

Appendix A

Ambient Air Quality Data

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Appendix A: Ambient Air Quality Data

A.1 INTRODUCTION

This Appendix includes more ambient air quality data and analysis for 8-hour ozone.

A.2 AMBIENT AIR QUALITY DATA

Table A-1 summarizes the annual fourth-highest daily maximum 8-hour average ozone concentrations for currently operating monitoring sites in the SJVAB for the years 1988-2005. The calculation of the 3 - year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is explained in Chapter 1. Table A-2 shows the 3 -year average of the annual fourth-highest daily maximum 8-hour average ozone concentration for each site within the SJVAB for the years 1990-2005. A dash (-) means that there is insufficient (or no) data available to determine the value.

Attainment status is determined for each site by analyzing 2003 through 2005 ozone measurements¹. If any monitoring site within the SJVAB has a design value that is greater than 0.08 ppm, then, by rules established by EPA, the entire air basin is nonattainment. Table A-3 summarizes the current attainment status on a site-by-site basis. Bold values indicate that one of the attainment tests is over the standard. Figure A-1 illustrates the San Joaquin Valley air basin map with 8-hour ozone design values on a site-by-site basis.

Table A-3 shows that three of the 21 air monitoring sites² in the SJVAB currently meet the attainment test for eight hour ozone: Stockton, Modesto, and Madera. Turlock and Hanford are very close to meeting the 8-hour average ozone NAAQS attainment test. Eighteen (18) out of 21 sites are nonattainment for the 8-hour average ozone standard for the 2003-2005 time period. This is an improvement from 1999 to 2001 period where twenty (20) out of 21 sites were nonattainment. Figure A-1 shows the Valley-wide design values for 1990-2005. Figure A-2 shows 2005 design values plotted on a map. More air quality trend data can be found at <<http://www.arb.ca.gov>>.

¹ 40 CFR (Code of Federal Regulations) Part 50, Appendix I, Sections 2.2 and 2.3, require that attainment calculations be based on at least the most recent three complete years of quality reviewed data. Data for the year 2006 has not completed the required review.

² A total of 22 ozone monitoring sites are currently operated in the SJVAB, but one of these (the Tracy – Airport site) has not been operating long enough to yield a design value.

