EXECUTIVE SUMMARY

Plan Purpose

The 2003 PM10 Plan (PM10 Plan) is the San Joaquin Valley Air Pollution Control District's (District) strategy for achieving the National Ambient Air Quality Standards (NAAQS) for particulate matter measuring less than 10 microns in diameter (PM10). The plan is designed to meet the requirements of the federal Clean Air Act (CAA) and contains measures needed to attain the NAAQS at the earliest possible date. The PM10 Plan will become part of the State Implementation Plan (SIP) for the San Joaquin Valley.

Description of PM10 and its Health Impacts

PM10 pollution is a serious health issue in the San Joaquin Valley Air Basin (SJVAB). Particulate matter (PM) is a generic term used to describe a complex group of air pollutants that vary in size and composition, depending upon the location and time of its source. The PM mixture of fine airborne solid particles and liquid droplets (aerosols) include components of nitrates, sulfates, elemental carbon, organic carbon compounds, acid aerosols, trace metals, and geological material. Some of the aerosols are formed in the atmosphere from gaseous combustion by-products such as volatile organic compounds (VOCs), oxides of sulfur (SOx) and nitrogen oxides (NOx). The size of PM can vary from coarse wind blown dust particles to fine particles directly emitted or formed from chemical reactions occurring in the atmosphere. PM10 comprises particles with an aerodynamic diameter less than or equal to a nominal 10 microns[1]. Aerodynamic diameter is defined as the product of the geometric diameter and the square root of the specific gravity of a particle.

Particle size determines the deposition points along the respiratory system. Particles larger than 10 microns in aerodynamic diameter are deposited almost entirely in the nose and throat area, whereas fine and ultrafine particles are able to reach the alveoli (air spaces) deep in the lungs.

Air quality standards are based on the fraction of PM that measures at less than 10 microns in aerodynamic diameter (in comparison, human hair is about 60 to 75 microns in diameter). This fraction of particulate matter is commonly referred to as PM10. PM10 can be inhaled through the upper respiratory airways, and deposited in the lungs causing serious health problems and the increased likelihood of death from other causes. Some of the particles that measure less than 10 microns can penetrate and deposit deeply in the lungs without an ability to be exhaled. This smaller fraction, commonly referred to as PM2.5, is of special concern to health. These particles are based on the fraction of PM10 that measures at less than 2.5 microns in diameter. These finer particles are easily inhaled deeply into the lungs

[1] The official term is micrometer or one millionth of a meter; however, micron is still in common use.

where they can be absorbed into the bloodstream or remain embedded for long periods of time.

Populations at general risk for suffering adverse health effects from exposures to particulate matter include children, people of all ages with asthma, and the elderly with illnesses like bronchitis, emphysema and pneumonia. Patients with chronic obstructive pulmonary disease, such as emphysema and bronchitis, are also potentially susceptible to mortality because of their vulnerability to physical and chemical stimuli and the absence of an adequate ventilatory reserve.[2] A more complete description of PM10 health impacts is found in Chapter 1.

PM10 Planning History

On July 1, 1987, the EPA revised the NAAQS for particulate matter (52 FR 24672), replacing standards for total suspended particulates (TSP) with new standards applying only to PM10. The new standards for PM10 reflected the knowledge that the fraction of TSP less than 10 microns in size has the greatest health impacts. The CAA Amendments of 1990 introduced air quality planning requirements for PM10.

The CAA required areas that exceeded the new PM10 standards (150 $\mu g/m^3$ for 24 hours and 50 $\mu g/m^3$ annually) to submit a Moderate Area PM10 Attainment Plan in 1991. The District submitted a plan that contained reasonably available control measures (RACM) required for moderate areas, but was unable to demonstrate attainment by the moderate area deadline of December 31, 1994.

The SJVAB was one of five areas that could not demonstrate attainment by this deadline and was reclassified as a Serious Nonattainment Area effective February 8, 1993. Nine other areas were given additional time to allow them to address such issues as international transport and the potential to attain the standard on schedule. The new serious areas were required to submit a plan that would implement best available control measures (BACM) no later than four years after re-classification to serious (February 8, 1997). The District submitted a Serious Area PM10 Plan containing a BACM commitment on September 13, 1994.

The next CAA requirement for serious nonattainment areas was to submit an attainment demonstration plan within four years after re-classification. The District submitted its PM10 Attainment Demonstration Plan on May 15, 1997. This plan predicted that the SJVAB would attain the annual standard by the December 31, 2001 deadline for serious areas, but requested an extension until 2006 to attain the 24-hour standard at all monitoring sites.

Late in 2001, EPA indicated that it intended to disapprove the 1997 PM10 Attainment Demonstration Plan, because it did not include an adequate BACM demonstration and a most stringent measures (MSM) demonstration required for

[2] Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options; State and Territorial Air Pollution Program Administrators and Association of Local Air Pollution Control Officials, DRAFT, February 1996, p. 2-12.

approval of an extension. The District realized that there was insufficient time to correct these deficiencies and withdrew the 1997 PM10 Plan in order to avoid an immediate freeze on transportation funding that would result from disapproval. This action led EPA to file a Notice of Failure to Submit the 1997 PM10 Plan and started a CAA sanction clock. If the District fails to correct this deficiency, EPA will implement the first sanction (2 to 1 stationary source offsets) on August 28, 2003. The second sanction (withholding federal transportation funds) would go into effect on February 28, 2004. The second sanction deadline also coincides with the date when EPA would be required to promulgate a federal implementation plan (FIP).

Since an extension was not approved, the District also missed the December 31, 2001 attainment deadline for serious areas. EPA made a final finding of failure to attain the PM10 standard on July 23, 2002 and final finding of failure to submit a five percent attainment plan by December 31, 2002 on March 21, 2003. Sanction clocks were started for each of these deficiencies; however, the earlier sanction clock for failure to submit the 1997 PM10 Plan would go into effect first and the same corrective action would stop all sanction clocks. The sanction clocks are stopped by the submittal of a complete PM10 Plan. EPA must find a plan complete within 60 days but not later than six months after receipt. EPA must approve, disapprove, partially approve or conditionally approve the plan within one year of finding the plan complete.

Table ES-1
PM10 Plan History and Sanction Clocks

Date	Event
November 7, 1991	District Board approves the Moderate Area PM10 Attainment Plan
January 8, 1993	District reclassified as a Serious Nonattainment Area
September 14, 1994	District Board approves the Serious Area PM10 Plan
May 15, 1997	District approves the PM10 Attainment Demonstration Plan
February 21, 2002	District initiates request to withdraw the PM10 Attainment Demonstration Plan
March 15, 2002	EPA makes proposed finding of failure to attain federal PM10 standards
March 18, 2002	EPA finds that the District did not submit a PM10 Attainment Demonstration Plan; started sanction clock effective February 28, 2002 with first sanction imposed August 28, 2003
July 23, 2002	EPA finds that the SJVAB did not attain the 24-hour and annual PM10 standards by December 31, 2001
March 21, 2003	EPA finds that the SJVAB failed to submit a 5% PM10 Attainment Plan by December 31, 2002 starting 18-month and 24-month sanction clock

PM10 Plan Required Elements

The following requirements apply to areas classified as serious nonattainment under the CAA. The third bullet requiring five percent per year reductions applies only to serious areas that have failed to achieve attainment by the deadlines specified in the CAA. The PM10 Plan contains all required elements.

