**San Joaquin Valley
Air Pollution
Control District**

Natural Events Action Plan

for High Wind Events in the San Joaquin Valley Air Basin

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List of acronyms, abbreviations, and initialisms

AQI: Air Quality Index
ARB: California Air Resources Board
BACM: Best Available Control Measures
CAA: Clean Air Act
CIMIS: California Irrigation Management Information System
CMP: Conservation Management Practices
District: San Joaquin Valley Unified Air Pollution Control District
EPA: Environmental Protection Agency
FR: Federal Register
NAAQS: National Ambient Air Quality Standards
NEAP: Natural Events Action Plan
NOx: nitrogen oxides
NWS: National Weather Service
PM: particulate matter
PM10: the fraction of PM no greater than 10 microns in aerodynamic diameter
PM2.5: particles no more than 2.5 microns in aerodynamic diameter
RFP: Reasonable Further Progress
SIP: State Implementation Plan
SJV: San Joaquin Valley
SJVAB: San Joaquin Valley Air Basin
SOx: oxides of sulfur
VOC: volatile organic compounds

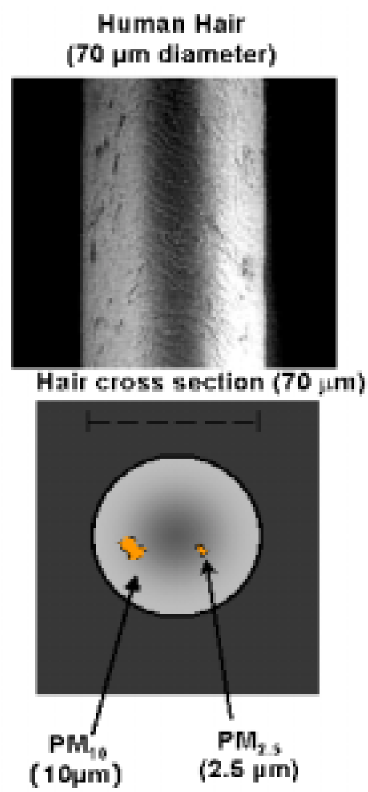
EXECUTIVE SUMMARY

A *Natural Events Action Plan (NEAP)* satisfies federal requirements triggered by U.S. Environmental Protection Agency (EPA) approval of a data flag for an exceedance of the particulate matter standard that is shown to be caused by a natural event. The San Joaquin Valley Unified Air Pollution Control District (District) had such an exceedance in Corcoran in September 2004. This *NEAP* provides an overview of this event as well as particulate matter in the San Joaquin Valley Air Basin (SJVAB). This *NEAP* also describes the meteorological forecasting criteria and public notification procedure that the District will use to protect public health if similar events occur in the future.

SECTION 1: PARTICULATE MATTER BACKGROUND

Particulate matter (PM) is a generic term for solid, liquid, or semi-volatile atmospheric materials (except pure water) that vary in size and composition. The PM mixture of fine airborne solid particles and liquid droplets (aerosols) includes components of nitrates, sulfates, elemental carbon, organic carbon compounds, acid aerosols, trace metals, and geological material. Some PM is directly emitted to the atmosphere (e.g., windblown dust). Some PM is formed in the atmosphere from gaseous combustion by-products, such as volatile organic compounds (VOCs), oxides of sulfur (SOx), and nitrogen oxides (NOx). PM may eventually be removed from the atmosphere by gravitational settling, rainout (attaching to water droplets as they fall to the ground), and washout (being absorbed by water molecules in clouds and later falling to the ground with rain). However, particles can condense or re-enter the gas phase under different environmental conditions.

Figure 1 Diameter Comparison: Human Hair, PM10, and PM2.5



For air quality purposes, PM is measured and expressed as the mass of particles contained in a cubic meter of air (micrograms per cubic meter, or $\mu g/m^3$). EPA has established two types of PM air quality standards: PM10 and PM2.5. Air quality standards based on PM10 reflect the fraction of PM no greater than 10 microns in aerodynamic diameter (in comparison, human hair is about 60 to 75 microns in diameter, as shown in Figure 1). Air quality standards for PM2.5 reflect a subset of PM10 composed of particles no more than 2.5 microns in diameter. The size of PM10 is part of why it can degrade visibility through the scattering of light and damage vegetation through interactions with plant tissue. PM10 is also small enough to be inhaled through the upper respiratory airways and deposited in the lungs, thereby causing serious health problems and increasing the likelihood of death from other causes.

The target organs in humans for PM are in the respiratory system. Particles 10 microns or less are considered respirable. Generally, the smaller the particle, the greater the likelihood that it will penetrate deeply into the lungs (HEI 2002). Finer particles may carry toxic materials that can be absorbed by the blood in the gas exchange tissues of the lungs and carried to other parts of the body. While PM's initial target organ is the lung, smaller particles have been reported to penetrate into the blood and be detected in the systemic circulation within minutes of inhalation (Nemmar et al., 2001a, b). The health outcomes associated with PM inhalation include hospitalization for cardiovascular or respiratory disease, emergency room and urgent care visits, asthma exacerbation, acute and chronic bronchitis, activity restrictions, work loss, school absenteeism, respiratory symptoms, and decrements in lung functions (ARB 2002).

Studies (such as Schiller-Scotland et al 1994 and Bennett and Zeman 1998) suggest that children may experience proportionately greater particle deposition than adults. Because of differences in anatomy, activity, and ventilation patterns, children are likely to inhale and retain larger quantities of pollutants per unit body weight than adults (Adams 1993). For infants, associations have been made between PM and low birth weight and premature delivery (occurring at less than 37 weeks of gestation) among a cohort of 98,000 neonates born in Southern California between 1989 and 1993 (Ritz et al. 2000). Children are the most susceptible to air pollutants because their respiratory systems are still developing and they breathe 50 percent more air per pound of body weight than adults. Exposure to fine particles is associated with increased frequency of childhood illnesses, which are of concern both in the short run and for the future development of healthy lungs in the affected children. Fresno County leads the state in terms of the occurrence of childhood asthma, with one in six children having lung disease (Anderson 2002). Other results include school absences and limitations in normal childhood activities.

PM also has a disproportionate effect on the elderly. The most susceptible population segment at risk at low-level exposures consists of elderly individuals with preexisting cardiovascular and respiratory diseases, the majority of which are either current or former smokers. In addition, certain subpopulations are at risk for increased exposure to particulates tat can lead to adverse health impacts. These populations include people living near transit corridors and people who spend a significant amount of time in-transit (Dockery et al., 1993; Krewski et al., 2000; McDonnell et al., 2000; Zanobetti and Schwartz, 2000; and Samet et al., 2000).

Based on human health and other environmental considerations, both the state and the federal government set ambient air quality standards for PM10. The federal government sets "primary standards," which include a margin of safety, to protect public health and "secondary standards" to protect public welfare (e.g., material degradation, haze, and environmental effects). California standards are set to protect public health.