Table A-1 Fourth Highest Eight Hour Average Ozone (ppm)³

Name	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Stockton	0.090	0.077	0.083	0.082	0.083	0.078	0.085	0.090	0.080	0.071	0.086	0.085	0.076	0.076	0.073	0.075	0.073	0.073
Modesto	0.093	0.093	0.097	0.086	0.082	0.090	0.091	0.095	0.094	0.082	0.098	0.087	0.086	0.091	0.087	0.082	0.080	0.089
Turlock	-	-	-	-	0.095	0.096	0.088	0.103	0.098	0.089	0.107	0.090	0.091	0.094	0.102	0.093	0.087	0.079
Merced		-	-	0.097	0.102	0.096	0.097	0.107	0.102	0.074	0.112	0.105	0.103	0.096	0.105	0.107	0.096	0.083
Madera	-	-	-	-	-	-	-	-	-	-	0.093	0.088	0.088	0.090	0.096	0.093	0.078	0.076
Fresno-SSP	0.112	0.100	0.071	0.105	0.106	0.110	0.099	0.103	0.105	0.097	0.122	0.099	0.114	0.113	0.119	0.102	0.091	0.101
Clovis	-	-	0.095	0.093	0.108	0.105	0.099	0.108	0.108	0.115	0.121	0.104	0.104	0.110	0.104	0.097	0.085	0.093
Fresno-First	-	-	0.103	0.118	0.105	0.111	0.105	0.108	0.109	0.098	0.117	0.104	0.104	0.104	0.109	0.106	0.092	0.101
Fresno-Drummond	0.107	0.098	0.103	0.103	0.097	0.100	0.090	0.089	0.104	0.092	0.113	0.102	0.099	0.097	0.110	0.104	0.091	0.086
Parlier	0.115	0.113	0.103	0.108	0.108	0.103	0.089	0.106	0.110	0.106	0.108	0.105	0.108	0.109	0.115	0.111	0.087	0.091
Ash Mountain	-	-	-	-	-	-	-	-	-	-	-	0.105	0.105	0.104	0.107	0.110	0.099	0.107
Lower Kaweah	0.094	0.093	0.096	0.097	0.102	0.106	0.106	0.095	0.105	0.097	0.094	0.097	0.090	0.096	0.108	0.100	0.095	0.097
Visalia	0.105	0.113	0.102	0.098	0.098	0.108	0.109	0.104	0.103	0.095	0.109	0.100	0.099	0.099	0.102	0.096	0.089	0.095
Hanford	-	-	-	-	-	-	0.093	0.080	0.116	0.097	0.104	0.098	0.105	0.093	0.101	0.092	0.088	0.085
Arvin	-	0.120	0.118	0.117	0.110	0.111	0.112	0.115	0.126	0.105	0.114	0.109	0.111	0.109	0.118	0.119	0.112	0.108
Bakersfield-California	-	-	-	-	-	-	0.098	0.107	0.110	0.097	0.103	0.099	0.102	0.099	0.101	0.101	0.091	0.099
Bakersfield-Golden	-	-	-	-	-	-	0.095	0.096	0.108	0.090	0.105	0.096	0.099	0.095	0.101	0.098	0.085	0.088
Edison	0.120	0.110	0.108	0.110	0.093	0.117	0.118	0.123	0.118	0.105	0.124	0.105	0.105	0.104	0.109	0.100	0.095	0.097
Maricopa	0.111	0.106	0.098	0.097	0.100	0.101	0.093	0.109	0.111	0.097	0.123	0.089	0.093	0.098	0.106	0.095	0.088	0.090
Oildale	0.111	0.101	0.098	0.101	0.100	0.101	0.097	0.101	0.106	0.088	0.109	0.092	0.103	0.097	0.102	0.100	0.094	0.096
Shafter	-	0.100	0.093	0.098	0.093	0.097	0.099	0.095	0.102	0.085	0.101	0.094	0.092	0.098	0.096	0.096	0.084	0.090

A dash (-) indicates that there is insufficient data available to determine the value.

³ A total of 22 ozone monitoring sites are currently operated in the SJVAB, but one of these (the Tracy – Airport site) has not been operating long enough to yield a design value.