- Demonstrate attainment at earliest practicable date
- Implement Best Available Control Measures/Technology (BACM/BACT) for all significant sources of PM10 or PM10 precursors
- Provide annual reductions of at least five percent of PM10 or PM10 precursor emissions based on the most recent inventory until attainment
- Provide quantitative milestones for reasonable further progress
- Adopt contingency measures to assure that emission reductions are in place that can be implemented if a milestone is not achieved on schedule

Extent of the PM10 Problem

The SJVAB exceeds both the federal 24 hour standard of 150 $\mu g/m^3$ and the annual standard of 50 $\mu g/m^3$. Table ES-2 (Column A) displays the highest ambient levels recorded at monitoring sites for the SJVAB based on the period 1999 to 2001. These values are used to determine the “design value” for each monitoring site. The design value is the benchmark used to determine whether a site attains the standard and to provide a starting point for demonstrating attainment in the future after the control strategy is implemented. Table ES-2 (Column B) displays the design value for the annual standard based on the same years. This period was chosen because it includes the most recent years having complete quality controlled data and is consistent with EPA guidance for determining attainment status. PM10 levels exceeded the standard in all three regions of the SJVAB.

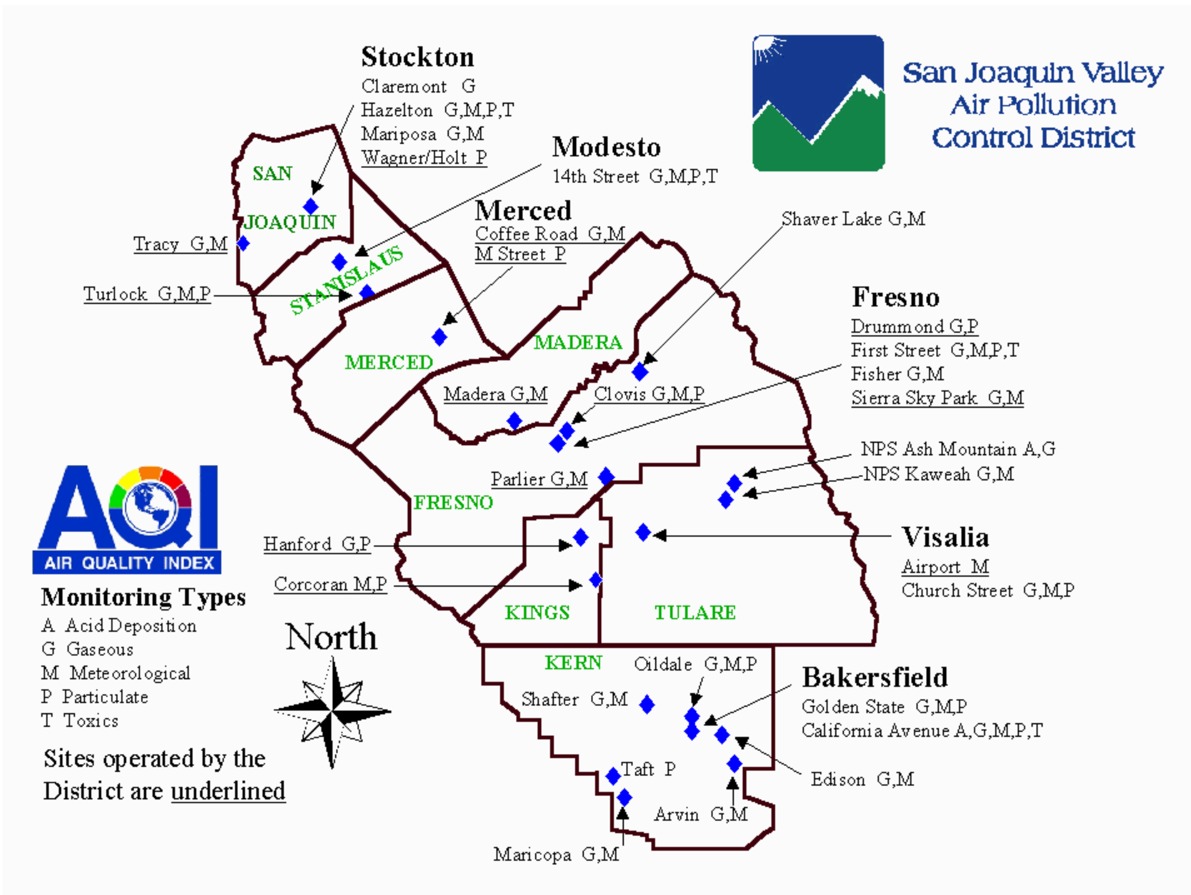
Table ES-2
Design Values (µg/m3)
Based on 1999-2001 Data

Site Name	SJVAB PM10 Design Value Column A	Annual Average PM10 Design Values Column B
Bakersfield, California Ave.	**190**	48
Bakersfield-Golden #2	**205**	**57**
Clovis	**155**	43
Corcoran, Patterson Ave.	**174**	49
Fresno-Drummond	**186**	50
Fresno-First	**193**	42
Hanford, Irwin St	**185**	**53**
Merced-M Street	134	40
Modesto, 14th Street	**158**	37
Oildale, 3311 Manor St	**158**	46
Stockton, Hazelton-HD	150	35
Stockton, Wagner-Holt	119	30
Taft, College	128	36
Turlock, 900 Minaret Street	**157**	39
Visalia, Church Street	152	**54**

Column A: Values in bold font exceed the 24-hour standard.
Column B: Values in bold font exceed the annual standard.

