Appendix A: Analysis of Ambient Air Quality

This Progress Report evaluates the San Joaquin Valley's (Valley) ambient PM2.5 concentrations since the *2008 PM2.5 Plan* through a variety of metrics. The District conducted extensive analysis of ambient air quality data to better understand the nature of observed improvements as well as areas within the data set that have been more resistant to improvement. This Appendix presents the District's thorough analysis, which was summarized in Section 3 of this Progress Report.

PM2.5 monitoring began in 1999. The Valley's PM2.5 monitoring network is reviewed and described in the District's Annual Monitoring Network Plans.[1] The District uses ambient air quality data as maintained in EPA's Air Quality System (AQS),[2] the official repository for ambient air quality data. Copies of official PM2.5 data and design value reports are available upon request. PM2.5 data from 2010 are preliminary as of the time of these analyses. Data certification for 2010 will be complete in mid-2011. Where possible and applicable, the District includes 2010 data throughout this appendix.

A.1 Design Values

Design values are one metric for assessing air quality improvements. Design value calculations are three-year averages that follow U.S. Environmental Protection Agency (EPA) protocols for rounding, averaging conventions, determining sufficiency in the number of samples, etc. The *2008 PM2.5 Plan* more fully describes this protocol. 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 $\mu g/m^3$, and the annual PM2.5 standard of 15 $\mu g/m^3$. If any monitoring site within the air basin has either a 24-hour or annual PM2.5 design value higher than the respective standard, then the entire air basin is designated nonattainment. The *2008 PM2.5 Plan* demonstrated that all Valley sites will attain the 1997 PM2.5 NAAQS by 2015.

Table A-1 shows single-year, 98th percentile averages, and these values are used to generate the three-year average 24-hour design values in Table A-2. This data is shown graphically in Figure A-1 and A-3. Bakersfield's 24-hour design values have increased slightly to levels just above the 24-hour standard. As described in Section 3 of this Progress Report, and as will be documented in this Appendix, wildfires and data handling contribute to Bakersfield's resistant 24-hour design values.

Table A-3 shows single-year average PM2.5 concentrations, and these values are used to generate the three-year average annual design values in Table A-4. This data is shown graphically in Figures A-2 and A-4. Most Valley air monitoring sites do not meet the annual PM2.5 standard. The *2008 PM2.5 Plan* identified the annual PM2.5

[1] For more details on the San Joaquin Valley air monitoring sites, refer to San Joaquin Valley Air Pollution Control District Ambient Air Monitoring Network Plan, June 30, 2010
http://www.valleyair.org/aqinfo/Docs/02%20FINAL%202010%20monitoring%20network%20plan.pdf
[2] U.S. Environmental Protection Agency. Technology Transfer Network; Air Quality System: *AQS Web Application.* Retrieved from website: http://www.epa.gov/ttn/airs/airsaqs/aqsweb/

standard of 15 µg/m³ as the primary progress indicator, since this will be the more challenging component of the NAAQS for the Valley to attain.

Average ambient PM2.5 concentrations vary by monitoring site within the Valley. In general, monitoring sites in the northern part of the Valley record the lowest ambient PM2.5 concentrations. The Bakersfield-Planz monitoring site was the design site in the *2008 PM2.5 Plan*, meaning it was the site with the highest PM2.5 design values based on 2004-2006 data. Most of the Valley's annual PM2.5 design values have decreased from their 2004-2006 levels, and all of the Valley's annual PM2.5 design values have decreased since PM2.5 monitoring began. Section A-2 of this Appendix presents several caveats to consider in interpreting design values.

Evaluating multiple measures of air quality can provide a broader picture of overall air quality progress. Single-year averages (Tables A-1 and A-3) were lower in 2010 than in 2007 for every monitoring site and for both annual and 24-hour NAAQS levels. Also, in 2010, only two Valley monitoring sites had annual averages above 15 µg/m³, compared to nine monitoring sites above this level in 2008 and all sites above this level in 2000.

As noted in ARB's *Progress Report on Implementation of PM2.5 SIPs for the South Coast and San Joaquin Valley Air Basins and Proposed SIP Revisions*, adopted on April 28, 2011, between 2001 and 2010, the number of days considered unhealthy under the Air Quality Index (AQI) in the Valley has been cut in half (page 12 of ARB's Progress Report; see also Section 3.1.1 of the District's Progress Report). As explained in section A-3 of this Appendix (and Section 3 of this Progress Report), for many parameters, all Valley sites are showing important PM2.5 improvements.

Notes on Tables A-1 through A-4:

- **2010 data:** District staff acquired 2010 data from AQS on March 8, 2011. This data is preliminary and has not yet been fully reviewed for quality assurance and control.
- **Empty cell:** No data or insufficient data
- **Asterisk (*):** Values do not meet completeness criteria
- **Turlock 2008:** This site only operated for about six weeks in 2008. Data for this site and time period is available in AQS. Since this site operated for less than one full quarter in the calendar year, its data is not representative of an annual average and is therefore not included in annual analysis. However, this data is used for 24-hour average analysis.
- **Bakersfield-Golden 2010:** This site only operated for one week in 2010. Data for this site and time period is available in AQS. Since this site operated for less than one full quarter in the calendar year, its data is not representative of an annual average and is therefore not included in annual analysis. However, this data is used for 24-hour average analysis.

Table A-1 EPA AMP 480 Design Value Report, Single year 24-hour PM2.5 98th percentile values (µg/m^3), 1999-2010

SJV Monitoring Site	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010*
Stockton	79.0	55.0	58.0	50.0	41.0	36.0	44.0	42.0	48.0	61.6	40.4	***34.1****
Modesto	100.0	71.0	69.0	69.0	47.0	45.0	55.0	52.0	57.4	53.9	54.5	***33.6****
Turlock										67.4	53.1	***39.0***
Merced	91.9	60.0	49.3	55.1	44.2	43.0	48.3	43.8	52.7	54.0	45.2	***35.5***
Fresno-1st	120.0	90.0	75.0	75.0	56.0	52.0	71.0	51.0	67.0	57.4	55.8	***48.8***
Fresno-Winery		64.8	61.5	71.9	49.7	49.4	71.2	55.0	57.4	44.5	48.2	***37.0***
Clovis	59.2	72.5	71.5	53.2	48.1	52.4	63.0	51.3	60.9	49.0	49.0	***44.3***
Corcoran	53.0	55.1	89.5	65.1	42.2	49.4	74.5	50.1	57.9	47.9	53.4	***46.8***
Hanford												***30.5****
Visalia	114.0	103.0	96.0	70.0	47.0	54.0	65.0	50.0	59.7	62.1	53.9	***36.3***
Bakersfield-Golden	95.3	93.9	95.9	80.4	51.9	53.9	74.9	64.4	67.7	60.8	68.6	***61.5***
Bakersfield-California	97.4	92.7	94.9	73.0	48.3	61.5	63.2	60.5	73.0	64.5	66.7	***53.3***
Bakersfield-Planz		76.5	90.6	66.8	47.5	47.6	66.4	64.7	72.2	72.3	65.5	***56.2****
Please see table notes on page A-2 of this appendix												

Table A-2 EPA AMP 480 Design Value Report, 24-hour PM2.5 Design Values (three-year averages, µg/m^3) , to be compared to standard of 65 µg/m^3

SJV Monitoring Site	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010*
Stockton	64	54	50	42	40	41	45	51	50	***45***
Modesto	80	70	62	54	49	51	55	54	55	***47***
Turlock										***53***
Merced	67	55	50	47	45	45	48	50	51	***45***
Fresno-1st	95	80	69	61	60	58	63	58	60	***54***
Fresno-Winery	63	66	61	57	57	59	61	52	50	***43***
Clovis	68	66	58	51	55	56	58	54	53	***47***
Corcoran	66	70	66	52	55	58	61	52	53	***49***
Hanford										
Visalia	104	90	71	57	55	56	58	57	59	***51***
Bakersfield-Golden	95	90	76	62	60	64	69	64	66	***64***
Bakersfield-California	95	87	72	61	58	62	66	66	68	***62***
Bakersfield-Planz	84	78	68	54	54	60	68	70	70	***65***
Please see table notes on page A-2 of this appendix										