**Table A-2 3-year Average of the Annual Fourth-Highest Daily Maximum
8-hour Average Ozone Concentrations (ppm)**

Name	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Stockton	0.083	0.080	0.082	0.081	0.082	0.084	0.085	0.080	0.079	0.080	0.082	0.079	0.075	0.075	0.074	0.073
Modesto	0.094	0.092	0.088	0.086	0.087	0.092	0.093	0.090	0.091	0.089	0.090	0.088	0.088	0.086	0.083	0.083
Turlock	-	-	-	-	0.093	0.095	0.096	0.096	0.098	0.095	0.096	0.091	0.095	0.096	0.094	0.086
Merced	-	-	-	0.098	0.098	0.100	0.102	0.094	0.096	0.097	0.106	0.101	0.101	0.102	0.102	0.095
Madera	-	-	-	-	-	-	-	-	-	-	0.089	0.088	0.091	0.093	0.089	0.082
Clovis	-	-	0.098	0.102	0.104	0.104	0.105	0.111	0.115	0.113	0.109	0.106	0.106	0.103	0.095	0.091
Fresno- Drummond	0.102	0.101	0.101	0.100	0.095	0.093	0.094	0.095	0.103	0.102	0.104	0.099	0.102	0.103	0.101	0.093
Fresno- First	-	-	0.108	0.111	0.107	0.108	0.107	0.105	0.108	0.106	0.108	0.104	0.105	0.106	0.102	0.099
Fresno- SSP	0.094	0.092	0.094	0.107	0.105	0.104	0.102	0.101	0.108	0.106	0.111	0.108	0.115	0.111	0.104	0.098
Parlier	0.110	0.108	0.106	0.106	0.100	0.099	0.101	0.107	0.108	0.106	0.107	0.107	0.110	0.111	0.104	0.096
Ash Mtn.	-	-	-	-	-	-	-	-	-	-	-	0.104	0.105	0.107	0.105	0.105
Lower Kaweah	0.094	0.095	0.098	0.101	0.104	0.102	0.102	0.099	0.098	0.096	0.093	0.094	0.098	0.101	0.101	0.097
Visalia	0.106	0.104	0.099	0.101	0.105	0.107	0.105	0.100	0.102	0.101	0.102	0.099	0.100	0.099	0.095	0.093
Hanford	-	-	-	-	-	-	0.096	0.097	0.105	0.099	0.102	0.098	0.099	0.095	0.093	0.088
Arvin	-	0.118	0.115	0.112	0.111	0.112	0.117	0.115	0.115	0.109	0.111	0.109	0.112	0.115	0.116	0.113
Bakersfield- California	-	-	-	-	-	-	0.105	0.104	0.103	0.099	0.101	0.100	0.100	0.100	0.097	0.097
Bakersfield- Golden	-	-	-	-	-	-	0.099	0.098	0.101	0.097	0.100	0.096	0.098	0.098	0.094	0.090
Edison	0.112	0.109	0.103	0.106	0.109	0.119	0.119	0.115	0.115	0.111	0.111	0.104	0.106	0.104	0.101	0.097
Maricopa	0.105	0.100	0.098	0.099	0.098	0.101	0.104	0.105	0.110	0.103	0.102	0.094	0.099	0.099	0.096	0.091
Oildale	0.103	0.100	0.099	0.100	0.099	0.099	0.101	0.098	0.101	0.096	0.101	0.097	0.100	0.099	0.098	0.096
Shafter	-	0.097	0.094	0.096	0.096	0.097	0.098	0.094	0.096	0.093	0.095	0.094	0.095	0.096	0.092	0.090

A dash (-) indicates that there is insufficient data available to determine the value.

Table A-3 Current Ozone Air Quality Design Values and Attainment Status for the San Joaquin Valley Air Basin

County	Site	8 hour Ozone Design Values (ppm)*	Meets Attainment Test
San Joaquin	Stockton	0.07	yes
Stanislaus	Modesto	0.08	yes
Stanislaus	Turlock	0.09	no
Merced	Merced	0.10	no
Madera	Madera	0.08	yes
Fresno	Clovis	0.09	no
Fresno	Fresno - Drummond	0.09	no
Fresno	Fresno - Sierra Sky Park	0.10	no
Fresno	Fresno - 1st	0.10	no
Fresno	Parlier	0.10	no
Kings	Hanford	0.09	no
Tulare	Ash Mountain	0.11	no
Tulare	Lower Kaweah	0.10	no
Tulare	Visalia	0.09	no
Kern	Arvin	0.11	no
Kern	Bakersfield - Golden	0.09	no
Kern	Bakersfield - California	0.10	no
Kern	Edison	0.10	no
Kern	Maricopa	0.09	no
Kern	Oildale	0.10	no
Kern	Shafter	0.09	No
SJVAB	All Sites	0.11	No

* **Bold** indicates that the site does not meet the attainment test.

Figure A-1 Valley-wide 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations

