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California Environmental Protection Agency
AIR RESOURCES BOARD

Staff Report

Analysis of the San Joaquin Valley 2008 PM2.5 Plan

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EXECUTIVE SUMMARY

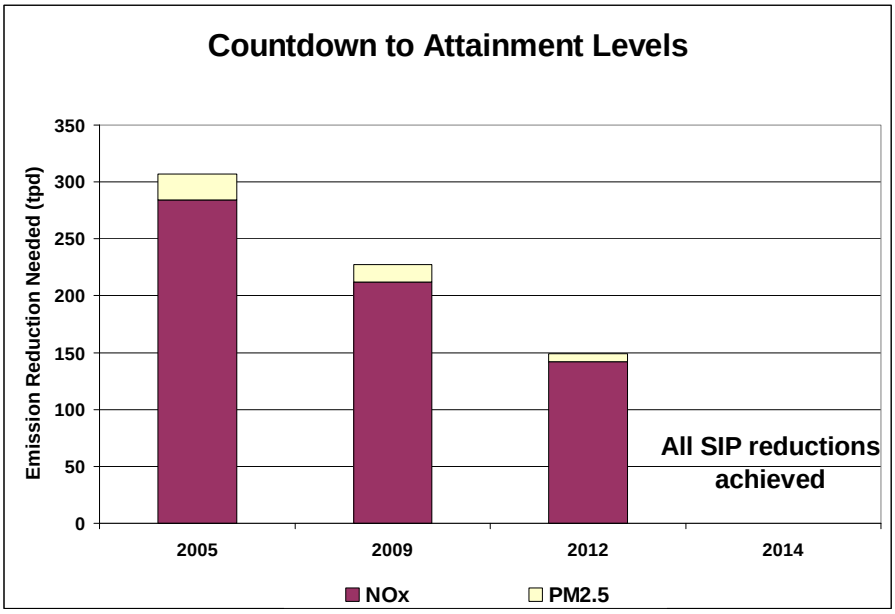
On April 30, 2008, the San Joaquin Valley Air Pollution Control District (District) adopted a PM2.5 Attainment Plan showing how the region will comply with the federal PM2.5 air quality standards set by the U.S. Environmental Protection Agency (U.S. EPA) in 1997. The staff of the Air Resources Board (ARB or Board) has reviewed the Plan and recommends that the Board approve it as a State Implementation Plan (SIP) revision to be submitted to U.S. EPA. The Plan shows that the region now meets the daily (24-hour) standard, and demonstrates how the more challenging annual standard will be met by 2014. The Plan documents that emissions of PM2.5 particles, and the pollutants that form PM2.5, are decreasing each year. A mid-course review of plan implementation will be done in 2011 as required by U.S. EPA

The Plan consists of adopted measures that provide increasing benefits each year, along with new emission reduction commitments from both ARB and the District. The Valley's particle pollution problem is well studied as a result of the $27 million invested in the California Regional Particulate Matter Study. This study provides the scientific foundation for the PM2.5 SIP by identifying the pollutants most important to formation of PM2.5 pollution. The results indicate that the key pollutants to reduce are NOx, SOx, and directly emitted PM2.5 particles. The Plan addresses these three pollutants consistent with U.S. EPA guidance. Emissions of VOC are also being reduced in the region as part of the ozone attainment strategy but are not required to be included in this SIP.

Overall, between 2005 and 2014, NOx emissions will decrease by almost 300 tons per day (tpd), direct PM2.5 emissions by over 20 tpd, and SOx by almost 3 tpd. Two thirds of the NOx and SOx reductions and one half of the PM2.5 reductions come from already adopted measures. A significant portion of the new commitments come from the ARB's State Strategy that was adopted in September 2007. The State Strategy provides an additional 76 tons of NOx reductions and 5 tons of PM2.5 reductions in 2014. The District has accelerated several measures in its 2007 Ozone Plan that are also part of the PM2.5 attainment strategy, and targeted a number of categories of PM2.5 for additional emission reductions, including residential wood burning and commercial cooking. Past District efforts to reduce impacts from residential wood burning have proven to be very effective, and continued reductions in this source category are expected to contribute significantly to further progress.

As emissions have decreased each year, parts of the Valley are already meeting the annual standard. The air quality modeling indicates that attaining the annual standard in the southern Valley is the biggest challenge, but all areas are projected to attain the standard by 2014. The Plan will also bring the region much closer to meeting a new federal PM2.5 standard that will apply to future SIP planning efforts. SIP planning for the newer standard will occur after U.S. EPA designates nonattainment areas and develops implementation rules.

The Plan demonstrates the rate of emission reductions that will occur between now and the attainment year. As shown below 307 tons per day of reductions are needed between 2005 and 2014. The Plan outlines how these reductions will be achieved. While the majority of the reductions are NOx, it is important to recognize that the PM2.5 reductions are also essential because air quality modeling shows each ton of direct PM2.5 is approximately nine times more effective ton per ton in the attainment year.



Staff's review indicates that the Plan meets the requirements of the Clean Air Act (Act) and U.S. EPA's PM2.5 implementation rule. The SJV 2008 PM2.5 Plan demonstrates attainment as expeditiously as practicable, no later than 2014, as required by the Act. The Plan also includes reasonable further progress calculations, reasonably available control measures and technologies, contingency measures, emission inventories, transportation conformity budgets, and a commitment for a SIP update in 2011. Additional reductions from adopted ARB measures will provide NOx reductions for contingency purposes should the region not attain in 2014.

The PM2.5 Plan is the result of a two year effort to update the emission inventories for each mobile, stationary, and area source category, conduct air quality modeling and data analysis, and to develop new control strategies. The 2011 SIP update will provide an important opportunity to assess air quality progress, update emission inventories, and check on the progress in achieving emission reductions.

Recommendations: Staff recommends that the Board approve the District's 2008 PM2.5 attainment Plan.

I. BACKGROUND

A. Profile of the San Joaquin Valley

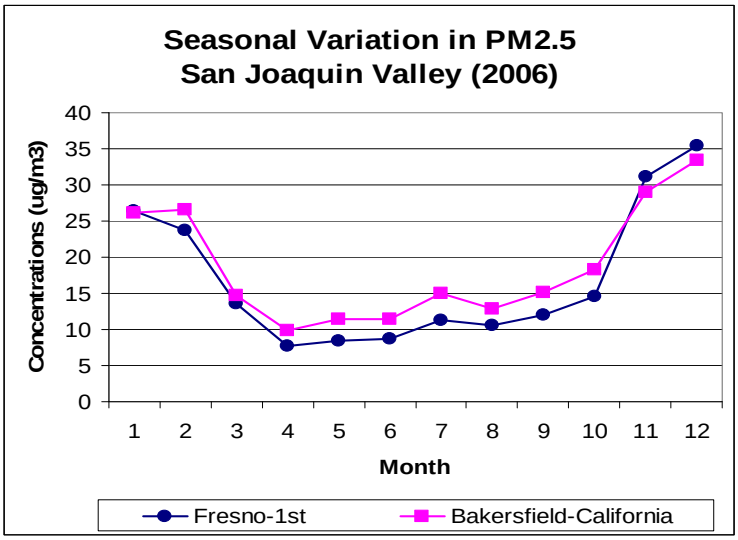
Covering nearly 25,000 square miles, the San Joaquin Valley is one of the dominant features in California's landscape. One of the fastest growing regions in the State, the Valley is home to more than 3.6 million people. The Valley has four large cities, Stockton, Modesto, Fresno, and Bakersfield, each with a population greater than 200,000. Numerous smaller cities and towns in the Valley are separated by large expanses of agricultural lands. With urbanization, agricultural lands continue to be converted to non-agricultural uses.

The San Joaquin Valley Air Basin is a lowland area bordered by the Sierra Nevada Mountains to the east, the Pacific Coast range to the west, and the Tehachapi Mountains to the south. The mountains act as air flow barriers, with the resulting stagnant conditions favoring the accumulation of emissions and pollutants. As a result, PM2.5 concentrations are higher in the southern and central portions of the Valley, where geography, emissions, and climate pose significant challenges to air quality progress.

PM2.5 is a complex mixture of many different species generated from a wide array of sources. PM2.5 can be either emitted directly into the air (primary particles) in forms such as soot, smoke, and the tiniest specs of dust, or it can be formed in the atmosphere (secondary particles or aerosol droplets) from the reactions of precursor gases, nitrogen oxides (NOx), sulfur oxides (SOx), reactive organic gases (ROG), and ammonia. NOx and ROG are also precursors of ozone pollution. Understanding the nature of the PM2.5 problem is key to designing an effective control strategy.