Table A-3 EPA AMP 480 Design Value Report, Single Year Annual Mean PM2.5 Concentrations (µg/m^3), 1999-2010

SJV Monitoring Site	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010*
Stockton	19.7	15.5	13.9	16.7	13.6	13.2	12.5	13.1	12.9	14.4	11.3	*11.0**
Modesto	24.9	18.7	15.6	18.7	14.5	13.6	13.9	14.8	15.0	16.0	13.0	*12.7**
Turlock											16.1	*12.5**
Merced	22.6	16.7	14.5*	18.7	15.7	15.2	14.1	14.8	15.2	14.9*	13.6	*11.2*
Fresno-1st	27.6	24.5	19.8	21.5	17.8	16.3	16.7	16.8	18.8	17.4	15.1	*13.0*
Fresno-Winery		18.4	18.6	21.3	17.8	17.0	16.9	17.6	16.8	16.5	14.6	*13.4*
Clovis	19.8	16.3	18.0	16.2	18.5*	16.4	16.3	16.4	16.4	16.2	18.3	*14.7*
Corcoran	14.3*	16.4	19.2	21.5	16.2	17.4	17.5	16.9	18.4	15.8	17.7	*17.9*
Hanford												*13.4**
Visalia	27.6	23.9	22.5	23.2	18.2	17.0	18.8	18.8	20.4	19.8	16.0	*13.6*
Bakersfield-Golden	26.2	22.6	21.8	24.1	19.6	18.2	19.1	18.6	19.9	17.9	20.0	
Bakersfield-California	23.8	22.5	21.2	22.7	17.1	18.9	18.0	18.7	22.0	21.9	19.0	*14.2*
Bakersfield-Planz		20.3	20.8	23.5	17.8	17.4	19.8	19.3	21.8	23.5	22.5	*17.6*
Please see table notes on page A-2 of this appendix												

Table A-4 EPA AMP 480 Design Value Report, Annual PM2.5 Design Values (three-year averages, µg/m^3), to be compared to standard of 15 µg/m^3

Monitoring Site	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010*
Stockton	16.4	15.3	14.7	14.5	13.1	12.9	12.8	13.5	12.9	*12.2*
Modesto	19.7	17.7	16.2	15.6	14.0	14.1	14.6	15.3	14.7	*13.9*
Turlock										
Merced	17.9	16.6	16.3	16.5	15.0	14.7	14.7	15.0	14.5	*13.2*
Fresno-1st	24.0	21.9	19.7	18.6	16.9	16.6	17.4	17.7	17.1	*15.2*
Fresno-Winery	18.5	19.4	19.2	18.7	17.2	17.2	17.1	17.0	16.0	*14.9*
Clovis	18.0	16.8	17.6	17.0	17.1	16.4	16.4	16.3	17.0	*16.4*
Corcoran		19.0	19.0	18.4	17.0	17.2	17.6	17.0	17.3	*17.1*
Hanford										*13.4*
Visalia	24.7	23.2	21.3	19.5	18.0	18.2	19.3	19.7	18.8	*16.5*
Bakersfield-Golden	23.6	22.8	21.8	20.6	19.0	18.6	19.2	18.8	19.3	
Bakersfield-California	22.5	22.1	20.3	19.6	18.0	18.5	19.6	20.9	21.0	*18.4*
Bakersfield-Planz		21.5	20.7	19.6	18.4	18.9	20.3	21.5	22.6	*21.2*
Please see table notes on page A-2 of this appendix										

Figure A-1 24-hour PM2.5 Design Values from 2001 (1999-2001 average) to 2010 (2008-2010 average)

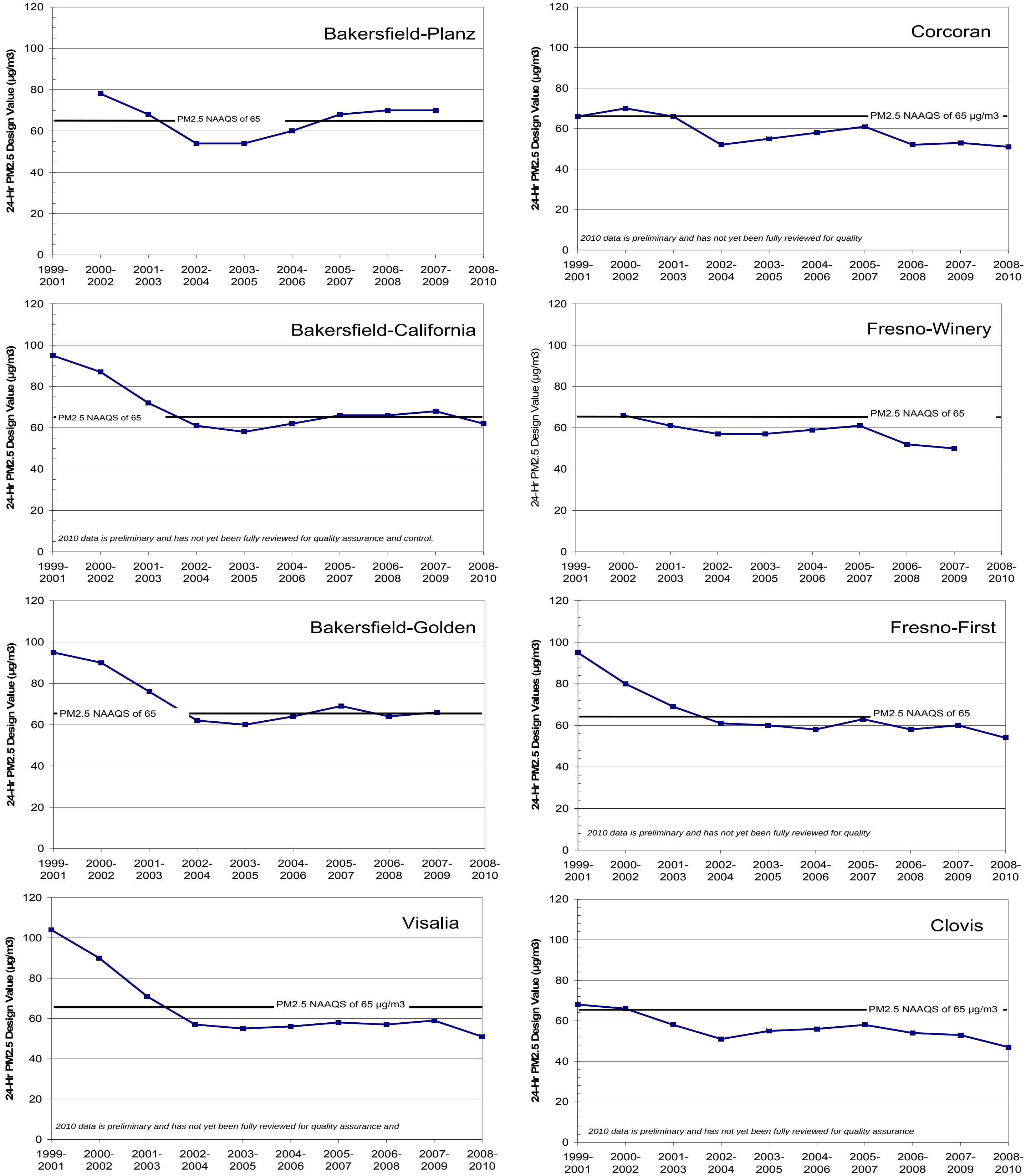
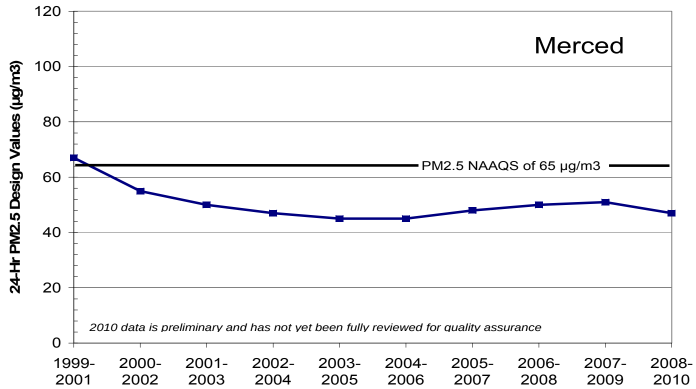
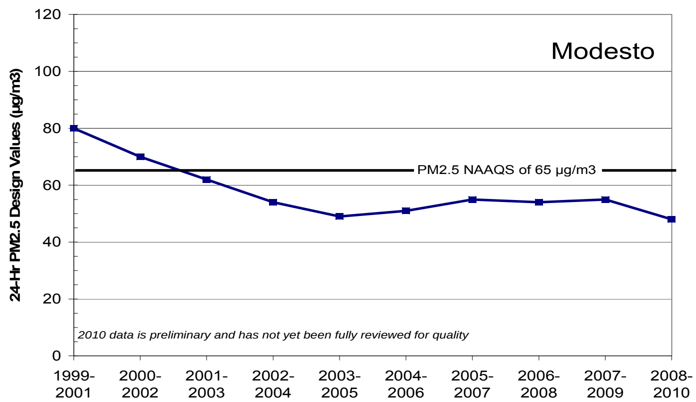