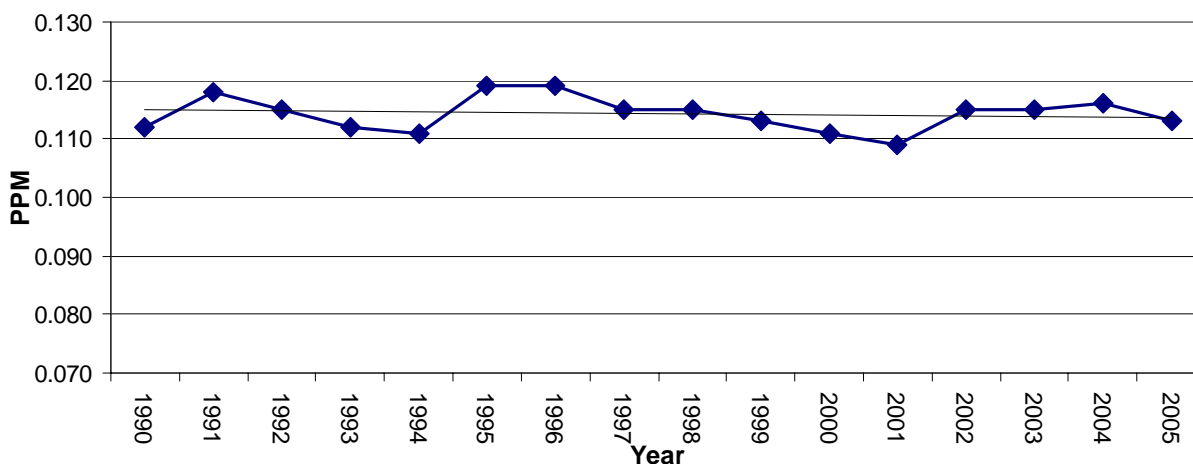
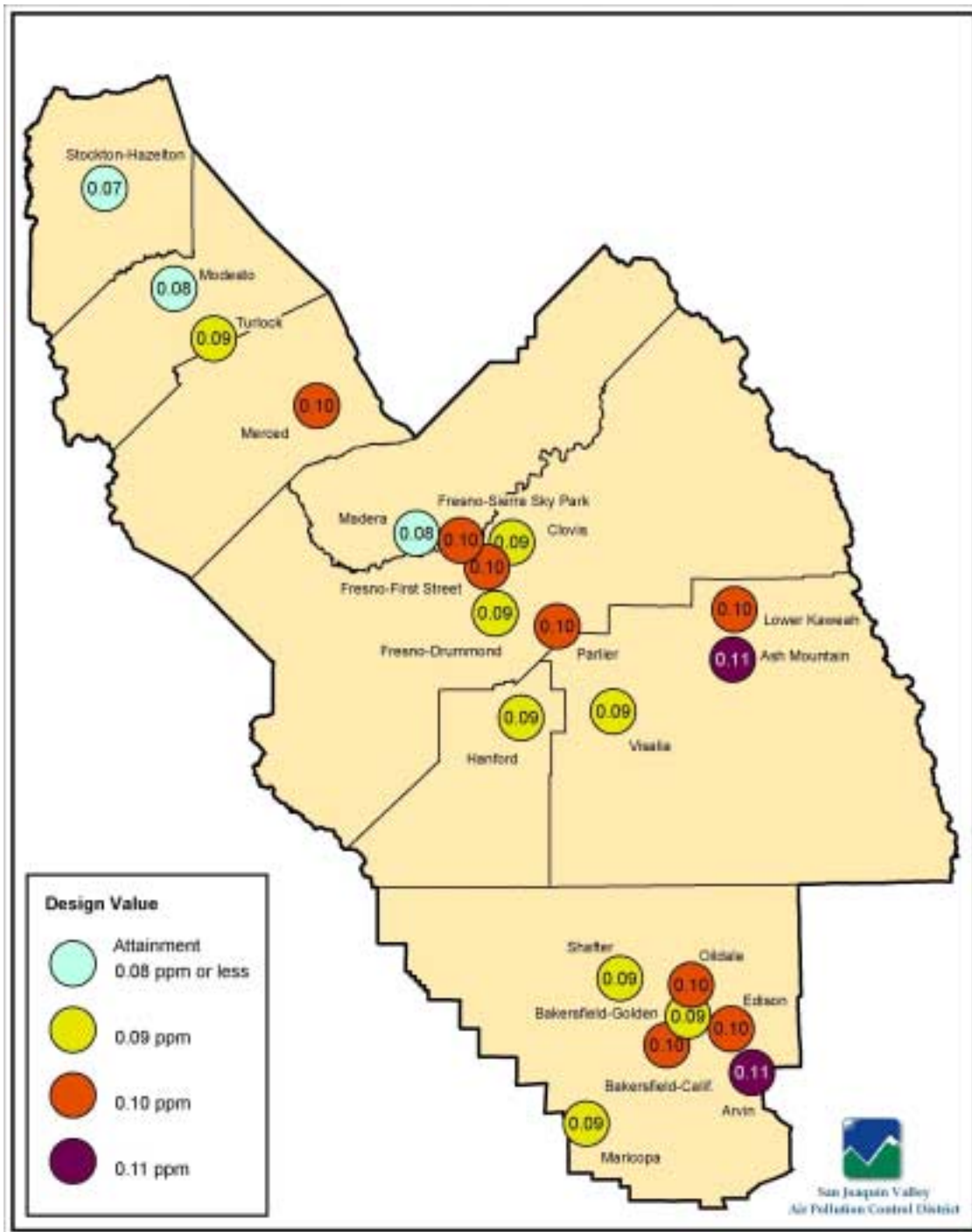