The current California and federal ambient air quality standards (NAAQS) are listed in Table 1. EPA is required to update the federal PM standards by September 2006.

The District is designated as a serious nonattainment area for PM10 and as a nonattainment area for PM2.5. Nonattainment of NAAQS triggers federal planning requirements for State Implementation Plans (SIPs). These include the District's *2006 PM10 Plan*, due to EPA by March 31, 2006, and the District's *PM2.5 Plan*, due to EPA in April 2008. However, this *NEAP* is not part of the SIP.

Table 1 National and State Ambient Air Quality Standards for PM

Averaging Time	PM10	PM2.5
Federal[1]		
Annual[2]	50 $\mu g/m^3$	15 $\mu g/m^3$
24 Hours	150 $\mu g/m^3$	65 $\mu g/m^3$
California		
Annual[2]	20 $\mu g/m^3$	12 $\mu g/m^3$
24 Hours	50 $\mu g/m^3$	NA[3]

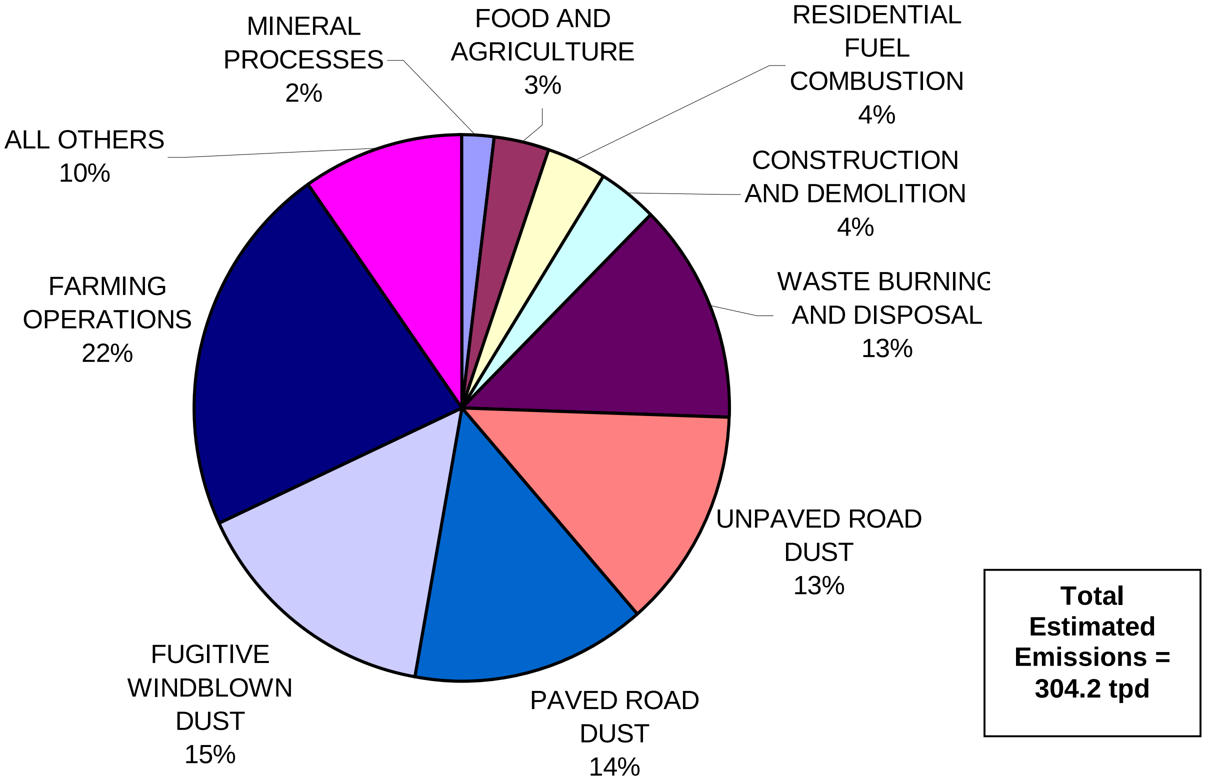
1 On December 20, 2005, EPA announced its intent to immediately revoke the PM10 NAAQS, revise the PM2.5 NAAQS, and establish a new 24-hour NAAQS for the PM2.5-10 fraction (urban areas only). These proposed changes are driven by new evidence on health effects from specific size fractions, federal CAA requirements, and case law affecting the PM10 and PM2.5 standards.
2 Annual arithmetic mean
3 No state 24-hour PM2.5 air quality standard exists for California

PM10 is a primary pollutant (emitted directly to the atmosphere) as well as a secondary pollutant formed in the atmosphere through chemical and physical processes. Primary or direct PM sources, which emit PM directly into the atmosphere, include both human and natural activities and processes. However, on an annual average basis, most primary PM emissions are generated from human (anthropogenic) activity. These types of activities include agricultural operations, industrial processes, combustion of wood and fossil fuels, construction and demolition activities, and entrainment of road dust into the air. Figure 2 shows some of the major sources of anthropogenic direct PM for the San Joaquin Valley Air Basin. On an annual average basis, windblown dust[1] contributes about 15% of the anthropogenic direct PM10 emissions in the SJVAB, as shown in Figure 2. Abnormally high winds passing over developed areas can lead to episodes of high atmospheric PM10 levels that exceed short term (24 hour) standards; this scenario is the primary focus of the this *NEAP*. However, for there to be a NEAP episode, the wind speeds must be sufficient to entrain dust, and then winds must be slowed at a location near a PM10 monitor. The likelihood of a NEAP episode also depends on the time of year, the level of human activity that is controlled by BACM (best available control measures), and timing of precipitation, not just winds alone. For example, a high wind event occurred in the San Joaquin Valley on January 7, 2005 with peak hourly wind speeds of 34 mph, which occurred in Merced at a height of 10 meters above ground level from 1:00 to 2:00 pm local time, yet the highest PM10 concentration

[1] This category represents dust entrained by wind passing over developed areas, such as agricultural lands, unpaved roads, and associated areas.

recorded that day was 31 µg/m^3. Contributing factors to the relatively low PM10 levels were precipitation occurring before the winds and the generally high winds throughout the SJVAB.

Figure 2 Sources of Direct PM10 Emissions in the SJVAB, 2005 (Annual Average)



Source: Based on CCOS v.2.14, ARB (2005)

SECTION 2: METEOROLOGY OF THE SJVAB

According to air quality monitoring data, exceedances of the federal 24-hour PM10 standard are generally seasonal, usually occurring during fall and winter months. The SJVAB has an "inland Mediterranean" climate, which is characterized by hot, dry summers and cool, rainy winters. The most significant single control of the weather pattern is the semi-permanent subtropical high-pressure belt, often referred to as the “Pacific High.” It is located off the west coast of North America and is a cell in which air descends almost continuously. The descending air is compressed, thereby raising temperatures and lowering the relative humidity. Major storms and region-wide precipitation are not typical when this pressure cell is dominant. This belt of high pressure migrates north and south seasonally. The SJVAB is under its influence almost continuously during summer months. In winter, the influence of the Pacific High is intermittent, giving rise to alternate periods of stormy, unsettled weather and periods of stable, rainless conditions. The SJVAB averages over 260 sunny days per year (District 2003). Air pollutants are generally transported from the north to the south in the summer and in a reverse flow in the winter due to these influences. Strong temperature inversions occur throughout the SJVAB in the summer, fall, and winter.

