San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

2008 PM2.5 Plan Progress Report

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HEALTHY AIR LIVING™

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2008 PM2.5 Plan Progress Report

Executive Summary

The San Joaquin Valley Air Pollution Control District (District) Governing Board adopted the *2008 PM2.5 Plan* on April 30, 2008. This aggressive plan built upon the District's public process, the comprehensive strategy adopted in the District's *2007 Ozone Plan,* and extensive science to bring the Valley into attainment of the 1997 National Ambient Air Quality Standards (NAAQS) for PM2.5 (particulate matter that is 2.5 microns or less in diameter). This Progress Report documents the District's and stakeholders' efforts to implement the PM2.5 plan strategy and corresponding air quality trends and progress.

Since the plan was adopted, the District has made significant progress implementing its multi-faceted control strategy, which affects a wide range of sources. The District has implemented innovative new rules, such as the Employer Based Trip Reduction rule, and further strengthened existing rules, such as the Agricultural Open Burning rule. In aggregate, the District's adopted control measures surpass reduction commitments from the plan (see Section 2). These reductions come to fruition through the significant investments made by Valley businesses to comply with District rules. The general public has also played an important role in bringing continued air quality improvements to the Valley through compliance with the District's wood burning rule and wood burning prohibitions, and by participating in the District's Healthy Air Living outreach program, which empowers individuals and organizations to make air quality a priority in daily decision making.

The District's voluntary incentive programs also play a critical role in the *2008 PM2.5 Plan's* multi-faceted strategy by accelerating and achieving significant additional emissions reductions. The District continues to actively pursue new funding sources and develop new incentive programs, such as the expedited Voucher Incentive Program (VIP), the Technology Advancement Program (TAP), and other programs. Since inception, the District has awarded more than $300 million in incentives, resulting in more than 75,000 tons of lifetime emissions reductions.

The District has conducted a thorough evaluation of PM2.5 trends in the Valley to better understand areas of air quality improvement as well as issues that limited air quality improvements. In the months immediately following PM2.5 plan adoption, in the summer and fall of 2008, wildfires impacted much of California, burning over a million acres and causing unprecedented levels of PM2.5 and ozone throughout the state. The Valley's annual average PM2.5 concentration was elevated in 2008 as a result. However, due to the District's wood burning curtailments and the public's compliance with these prohibitions, the Valley continues to experience cleaner winters, with more "Good" air quality index (AQI) days and fewer "Unhealthy" AQI days in each of the last three wood burning seasons. Wood burning prohibitions reduce emissions of some of the most health-impacting particles when and where these reductions are most needed. As a result, Valley residents are experiencing better air quality due to implementation of the *2008 PM2.5 Plan* and the involvement of the general public.

Past successes like the wood burning rule give us confidence that future efforts will continue to be effective. However, many air quality challenges remain for the Valley. The Valley's bowl-shaped topography and consistently-stagnant weather patterns exacerbate the formation and retention of high levels of air pollution. About 80% of the Valley's NOx emissions are generated by on-road and off-road mobile sources, yet the District does not have direct jurisdiction over these sources. These existing challenges will continue under increasingly stringent and more health-protective federal standards. The District is in the process of preparing the *2012 PM2.5 Attainment Plan* for the 2006 PM2.5 NAAQS (described in Section 4), and EPA is expected to adopt a revised PM2.5 NAAQS in 2011. The District has already implemented several generations of emissions control measures on stationary sources, and there are not many available or foreseeable opportunities remaining for new control measure commitments. As PM2.5 standards become increasingly stringent, the District will pursue a multi-faceted, risk-based approach to prioritize control measures that maximize health benefits while assuring expeditious attainment.

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The San Joaquin Valley Air Pollution Control District (District) prepared this *2008 PM2.5 Plan Progress Report* (Progress Report) to demonstrate to EPA and to the public that the District has met its *2008 PM2.5 Plan* commitments and that the San Joaquin Valley's (Valley) air quality for PM2.5 (particulate matter that is 2.5 microns or less in diameter) is improving under plan implementation. This Progress Report demonstrates that the District's efforts, along with the Valley's business and resident efforts, have reduced direct PM2.5 and PM2.5 precursor emissions. These reductions correspond to a continued downward trend of ambient PM2.5 concentrations.

This report is to be forwarded to the California Air Resources Board (ARB) for submittal to the United States Environmental Protection Agency (EPA). In addition, in April 2011, ARB will update the state strategy, also to be submitted to EPA.

1.1 PM2.5 in the San Joaquin Valley

Under current regulations, particulate matter (PM) is differentiated by particle size. PM2.5 can be inhaled deep into the lungs, where it can be absorbed into the bloodstream or remain embedded for long periods of time without being exhaled. Numerous studies link PM2.5 to a variety of health effects, including (but not limited to) aggravated asthma, coughing, decreased lung function in children, chronic bronchitis, and premature death. The chemical species of PM2.5 can be a factor in the type and severity of health impacts. However, the U.S. Environmental Protection Agency's (EPA) health-based standards are currently mass-based standards. The National Ambient Air Quality Standards (NAAQS) for PM2.5, as set in 1997, are 65 $\mu g/m^3$ for 24-hour average concentrations and 15 $\mu g/m^3$ for annual average concentrations. EPA designated the Valley as nonattainment of the 1997 PM2.5 NAAQS in 2005.

PM2.5 can be emitted directly, or secondary PM2.5 can form in the atmosphere through the reactions of precursors, such as oxides of nitrogen (NOx), sulfur dioxide (SO_2), and, in some areas, volatile organic compounds (VOCs) and ammonia. The San Joaquin Valley's topography and meteorological conditions create an environment that naturally exacerbates the formation and retention of PM2.5. The Valley's population growth and the District's jurisdictional limits also add to the Valley's PM2.5 challenges.