Figure A-1 (continued) 24-hour PM2.5 Design Values from 2001 (1999-2001 average) to 2010 (2008-2010 average)





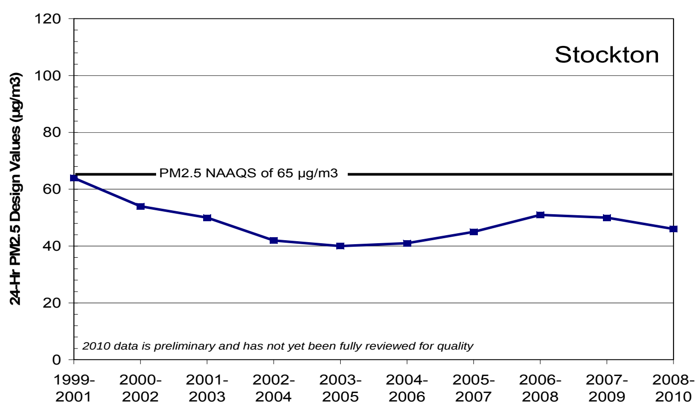


Figure A-2 Annual PM2.5 Design Values from 2001 (1999-2001 average) to 2010 (2008-2010 average)

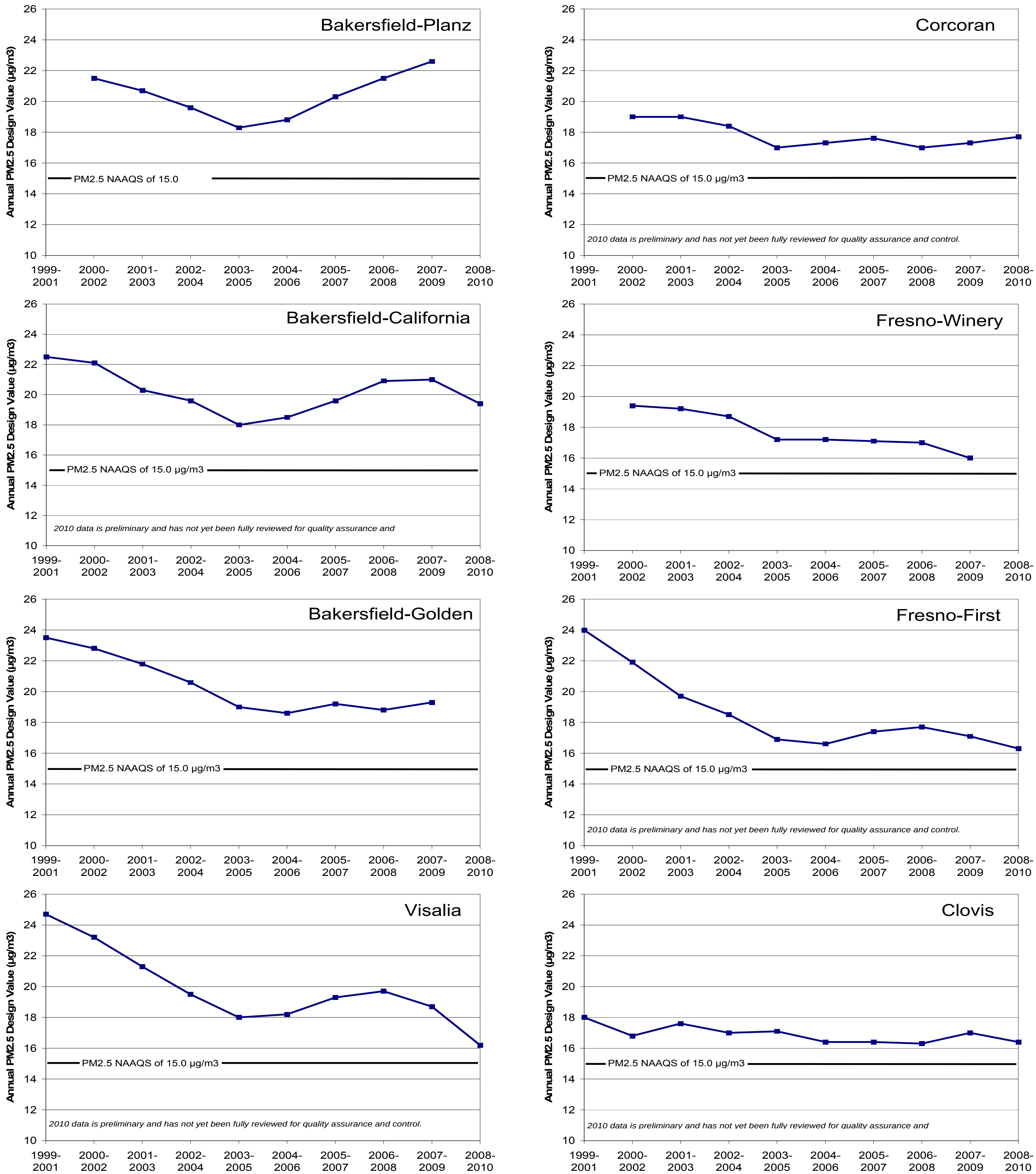
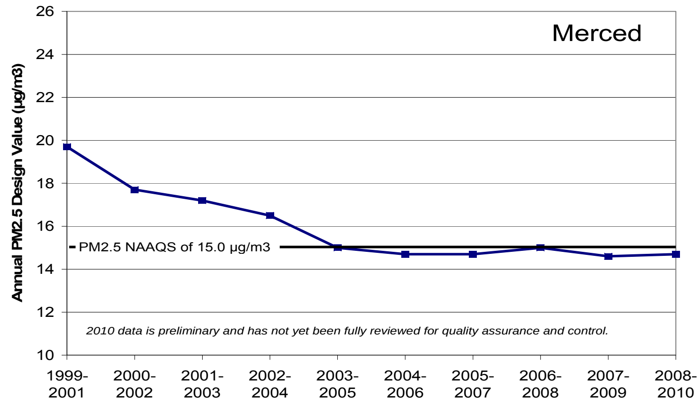
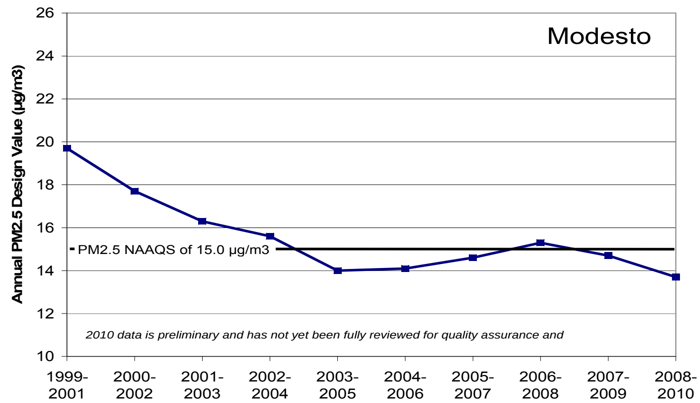