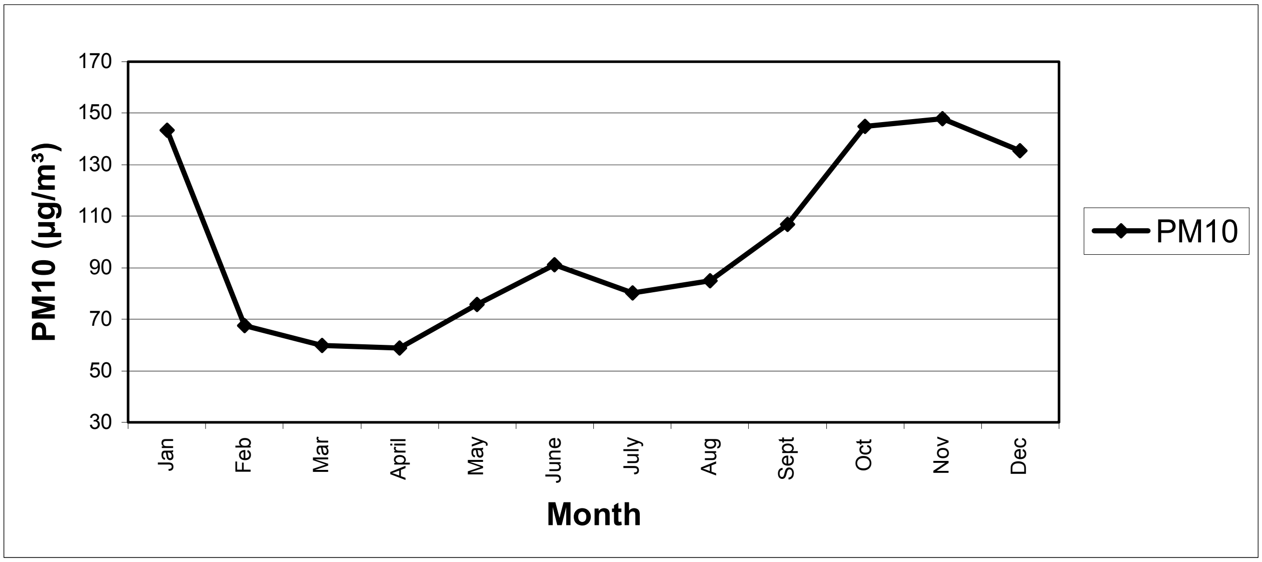
The highest levels and greatest numbers of exceedances were recorded at monitoring stations in the Fresno metropolitan area, the Bakersfield metropolitan area, and the City of Corcoran. Other areas that have experienced exceedances during the last three years include the City of Modesto, the City of Turlock, the City of Hanford, and the City of Visalia. Three monitoring stations exceeded the annual standard. They are Bakersfield, Hanford, and Visalia. A map displaying the location of the San Joaquin Valley's air monitoring sites is provided in Figure ES-1.

Figure ES-1
San Joaquin Valley Air Monitoring Sites
1999



PM10 emissions vary significantly from season to season. Figure ES-2 displays the seasonal variation. The highest peak concentrations occur during October through January. Spring and summer experience the lowest peak concentrations.

Figure ES-2
Average of Peak PM10 Monthly Concentrations, 1998-2001



Average of 1998 to 2001 peak readings from the highest site for each month.

Ambient PM10 levels and the number of days over the standard have declined substantially over the last decade. During the early 1990s a 24-hour reading of 439 was recorded at Kettleman City and a value of 279 µg/m3 was recorded at the Corcoran monitoring site. These two exceedances were dominated by geologic material and occurred during the fall season. The highest reading during the last three years was a 205 µg/m3 at the Bakersfield Golden State monitoring site in 2001. This exceedance was nitrate dominated and occurred during the winter season. Since 24-hour samples are only collected every sixth day at most sites, each observed exceedance of the standard is assumed to mean that a single monitored exceedance equals six probable exceedances. During the early 1990s an average of 35 days were estimated to have exceeded the 24-hour standard each year. During the three year period 1999-2001, between 0 and 12 days were over the standard based on every 6-day and 3-day monitoring for some sites. Figure ES-3 displays the trend in PM10 levels between 1989 and 2001. Figure ES-4 shows the number of days over the standard at the worst site in the Valley for each year between 1989 and 2001.

Three of the eight counties (San Joaquin, Merced, and Madera) are in attainment of the 24-hr PM10 standards and five of the eight (San Joaquin, Stanislaus, Merced, Madera, and Fresno) are in attainment of the annual standard. Between 1999 and 2001, Fresno had one observation over the 24-hr standard each year, Stanislaus had two in three years, Kern had five in three years and Tulare had none over the standard.

Figure ES-3

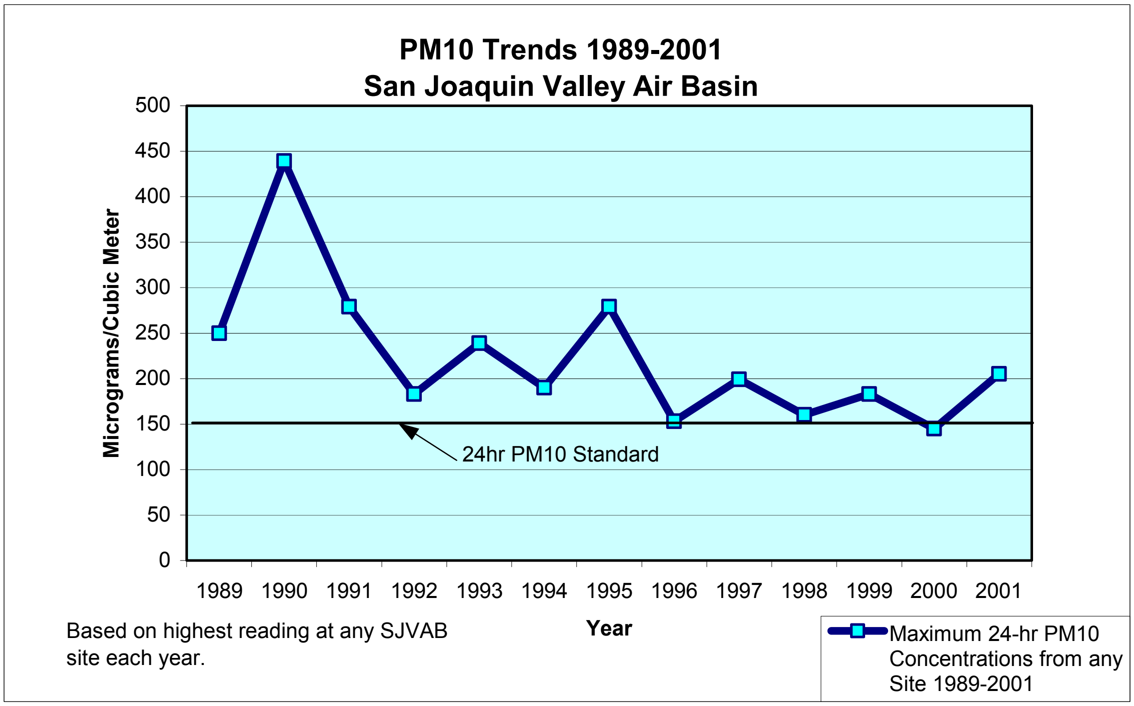
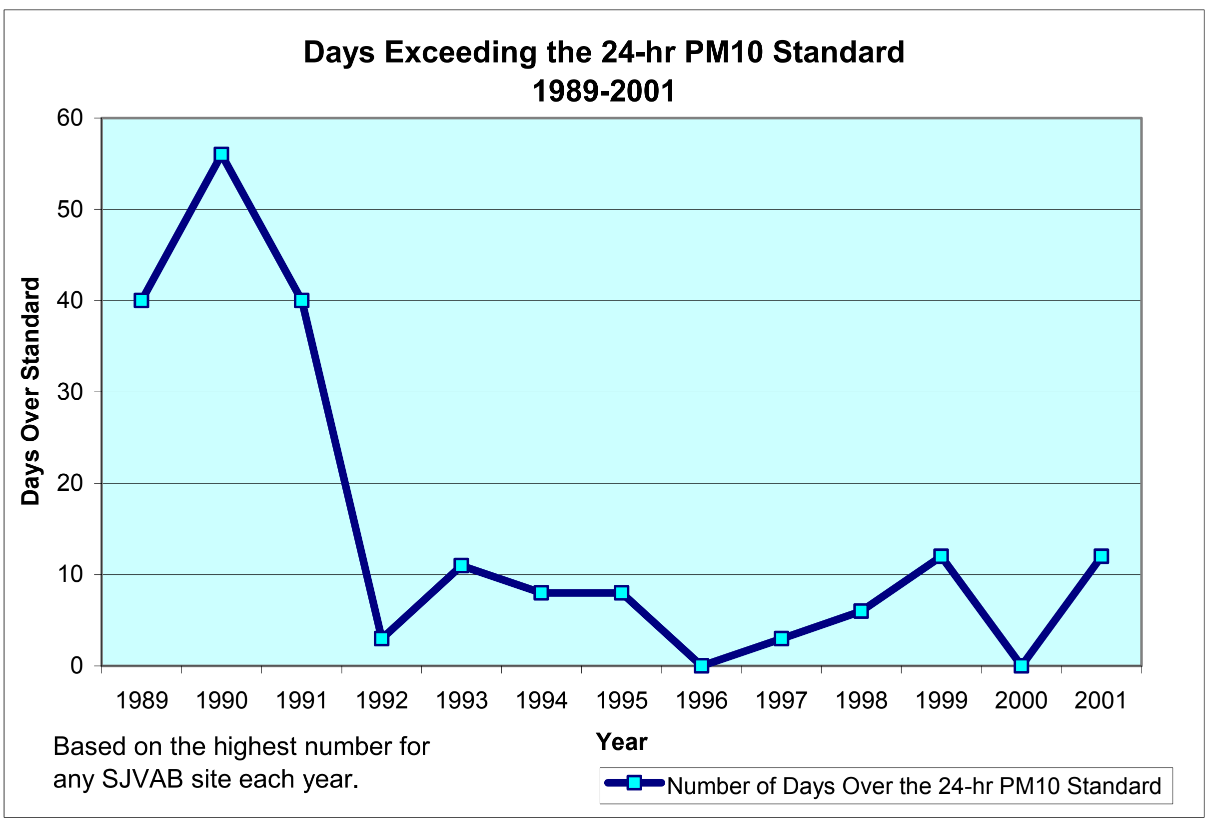