1.2 The 2008 PM2.5 Plan

The District Governing Board adopted the *2008 PM2.5 Plan* on April 30, 2008. This aggressive plan built on the far-reaching strategy developed for the District's *2007 Ozone Plan* and is a continuation of the District's comprehensive strategy to improve the air quality in the San Joaquin Valley. The *2008 PM2.5 Plan* addressed directly-emitted PM2.5 as well as precursors found to significantly contribute to PM2.5 concentrations in the Valley. Due to the Valley's wintertime ambient conditions and atmospheric chemistry, and because of the magnitude of the Valley's NOx inventory, NOx reductions are especially critical to the Valley's PM2.5 attainment.

The California Regional Particulate Air Quality Study (CRPAQS) provided the scientific foundation for *2008 PM2.5 Plan* modeling and analysis. This $30 million study program has been an inter-agency effort with involvement from the California Air Resources Board (ARB), EPA, the District, other air districts, research institutions, and independent researchers, and it has generated dozens of presentations, reports, and peer-reviewed papers. CRPAQS confirmed that NOx and SO_2 are significant PM2.5 precursors in the Valley, while reductions in VOC and ammonia are not effective for significantly reducing the Valley's PM2.5 concentrations. CRPAQS results incorporated into the *2008 PM2.5 Plan's* thorough weight-of-evidence analysis confirmed the effectiveness of the District's and ARB's control strategy, which emphasizes NOx reductions while also achieving reductions of SO_2 and directly emitted PM2.5.

NOx reductions in the Valley contribute to both PM2.5 and ozone air quality improvements. However, more than 80% of the Valley's NOx emissions are generated by mobile sources, which are beyond the District's direct jurisdiction. The District's NOx strategy has thus been a multi-faceted approach coupling both regulatory and non-regulatory strategies. This approach maximizes emissions reductions to expedite attainment of health-based air quality standards for both PM2.5 and ozone.

With its extensive science and far-reaching control strategy, the *2008 PM2.5 Plan* ensures continuous progress towards the EPA's health-based air quality standards and expeditious attainment of the 1997 PM2.5 NAAQS by April 5, 2015, based on 2012, 2013, and 2014 data.

On November 30, 2010 (75 *Federal Register* 74518-74543), EPA proposed a limited approval and limited disapproval of the *2008 PM2.5 Plan*. The District and ARB submitted extensive documentation and comments to EPA regarding the disapproval issues raised. The District believes that the collective comments from the District and the State of California (available in Appendix B) fully address the issues EPA identified in its proposed disapproval.
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The District has committed to one of the nation's the most aggressive rule development schedules to meet its 2007 *Ozone Plan* and *2008 PM2.5 Plan* attainment goals. The District's four-faceted control strategy, as discussed in the *2007 Ozone Plan* and *2008 PM2.5 Plan*, includes:

- Regulatory control measures
- Incentive-based strategies
- Innovative Strategies and Programs
- Local, State, and Federal Sources/Partnerships

This section discusses the District's progress in implementing control measure commitments of the *2008 PM2.5 Plan* and shows that in aggregate, District control measures achieve more emissions reductions than were anticipated at the time of the *2008 PM2.5 Plan*. This section also discusses the incentive-based strategies and other innovative programs that supplement the District's traditional regulatory efforts and generate more emissions reductions than could otherwise be reasonably obtained.

2.1 A Summary of Adopted District Control Measures

The *2008 PM2.5 Plan* adopted by the District Governing Board was a robust and comprehensive attainment plan that included a combination of technologically feasible and technology forcing measures. Of the thirteen District regulatory control measure commitments in the plan, the District has adopted eleven to date (Table 2-1).

The *2008 PM2.5 Plan* identifies control measures, expected emissions reductions, and a schedule for the implementation of such measures. During control measure development, District staff works closely with stakeholders, ARB, EPA, and other interested parties to discuss concerns, examine possible impacts, and uncover mitigation strategies that will protect both the health and economic strength of the Valley. During this process, the scope and structure of control measures can evolve from their original plan commitments. Table 2-2 summarizes District rules adopted or amended consistent with the *2008 PM2.5 Plan* along with corresponding emission reductions. Table 2-2 shows that the District's adopted control measures achieve more PM2.5 equivalent reductions than committed to in the *2008 PM2.5 Plan.* More details on each control measure are available in Appendix C of this Progress Report.

Table 2-1 Regulatory Control Measure Commitments from the *2008 PM2.5 Plan*

Control Measure #	Control Measure	Rule #	Completion
Completed Rules			
S-COM-5	Stationary Gas Turbines	4703	2007
S-COM-1	Large Boilers	4306/4320	2008
S-COM-2	Medium Boilers	4307	2008
S-COM-7	Glass Melting Furnaces	4354	2008
S-COM-9	Residential Water Heaters	4902	2009
S-IND-9	Commercial Charbroiling	4692	2009
S-COM-11	Wood Burning Fireplaces and Heaters	4901	2009
S-COM-3	Small Boilers	4308	2009
M-TRAN-1	Employer-Based Trip Reduction	9410	2009
S-AGR-1	Open Burning	4103	2010
Remaining Rule Commitments			
S-COM-6	Reciprocating Internal Combustion Engines	4702	2011
S-COM-10	Natural, gas-Fired, Fan-Type Residential Central Furnaces	4905	2014

Table 2-2 Reductions Achieved by Adopted *2008 PM2.5 Plan* Rules

Control Measure	Rule #	*2008 PM2.5 Plan* Projections (tons per day)				Actual Reductions (tons per day)			
		PM2.5	NOx[1]	SOx[2]	PM2.5 Equivalent[1, 2]	PM2.5	NOx[1]	SOx[2]	PM2.5 Equivalent[1, 2]
Stationary Gas Turbines	4703	0	2.21	0	0.25	0	2.20	0	0.24
Large Boilers	4306/ 4320	0.24	1.52	0.76	1.17	0.24	1.60	1.92	2.34
Medium Boilers	4307	0	0	0	0.00	0	1.29	0	0.14
Glass Melting Furnaces	4354	0	1.58	0	0.18	0	3.64	1.62	2.02
Residential Water Heaters	4902	0	0.40	0	0.04	0	0.50	0	0.06
Commercial Charbroiling	4692	2.28	0	0	2.28	0.87	0	0	0.87
Wood Burning Fireplaces and Heaters	4901	0.69	0.06	0.02	0.72	1.08	0.12	0.02	1.11
Small Boilers	4308	0	0.55	0	0.06	0	1.45	0	0.16
Employer-Based Trip Reduction	9410	0	0	0	0.00	0.03	0.33	0	0.07
Open Burning	4103	3.49	2.65	0.14	3.92	2.91	1.87	0.05	3.17
Totals as PM2.5 equivalent		---			8.62	---			10.18
PM2.5 equivalent reductions achieved beyond Plan commitment		**1.57 tons per day**							