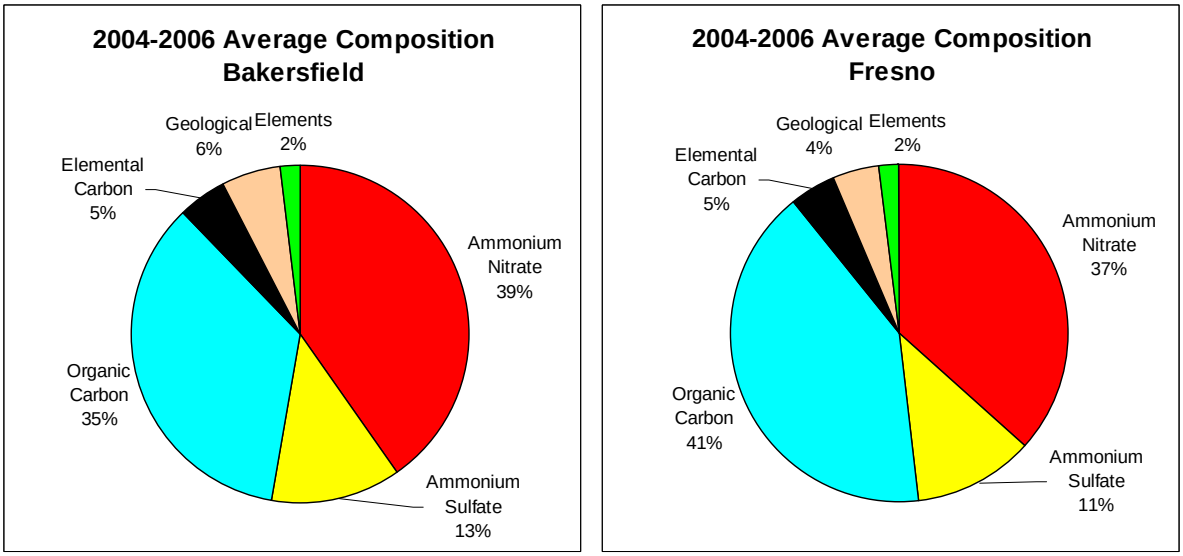
In the Valley, the levels and nature of PM2.5 concentrations typically differ by season (Figure 1). Higher PM2.5 concentrations occur during the winter, between late November and February during extended periods of stagnant weather with cold, damp, foggy conditions, which are conducive to the formation of secondary ammonium nitrate particulates. At these times, PM2.5 is dominated by ammonium nitrate formed from NOx and ammonia emissions, and directly emitted particles, such as wood smoke and other combustion sources.

Figure 1. Seasonal Variation in PM2.5 Concentrations in the San Joaquin Valley.



The elevated winter PM2.5 concentrations drive the annual average PM2.5 levels. On an annual basis, PM2.5 in the Valley consists mostly of ammonium nitrate, organic carbon, and ammonium sulfate (Figure 2). Ammonium nitrate is formed from chemical reactions of NOx emitted from motor vehicles and stationary combustion sources with ammonia. Burning activities, such as residential wood combustion, cooking, and direct tailpipe emissions from mobile sources are major sources of organic carbon. Ammonium sulfate is also formed in the atmosphere from chemical reactions of SOx emitted from combustion sources and ammonia. To a lesser extent, elemental carbon resulting from mobile and stationary combustion sources, and geological material from roads and other dust producing activities also contribute to PM2.5.

Figure 2. PM2.5 Composition in the San Joaquin Valley



B. PM2.5 Health Effects and Federal Air Quality Standards

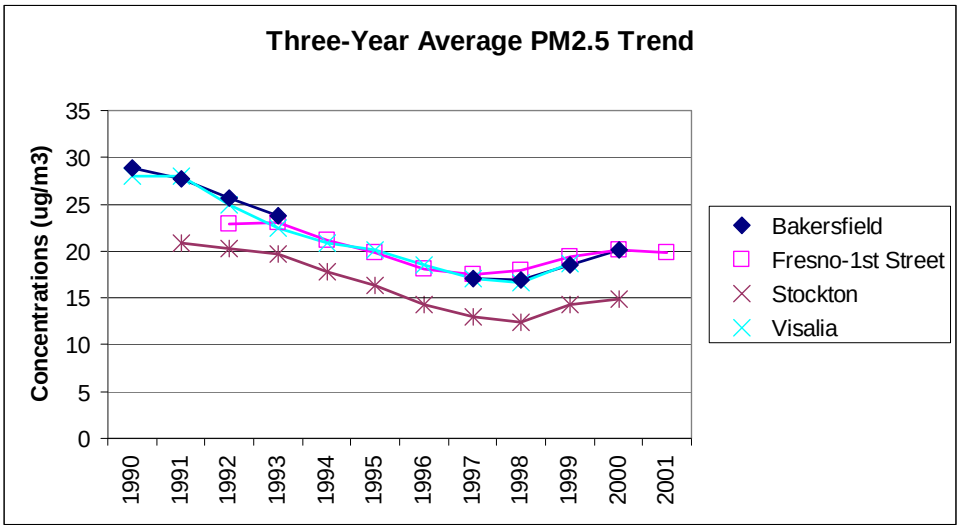
Extensive research over the last two decades has investigated the effects that breathing PM2.5 has on people's health. Research studies have consistently found a link between PM2.5 exposure and premature death in people with existing cardiac or respiratory disease. Studies of large populations have found that exposure to PM2.5 is associated with increased hospital admissions and emergency room visits due to frequent and severe asthma attacks, pneumonia, and acute and chronic bronchitis, primarily in people with chronic heart or lung diseases. Long-term exposure to PM2.5 has also been linked to an increase in lung cancer mortality risk. Those most at risk of experiencing adverse effects with PM2.5 exposure include infants, children, the elderly, and persons with pre-existing cardiopulmonary disease.

U.S. Environmental Protection Agency (U.S. EPA) adopted national ambient air quality standards (NAAQS) for PM2.5 in 1997, with a 24-hour PM2.5 standard of 65 micrograms per cubic meter ($\mu g/m^3$) and an annual standard of 15 $\mu g/m^3$. State Implementation Plans (SIPs) for areas designated nonattainment for these standards are due to U.S. EPA in 2008. The San Joaquin Valley is currently designated as nonattainment for the 1997 PM2.5 standards and the 2008 SJV PM2.5 Plan addresses these standards. In 2006, U.S. EPA adopted a new 24-hour PM2.5 standard that will apply to future SIP planning efforts. SIP planning for the newer standard will occur after U.S. EPA designates nonattainment areas and develops implementation rules

C. Air Quality

While the San Joaquin Valley has one of the most severe PM2.5 problems in the nation, PM2.5 air quality has shown considerable improvement. Initial efforts to monitor PM2.5 began in 1990. Annual average PM2.5 concentrations decreased between 20 to 30 percent during the period of 1990 through 2001. Due to the marked and complex variability in the Valley's meteorological conditions, some years are far more conducive to PM2.5 formation and accumulation than others. However, overall concentrations show a downward long-term trend (Figure 3).

Figure 3. Long-term Trends in PM2.5 Concentrations in the San Joaquin Valley



Since 1999, when monitoring for compliance with the federal PM2.5 standards began, PM2.5 annual average concentrations have dropped a further 19 to 29 percent. When the San Joaquin Valley was first designated nonattainment for the federal PM2.5 standards, the basin exceeded both the annual and the 24-hour PM2.5 standards. However, based on 2004-2006 data, the San Joaquin Valley now meets the federal 24-hour PM2.5 standard of 65 ug/$m^{3.}$ Thus, this SIP focuses on what more is needed to attain the annual standard.

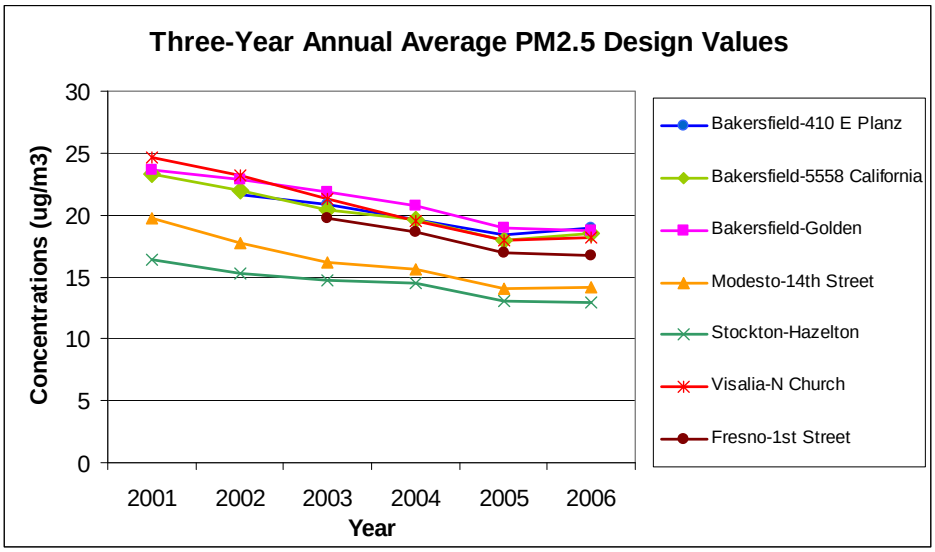
For planning purposes, U.S. EPA recommends using the average of the mean annual PM2.5 concentrations measured over a three year period. This is referred to as the "design value" and reduces the year to year variability. Table 1 provides the 2006 annual standard design values and the annual average values for 2004, 2005, and 2006 for each monitoring site with complete data. The northern portion of the Valley meets the annual PM2.5 standard, as indicated by the design values at Stockton, Modesto, and Merced. The highest PM2.5 annual design values are located in the southern and central portions of the basin, including Bakersfield and Visalia.