Precipitation in the SJVAB is confined primarily to the winter months, with some occurring in late fall and early spring. Nearly 90 percent of the annual precipitation in the SJVAB falls between the months of November through April. Average annual rainfall for the entire SJVAB is about 10 inches on the valley floor. Annual rainfall totals vary from north to south, with northern counties experiencing as much as 11 inches of rainfall and southern counties experiencing as little as four inches per year (District 2003). North-south and east-west regional differences exist, with higher rainfall occurring in the northern and eastern parts of the SJVAB. Historical evaluations have correlated increased annual rainfall to decreased PM10 concentrations.

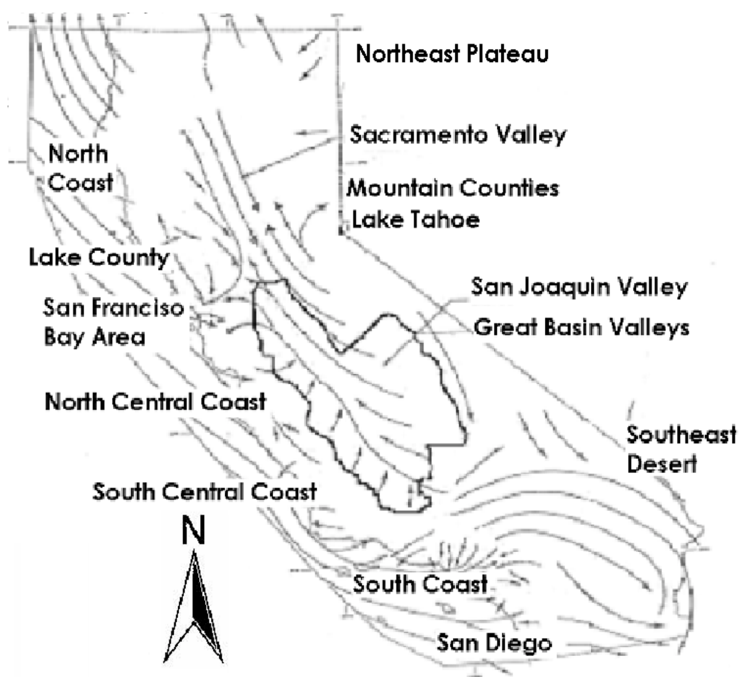
Horizontal mixing, or transport, is also important in the dispersal of air pollutants. The greater the velocity of the wind in the mixing layer, the greater the amount of mixing (dispersion) and transport of pollutants. In the SJVAB, meteorological data indicate that during the summer the light and variable winds usually from an influx of air from the Pacific Ocean through the Bay Area delta region entering the north end of the valley (District 2003). The wind generally flows towards the south-southeast through the valley, through the Tehachapi Pass and into the Southeast Desert Air Basin portion of Kern County. Figure 3 shows the wind flow entries and exits during the Valley's summer months.

During the winter (shown in Figure 4), wind occasionally varies from the south-southeasterly direction and originates from the south end of the Valley, flowing in a north-northwesterly direction (District 2003). Both summer and winter SJV wind patterns illustrate the potential for transport of PM10 and PM10 precursors.

PM10 geologic dust emissions in the SJVAB do not follow the conventional assumption that wind erosion is the dominant factor. The average wind velocity in the SJVAB is the lowest in the nation for an area this large (District 2003). Only on 30 to 50 days per year do winds normally exceed velocities necessary for erosion to occur. Erosive winds are defined as having a velocity of 13 mph at a height of one foot above the ground or 18 miles per hour at a height of approximately 33 feet above the ground; these two wind speeds are considered equivalent (District 2003). Erosive wind speeds can be much lower for some soil conditions. According to another study, a threshold of 16 to 18 mile per hour winds can cause rapid increases in PM10 concentrations in the SJVAB (T&B Systems 2004).

Figure 3 SJV Summer Wind Patterns

Figure 4 SJV Winter Wind Patterns



Sites along the southeastern edge of the SJVAB have a significantly lower number of erosive wind days than the western edge due to the mountain ranges, which act as wind barriers adjacent to these areas. Over 75 percent of the winds with enough velocity to cause erosion occur in the spring and summer seasons in the SJVAB, when PM10 concentrations are among the lowest. This suggests that these winds are effective in dispersing or transporting PM10 out of the SJVAB. Also, factors such as soil type and soil moisture content prevent these winds from entraining a large amount of PM10 during this period.

Variations of source operations and activity levels and seasonal differences in atmospheric processes that affect particle formation and retention result in extensive seasonal variation of PM10 concentrations. During the October to January period, the PM10 concentrations undergo a shift from dominance by primary particles to dominance by secondary particles. Secondary particles are a major fraction in colder, wetter periods, but are present in smaller amounts before mid-November. The October through January period is discernable as dividing into two overlapping periods that develop high particulate concentrations from different sources and atmospheric processes. Both seasonal periods commonly experience stagnant conditions. During a stagnant period, primary geologic or secondary particulates accumulate, resulting in concentrations, which eventually exceed the PM10 standard.

The October and November episodes that have occurred in the last several years were low wind speed events. High wind PM10 events are not typical within the SJVAB, but they have occurred and have contributed to high PM10 concentrations in the past. The October-November low wind speed events tend to be localized stagnation events with wind speeds that are insufficient to disperse high PM10 concentrations. The episodes affected only a few urban areas in the SJVAB. Air quality field programs identified the highest concentrations of PM10 in urban areas. In these episodes, anthropogenic (human) activities entrain PM10 in fugitive geological dust, adding to emissions dispersing from surrounding agricultural operations. The emissions inventory for the SJVAB indicates that most of the directly emitted PM10 is due to open area fugitive geological dust sources. Anthropogenic sources (paved and unpaved road dust, farming operations, and construction/demolition) account for most of the fugitive geological PM10 emissions, and wind erosion of exposed surfaces of geological material accounts for the balance as represented in the emissions inventory. However, downwind ambient PM10 concentrations are not proportional to the emission estimates of fugitive geological PM10 emissions. Most of the large geologic particles settle to the ground within a few kilometers of their source when wind velocities are low; therefore, significant contribution to the urban area exceedances involve only the emissions of large PM10 particles that occur in the urban area and within a few kilometers of the urban area. Implementing control measures for fugitive emissions of geological origin is especially valuable during these months when the contributions from geological sources are highest.