[1] 9.0 tons of NOx per ton of PM2.5. Based on the worst-case annual average interpollutant ratio provided by ARB. The ratios used for permitting acts can be lower during PM2.5 season when NOx predominantly acts as a PM2.5 precursor.
[2] 1.0 ton of SOx per ton of PM2.5

2.2 Feasibility Studies

The *2008 PM2.5 Plan* included commitments to conduct several Feasibility Studies in cases where there was insufficient information available to determine the feasibility or effectiveness the potential control measures at the time of plan adoption. The goal of a Feasibility Study is to determine whether an emissions source is significant enough to

warrant a control measure and whether there are technically and economically sound control technologies or practices available. The Feasibility Study will help determine whether a regulation, incentive program, or new advocacy program would reduce pollutant emissions and contribute towards attainment.

The District has completed many of the Feasibility Studies committed to in the *2008 PM2.5 Plan*. The District is continuing work on a few of the studies to allow for more information gathering and analysis. Studies that point toward possible emission reduction opportunities will be included in future attainment plans with specific development schedules and emission reduction commitments. Prior to implementation of any of the preliminary recommendations, the District will undertake a public process, solicit stakeholder input, and take the implementation recommendations to the District's Governing Board in a public meeting for consideration and approval. Table 2-3 summarizes completed Feasibility Studies as well as continuing studies for which the District is establishing a revised completion date. Summaries of each Feasibility Study effort follow.

Table 2-3 2008 PM2.5 Plan Feasibility Studies, Revised Schedule

Control Measure Number	Control Measure Name	
Completed Feasibility Studies		
S-COM-6A	Small Spark-Ignited Engines & Agricultural Spark Ignited Engines	
S-GOV-6	Prescribed Burning	
S-COM-4	Solid Fuel Boilers Steam Generators, Process Heaters	
M-OTH-8	Indirect Source Review (ISR) Enhancement	
S-COM-8	Lime Kilns	
Continuing Feasibility Studies		**Projected Completion Date**
S-IND-4	Fugitive PM10 Prohibitions (Regulation VIII)	2011
S-AGR-2	Conservation Management Practices	2011
S-COM-11	Dryers	2011
S-IND-8	Cotton Gins	2012
M-OTH-10	Fireworks	2012

2.3 Incentives

The District's highly successful incentive program expedites emissions reductions and helps the District achieve emissions reductions from sources that may be beyond the District's regulatory control. Since adoption of the *2008 PM2.5 Plan*, the District has expanded its incentive opportunities even further. New incentive programs include: the California Proposition 1B Goods Movement Emission Reduction Program (Prop 1B); the Lower-Emission School Bus Program; the Diesel Emissions Reduction Act (DERA) National Clean Diesel School Bus Replacement Program; the Technology Advancement Program (TAP); and the Charbroiler Incentive Program. In 2008 through 2010, the District secured more than $117 million to support the implementation of these programs.

Table 2-4 identifies the District-administered incentive programs, including the total funding amount for each program, the number of projects and vehicles or engines that were funded for each program, and the applicable NOx, PM, and VOC emissions reductions attributable to each program. Table 2-5 itemizes the total funding received each year from 1998 through 2010 and the associated surplus emissions reductions each year.

In addition to applying for various funding sources, the District is working with ARB to make the Carl Moyer and the Prop 1B Programs more flexible and streamlined to attract a greater pool of potential projects to fund. Over the last few years, ARB has adopted new rules and regulations that claim emission reductions from sources that participate in the District's incentive programs. As these sources approach compliance deadlines, the opportunities for awarding incentive funds for these projects are reduced. The District and ARB are committed to working within the framework of these regulations to identify opportunities for continued funding. In addition, the District is working with ARB staff to identify new sources and project types for funding consideration.

The District relies on a combination of funding sources to support its comprehensive incentive program. The annual amount of funding available to the District is currently more than $112 million for the 2010-2011 fiscal year. The primary sources of these funds includes expected revenue from the District's Indirect Source Review Rule, voluntary development mitigation agreements, local DMV surcharge fees, the state's Carl Moyer Program, Prop 1B, and various federal funding sources.

In light of past successes and the ongoing need for additional emissions reductions, the District continues to develop new avenues for incentive funding opportunities.

Table 2-4 Incentive Program Totals, 1998 - 2010

Program	# of Projects	# of Vehicles/ Engines	NOx (tons)	VOC (tons)	PM (tons)	District Grant Amount
Agricultural Engine	2,563	5,954	46,436	2,130	1,719	$100,349,917
Agricultural Utility Terrain Vehicle	20	20	NC	NC	NC	$46,681
Alternative Fuel/Hybrid Vehicle Rebate	3	3	NC	NC	NC	$23,665
Bicycle Infrastructure	14	16	11	17	5	$761,433
Car Crushing	203	593	24	37	0	$2,384,022
Commuter Subsidy	186	198	34	41	112	$1,619,630
E-Mobility	9	9	5	5	1	$606,412
Electric Forklift	7	35	30	2	1	$323,213
Infrastructure	15	15	NC	NC	NC	$2,931,913
Lawn Mower	1,338	1,338	NC	NC	NC	$334,500
Light and Medium Duty	38	206	58	102	NC	$421,275
Locomotive	5	29	1,151	64	24	$13,093,912
Off-Road Heavy Duty	651	1,239	8,232	407	263	$43,013,552
Off-Road Forklift	1	5	13	NC	NC	$32,625
On-Road Heavy Duty	247	1,430	5,213	6	473	$33,147,000
On-Road Heavy Duty Prop1B	356	926	8,071	NC	376	$44,765,902
On-Road Heavy Duty VIP	46	46	NC	NC	NC	$1,655,000
School Bus Program	237	1,487	26	NC	NC	$53,563,503
Truck Electrification	1	202	2,634	NC	6	$1,795,000
Wood Stove Change Out	1,164	1,168	NC	NC	276	$735,350
Totals	**7,104**	**14,919**	**71,939**	**2,810**	**3,258**	**$301,604,505**