Table 1. PM2.5 Annual Average Concentrations and 2006 Design Values

Monitor	Annual Average (ug/m^3)			2006 3-year Annual Average Design Value (ug/m^3)
	2004	2005	2006	
Clovis-N Villa Avenue	15.8	16.0	16.8	16.2
Bakersfield-410 E Planz Road	17.4	19.9	19.3	**18.9**
Bakersfield-5558 California Avenue	19.0	17.9	18.7	18.5
Bakersfield-Golden State Highway	18.1	18.9	18.6	18.5
Corcoran-Patterson Avenue	17.3	17.6	16.7	17.2
Fresno-1st Street	16.4	16.9	16.8	16.7
Fresno-Hamilton and Winery	17.0	16.9	17.6	17.2
Merced-2334 M Street	15.3	14.1	14.8	14.7
Modesto-14th Street	13.6	13.9	14.8	14.1
Stockton-Hazelton Street	13.2	12.5	13.1	12.9
Visalia-N Church Street	17.0	18.8	18.8	18.2

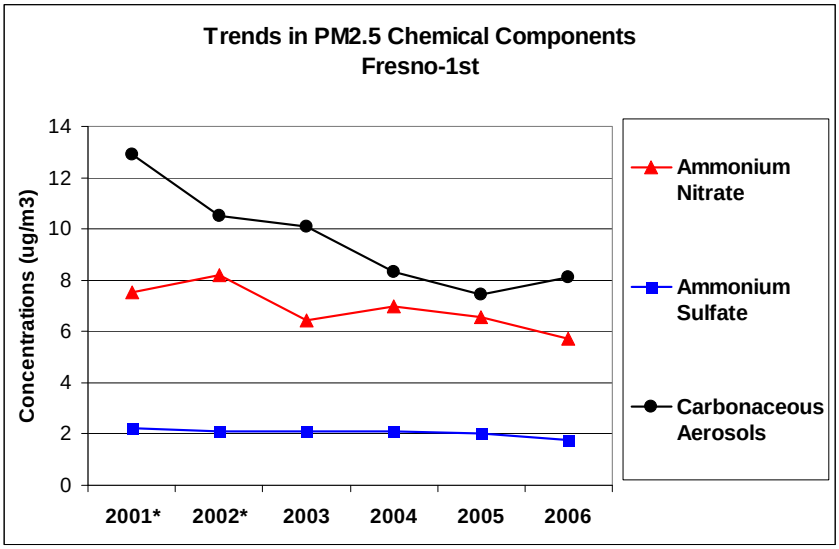
Trends in annual PM2.5 design values show that considerable progress has occurred in the San Joaquin Valley over the last five years (Figure 4). In 2001, all monitoring sites in the Valley had annual design values greater than 16 ug/m^3, with the Visalia site at approximately one and a half times the level of the standard. By 2006, design values decreased throughout the Valley, and only those sites in the southern and central portions of the Valley still have design values greater than 16 ug/m^3. Bakersfield–Planz is the current high site, with a design value which is 26 percent above the standard. The greatest rate of progress has occurred in the northern and central basin. These trends underscore the challenge the Valley faces in attaining the annual standard in the southern portions of the Valley. The surrounding mountains combined with the Valley's prevalent cold, damp, stagnant winters, create an environment very conducive to PM2.5 formation and buildup, especially in the southern end of the Valley.

Figure 4. Trends in Annual PM2.5 Design Values in the San Joaquin Valley



In addition to looking at trends in average concentrations of PM2.5, it is also useful to look at the trends of the different components that make up PM2.5. As stated earlier, PM2.5 is a complex mixture dominated by ammonium nitrate, organic carbon, and ammonium sulfate. Analysis of the trends in the different components of PM2.5 shows that over the last five years, decreases in carbonaceous aerosols and ammonium nitrate have had the greatest impact on declining PM2.5 levels. In Fresno, carbonaceous aerosols have declined by 37 percent and ammonium nitrate concentrations by 24 percent (Figure 5), while in Bakersfield, carbonaceous aerosols (organic plus elemental carbon) have declined by 16 percent and ammonium nitrate concentrations by 23 percent. During this same period, PM2.5 and NOx emissions, as well as NOx levels measured in the air also decreased. Longer-term records show concomitant decreases between ambient NOx and ammonium nitrate as well as between ambient SOx and ammonium sulfate. The combined downward trends in PM2.5 components, precursor concentrations, and emissions all indicate that the ongoing control program has had substantial benefits in improving air quality and that the reductions from measures in this Plan will provide continuing progress towards and attainment of the federal PM2.5 standards.

Figure 5. **Trends in PM2.5 Key Chemical Components**.



D. California Regional Particulate Matter Air Quality Study (CRPAQS)[1]

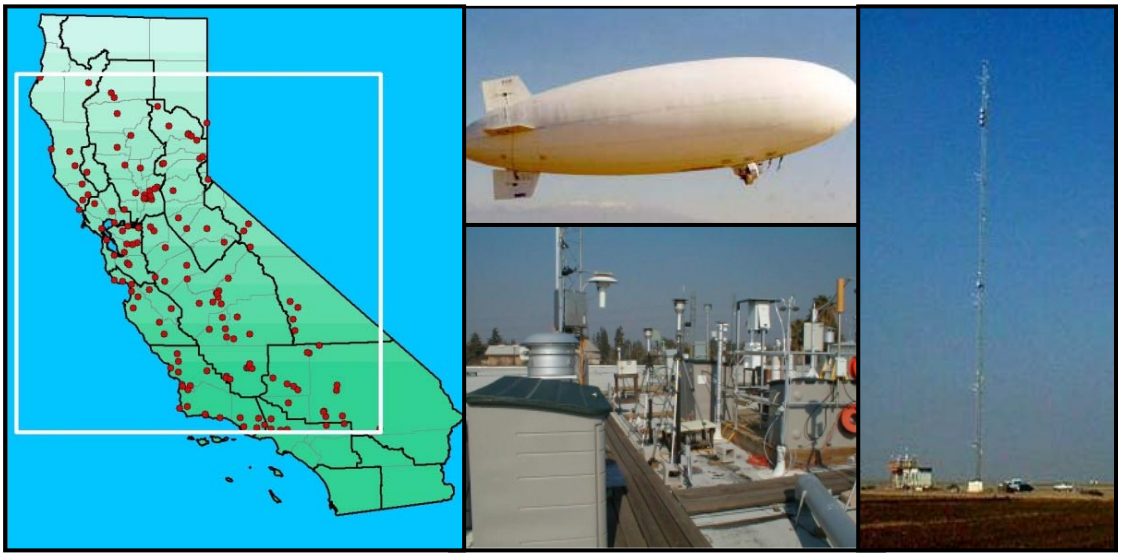
The California Regional Particulate Air Quality Study (CRPAQS) provides the scientific foundation upon which the PM2.5 SIP planning efforts are built. CRPAQS is a collaborative effort between the public and private sector designed to: 1) develop an improved understanding of particulate matter in central California; and, 2) provide

[1] http://www.arb.ca.gov/airways/ccaqs.htm

decision-makers with the tools needed to identify equitable and efficient control methods. The study is a comprehensive multi-year effort of meteorological and air quality monitoring, emission inventory development, data analysis, and air quality simulation modeling. The study reflects an investment of nearly 27 million dollars, coupled with extensive in-kind support from study sponsors, extending over a 15-year period. The resulting data and analytical tools are providing the most advanced scientific understanding available for SIP development.

CRPAQS is intended to evaluate the Valley's particulate matter challenges with respect to both the federal and State air quality standards for particulate matter smaller than 10 micrometers in diameter (PM10) and PM2.5. CRPAQS was designed to address annual particulate levels as well as fall and winter episodic conditions. Numerous teams of experts participated in the study. Data was collected for 14 months (December 1999 through February 2001) throughout the Valley and surrounding regions. The extensive field monitoring program collected data at the surface from hundreds of monitoring sites located throughout the study domain, and aloft with appropriately equipped air planes, blimp, specialized balloons, and towers (Figure 6). The effort resulted in millions of data records which have been housed in a world class data base. Focused efforts have also improved the emission inventory for the region. Finally, state-of–the-science air quality models have been tested with the extensive CRPAQS data base and are used in the CRPAQS and SIP modeling tasks.

Figure 6. CRAPQS Monitoring Program



II. AIR QUALITY PLANNING

A. Air Quality Planning Background

The federal Clean Air Act Amendments of 1990 (Act) establish the planning requirements for those areas that routinely exceed the health-based NAAQS. These nonattainment areas must adopt and implement a State Implementation Plan (SIP) that demonstrates how they will attain the standards by specified dates. Federal law holds each state responsible for implementing the provisions of the Act. California law assigns air quality planning responsibilities within the State. In the San Joaquin Valley, those responsibilities are shared among the San Joaquin Valley Air Pollution Control District (District), the Valley's metropolitan planning organizations, and the Air Resources Board (ARB).

In the air quality management process, many regulatory agencies in California work together to reduce air pollution levels. Each of these agencies is responsible for achieving emission reductions from a part of the inventory. ARB has primary regulatory authority over California's mobile sources, fuels, and consumer products. U.S. EPA sets new engine standards for sources including large farm and construction equipment and locomotives. Air districts have primary authority over stationary emission sources, including industrial and commercial equipment and area sources. The metropolitan planning organizations are responsible for developing the regional transportation plans that are used to estimate mobile source emissions. These transportation plans can also impact land use patterns, and the availability and attractiveness of transit alternatives.

The air districts develop and adopt local air quality plans. In this case, the District approved the SJV 2008 PM2.5 Plan on April 30, 2008. Upon approval by the ARB, SIPs are submitted to U.S.EPA for approval. Once approved by U.S. EPA, SIPs become enforceable.

B. Recent Air Quality Planning

Over the past decade, the District and ARB have adopted a series of regulations and measures to improve air quality in the Valley. New mobile source requirements, cleaner fuels, and multiple consumer products regulations have been adopted and are being implemented today. And, while California continues to face serious air quality challenges, it is important to recognize the progress made as a result of California's landmark air pollution control programs.