Figure A-2, (continued) Annual PM2.5 Design Values from 2001 (1999-2001 average) to 2010 (2008-2010 average)





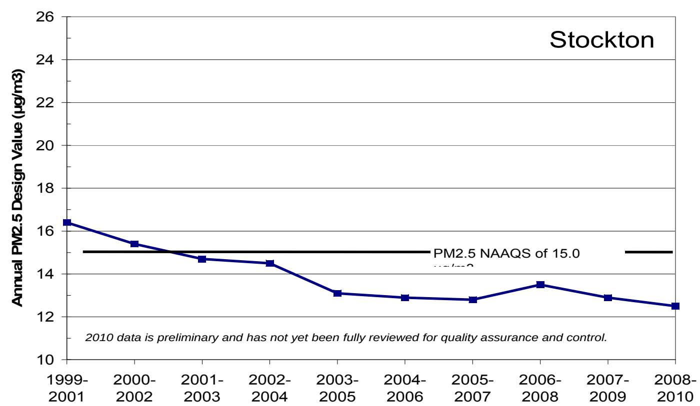
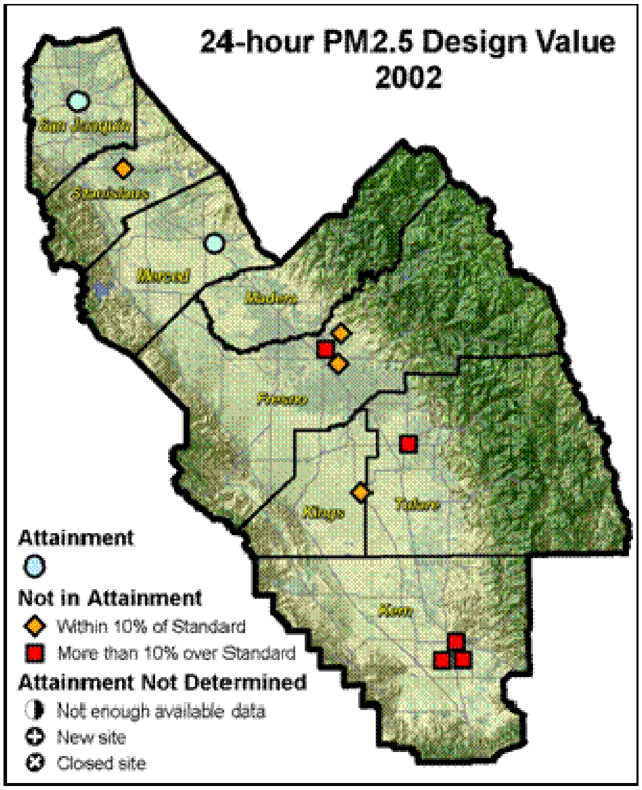


Figure A-3 PM2.5 24-hour Design Value Comparison, 2002 (2000-2002 Average) and 2010 (2008-2010 Average)



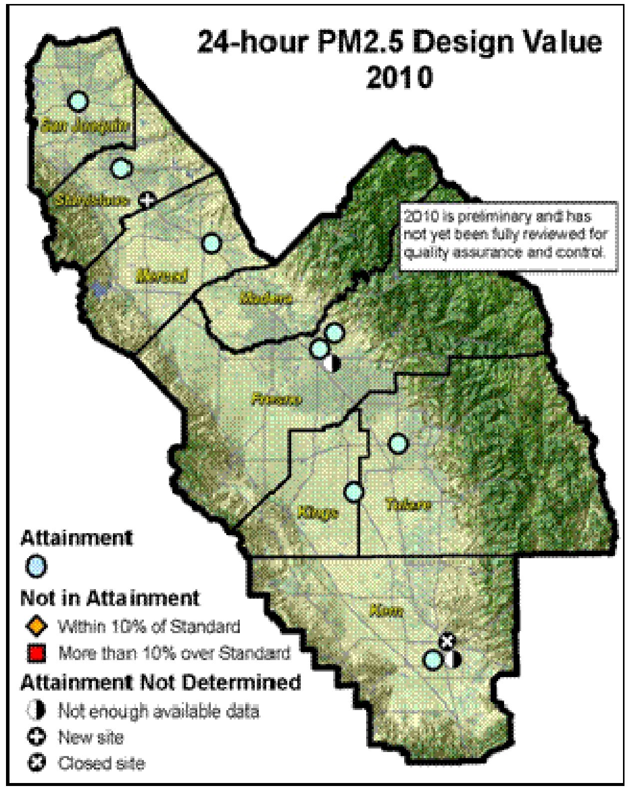
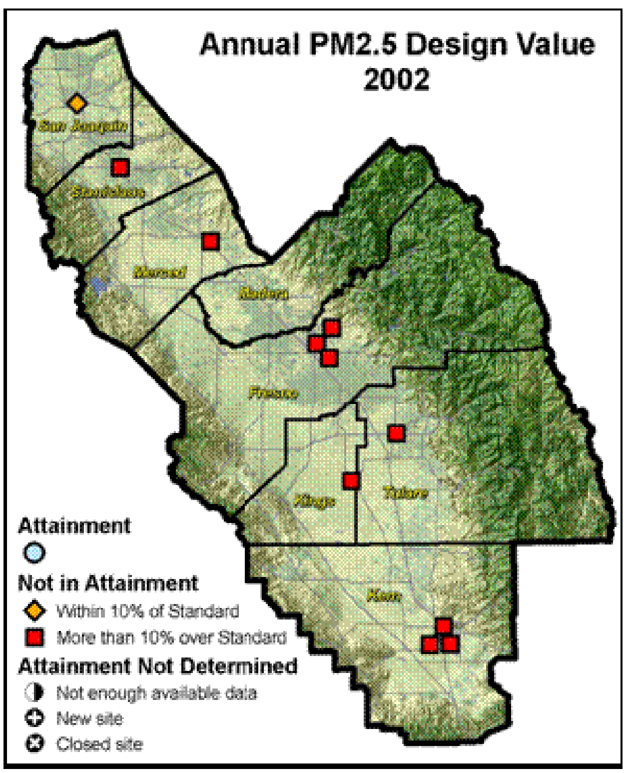


Figure A-4 Annual PM2.5 Design Value Comparison, 2002 (2000-2002 Average) and 2010 (2008-2010 Average)



