orange County stations on this day. The Roca Fire started near 1452 PST in the afternoon of October 21 at Aguanga, east of Temecula in southern Riverside County near the San Diego County border. Given the northwesterly wind flows on this day the impacts of this smoke would have been primarily over San Diego county. Smoke impacts from the Roca Fire to the AQMD Perris air monitoring station, over 30 miles to the northwest, or to the Lake Elsinore station, over 30 miles to the west-northwest, were unlikely. The Perris soluble potassium increased from near zero from the PM10 sample 6 days earlier to 1.94 $\mu g/m^3$. This was higher than normal, but still relatively low.

The Cajon Fire was the only known fire in San Bernardino County to start on October 21. The relatively small fire (250 acres) started at the end of the day (2315 PST), so this fire had little impact on the PM10 measured on October 21 in the downwind areas of San Bernardino and Riverside Counties. Several more fires in San Bernardino County started on October 22.

The Santiago Fire started in the Santa Ana Mountains of Orange County, approximately 10 miles east of the city of Orange, at 1655 PST. This location is over 15 miles east and south of the Anaheim air monitoring station. Anaheim had the most potential to be impacted by smoke of any AQMD particulate station on this day. The FRM PM10 at the AQMD Anaheim station in northwestern Orange County measured 489 $\mu g/m^3$. The PM-Coarse fraction of the PM10 at Anaheim was 94% for the day, indicating that crustal material from windblown dust was primarily responsible for most of the PM10, not the combustion products from the wildfire which would cause a higher PM2.5 fraction. The hourly BAM PM2.5 at Anaheim, however, spiked in the evening of October 21, to a peak of 134 $\mu g/m^3$, indicating that there was an impact from the fires that night. The soluble potassium analyzed from the Anaheim filter did increase on October 21, to 3.44 $\mu g/m^3$ from essentially zero on the previous sampling day. This was the highest potassium analyzed for the Basin on this day. This again is above normal, but still a relatively low concentration, indicating that while the smoke contributed to the particulate mass measured at Santa Clarita on this day, it accounts for only a small portion.

Windblown Dust Analysis

The true color image from the NASA Terra satellite pass at approximately 1035 PST on October 21 is shown in Figure 2-2. The fires burning at this time are marked in red. Smoke in the image appears more white or grey while dust appears more brown. The offshore flow is clearly seen in this image in the smoke and dust blowing from the land over the ocean. The smoke from the Canyon Fire in Malibu is especially visible at this time, with smoke blowing from the northeast into Santa Monica Bay and out to sea. The fires in Ventura County and northern Los Angeles County also contributed smoke offshore. Large amounts dust can be seen over the water off the coast, throughout the California Bight. Areas of significant dust can be seen from the Palos Verdes Peninsula and also blowing offshore across the Orange County coast. Denser dust plumes can be seen blowing from the coasts at San Diego and in northern Baja. Smoke can also be seen from the Harris Fire in southern San Diego County, mixing with the windblown dust. No smoke is evident in the inland portions of the Basin at this time. Any dust blowing in Riverside or San Bernardino County cannot be distinguished from the land background at this time, except that bands of windblown dust can be seen where the contract is greater over the Salton Sea and in the northern Gulf of California.

FIGURE 2-2
NASA Terra True Color Satellite Image near 1035 PST October 21, 2007

The composite true color image from NASA Aqua satellite passes at approximately 1215 and 1350 PST on October 21 is shown in Figure 2-3. The fires, shown in red, have grown considerably by this time. A large amount of smoke is blowing across Ventura County from the Ranch and Buckweed Fires near Santa Clarita. Windblown dust is also evident in that plume, since the fires were mostly burning in the windiest areas of the mountains and foothills were windblown dust was a factor. The Canyon Fire in Malibu is still contributing smoke offshore at this time as well. A fire is now mapped in the mountains north of the Basin, probably the October Fire, although little smoke can be distinguished from the marked area. The amount of windblown dust crossing the coast from Palos Verdes to San Diego County increased significantly in the time from the last image. Windblown dust can be seen over the Inland Empire portion of the Basin where the PM10 concentrations were highest. The hourly TEOM PM10 concentrations peaked at Mira Loma, Lake Elsinore and San Bernardino near this time. Smoke from the

relatively new Witch Fire in central San Diego County was starting to blow toward the west. Both smoke and dust are evident from the Harris Fire in San Diego County and a large area of dust is blowing across Baja California.