The District has implemented a successful PM10 attainment plan which has resulted in the Valley coming into attainment of the federal PM10 standard. U.S. EPA concurred with the District's attainment assessment, and on March 19, 2008, published a final affirmation of attainment of the PM10 standard for the Valley[2]. In addition, on

[2] Federal Register: March 19, 2008 (Volume 73, Number 54, pages 14687-14713)

April 25, 2008[3], U.S. EPA proposed approval of the District's plan to maintain the PM10 standard.

On April 2007, the District adopted the 2007 Ozone Plan. The ozone plan charts the course to attainment of the federal 8-hour ozone NAAQS in the Valley. ARB approved the ozone plan and submitted it to U.S. EPA as a SIP revision. Many of the measures in the PM10 and ozone plans are providing progress towards attainment of the PM2.5 standards.

On September 27, 2007, ARB adopted the 2007 State Strategy to achieve new emission reductions needed to bring areas of the State into attainment of both the federal PM2.5 and ozone air quality standards. The commitment for 2014 in the State Strategy includes reductions needed to attain the PM2.5 standards and provide progress towards meeting the ozone standard.

C. General Planning Requirements

On April 25, 2007, U.S. EPA finalized it's implementation rule for PM2.5[4]. The rule outlines the planning elements that the PM2.5 SIP must address. These include:

- base year and future year emission inventories for manmade sources of air pollution in the nonattainment area;
- air quality modeling that demonstrates attainment of the PM2.5 standards as expeditiously as practicable;
- weight of evidence - supplemental analysis of air quality, emission data, and trends supporting the primary modeled attainment demonstration;
- control strategies capable of meeting attainment;
- reasonable further progress (RFP) plan;
- contingency measures in the event the controls fall short of achieving needed reductions;
- demonstration that all reasonably available control technology (RACT) and reasonably available control measures (RACM) have been applied to existing sources;
- transportation conformity emission budgets to ensure transportation plans and projects are consistent with the SIP; and
- commitment for mid-course review.

[3] Federal Register: April 25, 2008 (Volume 73, Number 81, pages 22307-22318
[4] Federal Register: April 25, 2007 (Volume 72, Number 79, pages 20586-20587)

III. PLAN EVALUATION

A. Overview of the San Joaquin Valley PM2.5 Plan

The SJV 2008 PM2.5 Plan provides the technical foundation and control strategy for attaining the federal PM2.5 standards. The Plan demonstrates the Valley will attain the standards as expeditiously as practicable, no later than the 2014 deadline.

The Plan consists of adopted measures that provide increasing benefits each year, along with new emission reduction commitments from both ARB and the District. The Valley's particle pollution problem is well studied as a result of the $27 million invested in the California Regional Particulate Matter Study. This study provides the scientific foundation for the PM2.5 SIP by identifying the pollutants most important to formation of PM2.5 pollution. The results indicate that the key pollutants to reduce are NOx, SOx, and directly emitted PM2.5 particles. The Plan addresses these three pollutants consistent with U.S. EPA guidance. Emissions of VOC are also being reduced in the region as part of the ozone attainment strategy but are not required to be included in this SIP.

Overall, between 2005 and 2014, NOx emissions will decrease by almost 300 tons per day (tpd), direct PM2.5 emissions by over 20 tpd, and SOx by almost 3 tpd. Two thirds of the NOx and SOx reductions and one half of the PM2.5 reductions come from already adopted measures. A significant portion of the new commitments come from the ARB's State Strategy that was adopted in September 2007. The State Strategy provides an additional 76 tons of NOx reductions and 5 tons of PM2.5 reductions in 2014. The District has accelerated several measures in its 2007 Ozone Plan that are also part of the PM2.5 attainment strategy, and targeted a number of categories of PM2.5 for additional emission reductions, including residential wood burning and commercial cooking. Past District efforts to reduce impacts from residential wood burning have proven to be very effective, and continued reductions in this source category are expected to contribute significantly to further progress.

As emissions have decreased each year, the entire Valley already meets the daily standard and parts of the Valley are already attaining the annual standard. The air quality modeling indicates that attaining the annual standard in the southern Valley is the biggest challenge, but all areas are projected to attain the standard by 2014. The Plan will also bring the region much closer to meeting a new federal PM2.5 standard that will apply to future SIP planning efforts. SIP planning for the newer standard will occur after U.S. EPA designates nonattainment areas and develops implementation rules.

ARB staff has reviewed the 2008 PM2.5 Plan and the District's technical analysis and agrees that the Plan meets federal requirements. The following sections describe the major elements of the Plan.

B. Emission Inventory

An emission inventory consists of a systematic list of the sources of air pollutants with an estimate of amount of pollutants from each source or source category over a given period of time. The inventories used in this Plan were developed using the most recent planning assumptions and the best available technical information.

Air quality plans rely on emission inventories to help identify sources to control and as inputs to the photochemical models required for attainment demonstrations. Planning inventories which are aggregated by source type and inventory sector focus on anthropogenic sources and are expressed as annual average day and average seasonal day. In the case of PM2.5, ambient concentrations are highest in the winter so the planning inventory includes an estimate of average winter day emissions. This helps planners identify what source categories have the highest emissions during those periods when the PM2.5 ambient values are highest. Modeling inventories include both emissions from human activities (anthropogenic sources) and from natural sources (non-anthropogenic sources). Emissions are both spatially distributed geographically and represent hourly estimates for each grid cell in the modeling domain. The emission estimates also include the effects of climatic factors such as temperature and humidity. The models relate current air quality to current emissions levels of PM2.5 and its precursors, and simulate future air quality based on changes to the emissions as the result of new control measures. The current or baseline inventories used in the Plan reflect District and ARB controls adopted through 2006 and assume an estimated 24 percent growth in population and 14 percent growth in vehicle miles traveled in the estimated future year inventories. Baseline inventories do not include potential reductions from the new District measures identified in the SJV 2008 PM2.5 Plan or ARB measures in the adopted 2007 State Strategy.

1. Estimating Emissions

In California, computer models developed by ARB are used to estimate the emissions from on- and off-road mobile sources. Stationary source emissions estimates are developed by the Districts and derived from permit data. Area-wide emissions are estimated based on emission factors and information on expected activity from these diverse sources. Area-wide and off-road source emissions are estimated by ARB and the District. Emission inventories undergo routine reevaluation to ensure that they remain up to date and accurate.

Emission estimates used in the SJV PM2.5 2008 Plan take into account emission data, expected growth in activity, and ARB regulations and District rules adopted by December 2006. Mobile source emission inventories used in the Plan were developed using EMFAC2007, California's on-road motor vehicle emission factor model and OFFROAD2007 for emissions from mobile off-road vehicles and equipment. Transportation activity data was provided by the eight Valley Councils of Government (COGs) from their Regional Transportation Plans.

The District worked with ARB staff to update emission estimates from stationary and area source categories for which new and improved data became available. Improvements targeted the day-specific modeling inventory as well as the annual and winter planning inventories. Annual and winter planning inventory adjustments included District methodology revisions and impacts of adopted rules (e.g., open burning, wood burning fireplaces and heaters, cooking, manufacturing and industrial fuel combustion). A summary of a major District revision, as well as ARB updates follows:

- Non-point source manufacturing and industrial natural gas combustion.
  District staff refined the methodology for estimating emissions from industrial natural gas combustion sources that are too small to fall into the District's permitting program. Using data from the California Energy Commission on natural gas deliveries, District staff estimates 2005 NOx emissions are 25 tpd less that previously estimated and in 2014 they are 29 tpd less.

- PM2.5 size fractions for fugitive dust sources.
  ARB staff updated the estimates of dust in the PM2.5 size fraction based on PM size fraction profiles developed by the Western Regional Air Partnership (WRAP)[5,6] and PM2.5/PM10 ratios obtained from air quality measurements in California. Previously used profiles for dust emitting categories (e.g., paved and unpaved roads, construction and demolition, agricultural tilling) overestimated the amount of dust in the PM2.5 size fraction.

- Paved Road Dust
  ARB staff refined PM2.5 emission estimates from paved road dust by subtracting PM2.5 emissions from vehicle exhaust, tire wear, and brake wear to avoid double counting. These emissions are already accounted for in the on-road motor vehicle emission inventory. In addition, ARB staff revised the rate at which emissions are grown from the base year to a future year to reflect projected lane miles of new road.

2. Summary of Baseline Emissions

Emission sources in the San Joaquin Valley are diverse. The San Joaquin Valley is an important transportation corridor for moving goods and people inside the State and beyond. In addition, it is one of the most productive agricultural regions in the world, as well as home to industrial and commercial activities. All of these sources contribute to the concentrations of pollutants in the Valley.

The following discussion focuses on the annual planning inventory used in the SJV 2008 PM2.5 Plan. Appendix B of the SJV 2008 PM2.5 Plan includes detailed

[5] Cowherd, C. *Analysis of the Fine Fraction of Particulate Matter in Fugitive Dust*, Final Report. October 12, 2005. Midwest Research Institute. MRI Project No. 110397. phttp://www.wrapair.org/forums/dejf/documents/fffd/Final_Fractions_Dust_Report.pdf

[6] Cowherd, C., Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors. November 7, 2005. Midwest Research Institute. MRI Project No. 110397

annual average and winter average daily planning inventories for directly emitted PM2.5, and the precursors NOx and SOx for 2005 and for each year from 2009 to 2014.

Table 2 lists the baseline annual planning inventory for 2005 and 2014 for directly emitted PM2.5, NOx, and SOx precursors in the San Joaquin Valley in 2005 and emissions projected for the 2014 attainment year split by source category.