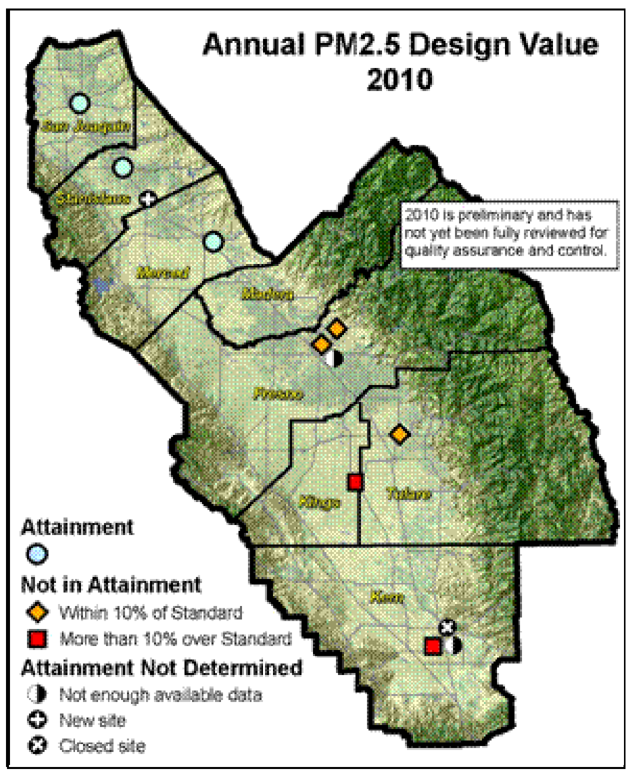
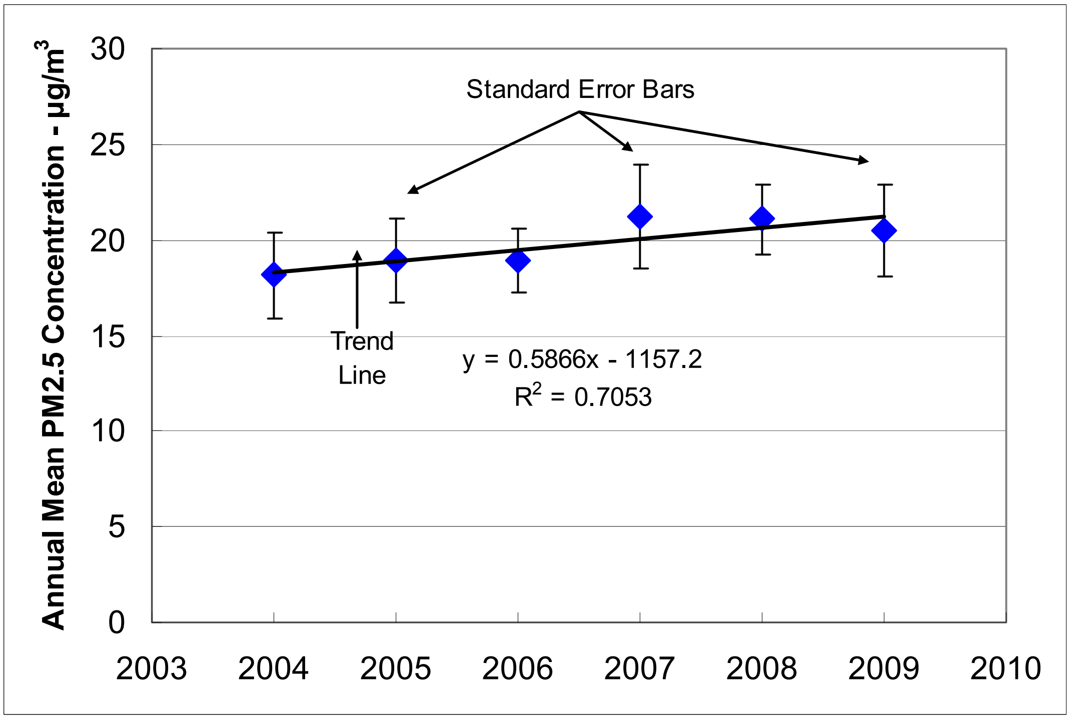


Figure A-5 Bakersfield Annual Design Values Within Standard Deviation



A.2 Factors Affecting Design Values

Some recent design values do not reflect the expected PM2.5 progress, but official 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 increase 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.

A.2.1 Monitor types

The District and ARB presently use three types of PM2.5 monitors in the Valley:

- Filter-based Federal Reference Method (FRM), defined as the standard for data collection;
- Real-time Beta-attenuation method (BAM) monitors designated as federal equivalent method (FEM) (hereafter BAM/FEM); and
- Ordinary BAMs, not designated FEM (hereafter referred to as BAM)

Only FRM and BAM/FEM monitors produce data that is suitable for comparison with the NAAQS. Real-time monitors (BAM/FEM and BAM) produce hourly measurements that the District uses every day to produce daily air quality forecasting, wood burning prohibitions, public health notifications, and Real-time Air Advisory Network (RAAN) notifications for schools.

The District's Annual Monitoring Network Plans summarize the types of monitors used at Valley air monitoring sites. The District is considering replacing some PM2.5 FRMs with BAM/FEMs, due to FRM maintenance and part replacement difficulties. Historical data shows that FRM and FEM data are not truly equivalent in the Valley, and therefore monitor type may impact design values. This issue will be analyzed further in future Monitoring Network Plans and PM2.5 attainment plans.

A.2.2 Effects of Exceptional Events on PM2.5 Data

With proper documentation and EPA concurrence, data influenced by exceptional events can be excluded from official design value calculations.[3] The Valley has experienced three main types of exceptional events: wildfires, high winds, and fireworks. Exceptional events are not reasonably preventable or controllable, so it is inappropriate to use data without recognition of these circumstances. 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. Even without formal submittal, the District tracks these events and their impact on design values as part of its ongoing air quality analysis. In its effort to more accurately characterize ambient PM2.5 concentrations, the District evaluated the Valley's PM2.5 data with careful consideration of exceptional events, including those not formally submitted to EPA.

A.2.2.1 PM2.5 Exceptional Event Documentation Submitted to EPA

The District submitted documentation for exceptional events of fireworks and wildfires that occurred in the summers of 2007 and 2008. If EPA approves this documentation, data from those events will be excluded from official design value calculations.

On July 4th and 5th, 2007, hourly PM2.5 concentrations at Fresno-First and Bakersfield-California coinciding with fireworks activity. 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. Valley PM2.5 concentrations were elevated for a number of days during this period.

These exceptional events caused the Valley's PM2.5 design values to be higher than normal. Table A-7 summarizes the affects of removing this data from official design values. The prolonged 2008 wildfire event has a noticeable impact on design values, especially for monitoring sites closest to the wildfire in the northern portion of the Valley. The largest difference occurred at the Stockton air monitoring site, where the 24-hour value was 61.6 µg/m³ with the exceptional event data included, and 48.2 µg/m³ with that data removed. Excluding days that were impacted by smoke reduces the PM2.5 annual average design value by 0.7 µg/m³.

[3] EPA's Treatment of Air Quality Monitoring Data Influence by Exceptional Events, Codified in 40 CFR Chapter 1 (7-1-2010 Edition), Section 50.14.

Table A-5 Exceptional Event Impact on 24-hour and Annual Mean PM2.5 Values

Year	Site	Annual Mean Before EE Concurrence	Annual Mean with EPA EE Concurrence	Difference $\mu g/m^3$	24-hour Mean Before EE Concurrence	24-hour Mean with EPA EE Concurrence	Difference $\mu g/m^3$
2008	Stockton	14.4	12.9	-1.5	61.6	48.2	-13.4
	Modesto	16.0	14.7	-1.3	53.3	49.5	-3.8
	Merced	14.9	13.9	-1.0	51.1	45.2	-5.9
	Clovis	16.0	14.8	-1.2	49.0	49.0	0.0
	Fresno-1st	17.4	16.1	-1.3	57.4	54.4	-3.0
	Fresno-Winery	16.5	15.6	-0.9	44.5	44.5	0.0
	Visalia	21.0	19.5	-1.5	62.1	55.5	-6.6
	BAK-CA	21.9	20.0	-1.9	64.5	63.4	-1.1
	BAK-Planz	23.5	22.8	-0.7	72.3	72.3	0.0
2007	Fresno 1st	18.8	18.4	-0.4	67.0	66.0	-1.0
	BAK-CA	22.0	21.8	-0.2	73.0	73.0	0.0

A.2.2.2 High-Wind Events Effects on PM2.5 Data

The District has also been evaluating the possible PM2.5 impact of high wind events, though the District has not submitted formal PM2.5 exceptional event document to EPA for these events at this time. In some most of these cases, the District submitted formal PM10 exceptional event documentation for these dates and monitors. Geologic particulates are the primary component of elevated PM10 during high wind events, but the geologic component of PM2.5 is still under investigation.

The District has observed similarities in hourly increases in PM10 and PM2.5 during certain high wind events, though. High-wind events affected Bakerfield-Planz on January 4, 2008 and October 13, 2009, and corresponding PM2.5 measurements were unusually high at 100.3 $\mu g/m^3$ and 167.7 $\mu g/m^3$, respectively. Table A-8 summarizes the impact of the 2008 and 2009 events on Bakersfield-Planz design values. Similarly, the District expects to document a PM10 exceptional event affecting Bakersfield-Planz on April 11, 2010. PM2.5 levels were also much higher than normal in conjunction with this event, and excluding this single day would decrease the 2008-2010 24-hour design value by about 10 $\mu g/m^3$ (as mentioned in Section 3.2.2 of this Progress Report).