Figure ES-4



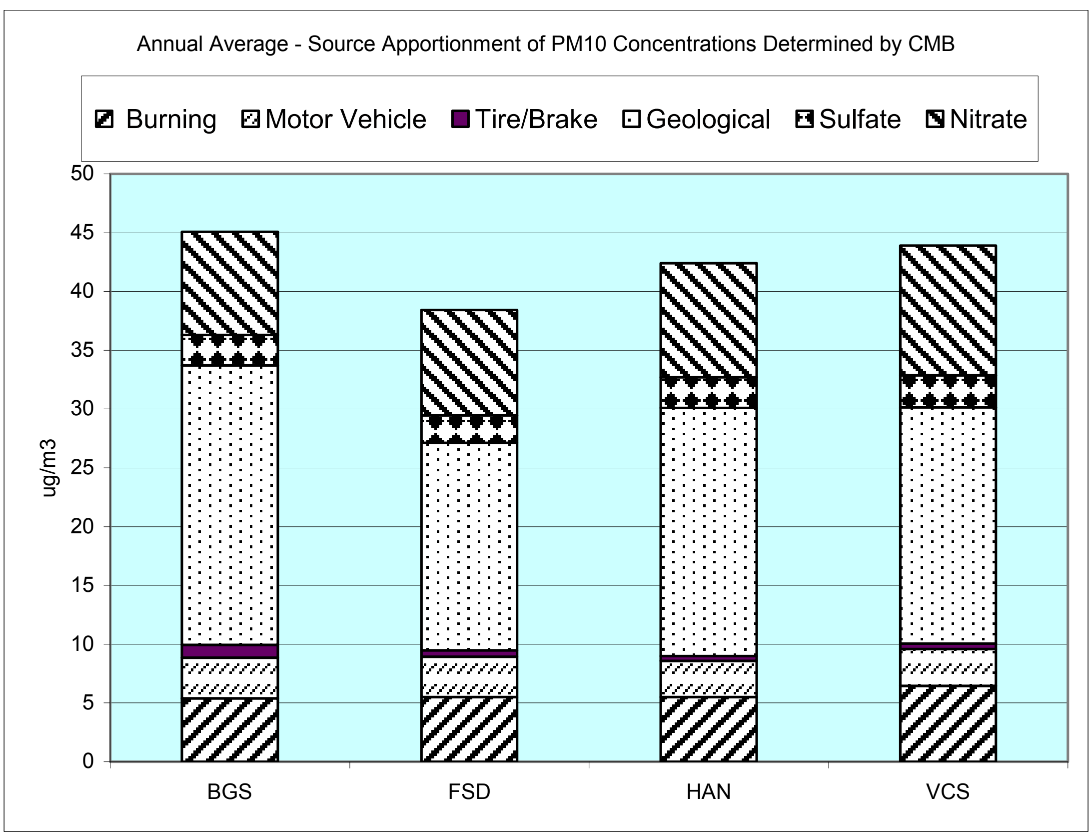
Source: California Air Resources Board, http://www.arb.ca.gov/aqd/aqd.htm

Causes of the San Joaquin Valley's PM10 Problem

The causes of the San Joaquin Valley's PM10 problem are complex, but our understanding has benefited through investment in air quality research focused on the region. The District, state government, federal government and industry have allocated nearly $30 million to understand the causes of the SJVAB's PM10 problem. The Integrated Monitoring Study 1995 (IMS95) and California Regional Particulate Air Quality Study (CRPAQS) field studies collected PM10 samples during intensive monitoring periods in 1995 and 2000-2001 respectively. Although the data analysis phase of these studies is not complete, some findings were available to assist in developing this PM10 Plan. When final results are released, the District is committed to incorporating any new findings into a future update of the PM10 Plan. In addition to the study data, the District's monitoring network collects samples on an every six-day cycle (Corcoran has co-located monitors that collect samples every three days). The District monitoring sites are the official source of data for determining the SJVAB attainment status.