Table 2. San Joaquin Valley Air Basin Baseline Emission Trends[a,b]
(Annual Planning Inventory in tons per day, tpd)

Pollutant	Emissions	Source Category			
		Stationary and Area-Wide	On-Road Vehicles	Off-Road Vehicles and Equipment	Total[b]
PM2.5	2005 (tpd)	64.9	12.1	9.0	86.0
	2014 (tpd)	59.5	8.9	6.6	75.0
	Change (tpd)	-5.4	-3.2	-2.4	-11.0
	Change (%)	-8%	-26%	-27%	-13%
NOx	2005 (tpd)	93.6	327.9	153.9	575.4
	2014 (tpd)	67.3	206.7	102.2	376.2
	Change (tpd)	-26.3	-121.2	-51.7	-199.2
	Change (%)	-28%	-37%	-34%	-35%
SOx	2005 (tpd)	21.3	2.6	2.4	26.4
	2014 (tpd)	22.9	0.7	0.8	24.5
	Change (tpd)	+1.6	-1.9	-1.6	-1.9
	Change (%)	+7%	-73%	-67%	-7%

a. Baseline emissions include State control measures and District controls adopted through 2006.
b. Numbers may not add up exactly due to rounding.

In summary, baseline PM2.5, NOx, and SOx emissions from all sources in the Valley show an overall downward trend due to already adopted regulations and programs. The slight increase in SOx from stationary sources is addressed in the Plan. Although motor vehicle miles traveled in the basin continue to increase, on-road vehicle emissions are dropping because of more stringent vehicle emission standards and fleet turnover. This trend will be strengthened between 2005 and 2014 as newer, lower-emitting vehicles become part of the fleet.

C. Air Quality Modeling

Air quality modeling guides the selection of the most effective pollutants to control and the magnitude of emission reductions needed from each of the pollutants. U.S. EPA's modeling guidance requires the use of air quality modeling to relate current PM2.5 levels to emissions (of PM2.5 and PM2.5 precursors) and meteorology in a region, and to simulate future air quality based on changes in emissions. PM2.5 air quality modeling uses day-specific grid-based emission inventories and meteorological measurements to establish this relationship. Model predictions combined with observed concentrations of PM2.5 and its individual components provide the foundation for the U.S. EPA-recommended attainment demonstration (Speciated Modeled Attainment Test). Rather than using air quality model predicted PM2.5 concentrations results directly, U.S. EPA Guidance calls for using models in a relative sense to develop relative response factors (RRFs) for each of the PM2.5 chemical species. The RRFs are calculated as the ratios of the future-year to reference-year model-simulated concentrations of PM2.5 species at a specific location. The impact that emission reductions have on the future-year modeled PM2.5 species is assumed to be proportional to the impact on the base-year PM2.5 design value. The attainment test provides reconciliation between speciated and bulk mass concentration measurements, and is the basis for a connection between observations, modeled PM2.5 concentrations, and the air quality standard.

ARB staff conducted the grid-based photochemical modeling used in the SJV 2008 PM2.5 Plan with input from the District. The modeling analysis is based on data acquired from the $27 million state-of-the-science CPRAQS study. Modeling procedures followed U.S. EPA guidelines. A brief summary is provided below with more information on the air quality modeling conducted by ARB staff in Appendix A to this report and Appendix F of the SJV 2008 PM2.5 Plan.

1. Grid-based Photochemical Modeling

Grid-based photochemical modeling supports attainment demonstrations of the annual and the 24-hour PM2.5 standards in the San Joaquin Valley. The modeling platforms and chemical mechanism used in the photochemical modeling are summarized below.

U.S. EPA's Community Multiscale Air Quality Modeling System (CMAQ) was selected to simulate air quality in the San Joaquin Valley. CMAQ is a state-of-the-science "one-atmosphere" system that treats major atmospheric and land processes and a range of

species in a comprehensive framework. CMAQ has been extensively peer-reviewed and is well documented. A meteorological model, the Mesoscale Model version 5 (MM5), was used to generate the meteorological fields for the CMAQ model. Modelers chose the most up-to-date and comprehensive chemical mechanism (SAPRC99) along with CMAQ aerosol code version 4 and aqueous phase chemistry to simulate the complex mixture of PM2.5 species in the San Joaquin Valley.

CMAQ was run for the year 2000 to provide the basis for the model performance evaluation. It was during 2000 that the CRPAQS took place. The study resulted in a wealth of data with which to evaluate model performance. As it is necessary to execute simulations for a model reference year and a future year to perform the recommended modeled attainment demonstration, 2005 and 2014 were also simulated. Simulations for all years were driven by the meteorological inputs for 2000, while emissions varied from year to year. Meteorological conditions during 2000 were very conducive to the formation and accumulation of PM2.5.

As recommended by U.S. EPA, the SMAT procedure was applied to Federal Reference Monitors (FRM) operating in the San Joaquin Valley. The 2006 design value (average of the 2004, 2005, and 2006 annual average PM2.5 concentrations) was used as a basis from which to project estimated future year design values for the year 2014 (average of the 2012, 2013, 2014 annual average PM2.5 concentrations). Speciation of the FRM mass was based on data from the Speciated Trends Network (STN) sites in the Valley and on analysis of CRPAQS data.

The attainment demonstration for the annual standard required modeling PM2.5 concentrations for each day of the reference year (2005) and future year (2014). The attainment demonstration for the 24-hour PM2.5 standard used only the top 25% of the measured and modeled days for each quarter instead of all available days.

ARB staff evaluated air quality model and meteorological model performance based on U.S. EPA guidance and other related methods in the published academic literature. As noted above, model performance evaluation benefited from use of the extensive CRPAQS data set, ensuring a robust modeling simulation.

2. Weight of Evidence

The Weight of Evidence (WOE) analysis provides a set of complementary analyses that supplement the SIP-required photochemical modeling. A WOE approach looks at the entirety of the information at hand to provide a more informed basis for the attainment strategy. Because all methods have inherent strengths and weaknesses, examining an air quality problem in a variety of ways offsets the limitations and uncertainty that are inherent in photochemical modeling. This approach also provides a better understanding of the overall problem and the level and mix of emissions controls needed for attainment.

Appendix H of the SJV 2008 PM2.5 Plan includes the initial draft of the WOE analysis. Appendix B of this staff report updates this analysis and summarizes the analyses that comprise the WOE assessment for the San Joaquin Valley. ARB staff evaluated air quality and emission trends; observational model results, including those of source receptor models, such as chemical mass balance (CMB) and positive matrix factorization (PMF); and evaluated diagnostic indicator species results. Along with the results from the photochemical modeling, District staff conducted a rollback modeling analysis to estimate the impacts of future emission reductions on resulting air quality. Rollback modeling combines source receptor model results with predicted emission inventory data that include emission reductions from adopted and proposed control measures to estimate future PM2.5 concentrations. Source receptor models use data on the concentrations of chemical species measured in ambient PM2.5 to identify the contributing sources. An extensive discussion of the rollback methodology and the results are provided in Chapter 3 of the SJV 2008 PM2.5 Plan.

3. Demonstrating Attainment

Modeling was used to establish emission reduction targets for developing the control strategy in the Plan. ARB staff used photochemical modeling to verify that the proposed control strategy would result in attainment of the PM2.5 standards throughout the basin in 2014. The emission reductions needed from new control measures to reach attainment throughout the Valley in 2014 are summarized in Table 3:

Table 3. Emissions and Emission Reductions[a]
(annual average emissions in tpd)

	Direct PM2.5	NOx	SOx
2014 Baseline Emissions	75.0	376.2	25.6
2014 Control Measure Emission Reduction Commitments	12.7	85.0	0.9
2014 Attainment Emissions	63.3	291.2	24.5

a. Numbers may not add up exactly due to rounding.

As mentioned earlier, based on 2004-2006 data, the Valley already meets the federal 24-hour standard. Modeling results for the five sites with highest 2006 design values show that further emission controls will result in even lower 24-hour design values in 2014 (Table 4), ensuring continued progress towards the strengthened 24-hour standard which will be addressed in future planning efforts.

Table 4. Reference and Future Year 24-hour Design Values (DV)[a]
(micrograms per cubic meter, $\mu g/m^3$)

Site	2006 DV	2014 "Controlled" DV
Bakersfield - California	62.4	46.2
Bakersfield - Planz	65.2	45.9
Bakersfield - Golden	64.4	45.3
Fresno - 1st Street	58.0	41.2
Fresno - Hamilton	58.5	41.7

a. Design values equal to or below 65.4 $\mu g/m^3$ meet the annual PM2.5 NAAQS.

Modeled design values demonstrate the San Joaquin Valley will attain the annual PM2.5 federal standard in 2014 at all monitoring sites (Table 5). The 2014 design value is the three-year average of modeled 2012, 2013, and 2014 values. For comparison, Table 5 also lists the 2006 design values calculated from measured PM2.5 concentrations and the impact of baseline emission reductions on modeled 2014 design values. Baseline emission reductions due to already adopted rules provide from 58 to 63 percent of progress towards attainment. Sites in the northern and central Valley would be expected to attain the standard in 2014 with baseline emission reductions. With the addition of the new State and local measures, the sites with the most severe problem – Visalia and Bakersfield – would also attain in 2014, with a maximum design value of 14.7 in Bakersfield. The linear rollback analyses showed similar results, providing a consistent assessment of attainment prospects. Modeling analyses also show that annual PM2.5 concentrations are more sensitive to reductions in directly emitted PM2.5 as compared to NOx in 2014. On average, reducing 1 tpd in PM2.5 emitted from combustion activities is approximately 9 times more effective than reducing 1 tpd of NOx.