Table A-6 High-Wind Event Influence on Bakersfield–Planz Design Value

	24-hour Design Values µg/m^3		Annual Design Values µg/m^3	
	High-Wind Event			
	Included	Excluded	Included	Excluded
2007*	72.2	72.2	21.8	21.8
2008	72.3	61.0	23.5	22.6
2009	65.5	65.4	22.5	21.4
Design Value 2007-2009	**70**	**66**	**22.6**	**21.9**
Difference	4		0.7	

* - No high wind events were captured in the 2007 data set.

A.3 PM2.5 Trends

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 design values alone will not reveal how public health might be impacted by PM2.5 from day-to-day or throughout the day. The District's multi-faceted analysis of all available Valley PM2.5 data reveals patterns of seasonal variations and hourly fluctuations and, in general, demonstrates air quality improvements between 2005 and 2010. The District also investigated potential emissions source changes and PM2.5 sample speciation, where available, to consider potential causes for the Valley's PM2.5 patterns.

A.3.1 Daily PM2.5 Trends

As mentioned in section A.2.2 of this appendix, 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. The District compiled long-term diurnal profiles to analyze how PM2.5 concentrations vary throughout the day at each Valley monitoring site (Figure A-6).

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 4-4, 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. 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 A-6 Average Annual PM2.5 Diurnal Profiles by Year by Site

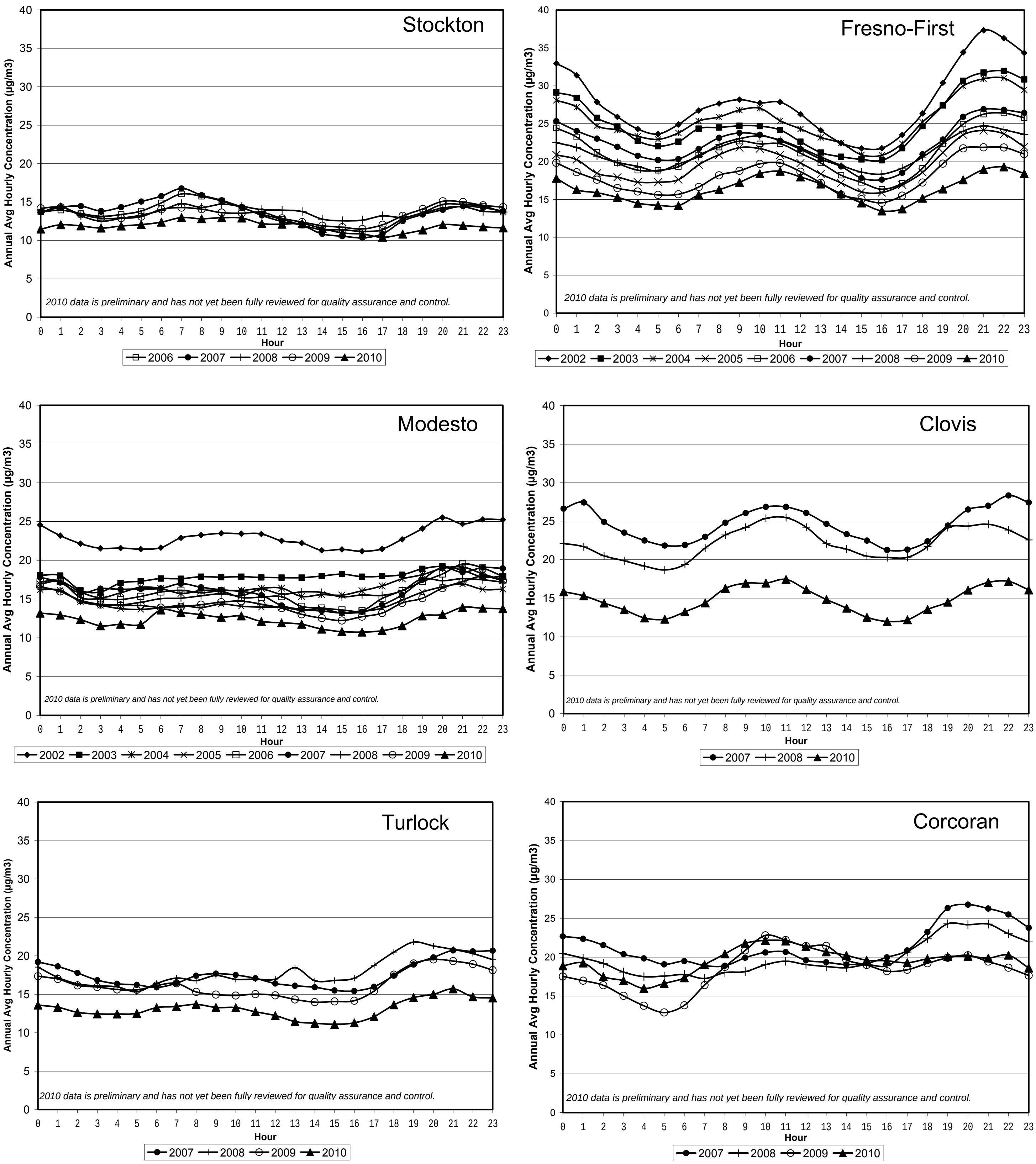
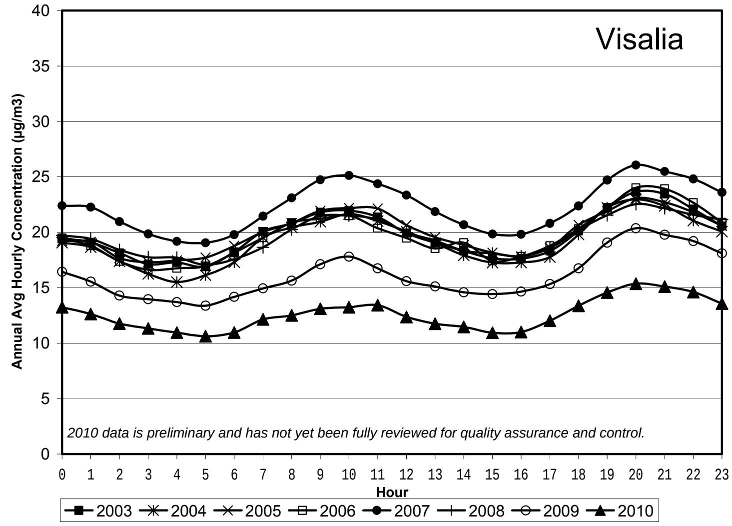
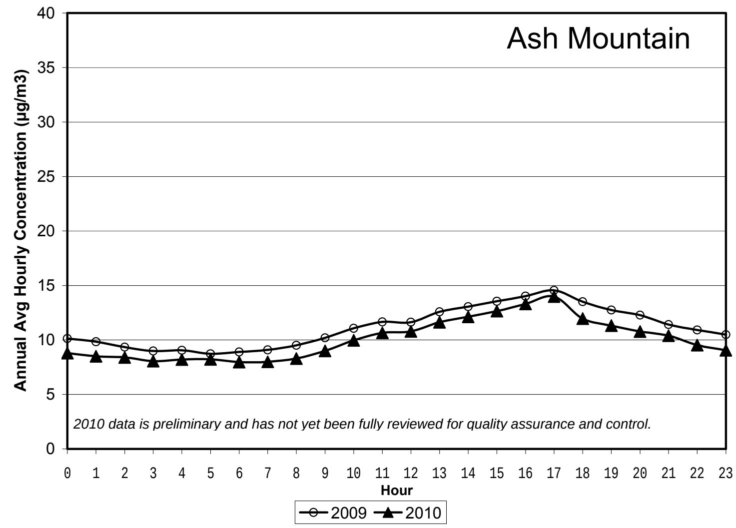
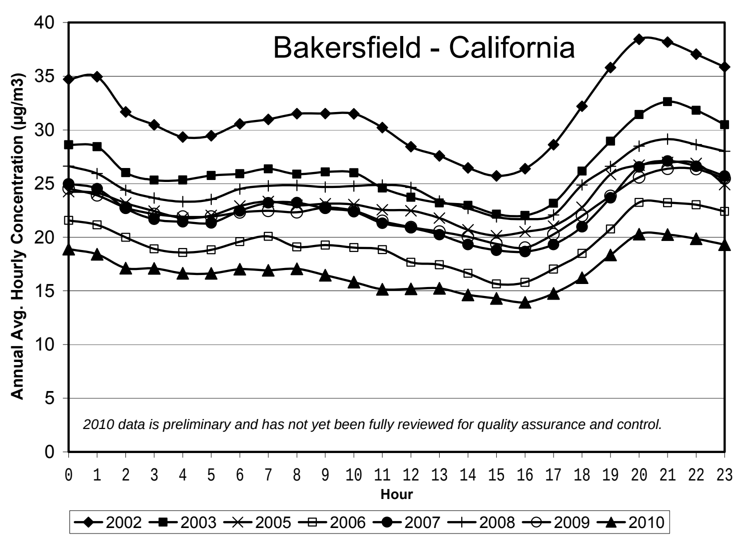