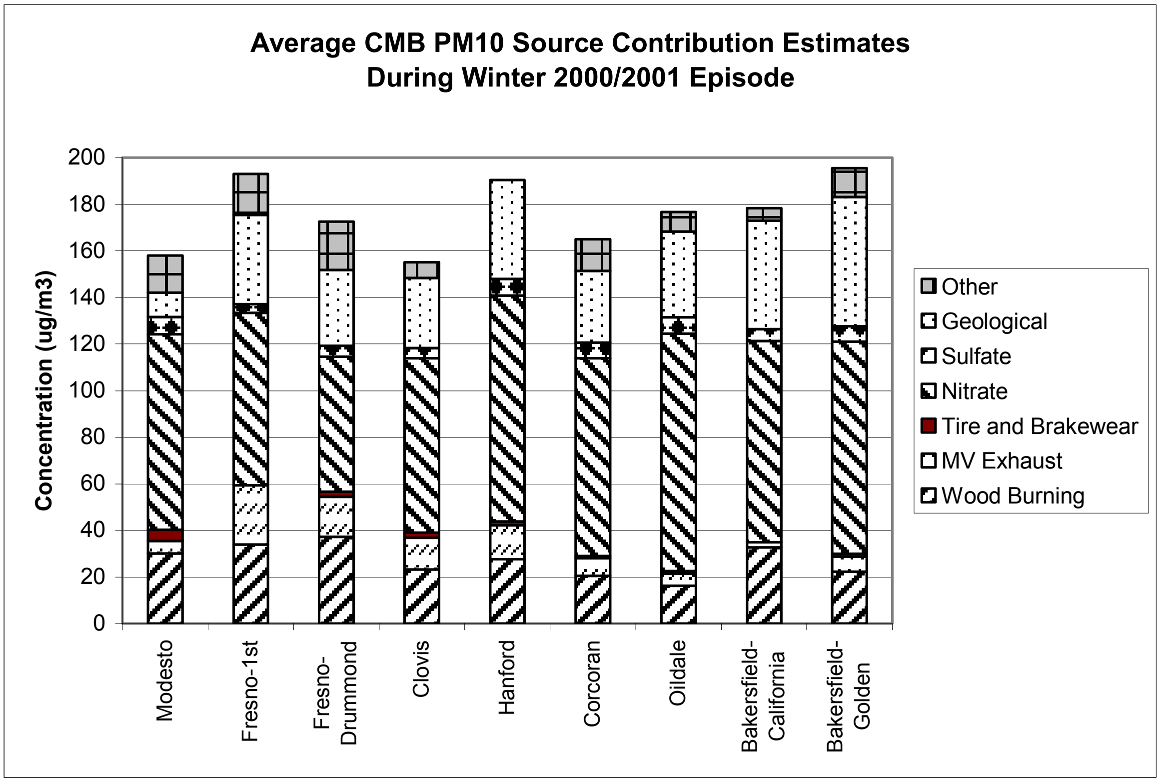
PM10 samples from the different sites have been analyzed to determine the various chemical components. The results of this analysis are presented in Figures ES-5 and ES-6.

Figure ES-5
Sources of PM10 in the San Joaquin Valley Air Basin
Monitoring Stations over the Annual Standard



BGS = Bakersfield Golden State, FSD = Fresno First St., HAN = Hanford, VCS = Visalia Church St.

Figure ES-6



The SJVAB experiences the highest PM10 concentrations during the fall and winter seasons. The largest fraction of material responsible for fall exceedances is fugitive dust; however, there was only one fall episode over the standard recorded during the last three years (October 21, 1999). Ammonium nitrate comprises the largest fraction during winter episodes. Geologic material is the second largest contributor in most winter episodes, but carbon particles from wood combustion can also be high during periods when fireplace and woodstove use is high. The worst episodes occur during long periods of stagnant conditions with light winds. Wind related PM10 events are rare but possible when conditions are right. None of the exceedances recorded during the last three years were wind related.

CART Analysis

In order to verify the understanding of the effect of meteorology on the SJVAB PM10 problem, the ARB prepared an analysis using Classification and Regression Trees (CART). CART is a powerful, statistically based model that establishes relationships between dependent air quality (i.e. PM10 or PM2.5) variables, and independent meteorological variables, such as relative humidity, temperature, stability, precipitation, visibility, etc. The output provides diagrams in the form of “trees” that illustrate which meteorological variables contribute to PM concentrations and provides the relevancy of each meteorological variable. The results of the CART Analysis are provided in Appendix L.

CART results reveal that stability is by far the most important meteorological parameter in defining high PM concentrations for either PM10 or PM2.5. This is unlike other serious nonattainment areas such as Phoenix, Arizona, Clark County, Nevada, and Coachella Valley, California where high wind speed is the most important determinant of high PM concentrations. Other important parameters include minimum and maximum temperature, visibility, and only rarely relative humidity and wind speed. PM concentration means below 20 $\mu g/m^3$ were reported for the more favorable meteorological regimes (in most cases, defined by low stability, higher minimum temperatures, higher wind speed, and normal relative humidity). The winter analysis indicated that there is a little more spread of variables that are important; while stability is still quite important, minimum temperature and visibility take on a greater importance. Results of the fall seasonal runs indicate more dependence on visibility than stability, as was the case for the winter analysis.

Emissions Inventory

Another tool used to identify the source of pollutants is the emissions inventory (EI). The emissions inventory is an air pollutant accounting system. The inventory is a compilation of emission rates multiplied by activity levels for each anthropogenic source of pollution in the air basin. The pollutants in the inventory are distributed geographically in a grid system when used in air quality modeling. The quality of the emission inventory varies a great deal from source category to source category. In general, emissions from vehicles, engines, and industrial processes are reasonably well understood and have agreed upon measurement techniques. Fugitive dust and ammonia emissions on the other hand are highly variable due to environmental conditions and are difficult to measure. This difference should be kept in mind when comparing emission source categories.

The inventory for the SJVAB is further complicated by the need to examine sources of directly emitted PM10 as well as sources of PM10 precursors. As was shown in Figure ES-6, during the worst PM10 episode in January 2001 over 50 percent of the particles were secondary nitrate and sulfate particles formed by precursor gases. The inventory of directly emitted PM10 is more seasonably variable than the precursor inventory.

The emissions inventory for the PM10 Plan has many improvements over the inventory submitted with the 1997 PM10 Attainment Demonstration Plan. These improvements were the result of extensive coordination between the District, ARB, and EPA. In addition, dozens of meetings were held with stakeholders to ensure that the best, most accurate, San Joaquin Valley specific data are included in the emission inventory. Chapter 3 describes the inventory in greater detail. The inventory is a joint responsibility of the District and the ARB.

The emission estimates for a particular source of PM10 emissions is not necessarily proportional to the impact on ambient PM10 levels. Particles fall out of the atmosphere at different rates depending on their size and chemical composition and on meteorological variables such as wind speed and relative humidity. Under stable conditions and a wind speed of 1 meter per second, 10-micron particles are estimated to travel a mean distance of 1.1 kilometers[3]. A large source of directly emitted PM10 that is found primarily in locations away from urban areas or is widely dispersed in areas with few other sources is likely to have less impact than a smaller source category in an urban area where many sources are located. The concentration of sources and the intensity of activity at those sources (source density) is the primary consideration for fugitive dust impacts. PM10 precursors, on the other hand, tend to be more regional in nature and can impact areas far from their source. The inventory is used to estimate the emissions coming from each source of pollution and as an indicator of which sources need to be controlled.

The PM10 Plan includes inventories for volatile organic compounds (VOC), oxides of nitrogen (NOx), oxides of sulfur (SOx), ammonia, and PM10 for the years 1999, 2002, 2005, 2008, and 2010. More information on the emission inventory can be found in Chapter 3, which also includes inventory summaries for each of these pollutants and years. The year 1999 is used as the baseline inventory because it has the most complete data. 2002 is used as the base year from which to calculate all future year milestones (i.e., 5% per year requirement, and reasonable further progress).