Table 5. Reference and Future Year Annual Design Values[a]
(µg/m^3)

Site	2006 DV	2014 Baseline DV	2014 "Controlled" DV
Bakersfield - California	18.51	15.86	14.28
Bakersfield - Planz	18.86	16.26	14.70
Bakersfield - Golden	18.64	15.98	14.39
Clovis	16.39	14.10	12.72
Corcoran	17.24	14.75	13.27
Fresno - 1st Street	16.68	14.43	13.01
Fresno - Hamilton	17.16	14.93	13.47
Merced	14.69	12.85	11.76
Modesto	14.10	12.52	11.44
Stockton	12.93	11.77	10.87
Visalia	18.20	16.05	14.47

a. Design values equal to or below 15.04 µg/m^3 meet the annual PM2.5 NAAQS.

The weight-of-evidence analyses provide a consistent assessment that the San Joaquin Valley will attain the annual average PM2.5 standard throughout the Valley in 2014. Significant progress has already occurred, a 6 ug/m^3 drop in annual average design value between 2001 and 2006, which represents two-thirds of the progress needed to attain the annual standard by 2014. Ammonium nitrate, ammonium sulfate, and carbon concentrations have responded positively to past reductions in NOx, SOx, and primary PM2.5 emissions. Substantial future emission reductions will occur due to both baseline commitments as well as new measures from NOx, and primary PM2.5 emissions that have worked in the past. Linear rollback analysis indicates attainment in 2014. Grid-based aerosol modeling also indicates attainment in 2014 at all sites in the District. However, attainment is expected to phase in starting in the northern portion of the Valley and spreading south, with more and more areas reaching attainment as we move towards 2014. As mentioned earlier, the mountains surrounding the Valley act as air flow barriers, with the resulting stagnant conditions favoring the accumulation of emissions and pollutants, making it harder for the southern portion of the Valley to reach attainment sooner.

4. Attainment Date

The Act requires nonattainment areas to attain the PM2.5 standards as expeditiously as practicable beginning in 2010, but no later than 2015. U.S. EPA guidance sets 2014 as the practical deadline for SIP planning purposes by requiring that the necessary emission reductions be achieved one year earlier. As required, the Plan identifies the proposed attainment date based on the severity of the PM2.5 problem and the availability and feasibility of control measures in the region. The District determined that feasible controls were not available to attain achieve the necessary emission reductions earlier than 2014. The State requests U.S. EPA approve April 5, 2015 as the deadline

consistent with its guidance that the SIP must provide for the necessary emission reductions by 2014. The request is based on:

- the magnitude of the remaining PM2.5 challenge in the San Joaquin Valley, as reflected by monitoring data;

- the significant amount of emission reductions required for reaching attainment
  - by 2014, on-going control programs will reduce direct PM2.5 emission by 13% from 2005 emission levels. To reach attainment, new measures need to reduce direct PM2.5 emissions by an additional 15%, plus
  - on-going control programs will reduce NOx emission by 35 % from 2005 emission levels. New measures need to reduce NOx emissions by an additional 15% to reach attainment; and

- the control strategy in the SJV 2008 PM2.5 Plan includes the District and State control measures that are available and feasible within the proposed attainment timeframe.

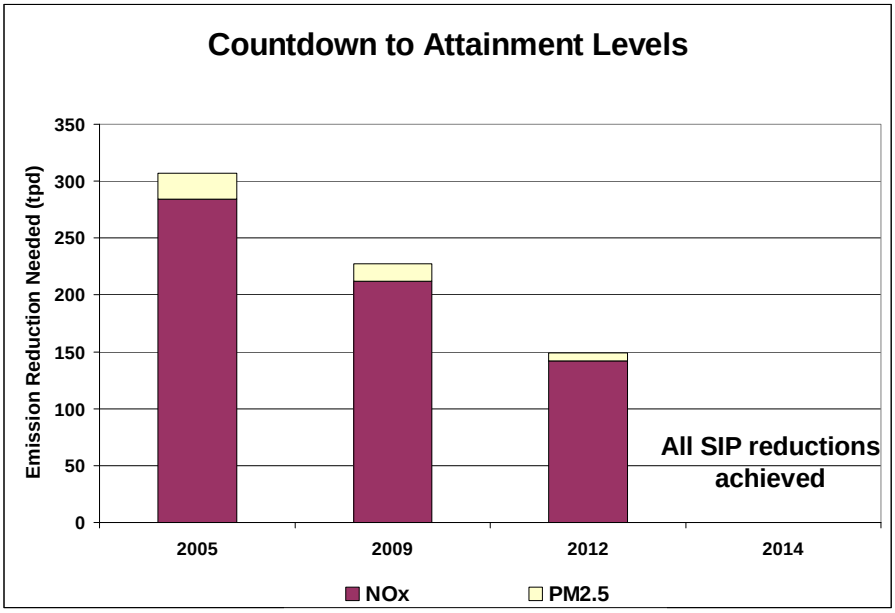
Considering the following factors, 2015 is identified as the earliest feasible attainment date: 1) baseline emission reductions that occur during the period up to 2014 are not sufficient alone to provide for attainment at all sites, and 2) the additional emission reductions resulting from the State Strategy will not phase in prior to 2014 due to the extraordinarily complex and innovative nature of developing and implementing these new measures.

ARB staff concurs with the District's assessment of the most expeditious and practicable attainment date for the San Joaquin Valley. As mentioned in the previous section, the results of the modeling and weight-of-evidence analyses, which include the impacts of control measures available and feasible at the District and State levels show the San Joaquin Valley will attain the PM2.5 standards in 2014.

D. Control Strategy

The SJV 2008 PM2.5 Plan integrates the NOx strategies adopted as part of the 2007 Ozone Plan. Among the guiding principles for developing the control strategy, the District gives precedence to NOx, which is also an ozone precursor. However, recognizing the importance of directly emitted PM2.5, additional measures to address this component have also been included. Directly emitted PM2.5 emission reductions are approximately nine times more effective than NOx reductions in the attainment year Overall, between 2005 and 2014, NOx emissions will decrease by almost 300 tons per day, direct PM2.5 emissions by over 20 tons per day, and SOx by almost 3 tons per day. Two thirds of the NOx and SOx reductions, and one half of the PM2.5 reductions come from already adopted measures. Figure 7 below illustrates the continuous progress in reducing NOx and PM2.5 emissions on the path towards attainment by 2014.

Figure 7



1. New District Measures

a. Rule Development Commitment

The Valley's approved PM2.5 Plan contains the District's commitment to develop and implement a suite of control measures for NOx, direct PM2.5, and SOx that in aggregate will achieve the total emission reductions specified in Table 6. Table 6 lists the 8 quantified measures, emission reductions in each reasonable further progress and attainment milestone years (2009, 2012, and 2014), and rule adoption timelines. By 2014, the District measures will reduce emissions by 9.0 tons per day of NOx, 6.7 tons per day of PM2.5, and 0.9 tons per day of SOx. Some of these measures may provide for additional emission reductions from other pollutants which are not quantified at this time. In addition, Table 7 lists 5 control measures for which the District has not specified emission reductions because work is currently underway to due to refine the emission inventory and assess current control efficiency. The District expects these measures to realize further emission reductions. All measures are to be developed by 2010, with implementation no later than 2012. The Plan shows attainment without the potential benefits of the measures.

The SJV 2008 PM2.5 Plan includes the 6 NOx control rules previously approved in the 2007 Ozone Plan. The District has accelerated adoption and implementation of one of the control measures. In addition, the District has added a new NOx control measure based on equipment attrition. The District has also made progress on two of the feasibility study measures from the Ozone Plan so that these are now control measures in this Plan.

Table 6
Summary of District Emission Reduction Commitments in the 2008 PM2.5 Plan
(Annual Average Planning tons per day)

CM#	Measure Name	Completion Date	Compliance Date	Reduction Start		Projected Reductions by Year					
						2009	2010	2011	2012	2013	2014
S-COM-5	Stationary Gas Turbines	2007 3Q	2012	2012	NOx	0	0	0	2.21	2.21	2.21
S-COM-1	Boilers, Steam Generators and Process Heaters (>5 MM Btu/hr)	2008 3Q	2012	2012	NOx	0	0	0	1.49	1.50	1.52
					PM2.5	0	0	0	0.23	0.24	0.24
					SOx	0	0	0	0.76	0.76	0.76
S-COM-7	Glass Melting Furnaces	2008 3Q	2009	2009	NOx	1.22	1.25	1.18	1.60	1.67	1.58
S-COM-9	Residential Water Heaters	2009 1Q	Attrition	2011	NOx	0	0	0.20	0.25	0.32	0.40
S-IND-9	Commercial Charbroiling	2009 2Q	2011	2011	PM2.5	0	0	2.17	2.21	2.25	2.28
S-COM-14	Wood Burning Fireplaces and Wood Burning Heaters	2009 3Q	2010	2010	NOx	0	0.04	0.08	0.07	0.07	0.06
					PM2.5	0	0.39	0.76	0.73	0.71	0.69
					SOx	0	0.01	0.02	0.02	0.02	0.02
S-COM-3	Boilers, Steam Generators and Process Heaters (0.075 to <2 MMBtu/hr)	2009 4Q	2011	2011	NOx	0	0	0.12	0.27	0.39	0.55
S-AGR-1	Open Burning	2010 2Q	2010	2009	NOx	1.21	1.95	2.68	2.67	2.66	2.65
					PM2.5	1.60	2.57	3.53	3.52	3.50	3.49
					SOx	0.06	0.10	0.14	0.14	0.14	0.14
TOTAL NOx REDUCTIONS						**2.43**	**3.24**	**4.26**	**8.56**	**8.82**	**8.97**
TOTAL PM2.5 REDUCTIONS						**1.60**	**2.96**	**4.46**	**6.69**	**6.70**	**6.70**
TOTAL SOx REDUCTIONS						**0.06**	**0.11**	**0.16**	**0.92**	**0.92**	**0.92**

Table 7. Implementation Schedule of Additional District Control Measures

CM#	Measure Name	Completion Date	Compliance Date	Reduction Start
S-COM-2	Boilers, Steam Generators and Process Heaters (2 to 5 MMBtu/hr)	2008 3Q	2012	2012
S-IND-21	Flares	2009 2Q	2010	2010
M-TRAN-1	Employer Based Trip Reduction Programs	2009 4Q	2012	2011
S-COM-10	Natural Gas-Fired, Fan Type Residential Central Furnace	2010 2Q	Attrition	2012
S-COM-6	Reciprocating Internal Combustion Engines	2010 4Q	2012	2012

The SJV 2008 PM2.5 Plan also identifies 11 future study measures, which upon completion, could result in opportunities for additional emission reductions. These study measures seek to explore where and how additional reductions may be achieved in the future. The District is committing to release study reports by the dates listed in Table 8 and to incorporate additional measures identified as fruitful in future PM2.5 plans. The Plan shows attainment without the potential benefits of these measures.