FIGURE 2-3
NASA Aqua True Color Satellite Image between 1215 and 1330 PST October 21, 2007
Diagonal line through Los Angeles due to composite of two passes: right portion at 1215 PST and left portion at 1350 PST)

Along with their high wind warnings issued at 1059 PST on October 21, NWS San Diego reported peak wind gusts measured throughout the day from the following areas of the Basin:

- 85 mph in Freemont Canyon in the Santa Ana Mountains in Orange County;
- 79 mph and Palm Elementary School in San Bernardino;
- 75 mph in Mira Loma;
- 74 mph in Rancho Cucamonga;
- 67 mph in Rialto;
- 63 mph at Ontario Airport;
- 49 mph at Corona Airport;
- 48 mph at Devore (in the Cajon Pass).

Section A.6 of the Appendix contains the Significant Wind Report issued by NWS Oxnard for the Santa Ana event, including the following maximum wind gusts (as measured during the routine 10 observation period) from reporting stations in the Los Angeles County portion of the Basin:

- 108 mph at Whitaker Peak (LA County Mountains, near Castaic);
- 91 mph at Warm Springs (near Castaic);
- 86 mph at Camp Nine (Angeles National Forest);
- 78 mph in Newhall Pass;
- 67 mph in Saugus (Santa Clarita area)
- 64 mph in the Malibu Hills;
- 62 mph at Sandberg (northern LA County Mountains, near Gorman)
- 62 mph at Clear Creek (Angeles National Forest);
- 61 mph at Leo Carrillo Beach;
- 48 mph at Malibu Canyon;
- 40 mph at Van Nuys

Section A.1 of the Appendix contains NWS METAR weather observations for stations in the Basin, from near 1200 PST on October 20 through October 22. These include the sustained wind direction (labeled WD) and wind speed (WS, in mph), the highest gust during the 10 minute reporting period (Gust, in mph), and the peak wind speed reported through the previous hour (labeled PK WS, in mph), when reported, along with Visibility (in miles) and reported weather conditions, such as blowing dust (BLDU) and smoke (FU). Winds were generally strongest in the mountains and became gusty in the northern portions earlier than in the Basin.

The Sandberg weather station, in the northern LA County mountains already had strong, gusty winds on October 20 that continued through the 22nd. The Sandberg winds peaked in the late morning on October 21, with the previously mentioned gusts of 62 mph and

peak wind gusts (PK WS) of 67 mph during the hour preceding the 1052 PST observation. At that time, the only weather remark reported that day at Sandberg was squalls (SQ). NWS defines a squall as "a strong wind characterized by a sudden onset in which the wind speed increases at least 16 knots and is sustained at 22 knots or more for at least one minute."

Unobstructed stations experienced the winds early and for most of the day. For example, Avalon Airport in Catalina Island experienced gusty easterly flow to 36 mph in the morning of October 21, starting at 0551 PST. The strong winds continued through most of the day, peaking at 54 mph before the 2251 PST observation. W.J. Fox Field in Lancaster experienced gusty winds through midday starting with the 0756 PST observation, peaking with a gust of 39 mph, then becoming light after 1700 PST. Blowing dust (BLDU) was also reported through the windy period. The winds at Palmdale Airport also spiked in the morning, starting at 0853 PST and continuing until 1700 PST with peak gusts to 43 mph. Van Nuys Airport in the San Fernando Valley measured strong winds, starting in the afternoon of October 20 and continuing through the next two days. Sustained winds at Van Nuys reached 29 mph early on October 21 with gust over 35 mph each hour through the morning that peaked at 44 mph at 0851 PST. No weather remarks were recorded at this station until 1351 PST when smoke was reported. The smoke reports at Van Nuys continued through the night and into the next day.