The second elevated PM10 period of the year begins mid-November to mid-December and extends through February. This season is characterized by extended periods of stagnant air interspersed with cold, damp, foggy conditions conducive to the formation of particulate nitrate in amounts that are frequently the dominant component of PM10 (often 70 percent or more of the material found on a filter). During the last several years episodes dominated by increased levels of nitrate particulates and primary and secondary carbon occurred in December and January. These episodes occurred during long stagnation periods in cold weather and affected one or more urban areas. Based on meteorology with poor dispersion, the District prohibited agricultural burning (no-burn status) during these events to limit emissions. Residential wood combustion, particles formed from exhaust gases, and poor dispersion of emissions contribute to PM10 buildup in these events. Air monitoring data indicates that when meteorological conditions produce little or no air movement with cold air temperature, secondary particulate levels (largely ammonium nitrate) are elevated in the entire SJVAB.

In summary, during the winter and spring, weather frontal passages provide moderate winds, and between extended frontal passages, winds may become stagnant (low to high winds). During the summer, winds are thermally driven and typically from the northwest. During the fall, winds become light under decreasing sunlight. Occasionally, a dry, gusty frontal passage creates areas of blowing dust after extended periods of low precipitation. The greatest potential for NEAP episodes is when soil is dry and wind speeds are sufficient to overcome BACM; these conditions tend to occur in the fall for the SJVAB.

SECTION 3: DOCUMENTATION OF HIGH WIND EVENTS

According to the EPA memorandum, *Areas Affected by PM10 Natural Events* (1996)[2], when a clear, causal relationship is shown between a PM10 exceedance and one of three categories of natural events (volcanic and seismic activity, unwanted wildland fires, and high wind events), air quality data can be flagged so that it does not count toward an area's attainment status. The conditions that create high winds vary from area to area. Under the EPA's natural events policy, high PM10 concentrations can only be treated as due to uncontrollable natural events if the dust originates from either nonanthropogenic sources or best available control measure (BACM)-controlled anthropogenic sources. After such an event, the State is responsible for establishing a clear causal relationship between the measured exceedance and the natural event. EPA (1996) suggests the following sources of documentation:

[2] Under SAFETEA-LU, EPA is required to propose a rule on natural and exceptional events policy by March 1, 2006 and finalize this rule no later than 1 year after proposal.

- Filter analysis
- Meteorological data (e.g., wind speed and wind direction to support a source receptor relationship)
- Modeling and receptor analysis
- Videos and/or photographs of the event and the resulting emissions
- Maps of the areas showing sources of emissions and the area affected by the event
- News accounts of the event
- In the case of high-wind events, States must document that BACM were required for anthropogenic sources at the time of the high-wind event

The District collaborates with the California Air Resources Board (ARB) on many of these points, including filter analysis and modeling. In consultation with ARB, the District compiles documentation of the causal relationship between the PM10 exceedance and the natural event and makes this documentation available for public review and comment. After public review, the District submits documentation to ARB. The documentation must be submitted to the Regional EPA Office within 180 days of the exceedance. The Regional Office will confirm or deny the data flag within 60 days of receiving the documentation. If the data is flagged, a *NEAP* is to be developed within 18 months of the exceedance date to address pubic health and future events. The *NEAP* should be reevaluated every five years, at minimum (EPA 1996).

The policy provides that EPA will redesignate nonattainment areas as attainment by applying Appendix K of 40 CFR part 50, on a case-by-case basis, to discount data in circumstances where an area would attain if there had not been uncontrollable natural events resulting in exceedances. Also, EPA will exercise its discretion under section 107(d)(3) of the CAA not to redesignate areas as nonattainment if the State develops and implements a plan to respond to the health impacts of natural events.

SECTION 4: CORCORAN EVENT IN SEPTEMBER 2004

On September 3, 2004, air monitoring data collected from an FRM (federal reference method) monitor (the variety of monitor used to obtain data for official attainment calculations) in Corcoran, California reflected a 24-hour PM10 concentration of 217 $\mu g/m^3$. This exceeded the 24-hour NAAQS for PM10, 150 $\mu g/m^3$ rounded to the nearest 10 $\mu g/m^3$. The abnormally high winds that were experienced throughout the Sacramento and San Joaquin Valley Air Basins on September 2 and 3, 2004 entrained dust into the atmosphere. Wind speeds in Corcoran on September 3, 2004 were higher than normal for that area, but they were still much weaker than wind speeds in surrounding areas. The very high wind speeds upwind of Corcoran picked up dust, and PM10 was deposited where the winds slowed in the Corcoran vicinity. This natural wind event resulted in a NAAQS exceedance for PM10.

In accordance with federal policy, the District submitted documentation of this event to EPA by March 3, 2005. This documentation effort included a search for media accounts and National Weather Service Alerts, a policy summary, BACM overview, a description of the District's monitoring network, evidence that monitors were functioning properly, a discussion of meteorology during the episode, lower air profiler images, and wind roses.

Documentation improvements requested by ARB were submitted to EPA on May 12, 2005, and the final document is available in Appendix A. On July 8, 2005, EPA approved the documentation and the request that the data be flagged as being caused by a natural event (Hogan 2005). This data is now excluded from District PM10 attainment calculations for the 24 hour standard. The District is now required to submit a *NEAP* for high wind events to EPA by March 3, 2006.

SECTION 5: COMPONENTS OF *NEAP*

The *NEAP* should be guided by the priority of protecting of public health and should include the following commitments, summarized from EPA (1996) guidance:

I. Establish public notification and education programs to inform the public of the short-term and long-term harmful effects that high concentrations of PM10 could have on their health:
    a. Certain natural events affect the air quality of the area periodically
    b. A natural event is imminent
    c. Specific actions are being taken to minimize the health impacts of events
II. Minimize public exposure to high concentrations of PM10 due to future natural events:
    a. Identify the people most at risk
    b. Notify the at-risk population that a natural event is imminent or currently taking place
    c. Suggest actions to be taken by the public to minimize their exposure to high concentrations of PM10
    d. Suggest precautions to take if exposure cannot be avoided
III. Minimize appropriate contributing controllable sources of PM10. In the case of high winds (as in the Corcoran event), the *NEAP* should include analyses of best available control measures (BACM) for contributing sources or any sources of soil that have been disturbed by anthropogenic activities.
IV. Identify, study, and implement practical mitigating measures as necessary. The plan must include a timely schedule for conducting such studies and implementing measures that are technologically and economically feasible.
V. Evaluate the *NEAP* every 5 years, at a minimum, for the conditions causing PM10 violations, the status of *NEAP* implementation, and the adequacy of actions being taken.