PM10 Air Quality Modeling

The EPA requires PM10 attainment plans to use air quality modeling techniques to apportion the causes of the problem to the appropriate sources and to predict the effectiveness of reducing pollutants from the sources on attainment. The PM10 Plan uses four modeling techniques. They are chemical mass balance (CMB) with speciated roll-back, a grid-based aerosol model, box modeling, and dispersion modeling. For a complete description of these models, see the Modeling Protocol in Appendix K and Chapter 5. These modeling techniques meet or exceed all EPA standards and guidance for the development of PM10 plans.

<u>UAM-Aero Modeling</u>

The District in consultation with ARB selected the Urban Airshed Model-Aerosol (UAM-Aero) to model the formation of secondary particles in the atmosphere. UAM-Aero was developed by the ARB and has been used on SIPs in several nonattainment areas.

ARB modeling staff ran sensitivity tests using UAM-Aero to determine the effect of reducing the emissions of various precursors to PM10. The results of these tests are used to guide the development of an appropriate precursor control strategy. The tests compared the effects of controlling NOx, VOC, and ammonia emissions. The modeling used data sets from work accomplished for the IMS-95 field study (the most complete data available). The dataset was not ideal. It covered only the southern part of the Valley, and as sometimes happens during air quality field studies, the field-monitoring period experienced relatively low PM10 levels. No site exceeded the PM10 standard during the period. The episode modeled occurred

[3] "Evaluation of Dust Particulate Matter Suspension Time and Travel Distance in Ambient Air -Draft." Tony Servin, P. E. January 13, 1995

during January 4-6, 1996. Although not ideal, the IMS-95 data covers the area of the SJVAB that experiences the highest PM10 levels. Monitoring data collected during CRPAQS and regular District monitoring confirms that the relative contribution of the secondary particles is consistent with that collected during IMS-95. Results of the sensitivity testing provide several important findings that will be described below.

NOx emission reductions of 50 percent are effective throughout the domain (the domain is the geographic area that the modeling covers). Results show that reductions correlate well with the peak simulated base case ammonium nitrate concentrations; i.e., reducing NOx reduces nitrate where nitrate is high. Consequently, an expeditious attainment strategy must contain significant NOx emission reductions.

VOC emission reductions of 50 percent had little impact throughout the domain. Comparing the effects of reductions with the simulated base case ammonium nitrate shows that reducing domain-wide VOC emissions have little impact on nitrate concentrations, and no impact where nitrate is highest. Therefore, an expeditious strategy does not include VOC reductions.

Ammonia emission reductions of 50 percent had mixed and uncertain results. The January 5 results indicate that ammonia controls may be somewhat effective in the mountains east of Bakersfield. The January 6 results showed some impact on the Valley floor south of Bakersfield. However, when you compare the effects of reductions with the simulated base case ammonium nitrate, the ammonia impact occurs in regions of low nitrate concentrations.

ARB staff further evaluated the potential effectiveness of ammonia controls in reducing nitrate by examining the relative abundance of ammonia, ammonium, sulfate, nitrate, and nitric acid in ambient data measured during the modeled episode. The analysis showed that unused ammonia remained after complete conversion to nitrate of the measured constituents. Thus, the ambient data indicate that nitrate formation was not limited by the availability of ammonia. This contradicts the modeling results. As a result, it is unclear from the data currently available whether an expeditious attainment strategy requires ammonia reductions. And at this time, ammonia reductions have not been shown to be an effective precursor control strategy.

<u>CMB with Speciated Rollback</u>

The District and ARB used CMB with speciated rollback as the primary model to demonstrate attainment of the annual and 24-hour PM10 standards. Speciated rollback uses chemical analysis of collected air monitoring samples and information about the chemical composition of contributing sources to evaluate the link between collected samples and emission sources. Figures ES-5 and ES-6 displayed earlier in this chapter provide a graph of CMB results for the base year.

The CMB model links the speciated chemical composition of the filter sample at the site to emissions inventories that represent the emissions at the time of the 24-hour observation, or that represent seasonal or annual average values as appropriate. Where emission information is lacking for a particular component (e.g., seasonally resolved mineral dust emissions) rollback can still be applied to other components. To demonstrate attainment the inventories are “rolled back,” reflecting all controls identified in the control strategy. When controls reduce emissions sufficiently, the model shows that ambient levels will be lower than the NAAQS

PM10 Plan Control Strategy

Air pollution control is a shared responsibility of the EPA, California Air Resources Board (ARB) the District, and local government agencies. The EPA is responsible for federal motor vehicle, certain off-road engines, trains, planes, ships, and fuel regulations. The ARB regulates California vehicles and fuels and consumer products. The District regulates stationary sources and has limited authority to implement transportation control measures and indirect source control programs. The local agencies possess authority to regulate land use, to implement transportation control measures, and to use their budget authority to implement measures that reduce emissions directly. Each of these entities is contributing to the overall attainment strategy.

The PM10 Plan control strategy consists of existing measures already adopted by each entity, new measures needed to fulfill the BACM/BACT requirement, and other new feasible measures needed to reach attainment at the earliest practicable date. Because of previous air quality planning efforts for PM10 and ozone, the vast majority of controls needed to attain the PM10 standards have already been adopted and implemented in the SJVAB. The new measures are mostly incremental improvements to controls on previously regulated sources. The most significant new control strategy is the Agricultural Conservation Management Practices (CMP) Program. Prior to this plan, no controls on agricultural production were in place, although voluntary participation in conservation practices and incentive programs has been noteworthy. A summary of the emission reductions obtained from adopted rules and regulations and new plan commitments is provided below.

Table ES-3
Emission Reduction Summary for 2010

	2002 Inventory (tons/day)	Emission Reductions in 2010 (tons/day)
New PM10 Reductions	329.4	66.4
Adopted PM10 Reductions		-20.7
New NOx Reductions	519.8	37.9
Adopted NOx Reductions		118.2
New VOC Reductions	413.0	20.8
Adopted VOC Reductions		48.0
New SOx Reductions	31.8	6.3
Adopted SOx Reductions		-1.5

Note that benefits of NOx and VOC controls are primarily from measures already adopted for ozone control and benefits from PM10 and SOx reductions are from new commitments. Negative numbers in Table ES-3 indicate that the inventory is expected to grow for that pollutant unless additional controls are adopted. Most of the new measures for NOx and VOC are commitments recently included in the 2002 and 2005 Ozone Rate of Progress Plan that are also included in the PM10 Plan. Measures that rely on fleet turnover, i.e., mobile source measures, accrue air quality benefits slowly over time and so show benefits well into the future. Most stationary source measures and prohibitory measures are quickly implemented and achieve their maximum benefit in a few years. These measures show a quick drop in emissions when implemented and then the emissions are flat or begin growing if the source category is expected to grow. In addition, because NOx and VOC controls have been adopted for the District's ozone strategy, more stationary and area source controls are now in place for these pollutants. Stationary source SOx and PM10 emissions were not identified as significant sources of PM10 in the District's previous PM10 Plan submittals; therefore, no new controls for these pollutants from stationary sources were adopted in recent years.