Figure A-2 8-Hour Ozone Design Value (2005)



A.3 TREND AND SPATIAL VARIATIONS

A.3.1 Local Trends

While the Valley-wide design values remain essentially consistent, some sites are improving. Despite the reduction of emissions in the San Joaquin Valley, one site's design value is increasing. All other SJVAB sites are showing either an improving or unchanged trend. Figure A-3 is an example of an improving trend. Seven of the 19 air monitoring sites in the SJVAB are showing an improving air quality trend: Stockton, Fresno-1st, Visalia, Hanford, Bakersfield – California, Bakersfield - Golden and Edison. Figure A-4 shows the trend of the only SJVAB site, Fresno Sierra Sky Park, where the 8-hour ozone air quality is getting worse despite emission reductions. Figure A-5 is an example of one of the eleven of the 19 monitoring sites, in the SJVAB with an unchanged trend. Modesto, Turlock, Merced, Clovis, Fresno-Drummond, Parlier, Lower Kaweah, Arvin, Maricopa, Oildale and Shafter are showing no improvement in 8-hour ozone air quality.

**Figure A-3 Visalia (one of seven improving sites in the SJVAB)
8-hour ozone 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations, 1990-2005**

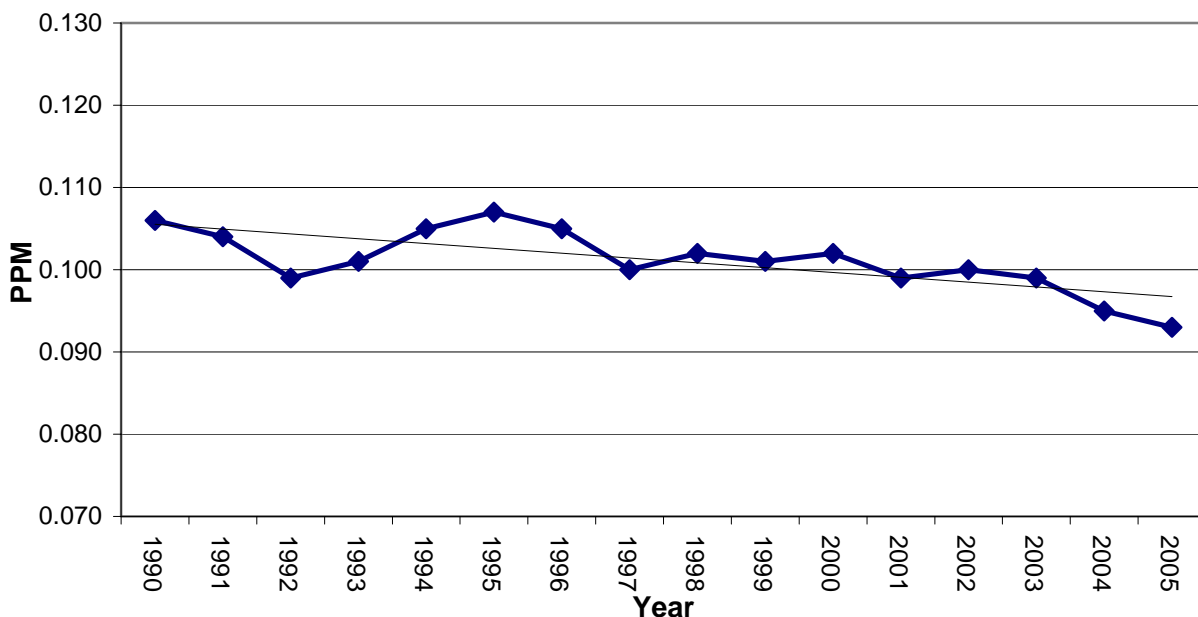


Figure A-4 Fresno – Sierra Sky Park (the only site where 8-hour ozone air quality is getting worse) 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations, 1990-2005