With the strong winds in the northern Los Angeles County mountains and below the passes and canyons in the Santa Clarita and San Fernando Valleys, the AQMD Santa Clarita air monitoring station measured FRM PM10 of 167 $\mu g/m^3$ for October 21. Unfortunately no PM10 or PM2.5 measurements at Van Nuys and no PM2.5 measurements at Santa Clarita were collected at this time to help assess the PM-coarse crustal material from windblown dust versus the PM2.5 combustion product from the Santa Clarita wildfire. However, a photomicrographic analysis was done by the AQMD Laboratory on a portion of the PM10 filter from Santa Clarita. These photographs are included in the Appendix, Section A.12. This analysis showed some evidence of ash from the wildfire as a minor component, estimated by the Laboratory between 1 and 10% of the total particles on the filter. Crustal materials (crystalline particles) were primarily found on the filter, as well as pollen and a small amount of rubber dust.

Chino Airport, in southwestern San Bernardino County reported mist (BR) at 0453 PST under calm conditions, then gusts to 31 mph during the next hour. The winds remained strong throughout the day with sustained winds reaching 32 mph and peak wind gusts to 44 mph in the morning and sustained winds to 34 mph in the afternoon and peak wind gusts reaching 52 mph in the evening. Blowing dust was reported at Chino during every hour between 0551 and1653 PST, with low visibilities down to 1.5 miles.

Gusty winds also started abruptly at Ontario International Airport (ONT) in the morning, with sustained winds of 25 mph and gusts to 36 mph reported at 0553 PST. The ONT winds remained high through the rest of the day and through October 22, reaching the day's peak gust of 63 mph in the early evening. Haze was initially reported with the onset of the gusty winds, then haze and blowing dust reports continued through the remainder of October 21, with reduced visibilities as low as 1.5 miles. On October 22, ONT started reporting smoke (FU) along with blowing dust at 0653 PST as the widespread fires started impacting the station.

The NWS station at Riverside Municipal Airport is offline at night, but the winds were already gusty when measurements began at 0553 PST. Sustained winds to 29 mph were reported, with gusts to 40 mph and some reduced visibilities and blowing dust (BD) and blowing sand (BN). Gusty winds at March Air Reserve Base (ARB) started later in the morning, and remained relatively gusty through the day along with blowing dust reported, starting at 0955 PST. Visibilities to 4 miles were reported. In the high desert of San Bernardino county, the Marine Corps Air Station (MCAS) at Twentynine Palms reported blowing dust, reduced visibility and gusty winds through the afternoon of October 20 and the early morning of October 21.

Much of the windblown dust generated in the mountains and deserts of Riverside and San Bernardino counties was deposited downwind in those counties. The Perris FRM in western Riverside County measured the extreme PM10 concentration of 1212 $\mu g/m^3$. FRM PM10 measurements at Mira Loma (681 $\mu g/m^3$), Rubidoux (559 $\mu g/m^3$), and Norco (332 $\mu g/m^3$) in the Riverside County portion of the Basin were also very high, as were the TEOM PM10 averages from Rubidoux (275 $\mu g/m^3$), Mira Loma (581 $\mu g/m^3$) and Lake Elsinore (382 $\mu g/m^3$). The hourly PM10 from the Rubidoux and Mira Loma stations (Table 2-3) were very high, starting in the late evening of October 20 and continuing until 1500 PST at Rubidoux and later at Mira Loma. The peak hourly PM10 at Rubidoux was 695 $\mu g/m^3$, although the instrument did not report for three hours in the early morning. Mira Loma measured three hours at 999 $\mu g/m^3$ between 0700 and 1100 PST, which is as high as the instrument is able to measure. The Lake Elsinore TEOM remained very high throughout the day, peaking at 824 $\mu g/m^3$ during the hour starting at 2200 PST.

In San Bernardino County, FRM PM10 measurements at Fontana (276 $\mu g/m^3$), Ontario Fire Station (275 $\mu g/m^3$) and San Bernardino (219 $\mu g/m^3$) were high, as were the TEOM averages at San Bernardino (171 $\mu g/m^3$). The AQMD stations at Upland and Redlands were sheltered from the strong winds and the high PM10, with relatively low concentrations for this day of 70 (TEOM) and 97 (FRM) $\mu g/m^3$ measured, respectively.