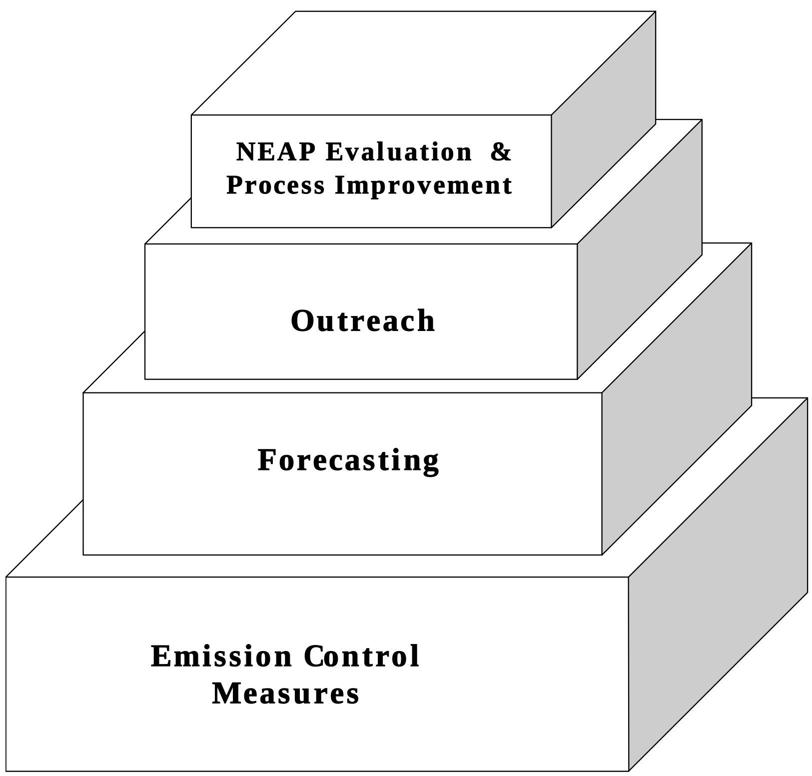
This *NEAP* for high wind events satisfies these requirements and shows how public health in the San Joaquin Valley Air Basin (SJVAB) will be protected during future natural wind events that may cause elevated PM10 levels. This *NEAP* applies to federal PM10 standards only. This plan is not part of the SIP, and it is not directly related to other District PM10 planning activities.

The District's *NEAP* describes the following:

- **An introduction to PM, SJVAB meteorology, and the health issues surrounding PM10**
- **The meteorological forecasting criteria that will be used to forecast a NEAP episode**
- **The process for public notification at the time of NEAP episodes**
- **Recommendations for limiting exposure to PM during a NEAP episode**
- **The strategy for general public outreach on the *NEAP***
- **BACM and mitigating measures that are in place**
- **Future *NEAP* evaluations**

Figure 5 illustrates the major building blocks of the *NEAP*: emission control measures, forecasting, outreach and evaluation/ process improvement. Each of these is discussed in subsequent sections.

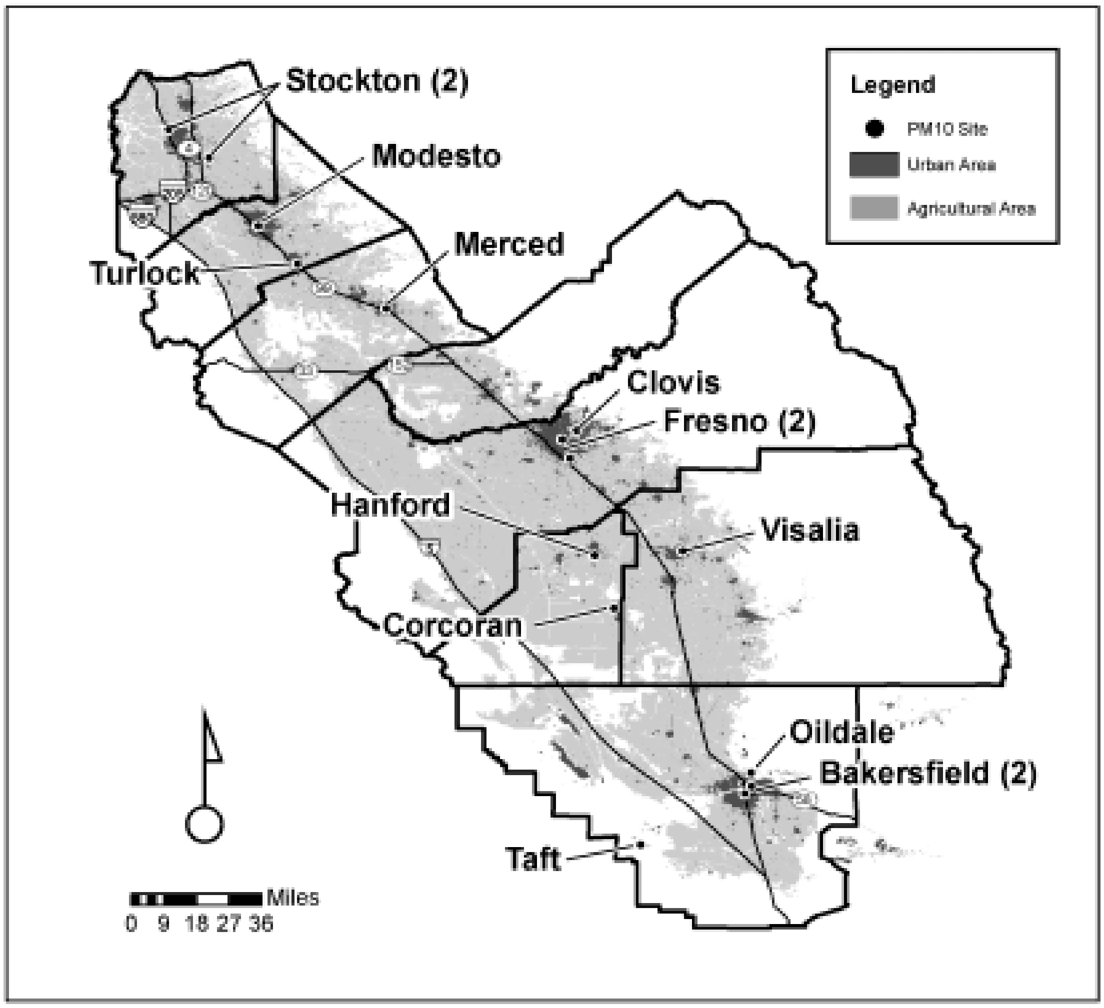
Figure 5 Building Blocks of the *NEAP*



SECTION 6: METEOROLOGICAL FORECASTING CRITERIA

In support of the *NEAP,* the District examined historical SJVAB wind data for correlations with PM10 data at selected reporting sites. Natural, high wind PM10 exceedances that are subject to the EPA's natural events policy must involve particulates that originate from either nonanthropogenic sources or from BACM-controlled anthropogenic sources. The emissions inventory maintained by ARB has not quantified nonanthropogenic sources of direct PM10 at this point. As shown in Figure 6, the District's PM10 monitors are surrounded by metropolitan and agricultural areas. Therefore, BACM-controlled anthropogenic sources likely dominate potential NEAP episodes.