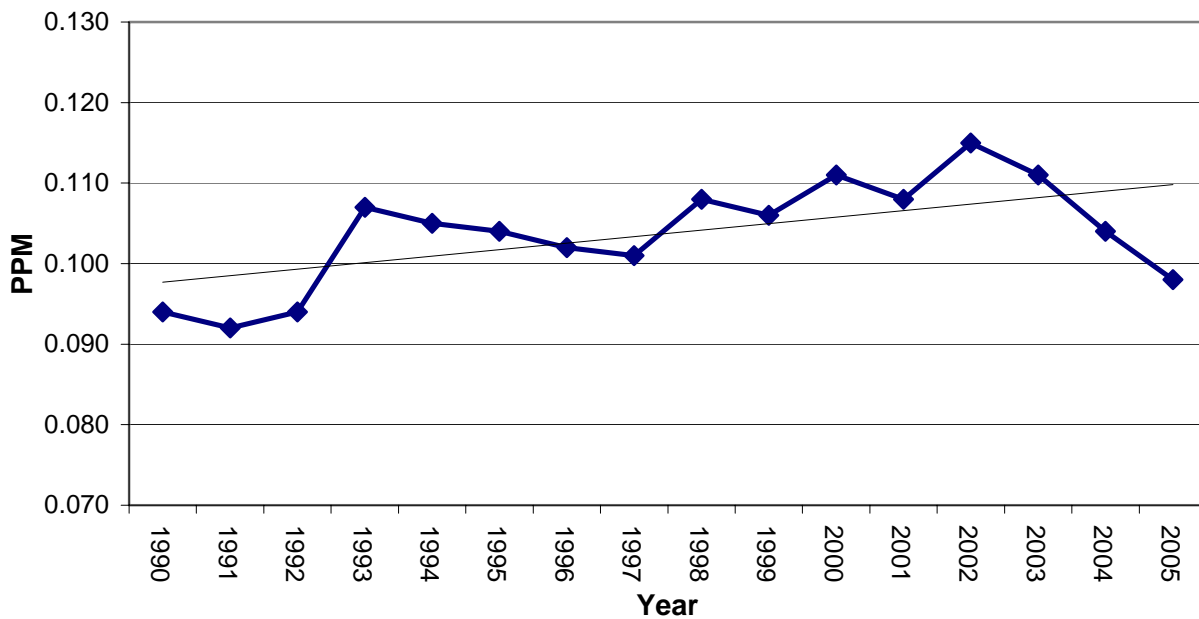
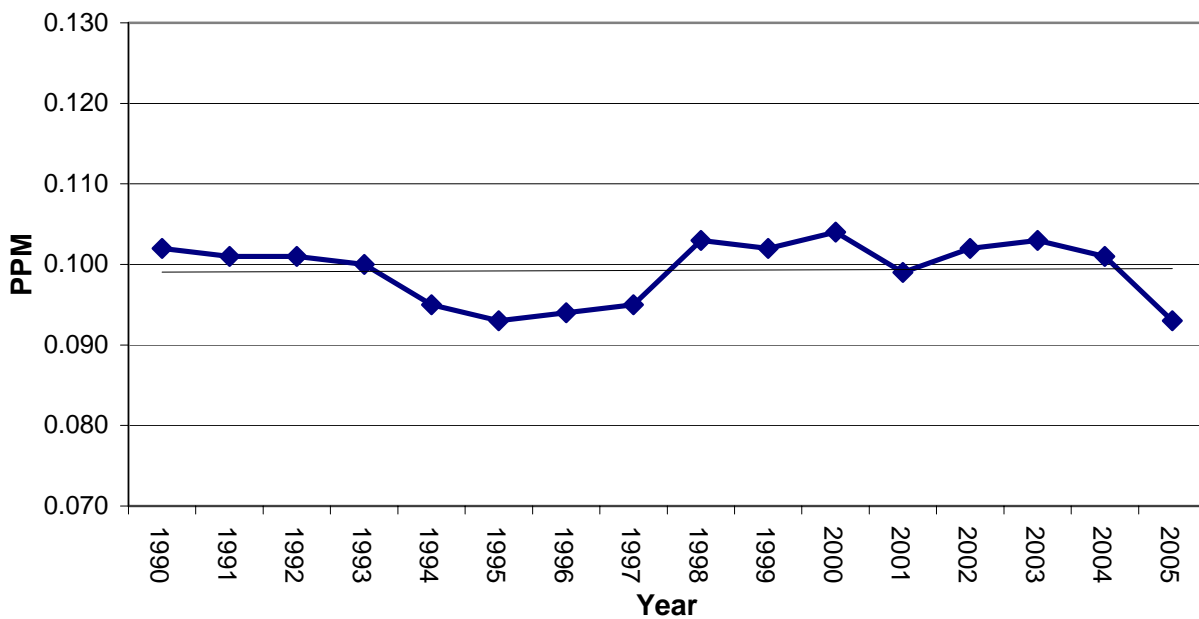