*NC – not calculated

Table 2-5 Total Annual Incentive Funding 1998 - 2010

Year	# of Projects	# of Vehicles/ Engines	NOx (tons)	VOC (tons)	PM (tons)	Total District Grant Amount
1998	25	126	722	NC	NC	$3,552,537
1999	95	373	3,198	NC	NC	$4,606,091
2000	159	377	3,427	NC	NC	$4,869,698
2001	447	1,099	7,148	NC	682	$13,926,978
2002	398	827	4,656	NC	321	$12,813,174
2003	309	675	5,769	NC	322	$10,018,459
2004	284	913	8,189	NC	282	$11,718,105
2005	286	601	5,171	57	189	$13,096,278
2006	467	1,400	6,643	559	230	$43,377,859
2007	340	1,552	5,914	617	179	$35,154,933
2008	460	1,143	5,035	770	203	$30,536,239
2009	708	1,188	6,245	471	169	$31,824,151
2010	3,126	4,645	9,824	334	683	$86,110,003
Totals	**7,104**	**14,919**	**71,939**	**2,810**	**3,259**	**$301,604,505**

*NC – Not calculated

2.4 Other Innovative Strategies & Programs

Past attainment plans primarily relied on regulatory controls, but new regulatory controls have become increasingly unavailable or cost-prohibitive. The District's need for further reductions must be balanced with the economic sustainability of the Valley. Reaching beyond traditional regulations and incentive programs, the District has been developing innovative strategies and programs to expedite the Valley's air quality improvements and achieve potential "black box" reductions for 8-hour ozone attainment. These innovative strategies are designed to enlist the public, local governments, businesses, and industry as willing contributors to a successful clean air strategy. In many instances, such as reducing energy use and reducing vehicle miles traveled, Valley businesses and residents can also reduce their costs – a "win-win" for the District and the Valley.

Most of the innovative strategies are not yet creditable in the State Implementation Plan (SIP) because they rely on voluntary participation. The implementation of such innovative strategies has led to increased public awareness of air quality issues, increased public participation towards air pollution solutions, and improvement in Valley air quality. This broad spectrum of involvement will be critical in helping the District reach attainment of current and future air quality standards, including attainment of the current 8-hour ozone standard by 2024.

2.4.1 Healthy Air Living

Healthy Air Living is a comprehensive, year-round outreach initiative that provides tools to help individuals and businesses make air quality a priority in their day-to-day choices. Healthy Air Living aims to reduce emissions through a variety of individual and organizational levels: reducing the number of vehicle miles traveled each day through the Valley; reducing emissions during peak smog episodes; reducing emissions created by equipment and processes; and encouraging higher energy efficiency and the development of cleaner energy sources. Healthy Air Living has produced several high-profile, high-participation campaigns, including the Kids for Clean Air pledge card contest and an annual hybrid vehicle giveaway.

2.4.2 Fast Track Measures

The District's 2007 Fast Track Action Plan identified several Fast Track Measures to accelerate the Valley's attainment. These Fast Track Measures include:

- Advanced Emission Reduction Options (AERO)
- Alternative Energy
- Energy Conservation
- Episodic & Regionally-Focused Controls
- Green Contracting
- Green Fleets
- Heat Island Mitigation
- High Speed Rail
- Inland Ports and Short Sea Shipping
- Truck Replacement and Retrofit

See Appendix C for summaries of Fast Track Measure development and implementation.

2.4.3 Technology Advancement Program (TAP)

On March 18, 2010, the District's Governing Board approved the Technology Advancement Program to identify, solicit, and support opportunities to advance and accelerate the deployment of innovative clean air technologies. The District has implemented TAP through a coordinated and collaborative process to engage technology developers and potential end-users.

The District initially allocated $900,000 for the first competitive TAP request for proposals (RFP), then allocated an additional $300,000 to make $1.2 million available. From the proposals submitted, the District selected six projects to demonstrate and accelerate deployment of technologies to reduce directly emitted PM and/or NO_X. The projects funded by the program include:

- Solar thermal energy storage technology to enable zero emission agricultural pumps in remote locations unserved by electrical infrastructure;

- Retrofit drive train systems to upgrade existing refuse trucks to hydraulic hybrid technology;
- Plug-in electric hybrid off-road equipment;
- NOx-reducing catalyst utilizing an 85 percent renewable ethanol blend (E85) as reductant for off-road engines allowing for wider adoption of the technology without diesel emission fluid [urea] infrastructure;
- Advanced selective catalytic reduction system for use on dairy biogas; and
- Innovative gas turbine system with high tolerance for low quality gas, enabling the use of mildly treated landfill gas and biogas.

The District has been working to identify additional funding for technology advancement through available grant and partnership opportunities. The District has been working closely with EPA in developing the Clean Air Technology Initiative, an interagency partnership focused on the development of advanced emission reduction technologies. This partnership has resulted in an additional $400,000 of EPA funding opportunity for of technology advancement. The District has allocated an additional $1 million of local funds in the 2010-11 Budget that may be used for technology advancement projects.