Figure 6 Map of District PM10 Monitors, Urban Areas, and Agricultural Areas



Since BACM has been in place in the District, high winds have produced just one PM10 exceedance. Therefore, insufficient data are available to allow for empirical analysis of the kinds of natural conditions that can overwhelm BACM in the SJVAB. Also, wind speeds vary with height above ground level, steadily increasing above the ground surface. Wind speeds tend to be slower near the Valley floor due to frictional forces. CIMIS (California Irrigation Management Information System) sites are positioned two meters above ground level, and District and ARB air monitoring sites are positioned 10 meters above ground level.

As described in Section 2, winds also follow a seasonal pattern in the SJVAB. Given the size and diversity of meteorological and soil conditions within the SJVAB, it is not possible to precisely determine wind speeds and durations that produce airborne particulate matter. However, District evaluation of past events (available in Appendix B) indicates that the areas with the highest PM10 levels are often not where the wind is highest, but rather where the wind begins to slow. Entrainment of blowing dust in such an event moves the particulates from the source area to downwind receptor areas. Where the wind slows, it can no longer keep the larger PM10 particles aloft. Nearby monitors detect high concentrations of PM as the dust settles towards the surface in a deposition area. However, when the duration of high winds is short, the 24-hour PM10 NAAQS is not exceeded.

Analysis of all pre-BACM high wind events in the SJVAB between 1990 and 2002 did not establish a linkage between CIMIS wind data and observed PM10 exceedances (Sweet 2004). The CIMIS data was processed to identify the hours of wind at all reporting sites that exceeded twenty miles per hour, thirteen miles per hour, and eight miles per hour. CIMIS data involving the highest maximum hourly winds was evaluated for the effect of gusts. This data was also reviewed with and without rainfall events to ensure that including or omitting rainfall did not bias the analysis of probable wind events.

The top one hundred values of each of the CIMIS analyses were evaluated in comparison to FRM (federal reference monitor) PM10 data to determine whether the sixth-day sampling schedule captured a representative set of events and whether there were correlations between the high winds and PM10 observations. This analysis indicated that the monitoring schedule captured a representative sample averaging 18 percent coincidence with high wind days (expected is 17%). From this review, only five PM10 events in thirteen years of reviewed pre-BACM PM10 data were connected to high winds. Table 2 includes descriptions of these five events. Three of these five PM10 events occurred in 1990 and 1991 during a multi-year drought. The remaining two events do not represent regional episodes. Other PM10 events occurred during stagnation events or days with relatively few hours of elevated winds. Wind events in the SJVAB can lead to temporarily elevated PM10 levels, but often the duration of the winds is relatively short. During these events, the 24-hour average PM10 concentration does not exceed the standard even though some of the hourly readings may be high.

Table 2 Days with Monitored PM10 Concentrations Exceeding 150 μg/m³ and Wind Speeds that Meet High Wind Screening Criteria

	2/16/1990	9/9/1991	11/14/1991	10/4/1995	5/20/2002
Concentrations	439 μg/m³ Kettleman	279 μg/m³ Kettleman, 204 μg/m³ Corcoran, 175 μg/m³ Visalia 164 μg/m³ Hanford	173 μg/m³ Bakersfield, 169 μg/m³ Oildale	279 μg/m³ Corcoran	189 μg/m³ Bakersfield - Golden State site)
Monitoring Comments	SJV-wide monitoring. 89 μg/m³ in Modesto was the next highest concentration.	SJV-wide monitoring.	SJV-wide monitoring. 123 μg/m³ in Taft was the next highest concentration.	Corcoran monitoring only. Extra sampling for the IMS95 Study.	SJV-wide monitoring. 65 μg/m³ in Bakersfield (California Street) was the next highest concentration. All other sites were less than 25 μg/m³.
Precipitation Comments	All CIMIS sites recorded precipitation. This is a known drought year.	No CIMIS sites recorded precipitation. This is a known drought year.	Two CIMIS sites recorded precipitation, but the data looks suspect and should be verified. This is a known drought year.	No CIMIS sites recorded precipitation.	Most CIMIS sites recorded precipitation. Thunderstorms and hail were witnessed on this day in the SJV.
Wind Comments	Strong winds throughout the SJV.	Strong winds throughout the SJV.	Strong winds throughout the SJV.	Strong winds throughout the SJV.	Strong winds throughout valley. Strongest winds in the southern SJV.
Additional Comments	Site affected by local activity – moving of bulk storage pile of sand.	Reduced water delivery impacted west side agricultural activities.	Episode occurred during a transitional time of year. This could be either a geologic or nitrate dominated episode.	IMS95 measurements in the surrounding area during this study showed lower concentrations in the rural areas than at the urban site.	Regional weather influence; however, only one site experienced an elevated PM10 concentration.

The cause of long periods of high winds in the SJVAB is linked to large-scale synoptic factors. When analyzing whether there is potential for a NEAP episode, the District will be considering whether there is potential for high winds in one area that can then be slowed within the District. These winds may entrain and then deposit dust. To determine which areas might be affected a by NEAP episode, the District will consider possible receptor areas within the District as well as areas upwind; these upwind areas may be within or adjacent to the SJVAB. There is not enough data available to specify potential zones of influence for all areas within the District for all possible meteorological scenarios involving high winds. The wind speed may not necessarily be exceptional; instead, the focus of NEAP episode forecasting is the prediction of natural wind conditions that may cause elevated PM10 concentrations. The District, in consultation with ARB meteorologists, will declare a NEAP episode if criteria five and most or all of criteria one through four are met:

1. **There has been no recent, measurable precipitation in the potential source region for fugitive dust. In contrast, if there has been recent precipitation, then the soil would contain more moisture and would therefore be less likely to be picked up by wind.**
2. **The National Weather Service (NWS) in Hanford and/or Sacramento has issued either a High Wind Warning, Wind Advisory, or Blowing Dust Advisory for certain parts of the San Joaquin Valley (SJV) and the predicted duration of high winds is sufficient to establish a NEAP episode. If high winds are occurring outside of the SJV, the District will use discretion in regards to PM10 deposition effects from these types of events.**
3. **The surface weather maps show a potential for high winds to occur in the near future. Two features of principal interest are close spacing of lines of constant pressure (isobars) and alignment of the air pressure gradient parallel to the Coastal Range and Sierra Nevada mountains surrounding the SJV.**
4. **Strong winds exist higher in the atmosphere in conjunction with other weather phenomena that can drive the higher wind speeds closer to the surface. District staff will look for upper level charts depicting a transferring mechanism for high winds aloft that can mix to the surface. The transferring mechanism could be the jet stream, thunderstorms, or other weather phenomena.**
5. **The 24-hour average PM10 level is forecast to be above the NAAQS at one or more SJV sites.**

These criteria are similar to those identified in Pauley et al (1996) and in earlier studies. When the meteorology and air quality forecasts indicate a potential NEAP episode, the District will issue an alert 24 hours in advance of the event and release an accompanying update on the day of the event. However, even if those conditions were not anticipated 24 hours in advance, the District will declare a NEAP episode as conditions become apparent. The District will issue declarations of NEAP episodes to the media, and the alert will be applied to the potential source areas as well as the predicted receptor area.