Figure A-6 (continued) Average Annual PM2.5 Diurnal Profiles by Year by Site





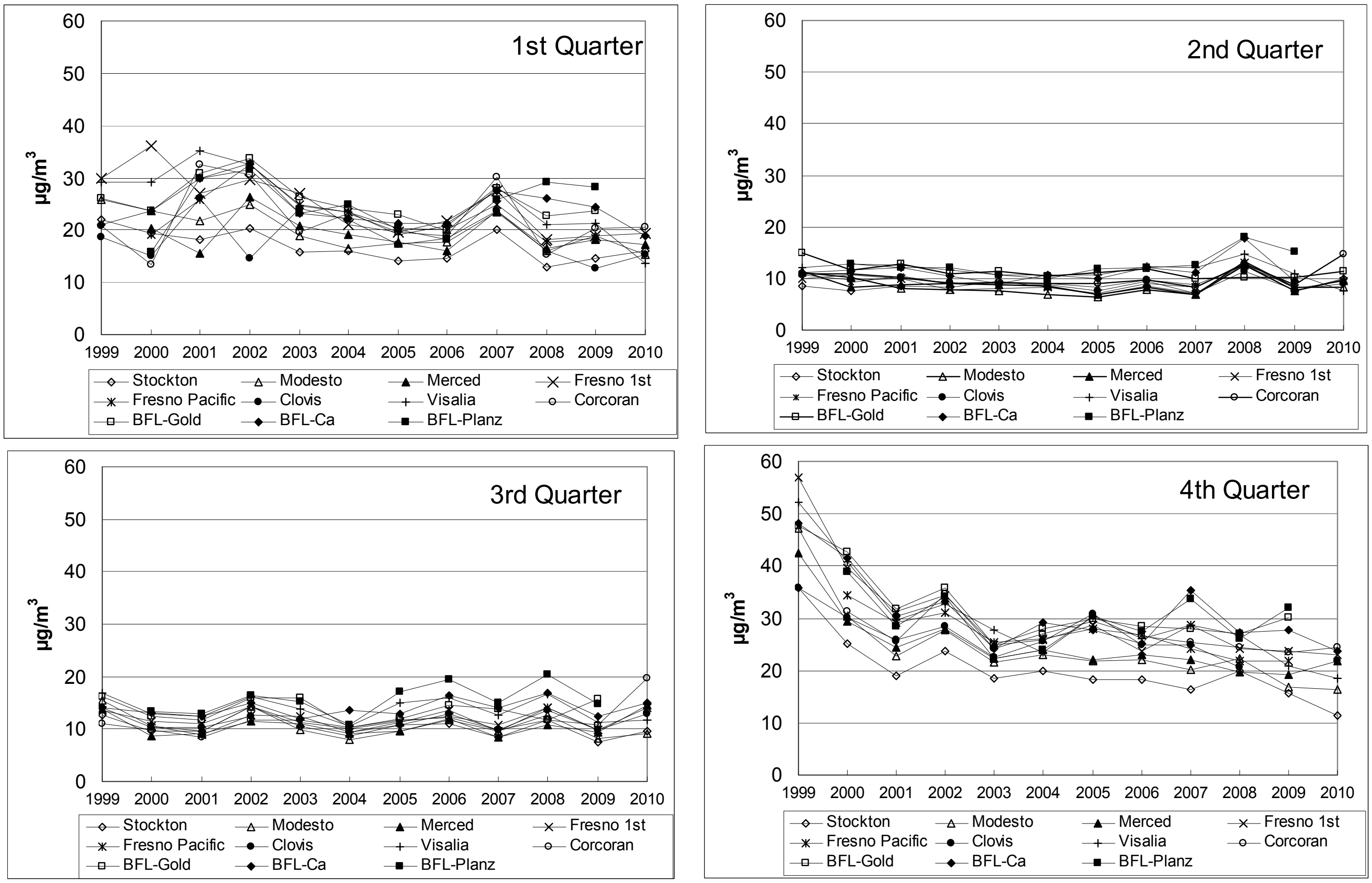


A.3.2 Seasonal PM2.5 Trends

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, as discussed in Section 3.1.1 of this Progress Report.

The District analyzed the Valley's long-term seasonal PM2.5 variations based on quarterly averages, which are the basis for annual average design value calculations (Figure A-7). First quarter (January-March) and fourth quarter (October-December) show significant improvements, and Rule 4901 wood burning prohibitions from November through February are a likely driver for much of this improvement. Despite this improvement, the Valley's third quarter (July-September) averages have not decreased. In some years, third quarter average increased. At least part of these increases is likely attributable to late summer wildfire smoke, particularly in 2008. While third quarter PM2.5 concentrations are not the year's highest values, an increase in this quarter impacts annual averages, somewhat masking the improvement seen during other times of the year. The District will continue to analyze possible emissions sources that could be disproportionally impacting third quarter emissions.

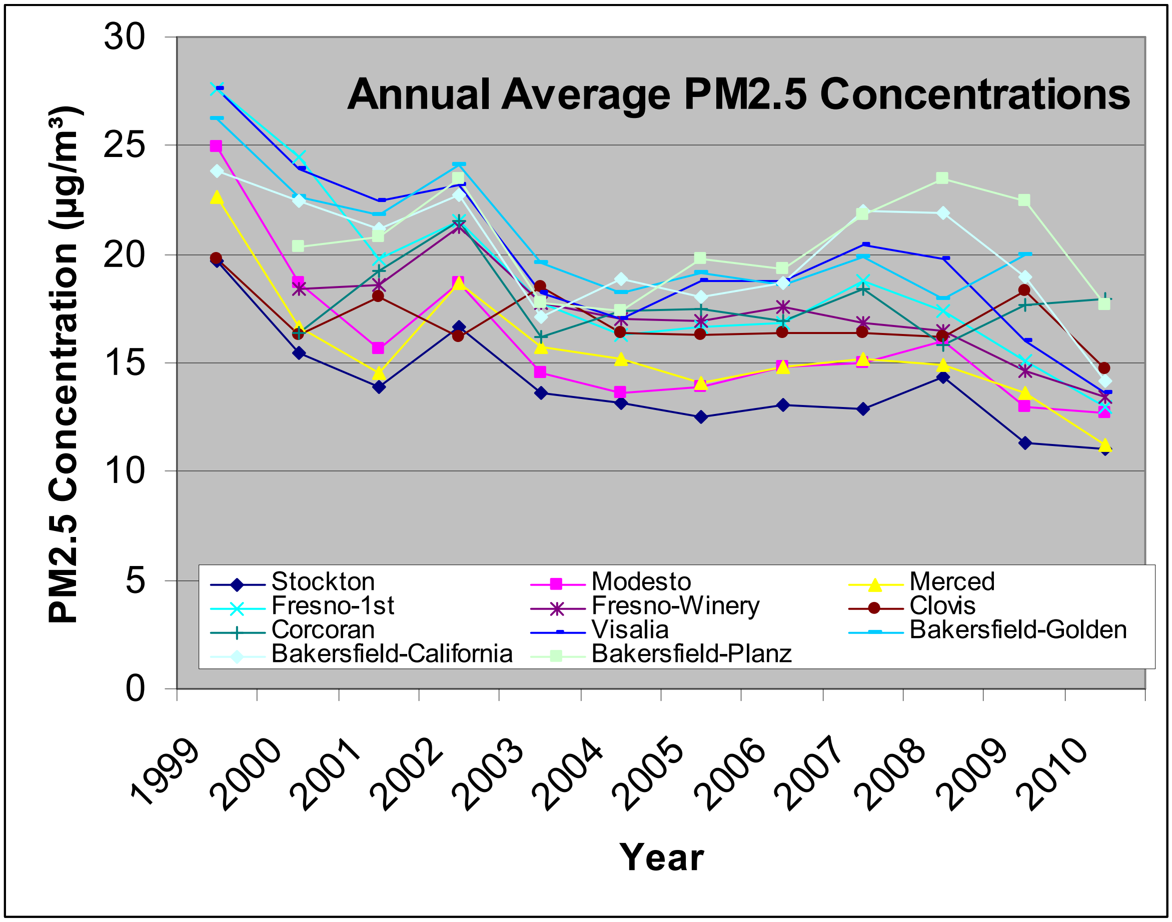
Figure A-7 PM2.5 Annual Mean by Monitor Site by Quarter