With these funds, the District plans to open a second competitive RFP for new projects in early 2011. Successful outreach during the past year in the course of launching the TAP has considerably expanded awareness of the program with potential technology partners and other agencies. This upcoming funding opportunity is expected to attract significant interest from potential partners.

Through TAP, the District is also active in establishing partnerships and collaborations to leverage the experience and resources of the District into regional technology efforts. The District is collaborating in the Clean Air Technology Initiative, a partnership with the ARB, EPA Region 9, and the South Coast AQMD, to identify technology advancement opportunities and goals. The District is actively forming partnerships with regional universities to build and expand local capacity for research and development in the San Joaquin Valley. The District has also worked in collaboration with South Coast AQMD to co-fund projects to develop prototype natural gas-fired, fan-type central furnaces with reduced NO_X emissions.

This Progress Report evaluates the Valley's ambient PM2.5 concentrations since the adoption of the *2008 PM2.5 Plan*. Under many metrics, Valley PM2.5 data has shown significant improvements. The District conducted extensive analysis of ambient air quality data to better understand the nature of observed improvements and to better understand areas within the data set that have been more resistant to improvement.

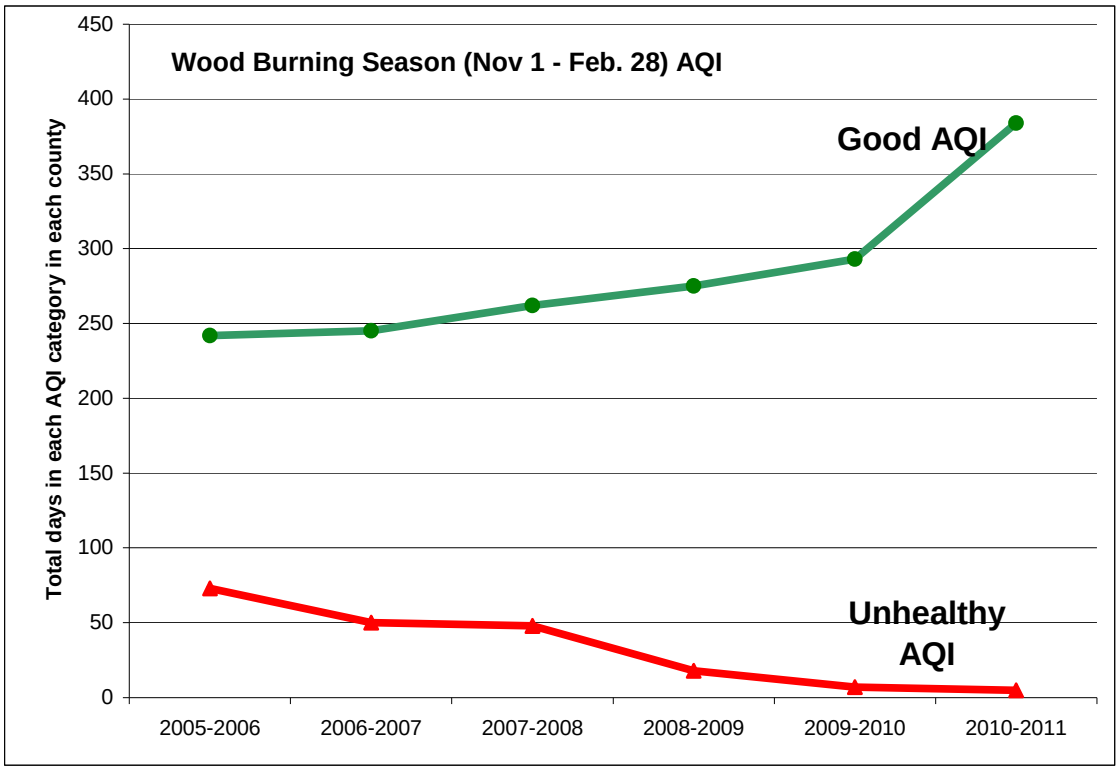
The Valley's ambient PM2.5 concentrations are influenced by a number of factors, including pollutant emissions, natural or exceptional events, and meteorology. The Valley's direct PM2.5 and NOx emissions have decreased significantly since PM2.5 monitoring began in 1999. Many more emissions reductions will be achieved between 2011 and 2015. Emissions decreases achieved thus far are contributing to lower 24-hour and annual average ambient PM2.5 concentrations, indicating general improvement in air quality. The degree of improvement in ambient PM2.5 concentrations varies by site, year, time of year, and time of day. This section is a summary of the District's thorough analysis, which is presented in Appendix A.

3.1 PM2.5 Trends

3.1.1 Winter PM2.5 trends

The Valley's PM2.5 concentrations vary throughout the year. PM2.5 levels are typically highest during the winter months as a result of low-level inversion layers that trap pollution in the atmosphere and increased PM2.5 emissions from residential wood burning and other sources. However, since the *2008 PM2.5 Plan* was adopted, the Valley has experienced some of the cleanest winters on record, thanks in part to District Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters) and associated residential wood burning curtailment days between November 1 and February 28. Under these wood burning prohibitions, and with the public's compliance with these prohibitions, the Valley continues to experience more "Good" air quality index (AQI) days and fewer "Unhealthy" AQI days in the November to February time period (Figure 3-1). Wood burning prohibitions reduce emissions of some of the most health-impacting particles when and where these reductions are most needed. As a result, Valley residents are experiencing better air quality due to implementation of the *2008 PM2.5 Plan* and due to the involvement of the general public.