Some wind stations were initially sheltered from the strong winds, but experienced gusty winds as the Santa Ana event progressed with more of an easterly wind component.

Burbank, for example, did not become gusty until the afternoon and peaked at 40 mph under northeasterly flow. In contrast, nearby Whiteman Airport in Pacoima reported gusty winds since the observations started at 0647 PST in the morning, peaking at 37 mph before 0747 PST.

Fullerton Airport in northern Orange County only reported wind gusts sporadically, starting at 1051 PST, after being calm all morning. The peak wind gust measured was 37 mph. Starting at this time, the station reported haze (HZ), which could also be smoke or dust from an automated station, along with reduced visibilities down to 2.5 miles through the much of the day. John Wayne Airport in Santa Ana started reporting wind gusts at 0553 PST under east-northeasterly flow. The gusts reached 32 mph at 0853 and remained over 25 mph through most of the day with sustained winds to 26 mph and gust to 41 mph reported in the late afternoon. As the wildfires in the Orange County mountains grew, smoke was reported at John Wayne starting at 1706 PST and continuing into the next day. Visibilities dropped to two miles after 1900 PST through the rest of the night.

The FRM PM10 at the AQMD Anaheim station in northwestern Orange County measured 489 $\mu g/m^3$. The PM-Coarse fraction of the PM10 at Anaheim was 94% for the day, indicating that crustal material from windblown dust was primarily responsible for most of the PM10, not the combustion products from the wildfire which would cause a higher PM2.5 fraction. The hourly BAM PM2.5 at Anaheim, however, spiked in the evening of October 21, to a peak of 134 $\mu g/m^3$, indicating that there was an impact from the fires that night. Further south in Orange County, the FRM PM10 at Mission Viejo only measured 74 $\mu g/m^3$. Unlike Anaheim, this site is sheltered from the northeasterly offshore wind flow by the Santa Ana mountains.

At Long Beach Airport, wind gusts were not reported until 1053 PST when easterly winds affected the station and a peak gust of 36 mph was recorded. Blowing dust and haze were reported with reduced visibilities, as low as 3 miles, through the rest of the day. At the time of the easterly wind shift at Long Beach Airport and blowing dust reported, the North Long Beach hourly TEOM PM10 climbed during the 1000 PST hour and spiked at 1100 PST to 343 $\mu g/m^3$ (Table 2-3 and Figure 2-1). While the winds in Long Beach were not particularly strong through rest of the day, this area was along the transport route for windblown dust generated upwind. The hourly PM10 remained high throughout the day, peaking at 622 $\mu g/m^3$ during the 1800 PST hour under easterly flow. The FRM monitor at the AQMD South and North Long Beach stations measured 432 and 232 $\mu g/m^3$, respectively, for the day and the Port Study temporary FRM stations were all high as well.

The winds at the NWS Downtown Los Angeles station at USC remained relatively calm through most of the day. The PM10 from the AQMD Central Los Angeles station also remained relatively low (63 $\mu g/m^3$) on October 21. The El Monte Airport winds also

stayed light throughout the day. Likewise, the NWS winds at Los Angeles International Airport (LAX) also remained light through the day, although smoke was reported, starting at 1150 PST and through the following day. LAX reported reduced visibilities to 6 miles through the evening. Winds at nearby Hawthorne Airport were also light. Santa Monica Airport winds were light as well. Further south in Los Angeles County at Torrance Airport, the winds were a little stronger, but no gusts were reported. Torrance reported blowing dust for two observations at 1147 and 1230 PST with visibility down to 4 miles. Torrance also reported smoke at the end of the day with reduced visibility. Brackett Field in La Verne (eastern LA County) remained sheltered by the mountains and did not report any gusty winds during the station's daytime operating period. These Los Angeles County stations were not in the primary transport route of windblown dust from upwind and the PM10 concentrations at the AQMD stations in Central and West Los Angeles County remained relatively low.