A.3.3 Annual PM2.5 Trends

Table A-3 presents single year annual average PM2.5 concentrations. While a 3-year design value can mask years of very high or very low PM2.5 concentrations, single year annual average trends can make progress or issues more apparent. Figure A-8 shows that overall, despite year-to-year variations, the Valley's annual average PM2.5 concentrations are decreasing. In 2010, only two monitoring sites had annual averages above 15 µg/m³, the level of the annual NAAQS.

Figure A-8 Annual Average PM2.5 Concentrations Decreasing

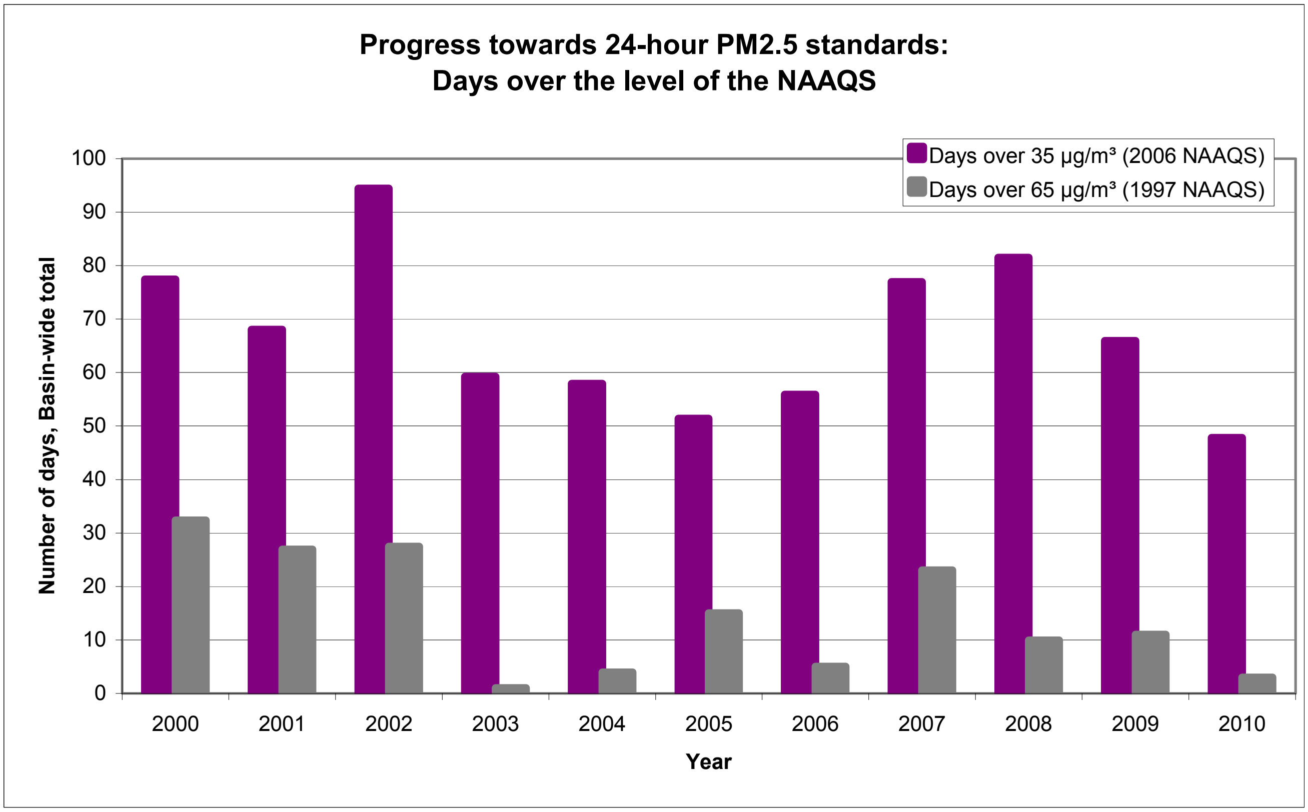


A.3.4 Days Over the 24-hour PM2.5 Standards

The number of days over the level of the PM2.5 NAAQS is another indicator of PM2.5 progress, though it would not be used for attainment determinations. Figure A-9 shows a basin-wide count of the number of days above the level of both the 1997 and 2006 24-hour average PM2.5 NAAQS (65 µg/m³ and 35 µg/m³, respectively). These counts have been normalized to account for the varying sampling schedules of the Valley's 1-in-6-day, 1-in-3-day, and daily PM2.5 monitors. Since the calculation form of the 24-hour NAAQS is a 98^{th} percentile standard, per monitoring site, an area could attain the NAAQS even where the basin-wide exceedance day count shows a few days over the level of the NAAQS.

Figure 9 shows that 2009 and 2010 had fewer exceedance days than 2007 and 2008. Also, 2010 had the lowest number of days over the level of the 2006 NAAQS since monitoring began.

Figure A-9 Days over the level of the 24-hour NAAQS



A.3.5 Ongoing Analysis of PM2.5 Sources and Species

Bakersfield-Planz is the Valley's design site, meaning it has the Valley's highest PM2.5 design values. As discussed in Section 3 and this Appendix, some of Planz's PM2.5 data analysis is influenced by exceptional events. Additionally, in some of the District's analyses, Planz patterns differ from patterns seen at other monitoring sites, even those seen at another Bakersfield site within five miles. While all three Bakersfield monitoring sites show higher annual average concentrations than other Valley monitoring sites, the Bakersfield-Planz site consistently measures the highest concentrations.

To investigate potential causes of the PM2.5 differences seen at Planz, the District evaluated emissions inventory data from collected from permitted sources within a 5-mile radius of monitoring site. However, this analysis couldn't capture non-permitted emissions activity (such as mobile sources), and the results were inconclusive.

The District and ARB also conducts speciation analysis to determine the types of particulates contributing to the Valley's PM2.5 concentrations. Accredited laboratories speciate many of the Valley's collected PM2.5 filters to quantify the amounts of up to 75 different chemical elements appearing on the filters. Though this analysis identifies individual atoms rather than complex molecules, these elemental trends can point to potential emissions sources warranting further investigation. The speciation analysis identifies the Valley's prominent PM2.5 chemical constituents, including ammonium ions, nitrates, silicon, organic carbon, and elemental carbon. Through the California Regional Particulate Air Quality Study (CRPAQS, described in section 1.2 of this Progress Report) and the District's own research efforts, additional speciation analysis is ongoing in preparation for the *2012 PM2.5 Attainment Plan* for the 2006 PM2.5 NAAQS (mentioned in Section 4 of this Progress Report).