Areas classified as serious nonattainment for PM10 are required to implement BACM and BACT on all significant sources of PM10 or PM10 precursor emissions. EPA defines significant sources as those contributing more that 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. BACM/BACT is defined as the maximum degree of emission reduction considering technical and economic feasibility and environmental impacts of the control. BACM/BACT must be implemented independent of attainment requirements. This means that BACM/BACT must be implemented even if it is not needed to attain the standards by the applicable attainment date since it would allow for an earlier attainment date. However, EPA guidance[4] allows for pursuing only precursor pollutants that would be effective in reducing ambient PM10 levels.

The District conducted BACM and BACT analyses of its existing controls and regulations. The analyses were intended to demonstrate that BACM/BACT has been implemented on all significant sources and to identify sources that needed tighter regulation or had additional potential for cost-effective emission reductions. The analyses compared District regulations with those adopted most recently in other serious nonattainment areas. Most of the District's existing regulations were found to meet the BACM/BACT definition. Sources identified as candidates for new or upgraded controls are listed in Chapter 4. The complete BACM and BACT Analysis reports are found in Appendix G.

As was indicated in the modeling section, air quality modeling using UAM-Aero identified several findings important for the PM10 precursor control strategy. First, the most effective strategy to reduce ammonium nitrate formation across the basin is to reduce the PM10 precursor oxides of nitrogen (NOx). Second, reducing the PM10 precursor volatile organic compounds (VOC) had little or no effect in reducing

[4] General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990, Section III(1)(g), April 16, 1992.

ambient nitrate concentrations in the SJVAB. Although the available modeling indicates that VOC reductions are ineffective, the possibility remains that they may be effective under some circumstances. This uncertainty is not critical since the District is pursuing all feasible VOC controls as part of its ozone control strategy. VOC controls adopted and proposed by the District meet the PM10 BACM/BACT requirement even if they are not needed for the PM10 attainment strategy. Third, it is unclear from the data currently available whether an expeditious attainment strategy requires ammonia reductions, and at this time, ammonia reductions have not been shown to be an effective precursor control strategy.

No ammonia controls are proposed for immediate implementation in the PM10 Plan; however, the District is committed to pursuing an expeditious ammonia control strategy. In light of the uncertainty regarding ammonia emission controls to achieve attainment, the PM10 Plan includes a strategy to further assess and develop any needed control for ammonia sources, especially dairies. Implementation of any controls would depend on further analysis of the Valley's ammonia chemistry as part of CRPAQS. As the results of that study become available, the District commits to adopting ammonia control measures that have been demonstrated as technologically and economically feasible and necessary for the San Joaquin Valley.

In the near term, the District expects to propose controls for dairy lagoons and livestock waste as part of the Ozone Plan that is under development. Although the primary purpose of those controls is to reduce VOCs, ammonia will also be considered.

District staff has investigated the current implementation of ammonia controls for Concentrated Animal Feeding Operations (CAFO) in other districts with a primary focus on dairies. No other District has adopted ammonia controls, and controls proposed for the 2003 South Coast Air Quality Management District (SCAQMD) SIP appear to be infeasible for the San Joaquin Valley. Manure generated by SCAQMD dairies is typically transported off-site, primarily due to high land costs in the area. Most dairy operators have no cropland near their dairies available to dispose of the manure and liquid waste as fertilizer. San Joaquin Valley dairies on the other hand, nearly all have large acreages available for on-site disposal. This means that dairy design and waste management practices employed are not comparable.

Another conclusion from the modeling work relevant to the control strategy is that the concentration of many different PM10 sources in urban areas leads to the highest ambient levels at urban area monitoring sites. Therefore, controls on pollutants emitted in the urban area and regional pollutants will have the greatest effect on the PM10 problem. This does not eliminate the need for rural controls. People living near activities that produce large quantities of PM10 can be exposed to unhealthy levels.

Chapter 4 provides a summary of each control measure including emission reductions and cost-effectiveness estimates.

Attainment Demonstration and Measures of Reasonable Further Progress

The air quality modeling conducted for the PM10 Plan identified the earliest practicable attainment date as 2010. There were no feasible measures identified that would result in an earlier attainment date. Substantial reductions in NOx and mobile source PM10 will occur after 2010 due to federal on-road diesel engine standards that will be phased in beginning in 2007. The benefits of these standards accrue over time as vehicle fleet managers retire old vehicles and purchase new cleaner ones. New off-road engine standards have not been adopted as of the time of this writing, but EPA is discussing a 2010 implementation date. The results of the rollback analysis are presented in Table ES-4 and ES-5.

Table ES-4
Projected 24-Hour PM10 Values

Site Name	Design Value	2010
Bakersfield - California Ave.	**190**	137
Bakersfield - Golden #2	**205**	151
Clovis	**155**	120
Corcoran - Patterson Ave. (two different events with the same 174 value)	**174**	143 138
Fresno - Drummond	**186**	140
Fresno – First	**193**	144
Hanford – Irwin St	**185**	143
Modesto – 14th Street	**158**	121
Oildale - 3311 Manor St	**158**	120
Turlock – 900 Minaret Street	**157**	116

Table ES-5
Projected Annual PM10 Values

Site Name	Design Value	2010 Projected Value
Bakersfield - Golden #2	**57**	49
Fresno - Drummond	50	45
Hanford - Irwin St	**53**	47
Visalia - Church Street	**54**	46

The plan demonstrates that the control strategy will achieve the five percent per year reduction of PM10 or PM10 precursors until attainment. Table ES-6 summarizes the results. Table ES-7 provides an alternative calculation method that also successfully achieves the five percent requirement.

Table ES-6
Five Percent per Year Milestone Demonstration
Annual Inventory

Year	NOx Emissions Tons/day	Percent NOx Reduced %	PM10 Emissions Tons/day	Percent PM10 Reduced %	Percent reduction NOx + PM10 (running average)
2002	**519.8**		**329.4**		
2003	493.5	5.1	329.4	0.0	5.1
2004	479.5	2.7	312.1	5.3	6.5
2005	461.8	3.4	285.5	8.0	8.1
2006	441.0	4.0	285.8	-0.1	7.1
2007	420.1	4.0	285.4	0.1	6.5
2008	403.6	3.3	280.1	1.6	6.2
2009	389.1	2.8	284.5	-1.3	5.5
2010	363.7	4.9	283.7	0.2	5.5

Table ES-7
Five Percent per Year Milestone Demonstration – Alternative Method
Annual Inventory

Year	NOx Emissions Tons/day	Percent NOx Reduced %	Percent NOx Carried Forward %	PM10 Emissions Tons/day	Percent PM10 Reduced %	Percent PM10 Carried Forward	Percent reduction NOx + PM10 (running average)
2002	**519.8**			**329.4**			
2003	493.5	**5.0**	**0.1**	329.4	0.0	0.0	5.1
2004	479.5	0.0	2.8	312.1	**5.0**	0.3	6.5
2005	461.8	0.0	6.2	285.5	**5.0**	3.3	8.1
2006	441.0	**5.0**	5.2	285.8	0.0	3.2	7.1
2007	420.1	**5.0**	4.2	285.4	0.0	3.3	6.5
2008	403.6	**5.0**	2.4	280.1	0.0	4.9	6.2
2009	389.1	**5.0**	0.2	284.5	0.0	3.6	5.5
2010	363.7	**5.0**	0.1	283.7	0.0	3.8	5.5

Bold percentages indicate the year and the pollutant used to meet the annual 5 percent requirement.