Figure 2-4 shows the back trajectories calculated using the NOAA HYSPLIT trajectory model with the 40 km grid resolution EDAS North American Model (NAM) meteorological data. Each chart shows the origin of the airmass over a 12-hour period that reached the Perris, Anaheim and Santa Clarita monitoring stations, every 8 hours on October 21 between midnight and midnight. This time range encompasses the high winds that affected the midnight to midnight PM10 filter measurements throughout the Basin. The trajectories show that the airmass that impacted these stations initially came primarily from the north and shifted to come from the northeast as the Santa Ana wind event progressed. The back trajectories also show the likelihood that windblown dust from the mountains and high deserts impacted the Basin stations, along with dust generated within the Basin from the gusty local winds.

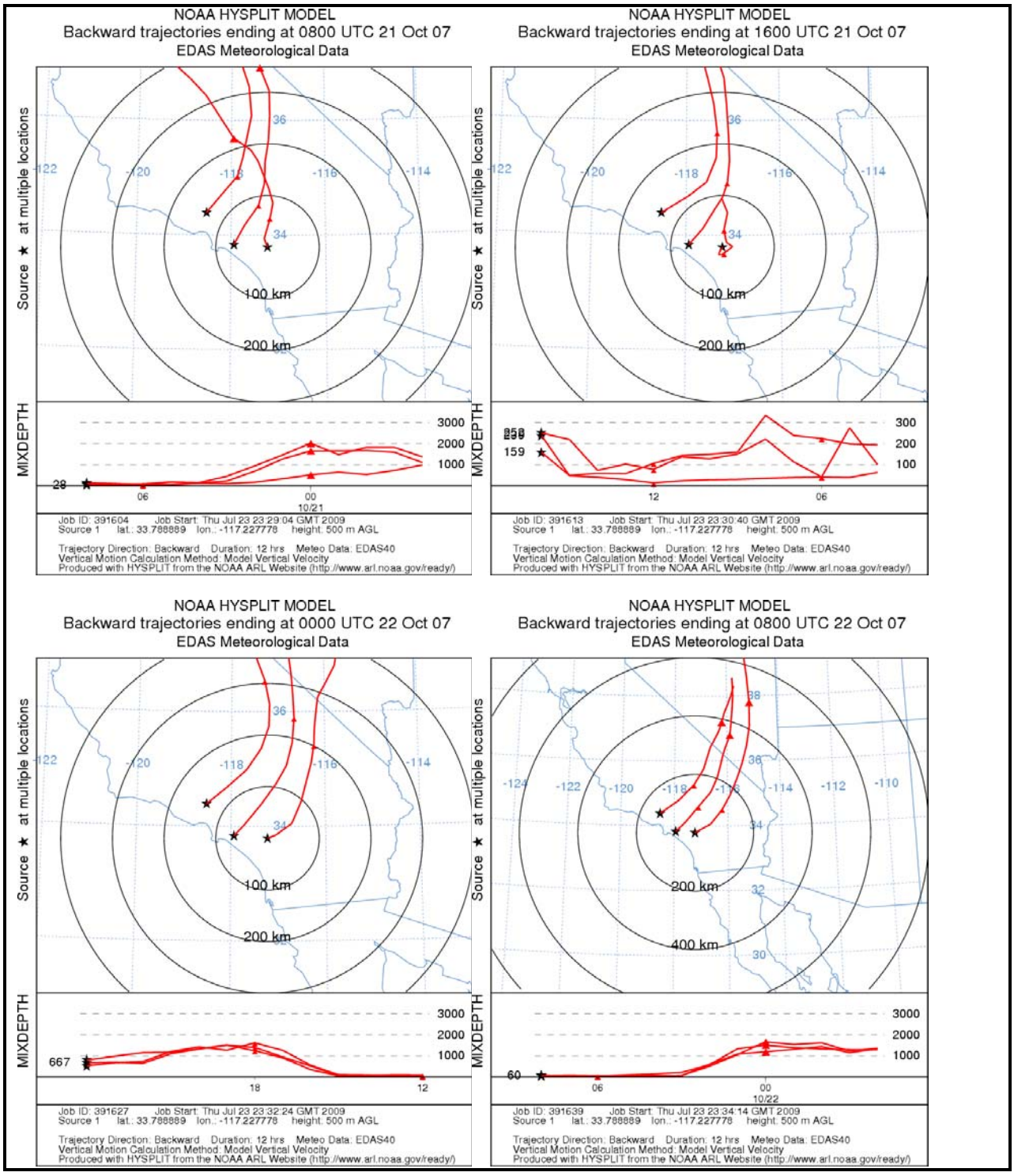


FIGURE 2-4

24-Hour Back Trajectories Reaching the Perris, Anaheim and Santa Clarita Air Monitoring Stations every 8 hours between 0000 PST (0800 UTC) October 21 and 0000 PST (0800 UTC) October 22 from NOAA HYSPLIT Model using EDAS Meteorological Inputs

(HYSPLIT Use Agreement: http://www.ready.noaa.gov/ready/hysplit_agreement.html)

A survey of the AQMD complaint records and inspection reports for the Riverside and San Bernardino County portions of the Basin indicated no evidence of unusual particulate emissions on October 21, 2007, other than related to the windblown dust event. The complaints are summarized in Table 2-10 from the AQMD CLean Air Support System (CLASS) database for complaints and compliance actions. Due to the windy conditions, AQMD Compliance staff responded to 17 complaints related to windblown dust. Most were in San Bernardino and Riverside Counties and many were in the same two areas (Mira Loma and Beaumont). No Notices of Violation or Notices to Comply were issued in the Basin for fugitive dust violations on this day. The control methods were generally effective throughout the Basin, but were apparently overwhelmed in several instances by the strong, gusty winds, causing windblown dust and sand to be entrained in the atmosphere and to cross property lines.

TABLE 2-10

Summary of PM-Related Complaints in the South Coast Air Basin on October 21, 2007

Complaint Date/Time	Location	Complaint Description	Disposition
10/21/07 0813 PST	Rancho Cucamonga	Blowing Dust from construction building a dam at 210 & 15 Fwys	Complainant observed dust at 0600 PST that kept blowing the whole day until approximately 0600 PST on 12/22. No blowing dust at follow-up on 10/23
10/21/07 0821 PST	Mira Loma	Excessive Dust, Very High Wind Everywhere – dust from construction site	Inspector did not observe dust on follow-up, but discussed increased watering and stabilization during high wind events with the contractor.