Table 8. District Stationary Source Feasibility Study Implementation Schedule

CM#	Measure Name	Completion Date
S-AGR-2	Conservation Management Practices	2010
S-COM-4	Solid Fuel Boilers Steam Generators, Process Heaters	2009
S-COM-6A	Small Spark-Ignited Engines and Agricultural Spark-Ignited Engines	2008
S-COM-8	Lime Kilns	2011
S-COM-11	Dryers	2011
S-GOV-6	Prescribed Burning	2008
S-IND-8	Cotton Gins	2009
S-IND-4	Fugitive PM10 Prohibitions (Regulation VIII)	2009
M-OTH-8	Indirect Source Review (ISR) Enhancement	2010
M-OTH-9	Healthy Air Living	TBD
M-OTH-10	Fireworks	2012

ARB staff reviewed the District's rule development commitments and considered comments received regarding further opportunities for emission reductions. On a case-by-case basis, staff considered emission sources, their distribution in the San Joaquin Valley, and the applicability of emission control approaches to the different types of sources. A summary of staff's findings for specific source categories follows:

Glass Melting Furnaces
The Plan includes rule development commitment S-COM-7 with adoption scheduled in the third quarter of 2008. The District has already released a draft rule for public comment and held a public workshop on February 8, 2008. As currently proposed, the rule would result in greater NOx reductions than those estimated in the Plan for S-COM-7, as well as those cited in public comments.

Internal Combustion (IC) Engines
The District's current rule for IC engines is comparable to other IC engine rules in California. The Plan includes rule development commitment S-COM-6 for non-agricultural (non-ag) IC engines, with adoption scheduled in the fourth quarter of 2010. In the ozone plan, S-COM-6 was listed as a feasibility study to be completed in 2012. In addition, the Plan includes feasibility study S-COM-6A for agricultural (ag) IC engines to be conducted in 2008. The District is considering the more stringent South Coast IC Engine Rule 1110.2 which sets requirements in common for both ag and non-ag IC engines, but applies to very few ag IC engines. The cost-effectiveness and feasibility of electrifying all engines will need to be carefully evaluated with consideration of the availability of electricity in some of the more rural areas in the Valley.

Dryers
The District recently adopted a rule for large dryers. In the Plan, the District commits to further studying control options for small dryers in 2011 (feasibility study S-COM-11). Existing control technology may not be applicable to all small dryers. The South Coast Ozone/PM2.5 Plan includes a proposed control measure for small dryers, but considers that pursuing emission reductions as part of a measure requiring facilities to modernize equipment and processes with materials complying with the best available controls would be a better fit.

Large Boilers - rated 5 MMBTU/HR and above
The Plan includes rule development commitment S-COM-1 with adoption in the third quarter of 2008. The District has already released a draft rule for public comment and held a public workshop on March 1, 2008. The draft rule sets NOx emission limits which can be met with Selective Catalytic Reduction or ultra-low NOx burners. As proposed, rule implementation would result in greater reductions than those estimated in the Plan.

Medium Boilers-rated 2-5 MMBTU/HR
The Plan includes rule development commitment S-COM-2 with adoption scheduled in the third quarter of 2008. The District has already released a draft rule for public comment and held a public workshop on March 17, 2008. The draft rule proposes

removing the exemption for school boilers by initially controlling them through an incentive funding program.

Small Boilers-rated 0.75-2 MMBTU/HR
The Plan includes rule development commitment S-COM-3 with adoption scheduled in the fourth quarter of 2009. The District is considering accelerating the replacement of old units by 5 percent and exploring electrification. In the ozone plan, S-COM-3 was listed as a feasibility study to be completed in 2010.

Solid Fueled Boilers
The Plan includes feasibility study S-COM-4 to be conducted in 2009. The Valley sources currently operate with selective non-catalytic reduction with ammonia injection. The District will consider emission limits in the Sacramento AQMD rule, as previously recommended by ARB staff, and will evaluate the applicability of Selective Catalytic Reduction.

Prescribed Burning
The San Joaquin Valley's existing Smoke Management Program does not allow agricultural field burns to occur when air quality is forecasted to be unhealthy. The Plan includes feasibility study S-GOV-6 to be completed in 2008. As part of the study, the District will analyze incentive options and will examine alternatives to burning.

Wood Burning Fireplaces and Wood Burning Heaters
The Plan includes rule development commitment S-COM-14 with adoption scheduled in the third quarter of 2009. The District is considering strengthening the rule by lowering the threshold of their mandatory curtailment program. The current rule has been pivotal in reducing the PM2.5 impacts of residential burning and key to the Valley attaining the federal PM10 standard.

Other suggestions were to also address VOCs and fugitive dust control measures. However, reductions in VOC emissions are not effective in reducing PM2.5 concentrations in the Valley. Photochemical modeling analyses conducted in support of the Plan show that the secondary organic component contributes less than 0.5 percent to the organic carbon fraction of PM2.5. In addition, more recent precursor sensitivity analyses show that ammonium nitrate formation is not VOC, but rather NOx limited. As mentioned earlier, chemical composition analyses of ambient air quality monitoring samples show that dust is a small component of measured PM2.5 and therefore, dust controls would not be effective in accelerating PM2.5 attainment. However, it remains useful to conduct feasibility studies to gather better information on dust emitting sources.

b. Incentive-based Strategies

In the attainment demonstration, the SJV 2008 PM2.5 Plan also includes emission reduction benefits of District incentive programs for which funding has been secured. As part of the 2007 Ozone Plan, the District committed to specific incentive-based NOx reductions in 2012, 2020 and 2023. The SJV 2008 PM2.5 Plan takes credit for the

2012 emission reduction commitment of 1.4 tpd NOx. These emission reductions are funded through a combination of Indirect Source Review fees, Developer Mitigation Contract fees, and Department of Motor Vehicle Surcharge fees. Carl Moyer Program reductions are not credited here, as they are included in the ARB baseline emission adjustments.

In addition, the District lists potential future incentive funding that can be used for air quality programs and may lead to "SIP creditable" emission reductions. Among these is the Proposition 1B: Goods Movement Emission Reduction Program. On February 28, 2008, ARB approved the first distribution of the funds under this program.

2. Adopted State Strategy

Cleaning up the mobile source NOx and PM2.5 sources is the most critical component of the State's emission control effort to reduce PM2.5 concentrations in the Valley. Vehicles and equipment operating in California are subject to the most stringent tailpipe emission standards in the world. ARB has a long history of adopting successful programs to reduce emissions from mobile sources. These regulations will result in fewer emissions as vehicles and equipment units meeting the cleanest emission standards enter into service. However, the benefits of these cleanest engines are only realized as new engines enter service and older engines are retired, and diesel engines have very long useful lives.

On September 27, 2007, ARB adopted the 2007 State Strategy to achieve new emission reductions needed to bring areas of the State into attainment of both the federal PM2.5 and ozone air quality standards. The commitment for 2014 in the State Strategy includes reductions needed to attain the PM2.5 standards and provide progress towards meeting the ozone standard. The San Joaquin Valley is relying on NOx, SOx, and direct PM2.5 emission reductions for PM2.5 attainment.