Figure 3-1 Valley Air Quality Improvements during Wood Burning Season



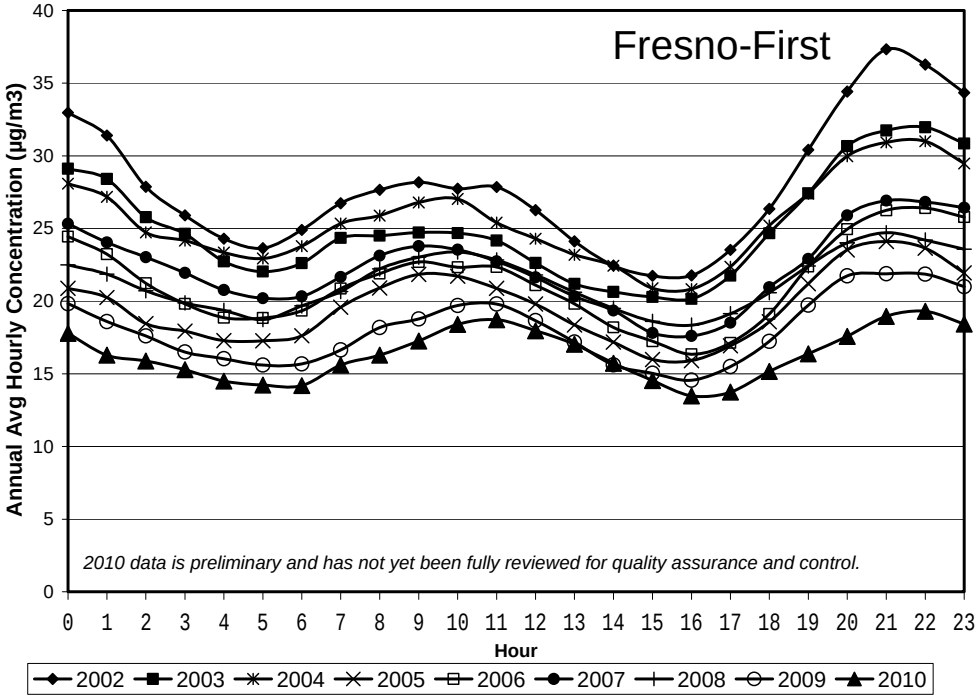
3.1.2 Daily PM2.5 Trends

Many of the Valley's air monitoring sites use real-time PM2.5 monitors, which produce hourly PM2.5 measurements. The District uses this data every day to produce daily air quality forecasting, wood burning prohibitions, public health notifications, and Real-time Air Advisory Network (RAAN) notifications for schools. For this Progress Report, the District compiled long-term diurnal profiles to analyze how PM2.5 concentrations vary throughout the day at each Valley monitoring site. The District found that PM2.5 concentrations generally peak in the early morning and late evening, with lower concentrations during the middle of the day. From year to year, this general pattern has remained consistent for most sites, but the magnitude of peaks have generally decreased to lower PM2.5 concentrations overall.

Two notable exceptions to this typical pattern are sites in Fresno and Corcoran. Data from the Fresno 1st Street site, as shown in Figure 3-2, shows more evening improvement, "flattening" the evening peak. Rule 4901 wood burning prohibitions are most likely generating this progress in evening PM2.5 levels in Fresno.

The profile of measurements from Corcoran, on the other hand, shows the development of a mid-day peak, which is higher than the evening peak in 2009 (see Appendix A). The District will continue to analyze this finding as more data becomes available to determine if there could be new source activity that may be impacting these daily patterns.

Figure 3-2 Average Annual PM2.5 Diurnal Profiles by Year at Fresno-First Monitoring Site



3.1.3 Annual Trends

The District evaluated single-year annual average trends to assess PM2.5 progress and potential issues. Overall, despite some year-to-year variation, the Valley's annual average PM2.5 concentrations are decreasing. In 2010, only two Valley monitoring sites had annual average PM2.5 concentrations above the level of the annual NAAQS of 15 µg/m³. In contrast, in 2005, eight Valley monitoring sites had annual average PM2.5 concentrations above the NAAQS, and in 2000, all Valley monitoring sites had annual averages PM2.5 concentrations above the NAAQS. See Appendix A for more information on annual averages.

3.2 Design values

Design values are one metric for assessing air quality improvements. Design value calculations are three-year averages that follow EPA protocols for rounding, averaging conventions, determining sufficiency in the number of samples, etc. The results provide consistency and transparency to determine basin-wide attainment for both components of the federal PM2.5 NAAQS: the 24-hour PM2.5 standard of 65 µg/m³, and the annual PM2.5 standard of 15 µg/m³.

Figures 3-3 and 3-4 show improvement in Valley design values. These figures also demonstrate that average ambient PM2.5 concentrations vary by monitoring site within the Valley. In general, monitoring sites in the northern part of the Valley continue to record the lowest ambient PM2.5 concentrations.

Figure 3-3 PM2.5 24-hour Design Value Comparison, 2002 (2000-2002 Average) and 2010 (2008-2010 Average)