10/21/07 0858 PST	Banning	House is covered with sand blowing all over. Ready mix facility not watering. Odor complaints	No blowing dust observed on follow-up. Inspector addressed odor complaints
10/21/07 0910 PST	Beaumont	Excessive dust coming from empty lot	At follow-up on 10/23, inspector observed a large plume of dust from a 2-acre vacant agricultural plot with wind speeds measured at an average of 31 mph with gusts to 37 mph from the east. Inspector met with owner and city managers to discuss further controls. Inspector determined that existing vegetation was overwhelmed by the Santa Ana wind event and that the site was in compliance.
10/21/07 0910 PST	Mira Loma	Excessive dust, no water trucks, dust all over	Second complainant related to the Mira Loma complaint above.
10/21/07 0941 PST	Irvine	Very thick dust, no dust control at construction sites	No visible fugitive dust was observed at follow-up on 10/23 and sites were operating in compliance. Site was near are burned by wildfire on 10/21.
10/21/07 0952 PST	Fontana	High dust control problem in front of business from city construction site	Inspector arrived at 1010 PST on 10/21. Winds were 15 mph on average with gust to 27 mph. A small dirt pile was present but no operations were ongoing. Inspector did not observe visible fugitive dust emissions, but discussed ways to control fugitive dust with the operator.
10/21/07 1000 PST	Beaumont	Excessive dust from construction site	Second complainant related to the Beaumont complaint above.
10/21/07 1124 PST	Fontana	Dirt & sand coming into yard and home	Unable to contact complainant
10/21/07 1205 PST	Beaumont	Dust from construction site	Third complainant related to the Beaumont complaint above.
10/21/07 1208 PST	Canyon Lake (Riverside County)	Excessive dust from construction site	Inspector found the construction site to be operating in compliance upon follow-up on 10/23.
10/21/07 1555 PST	Beaumont	Excessive dust blowing across Highland	Fourth Complainant related to the Beaumont complaint above. Complainant said he had never seen anything like this dust storm in 3.5 years of living there.
10/21/07 1607 PST	Anaheim Hills	Wind “blowing so hard you can’t breathe”	Inspector found the alleged source, a home construction site, operating in compliance at follow-up on 10/23.
10/21/07 1617 PST	Beaumont	Excessive dust, “at least a quarter in of dust on cars”	Fifth complaint related to the Beaumont complaint above.
10/21/07 1622 PST	Mira Loma	Excessive amount of dust (voicemail)	Third complainant related to the Mira Loma complaint above.
10/21/07 2003 PST	Beaumont	Excessive amount of dust (voicemail)	Fifth complaint related to the Beaumont complaint above.
10/21/07 2130 PST	Mira Loma	Excessive amount of dust (voicemail)	Fourth complainant related to the Mira Loma complaint above.