SECTION 7: PUBLIC NOTIFICATION OF NEAP EPISODES

Every day, District meteorologists consider current and forecast weather conditions to project Air Quality Index (AQI) values for areas throughout the SJV. AQI values communicate daily air quality to the public. High levels of pollutants in the atmosphere lead to a greater the likelihood of health effects as well as a higher AQI. Table 3 shows AQI values for PM10 and associated cautionary statements. Although the AQI is always available to the public, a NEAP episode will be declared when PM10 levels are expected to exceed the NAAQS and the proximal cause is a natural high wind event, as determined by the meteorological forecasting criteria discussed in the previous section.

Table 3 Air Quality Index (AQI): Particle Pollution

PM10 concentration ($\mu g/m^3$)	Index Values	Levels of Health Concern	Cautionary Statements
0-54	0-50	Good (green)	None
55-154	51-100*	Moderate (light yellow)	Unusually sensitive people should consider reducing prolonged or heavy exertion.
155-254	101-150	Unhealthy for Sensitive Groups (orange)	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
255-354	151-200	Unhealthy (red)	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
355-424	201-300	Very Unhealthy (purple)	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
425-604	301-500	Hazardous (deep purple)	People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors.

Elevated particulate levels may or may not be visible to the naked eye, so visibility alone cannot be used to judge the occurrence of a NEAP episode. The District will take additional steps to reduce public exposure and minimize the health impacts from a NEAP episode. The public notification program will follow an eight-step chronological process, which is outlined as follows:

Step 1 – Assess the situation and define target population based on currently available actual and forecasted data supplied by District meteorologists.

Step 2 – Inform all local media of the NEAP episode and the necessary steps to minimize exposure through a Press Release and media interviews.

Step 3 – Use Spare the Air email and fax lists to issue a regional NEAP episode advisory.

Step 4 – Update main homepage website box to display information regarding the NEAP episode, and update 1-800-SMOG INFO hotline to outline the situation and give steps to minimize exposure.

Step 5 – Send out informational email to all Community Group and Environmental Justice Subcommittee members to convey the message to District stakeholders with limited access to media and technology.

Step 6 – Inform all District employees of the NEAP episode via email.

Step 7 – When appropriate, coordinate efforts with "Health Advisory Notifications," "Spare the Air Notices," or "Wood Burning Curtailment Announcements."

Step 8 – Recap the NEAP episode in our monthly *Valley Air News* to educate the public further on this type of event.

The outreach plan will be evaluated following every NEAP episode to ensure that the members of the public most affected by the event have access to information regarding health and exposure. All elements of the plan can be altered to provide additional points of contact among the District and any members of the public affected by the event.

SECTION 8: LIMITING EXPOSURE DURING NEAP EPISODES

If the District forecasts a NEAP episode, the following precautions can be taken to help limit exposure to elevated particulates:

- **Keep windows and doors closed.**
- **If needed for comfort, use air conditioners or heating systems on recycle/ recirculation mode.**
- **If symptoms of heart or lung disease occur (including shortness of breath, chest tightness, chest pain, palpitations or unusual fatigue), immediately contact your health care provider.**
- **Individuals with heart or lung disease should follow their health management plan from their health care provider. Asthmatic individuals should follow a prescribed asthma management plan.**
- **Limit strenuous physical activity outside during the event.**
- **Wear a covering over your nose and mouth while you are outside to provide some protection from large particles. Wearing a properly fitted dust mask or a respirator with a particulate filter can also protect the airways in more extreme episodes.**

SECTION 9: GENERAL PUBLIC OUTREACH ON THE *NEAP*

In addition to alerting the public about high PM10 levels during NEAP episodes, the District will conduct an outreach program to educate the public about NEAP episodes, the possible health impacts, and the steps involved in minimizing exposure during these episodes. The District will incorporate the following elements into an outreach strategy to address health issues surrounding NEAP episodes:

1) **The District will facilitate a public education program on the *NEAP* to inform those individuals at risk and to help minimize potential health impacts of a NEAP episode.**
2) **The District will incorporate information regarding the health impacts of PM10 into its outreach and education programs.**

Key elements of both of these strategies will focus on:

a. **Informing the public when the air is unhealthy for sensitive groups**
b. **Explaining what the public can expect when high PM levels occur in the air due to NEAP episodes**
c. **Minimizing public exposure to these events**
d. **Informing public of steps that could be taken to control dust emissions during future NEAP episodes**

Due to the rare nature of this type of wind events, the District will implement this program when a NEAP episode is either forecasted to occur or as it is occurring. However, steps will be taken prior to the occurrence of a NEAP episode to provide general information regarding NEAP episodes through a variety of outreach venues.

The District has produced an air quality brochure (available in Appendix C) outlining the specifics of a NEAP episode and explaining the steps the public can take when a NEAP episode is occurring and when any extreme air quality event is occurring. This brochure will be used at the following outreach points:

- **Community Events and Health Fairs – The District attends approximately 100 community events and health fairs over the course of a typical year. These events occur throughout the San Joaquin Valley and are attended by thousands of valley residents. The District usually staffs an informational booth and provides brochures, which will now include the NEAP episode brochure.**
- **School Outreach – District staff work closely with local schools and often give air quality presentations to classrooms. Information regarding NEAP episodes will be incorporated into presentations to ensure a baseline of knowledge regarding the health risks associated with NEAP episodes.**
- **Civic Engagement – District staff actively participate in civic organizations such as asthma coalitions and lung associations. Staff will partner with these organizations to provide maximum public outreach with regard to NEAP episodes.**

Also, a noticed public workshop on the *NEAP* was held at District offices on November 10, 2005. There were no attendees from the public, so no verbal comments were received. Written comments were accepted and received through December 1, 2005. *NEAP* efforts were mentioned at workshops for the District's *2006 PM10 Plan* in August and October 2005 as well as at other District Community Groups meetings. Through the District's workshops and outreach venues, the media and public will understand the unique nature of these events and will be able to differentiate between a NEAP episode and a different air quality event, such as a Spare the Air day or a Residential Fireplace Use Prohibition day.