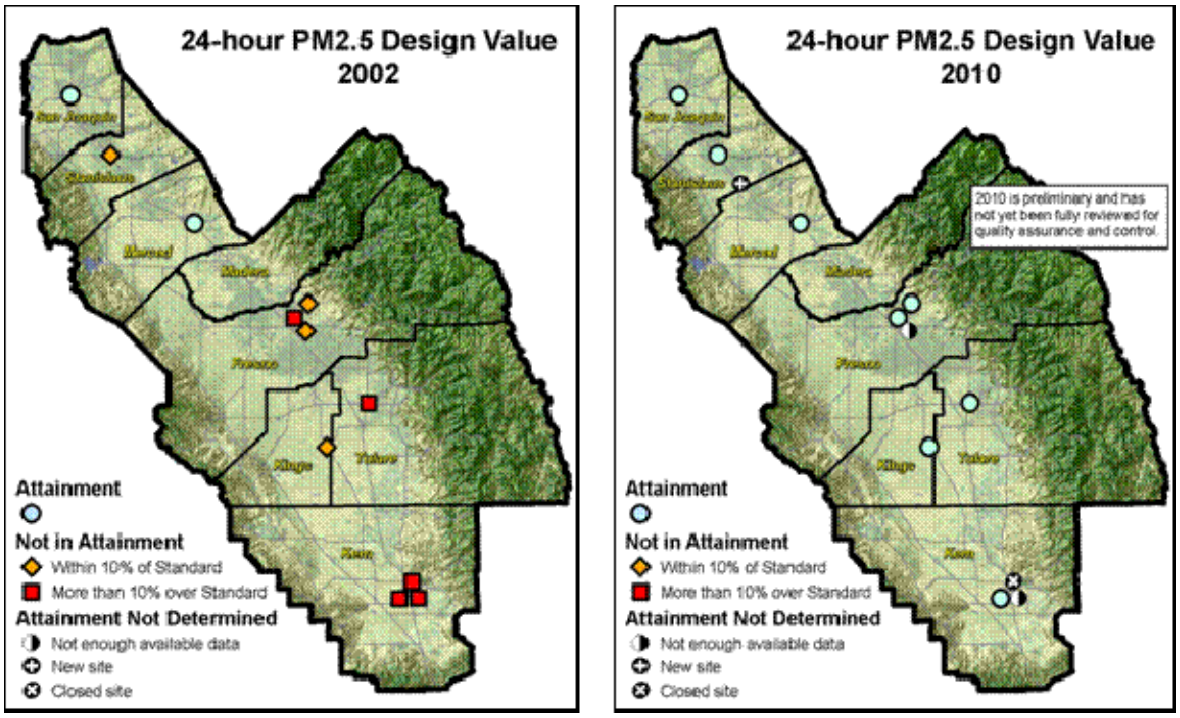
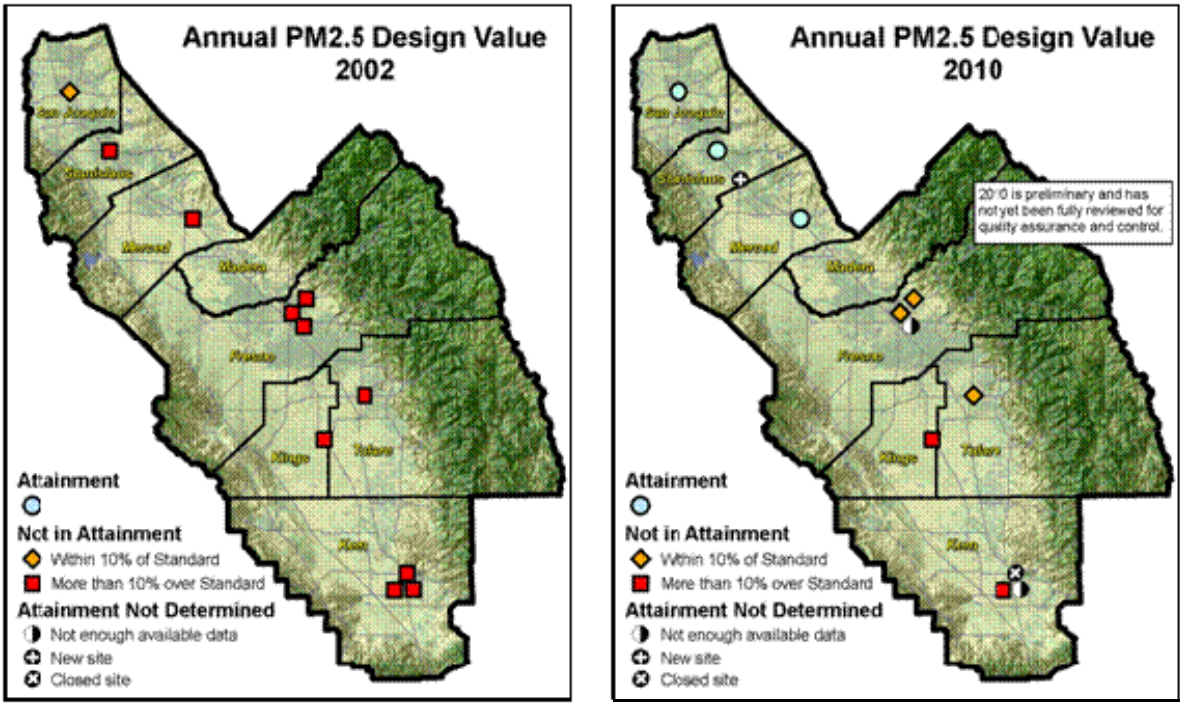


Figure 3-4 Annual PM2.5 Design Value Comparison, 2002 (2000-2002 Average) and 2010 (2008-2010 Average)



Some recent design values do not reflect the expected PM2.5 progress, but design values alone do not necessarily provide for the best or most complete understanding of air quality trends. Analysis shows that a few unusual issues overwhelmed the Valley's significant emissions reductions to impact certain design values. The purpose of this analysis is not to excuse the Valley from additional work to improve air quality, but to better inform the District on what types of additional work will be most effective.

3.2.1 Wildfires

In the summer of 2008, just months after adoption of the *2008 PM2.5 Plan*, California experienced a record number of wildfires, with 5,812 fires burning 1,339,839 acres. The resulting emissions, most from outside the Valley, caused serious public health impacts and unprecedented levels of PM2.5 and ozone in the Valley and throughout the state. These wildfires were natural events, not reasonably preventable or controllable, so it is inappropriate to use 2008 data without recognition of these circumstances. These fires might ordinarily be excluded from official calculations per EPA's Exceptional Events policy, with proper documentation. The District and ARB limit the submittal of documentation for these events, and EPA generally reviews only those requests that will directly affect an area's attainment status.

In its effort to more accurately characterize ambient PM2.5 concentrations for this Progress Report, the District evaluated the Valley's PM2.5 data with careful consideration of exceptional events, including those not formally submitted to EPA. Official design value calculations otherwise include measurements from these events. In annual averages, data influenced by wildfires can mask improvements in PM2.5 concentrations during other times of the year.

3.3 Summary

Design values summarize a site's large amounts of data with just two concentrations: an annual average, and a value representing 24-hour peaks. These parameters are important for attainment determinations, but alone will not reveal all relevant PM2.5 trends. Evaluating multiple measures of air quality can provide a broader picture of overall air quality progress. Appendix A to this Progress Report presents the District's analysis of the Valley's ambient PM2.5 data in greater detail.