Expeditious Attainment of the PM10 Standards

The PM10 Plan provides for attainment of the PM10 standards by 2010. To show that this date represents expeditious attainment, the District must demonstrate that an earlier attainment date is not possible. The attainment strategy primarily relies upon reductions in directly emitted PM10 and NOx. The three most significant source categories of directly emitted PM10 are addressed by Regulation VIII Fugitive PM10 Prohibitions, the Agricultural Conservation Management Practices Program, and Rule 4901 – Residential Wood Combustion. These rules and regulations will be fully implemented between 2003 and 2006. Most of the reductions from these measures will be obtained in the first few years of implementation. Exceptions are actions included in these rules and regulations that accrue benefits over time like unpaved road paving programs that add new paving each year and changeout of non-EPA certified woodburning devices at the time of sale. NOx reductions are obtained during the entire 2003-2010 period, but stationary source measures under the District's authority are nearly all implemented prior to 2006. Later stationary source measures have a high degree of uncertainty in their emission reductions and typically need additional emission inventory work prior to implementation. The bulk of the emission reductions scheduled for after 2006 are from adopted and committed state and federal mobile source measures that rely on fleet turnover at purchase of the vehicle or equipment. These regulations cannot be moved forward by the District, and because mobile sources represent a large part of the NOx inventory, attainment cannot be projected until 2010.

The monitoring sites with the highest design values in Fresno and Bakersfield attain the annual and 24-hour standards in 2010, but other SJVAB nonattainment sites with lower design values are expected to attain the standard earlier. Sites currently in attainment of the standard will benefit from the attainment strategy and are expected to stay well below the annual and 24-hour PM10 standards.

Contingency Measures

The CAA section 172(c)(9) requires attainment plans to provide for the implementation of specific measures to be undertaken if an area fails to make reasonable further progress (RFP). Contingency measures must take effect without any further action by the State or the EPA. The Addendum to the General Preamble Section VII(B)(4) states that EPA will require the submittal of a plan revision within nine months after failure to achieve a milestone that assures that the area will achieve the next milestone. This action would also necessitate the implementation of contingency measures. The District proposes several contingency measures to meet this requirement that are described below.

The first measure is the development of additional requirements for the District's Conservation Management Practice (CMP) Program. Under this contingency measure, the number of CMPs required per farm will be increased or the CMPs demonstrated to be least effective could be removed from the eligible CMP list. The amount of any increase or change in measures can be set to the level needed to make up any CMP Program shortfall. Rule development is scheduled to begin in the second quarter of 2003.

A second contingency measure is additional local measures. If the cause of the failure to achieve RFP is related to failure to meet local commitments, the local agencies will be required to identify and fund projects under their jurisdiction and budget authority that will reduce emissions prior to the next RFP milestone date. Since it is not possible to forecast future budgets with a high degree of accuracy, this measure must consider budgetary conditions at the time the reductions are needed. In fact, the reason for not meeting a local commitment may be budgetary constraints. The District will work with local jurisdictions to track progress and to identify alternative funding sources if needed.

The final contingency measure is developing additional changes to Regulation VIII, Fugitive PM10 Prohibitions. During the BACM analysis, several measures were rejected due to excessive cost. If an RFP milestone is not achieved, contingency measures must be implemented. The actual contingency measure provisions will be determined during rule development along with the other upgrades to Regulation VIII. That will provide an opportunity for public input and more detailed analysis of specific measure provisions.

The District has not identified contingency measures for NOx and VOC emissions. Since attainment of the PM10 standard by 2010 will require the implementation of all feasible NOx measures currently identified, no additional measures are available for contingencies. UAM-Aero modeling indicates that VOC reductions do not appear to significantly advance attainment of the PM10 standards and so contingency measures would also not be effective. The further study measures listed below may result in the adoption of measures that could be considered to be contingency measures; however, analysis and research is needed prior to their adoption that may result in their elimination from further consideration.

Further Study Measures

In some cases, information now available is inadequate to justify pursuit of a control measure. For those measures, the District proposes specific analysis or research that will be accomplished to determine if control is warranted. See Chapter 4 for additional information regarding further study measures.

The District received comments that leaf blowers should be regulated to prevent fugitive dust emissions from both the emissions created by the use of the machine and the emissions from the exhaust of the 2-cycle engine that powers the machine. Leaf blower PM10 emissions are not currently in the District’s emission inventory, but a preliminary analysis conducted for this Plan indicates that it could be a small but possibly significant source of emissions. No other air district has been identified that has adopted leaf blower regulations. Several local jurisdictions have adopted ordinances limiting the use of leaf blowers, primarily to address neighborhood noise concerns. The District will work with ARB to develop an emission inventory for this source and will attempt to identify a feasible control strategy should one be warranted.

One stationary source category was identified as significant; however, additional research is needed to determine if existing controls are BACT. The source category is Solid Fuel-Fired Boilers, Steam Generators, and Process Heaters. If more stringent controls are identified as technologically and economically feasible, the District will pursue an amendment to Rule 4352.

The District is committed to implementing technically and economically feasible controls on CAFOs as research is completed. The National Academy of Sciences final report “Air Emissions from Animal Feeding Operations: Current Knowledge, Future Needs” concludes that current emission estimation methods are not appropriate for most substances. The report identifies research needed to develop process based emission estimates for CAFOs that will provide a more valid basis for developing controls. Research on agricultural ammonia sources is ongoing. The District’s Agricultural Technical Advisory Committee, Dairy Subcommittee is completing a Dairy Research Action Plan that identifies specific research needs regarding emission factors for ammonia, VOC, and PM10 and potential control strategies. The County of Merced has initiated work in this area with a $600,000 project “Air Emission Mitigation Techniques and Technologies for California Dairies.” The state has allocated funding for the project and a contract is in process with the University of California, Davis. ARB and the District have contributed to recent research projects on ammonia and VOCs from dairies and can be expected to continue this effort.

To assure that issues related to ammonia and VOCs are addressed, the District commits to:

- Ongoing improvement in the VOC and ammonia emission inventories from livestock waste, primarily dairies,
- Continued development of aerosol modeling capability under CRPAQS and the evaluation of the effectiveness of ammonia reductions, and the
- Development of multi-pollutant emission reduction strategies to support SJVAB ozone and PM attainment.

California Regional Particulate Air Quality Study (CRPAQS)

The $30 million CRPAQS project is entering the data analysis and reporting phase that is expected to provide additional scientific basis to support the District’s attainment demonstration and control strategy. Preliminary reports should be available in 2004. Final reports should be completed during 2005. If the results indicate that reductions of ammonia will result in more expeditious attainment than the current NOx control strategy, the District commits to implement technically and economically feasible ammonia controls. This schedule coincides with the timeframe that the District will be preparing its PM10 Reasonable Further Progress Plan. That plan development process provides an opportunity to adopt new control measures for ammonia if needed and to re-evaluate commitments for other pollutants.