Table 9 summarizes the estimated benefits for 2014 in the San Joaquin Valley from the mix of concepts in the 2007 State Strategy. The potential emission reduction benefits of individual measures are provided for informational purposes only. Additional details on the individual measures are available in the 2007 State Strategy, which is available on-line at: http://www.arb.ca.gov/planning/sip/2007sip/2007sip.htm

Table 9. Expected Emission Reductions from 2007 SIP State Strategy (tons per day)

San Joaquin Valley -- 2014

Proposed New State SIP Measures	NOx	ROG	Direct PM2.5	SOx
Passenger Vehicles	**3.8**	**6.5**	**0.1**	**--**
Smog Check Improvements (BAR)	3.3	2.9	0.05	--
Expanded Vehicle Retirement	0.5	0.7	0.01	--
Modifications to Reformulated Gasoline Program	--	2.9	--	--
Heavy-Duty Trucks	**61.4**	**6.4**	**3.6**	**--**
Cleaner In-Use Heavy-Duty Trucks	61.4	6.4	3.6	--
Goods Movement Sources	**7.2**	**0.5**	**0.2**	**--**
Ship Auxiliary Engine Cold Ironing & Clean Technology	--	--	--	--
Cleaner Main Ship Engines and Fuel	--	--	--	--
Port Truck Modernization	--	--	--	--
Accelerated Introduction of Cleaner Line-Haul Locomotives	7.2	0.5	0.2	--
Clean Up Existing Harbor Craft	--	NYQ	--	--
Off-Road Equipment	**3.7**	**0.9**	**0.8**	**--**
Cleaner In-Use Off-Road Equipment (over 25hp)	3.7	0.9	0.8	--
Cleaner In-Use Agricultural Equipment	NYQ	NYQ	NYQ	--
Other Off-Road Sources	**0.1**	**3.5**	**--**	**--**
New Emission Standards for Recreational Boats	0.1	1.3	--	--
Expanded Off-Road Rec. Vehicle Emission Standards	--	2.2	--	--
Additional Evaporative Emission Standards	--	NYQ	--	NYQ
Vapor Recovery for Above Ground Storage Tanks	--	NYQ	--	NYQ
Areawide Sources	**--**	**5.7**	**--**	**--**
Consumer Products Program	--	3.2	--	--
Pesticides: DPR Regulation	--	2.5	--	--
Reductions from Proposed New State Measures	**76**	**23**	**5**	**0**
Reductions from Adopted State Measures	**211**	**49**	**7**	**0**
Total Emission Reductions from State Strategy	**287**	**72**	**12**	**0**

NYQ = Not Yet Quantified. BAR = Bureau of Automotive Repair. DPR = Dept. of Pesticide Regulation
Locomotives measure relies on U.S. EPA's rulemaking and industry agreement to accelerate fleet turnover.
Note: Emission reductions reflect the combined impact of regulations and supportive incentive programs. Emission reduction estimates for each proposed measure are shown for informational purposes only. Actual emission reductions from any particular measure may be greater than or less than the amounts shown.

E. Reasonable Further Progress

The Act requires SIPs to provide for steady progress in reducing emissions during the years leading to the attainment date. This requirement provides a way to ensure continuous reductions prior to the attainment date. For PM2.5, U.S. EPA requires that the RFP plan show generally linear progress[7] for the precursor pollutants identified in the attainment demonstration, in this case, direct PM2.5, NOx, and SOx. Since the Valley will be in attainment in 2014, 2009 and 2012 are milestone years for RFP. Table 10 shows projected emission levels, showing continuous progress towards the attainment levels.

Table 10. Projected Emission Levels in Milestone Years
(in tpd)

Milestone Year	Direct PM2.5	NOx	SOx
2005	86.0	575.4	26.4
2009	78.2	498.5	22.9
2012	70.3	415.8	22.9
2014	63.3	291.2	23.6

The SJV 2008 PM2.5 Plan meets RFP by achieving generally linear emission reductions towards attainment in 2014 for direct PM2.5 and NOx from the 2005 baseline year through the milestone years 2009 and 2012. Percent year decreases in PM2.5 emissions range from 2 to 3 percent and in NOx emissions from 3 to 5 percent. SOx emissions in both milestone years are below the attainment level.

F. Contingency Measures

The Act requires attainment plans to provide for contingency measures in the event the nonattainment area fails to make RFP or fails to attain the PM2.5 standard by its attainment date. These contingency measures are to take effect without further ARB or District action. U.S. EPA has interpreted this to mean that the contingency measures must be from the pool of already adopted measures. The PM2.5 implementation rule language does not require any set percent of emission reductions for contingencies[8].

ARB's on-going mobile source program and the new measures in the State Strategy will achieve the bulk of the emission reductions needed to attain the standards in the San Joaquin Valley. Historically, ARB's mobile source program has been very successful in reducing emissions in the Valley and throughout California. In addition, ARB has a well established record of adopting and implementing mobile source regulations on time. The methods used in the SJV 2008 PM2.5 Plan to calculate emission reductions needed to meet the RFP goals withheld reductions from the

[7] 72 FR 20633
[8] 72 FR 20667

on-going mobile source control program as contingencies (SJV 2008 PM2.5 Plan, Chapter 8). For 2009 and 2012 RFP, 1 percent of PM2.5 and 3 percent of NOx baseline emissions are being reserved as contingencies, which result in reductions of about 1 tpd of PM2.5 and about 17 tpd of NOx. For attainment, the 2015 baseline emission reductions are relied upon to meet the contingency requirements. For NOx, baseline emission reductions provide for an additional 21 tpd in 2015. Between 2015 and 2017, an additional 60 tpd of additional NOx reductions will be achieved for contingency purposes.

The District supplements these contingency reductions with two additional contingency measures. These measures rely on fee- and incentive-based funding that the District will spend to achieve emission reductions. Funding sources include the federally-mandated 1-hour ozone nonattainment fee and incentive programs such as the Carl Moyer Program and Proposition 1B.

G. Reasonably Available Control Measure Analysis

Section 172 (c) of the Act requires each nonattainment area to demonstrate that it has adopted all reasonably available control measures (RACM), including reasonably available control technologies (RACT) for stationary sources, necessary to show that it will attain the federal standards as expeditiously as practicable and to meet RFP requirements. RACM and RACT are those measures that are technologically and economically feasible within the nonattainment area. As part of the RACM/RACT demonstration, the District must show that there are no additional reasonable measures available to the District that, when considered in aggregate, would advance the attainment date by at least one year. In PM2.5 plans, the RACM/RACT analysis must address direct PM2.5, NOx and SOx.

1. District RACM

The SJV 2008 PM2.5 Plan includes the District's RACM and RACT demonstration for direct PM2.5, NOx and SOx. The District followed U.S. EPA guidance for evaluating potential control measures as RACM. This RACM demonstration includes a comparison of stationary source measures the District has implemented or plans to implement with U.S. EPA's list of suggested PM2.5 control measures. A detailed description of the District's RACM analysis is found in Chapter 6 of the Plan. ARB staff has reviewed the analysis and concurs that the federal RACM/RACT requirement is met.

2. Metropolitan Planning Organizations RACM

Following U.S. EPA guidance in their RACM analysis, the Valley's Metropolitan Planning Organizations (MPO's) conducted a review of Transportation Control Measures (TCMs) for possible consideration as local RACM. The analysis built on the MPO's previous RACM analysis for the 2007 Ozone Plan and focused on NOx. The analysis found that the potential TCMs identified will not advance PM2.5 attainment by a

full year, thus the SJV 2008 PM2.5 Plan does not include commitments to adopt any TCM.

H. Transportation Conformity Budgets

Under section 176(c) of the Act, transportation activities that receive federal funding or approval must be fully consistent with the SIP. U.S. EPA's transportation conformity rule[9] details requirements for establishing motor vehicle emission budgets (budgets) in SIPs for the purpose of ensuring the conformity of transportation plans and programs with the SIP. The budgets act as a "ceiling" for future on-road mobile source emissions. Exceedances of the budgets indicate an inconsistency with the SIP, and could jeopardize the flow of federal funds for transportation improvements in the region. Transportation agencies compare projected regional on-road mobile source emissions to these budgets during the periodic updates of regional transportation plans and programs.

The SJV 2008 PM2.5 Plan establishes county-level on-road motor vehicle emission budgets for each milestone year, as well as for the attainment year (Table 11). Emission budgets for direct PM2.5 and the PM2.5 precursor NOx, were calculated using EMFAC2007 and reflect annual average emissions. Detailed calculations used to derive the transportation conformity budgets can be found in Chapter 7 and Appendix C of the SJV 2008 PM2.5 Plan. The emission budgets established in the SJV 2008 PM2.5 Plan fulfill the requirements of the Act and U.S. EPA regulations to ensure that transportation projects will not interfere with progress and attainment of the annual PM2.5 standard.

[9] U.S. EPA maintains online information on its transportation conformity program, including access to relevant rulemakings, policy guidance, and reports at: http://www.epa.gov/otaq/transp/traqconf.htm

Table 11. Transportation Conformity Budgets
(tons per annual average day)

County	2009		2012		2014	
	PM2.5 (tpd)	**NOx** (tpd)	**PM2.5** (tpd)	**NOx** (tpd)	**PM2.5** (tpd)	**NOx** (tpd)
Fresno	2.2	56.5	1.9	44.2	1.1	26.0
Kern (SJV)	3.4	87.7	3.0	74.2	1.4	41.6
Kings	0.7	17.9	0.6	14.6	0.3	8.1
Madera	0.6	14.1	0.5	11.4	0.3	6.7
Merced	1.5	33.6	1.2	26.7	0.6	14.8
San Joaquin	1.6	39.1	1.4	32.8	0.9	20.3
Stanislaus	1.0	25.8	0.9	20.8	0.5	12.4
Tulare	0.9	23.3	0.8	19.5	0.5	12.2

I. Environmental Impacts

The California Environmental Quality Act (CEQA) requires that State and local agency projects be assessed for potential significant environmental impacts. Air quality plans are "projects" that are potentially subject to CEQA requirements. The District staff found that the Plan would not have a significant effect on the environment and prepared an Initial Study/Negative Declaration. The District Governing Board approved this Initial Study/Negative Declaration on April 30, 2008.

IV. STAFF RECOMMENDATION

We recommend that the Board take the following actions:

1. Adopt the SJV 2008 PM2.5 Plan, including the emission inventory, local control strategy, attainment demonstration, attainment deadline request, reasonable further progress plan, contingency measures, RACT/RACM demonstration, transportation conformity emission budgets, and the commitment to conduct a mid-course review, as a revision to the California SIP

2. Direct the Executive Officer to submit the SJV 2008 PM2.5 Plan to U.S. EPA as a revision to the California SIP.