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This Progress Report documents the District's significant progress in implementing the *2008 PM2.5 Plan* and its control strategies. The District's efforts and the efforts of Valley businesses and residences are reducing emissions of directly emitted PM2.5 and PM2.5 precursors, and this corresponds to improvements in ambient PM2.5 concentrations. These past successes give us confidence that future efforts will continue to be effective. However, the Valley's air quality challenges remain.

4.1 The Valley's Natural Environment

The Valley's geography and meteorology exacerbate the formation and retention of high levels of air pollution. The Valley is covers about 25,000 square miles and is bounded by the Sierra Nevada on the east, the Tehachapi Mountains on the south, and the Coastal and Temblor Ranges on the west, creating a "horseshoe" valley open to the northwest. This geography, together with consistently stagnant weather patterns, prevents the dispersal of pollutants that accumulate within the Valley.

4.2 Mobile Sources

The Valley's population growth rate is twice as high as the state average. Increased population generally increases vehicle activity and consumer product use, leading to increased pollutant emissions. The region also is home to the state's major arteries for goods and people movement, thereby attracting a large volume of vehicular traffic. Increases in vehicle miles traveled can undermine some of the progress made by regulations.

As discussed in this report, NOx emissions reductions are important to both ozone and PM2.5 attainment in the Valley. About 80% of the Valley's NOx emissions are generated by on-road and off-road mobile sources, yet the District does not have direct jurisdiction over these sources. This limitation increases the District's challenge, but the District has a history of interagency cooperation as well as innovative measures to reduce emissions that are not under the District's regulatory control. The District will continue to call upon local, state, and federal agencies to do their part to support improved air quality and improved public health in the Valley.

4.3 Increasingly stringent standards

The Valley's existing challenges will continue under increasingly stringent and more health-protective federal standards. EPA revised the PM2.5 NAAQS in 2006 while retaining the 1997 NAAQS and its requirements. The *2008 PM2.5 Plan* strategy is contributing to the Valley's progress towards both standards by their respective attainment dates. EPA is expected to issue another revised PM2.5 NAAQS in 2011. These parallel PM2.5 NAAQS are summarized in Table 4-1. The Valley will experience unique and significant difficulties in achieving these increasingly stringent standards, which are encroaching on naturally-occurring background concentrations.

Table 4-1 Summary of PM2.5 NAAQS

PM2.5 NAAQS	NAAQS thresholds		Attainment Plan to EPA	Latest Attainment Date
	24-hour	Annual		
1997 NAAQS	65 µg/m³	15 µg/m³	2008	2015
2006 NAAQS	35 µg/m³	15 µg/m³	2012	2019
2011 NAAQS	*EPA anticipates proposing a revised PM2.5 NAAQS in 2011.*			

4.4 Risk-based Strategy to Maximize Public Health Benefits

The District has already implemented several generations of emissions control measures on stationary sources, and there are not many available or foreseeable opportunities remaining for new control measure commitments. Health-based NAAQS are becoming increasingly stringent, yet remain as mass-based standards that do not account for particle speciation, even though PM health effects vary by species. Taking these factors into account, the District is now pursuing a risk-based strategy to maximize public health benefits while concurrently contributing to the Valley's progress towards the mass-based standards.

Through a risk-based strategy, the District can prioritize control measures and programs that reduce the most health-impacting PM2.5 species while reducing overall PM2.5 concentrations. For example, the Valley's ambient PM2.5 concentrations are predominately secondary ammonium nitrate, which does not impact public health as much as other types of PM2.5. In contrast, directly emitted PM associated with urban areas and roadways seem to be the most health-impacting.

As the risk-based approach is implemented, the District will continue to review existing health studies and support new studies to identify the most health-impacting PM species. The District will be increasingly better equipped to develop regulatory and incentives strategies that place higher priority on reducing pollutant species that most impact public health. The District may also be able to dedicate Technology Advancement Program (see Section 2.5.3) funds toward efforts that will decrease the most health-impacting emissions.

Several of the District's rules already reduce emissions reductions from more health-impacting pollutant sources. As discussed in Section 3 and Appendix C of this Progress Report, District Rule 4901, Wood Burning Fireplaces and Wood Burning Heaters, has been reducing harmful species of PM2.5 when and where those reductions are most needed: in urbanized areas when air quality is forecast to limit PM dispersion. District Rule 9310, School Bus Fleets, is decreasing emissions from older school buses, reducing children's exposure to these particles and reducing PM concentrations in urban areas.

District incentive programs also contribute to a risk-based approach. The Fireplace Change-out Program and the School Bus Grant Program have accelerated or supplemented emissions reductions associated with their respective rules. Through the District's popular Clean Green Yard Machine grant program, the District has replaced over 2,000 high-polluting gas-powered lawn mowers with cleaner electric mowers, decreasing the localized health risks associated with the use of gas-powered lawn and garden equipment, particularly in urban areas where use of this equipment is pervasive.

The District's information and educational programs also contribute to the risk-based strategy. The Air Quality Flag Program provides daily county-by-county air quality notification to participating schools throughout the Valley. In 2010, the District developed the Real-Time Air Quality Advisory Network (RAAN) as an innovative new tool to provide hourly air-quality information to Valley schools. RAAN alerts subscribing school staff, parents, and other interested parties via email when the hourly ozone or PM levels increase or decrease significantly, based on monitors closest to their school, enabling schools to modify sports and physical activities in light of current local air quality as appropriate.

As PM2.5 standards become increasingly stringent, the District's multi-faceted, risk-based approach can help the Valley maximize health benefits while assuring expeditious attainment. This Progress Report shows that the Valley continues to make progress towards EPA's health-based air quality standards for PM2.5. There are more opportunities to improve the Valley's PM2.5 levels, as ARB and the District implement recent control measures and continue laying the groundwork to develop the District's *2012 PM2.5 Attainment Plan* (for the 2006 PM2.5 NAAQS). The progress documented in this report is to be continued.

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