SECTION 10: DISTRICT ACTIONS TO MINIMIZE ELEVATED PM10 LEVELS - MITIGATING MEASURES AND BACM

Federal policy on natural events (EPA 1996) requires that BACM be implemented for significant anthropogenic sources contributing to PM10 exceedances during natural events. As a PM10 nonattainment area, the District is already subject to BACM requirements under the Clean Air Act (CAA). EPA defines BACM for PM10 as "techniques that achieve the maximum degree of emissions reductions from a source as determined on a case by case basis considering technological and economic feasibility" (59 FR 41998; August 16, 1994). EPA considers sources contributing more than 5 $\mu g/m^3$ to a violation of the 24-hour PM10 standard or 1 $\mu g/m^3$ to a violation of the annual PM10 standard to be a significant PM10 source. The District has adopted BACM controls for significant sources of PM10 in the San Joaquin Valley Air Basin. BACM analysis is available in the District's PM10 Plans, specifically Appendix G of the *2003 PM10 Plan*.

In addition to BACM, the District has adopted several other controls on PM and its precursors to meet attainment projections and reasonable further progress (RFP) requirements. The full text of adopted rules can be found on the District web site (http://www.valleyair.org/rules/1ruleslist.htm). More information on Regulation VIII (Fugitive Dust Controls) and Conservation Management Practices (CMPs), which are the most relevant rules for the *NEAP*, is available in the Corcoran documentation in Appendix A. Table 4 contains a list of the PM10 and PM10 precursor emission control rules adopted by the District from 1990 through December 2005.

Table 4 District PM10 and PM10 Precursor Rules Adopted and/or Amended Between 1990 - 2005

Rule Number	Rule Title
4101	Visible Emissions
4102	Open Burning (Nuisance)
4103	Open Burning
4104	Reduction of Animal Matter
4106	Prescribed Burning and Hazard Reduction Burning
4201	Particulate Matter Concentration
4202	Particulate Matter Emission Rate
4203	Particulate Matter Emissions from Incineration of Combustible Refuse
4204	Cotton Gins
4306	Boiler, Steam Generators, and Process Heaters Phase 3 (greater than 5 MMBtu/hr)
4307	Boilers, Steam Generators, and Process Heaters (2 to 5 MMBtu/hr)
4308	Boilers, Steam Generators, and Process Heaters (.75 to 2 MMBtu/hr)
4309	Commercial Dryers, Dehydrators, and Ovens
4404	Heavy Oil Test Station – Kern County
4406	Sulfur Compounds from Oil-Field Steam Generators – Kern County
4407	In-situ Combustion Well Vents
4408	Glycol Dehydration Systems
4409	Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities
4453	Refinery Vacuum Producing Devices or Systems
4454	Refinery Process Unit Turnaround
4455	Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants
4501	Alternative Compliance for Best Available Retrofit Control Technology (BARCT)
4550	Conservation Management Practices Program
4601	Architectural Coatings Program

Table 4 District PM10 and PM10 Precursor Rules Adopted and/or Amended between 1990 - 2005 (cont.)	
Rule Number	**Rule Title**
4602	Motor Vehicle and Mobile Equipment Refinishing Operations
4603	Surface Coating of Metal Parts and Products
4604	Can and Coil Coating Operations
4605	Aerospace Assembly and Component Manufacturing Operations
4606	Wood Products Coating Operations
4607	Graphic Arts
4610	Glass Coating Operations
4621	Gasoline Transfer into Stationary Storage Containers, Delivery Vessels, and Bulk Plants
4622	Gasoline Transfer into Stationary Storage Containers, Delivery Vessels and Bulk Plants
4623	Storage of Organic Liquids
4624	Organic Liquid Loading
4625	Wastewater Separators
4641	Cutback, Slow Cure, and Emulsified Asphalt Paving and Maintenance Operations
4642	Solid Waste Disposal Sites
4651	Volatile Organic Compound Emissions from Decontamination of Soil
4652	Coatings and Ink Manufacturing
4653	Adhesives
4661	Organic Solvents
4662	Organic Solvent Degreasing Operations
4663	Organic Solvent Cleaning, Storage and Disposal
4672	Petroleum Solvent Dry Cleaning Operations
4681	Rubber Tire Manufacturing
4682	Polystyrene Foam, Polyethylene and Polypropylene Manufacturing
4684	Polyester Resin Operations
4691	Vegetable Oil Processing Operations
4692	Commercial Charbroiling Operations
4693	Bakery Ovens
4702	Internal Combustion Engines - (Phase 2)
4703	Stationary Gas Turbines
4801	Sulfur Compounds
4802	Sulfuric Acid Mist
4901	Wood Burning Fireplaces and Wood Burning Heaters
4902	Residential Water Heaters
4903	Natural Gas-Fired, Fan-Type Residential Central Furnaces
Reg VIII	**Fugitive PM10 Prohibitions**
8011	General Requirements
8021	Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities
8031	Bulk Materials
8041	Carryout and Trackout
8051	Open Areas
8061	Paved and Unpaved Roads
8071	Unpaved Vehicle/Equipment Traffic Areas
8081	Agricultural Sources
9510	Indirect Source Review (ISR)

The District's controls on PM are some of the most effective in the state of California. California Senate Bill 656, codified as California Health and Safety Code Section 39614, required all air districts, regardless of PM attainment status, to adopt an implementation schedule of locally selected control measures from a list developed by California Air Resources Board (ARB). This list was composed of PM10 controls existing as of January 1, 2004. Thirty-seven of the 103 measures on this list cited District measures as the best level of emission control statewide, considering factors such as emissions limits, performance requirements, and scope of some activities covered. Of the remaining measures, many of the District rules or programs covering the same source categories have similar limits or programs as the rules cited by ARB. In other cases, the measures proposed by ARB are control measure commitments of the District's *2003 PM10 Plan* or *Extreme Ozone Attainment Demonstration Plan*. Collectively, this reflects the District's leadership in controlling PM.

In addition to controls already adopted, commitments for further controls are included in the District's PM10 Plans. The District will continue to develop future control commitments and BACM analyses through the *2007 8-hour Ozone Plan* and the *2008 PM2.5 Plan*.

SECTION 11: FUTURE EVALUATIONS OF THE *NEAP*

EPA's current policy on natural events requires an area to periodically reevaluate its *NEAP* every five years, at minimum, for the following factors:

- **The conditions causing violations of PM10 NAAQS in the area**
- **The status of *NEAP* implementation**
- **The adequacy of the actions being implemented**

This *NEAP* is due to EPA by March 3, 2006[3], and the District is committed to completing a reevaluation of the *NEAP* no later than March 3, 2011. Since areas within the SJVAB are subject to a wide-range of natural circumstances that may lead to PM10 exceedances, the District will continually analyze the wind conditions that may cause violations of PM10 NAAQS. The District will consider amending the *NEAP* at an earlier time if warranted by unanticipated natural events that lead to a NAAQS exceedance, by revisions to EPA's policy for natural events, or by changes to PM10 standards.

[3] This date is tied to the date of the natural event triggering the *NEAP* (September 3, 2004).

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