Conclusion

There is a strong causal connection between the high PM10 measured in the Basin on October 21 and the strong Santa Ana high wind event, supported by the meteorological conditions. An upper level trough and frontal system preceded the development of a strong pressure gradient between the high pressure that developed in the northwestern United States and the low pressure in southern California. This brought strong northerly winds in the evening of October 20 that shifted to northerly and easterly directions through the day on October 21 as the Great Basin high expanded eastward. The pressure gradients were very strong and extremely high wind gusts were measured throughout the day in the areas that favor northeasterly winds, especially the mountains surrounding the Basin and through and below canyons and passes. The synoptic weather pattern aloft and thermal structure also supported the strong Santa Ana wind event.

Peak wind gusts to 108 mph were recorded in the mountains, with gusts to 79 mph measured in the low land areas of the Basin on the lee side of the mountains. NWS observations of reduced visibilities and NCDC storm damage event reports also support the windblown dust analysis. Due to the widespread winds, sources of the windblown dust included both natural, undisturbed areas, particularly in the mountains and high deserts, and BACM-controlled anthropogenic sources. The timing of the this event is verified with the high wind observations and reports of reduced visibility and blowing sand and dust, in conjunction with the hourly TEOM PM10 measurements from available monitors. These show a strong correlation between the high winds and high hourly PM10 concentrations.

The strong winds on October 21 fanned a total of 12 wildfires on October 20 and 21. These were analyzed for their contribution to the PM10 measurements. Overall, the fires contributed only a small fraction to the PM10 measured as shown by the relatively low concentrations of PM2.5 and soluble potassium. The Anaheim and Santa Clarita stations had the greatest smoke impacts measured in the Basin on October 21, but the contribution of the larger crustal particles (PM-Coarse) was significantly greater than that from the smaller combustion particles (PM2.5). Much of the smoke on this day was blown offshore by the strong winds. Smoke impacts played a greater role in the following days as the winds diminished and the onshore flow started to return, causing PM2.5 24-hour NAAQS violations.

The PM10 concentrations were very high at 11 FRM station in the Basin, including areas of all four counties. The 24-hour PM10 concentrations at Perris, Mira Loma High School, Riverside-Rubidoux, Anaheim and South Long Beach were extreme, far exceeding the measurements in the Basin for many years. Station operators reported large amounts of windblown dust and sand around, on and in those monitors when the filters were collected. The area of the Banning Airport air monitoring was also reported

to have large deposits of windblown sand and dust, but this filter was damaged before it could be retrieved.

If not for the high wind event and the associated wind-entrained dust, the PM10 NAAQS violations measured at Basin air monitoring stations on October 21 would not have occurred. Therefore, with the weight of evidence provided, AQMD staff recommends the flagging of the PM10 NAAQS violations on October 21, 2007 as exceptional events due to high winds in the U.S. EPA Air Quality System (AQS) database.