Figure A-5 Fresno – Drummond (one of the eleven sites with no clear trend) 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations, 1990-2005

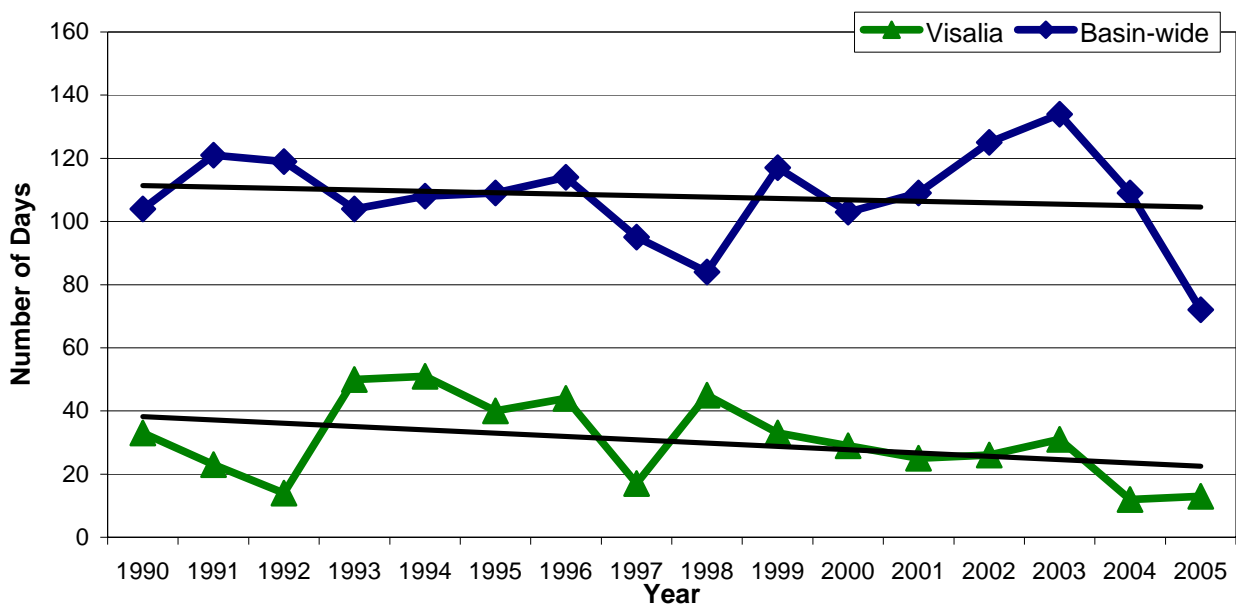


A.3.2 Number of Days Above the Eight Hour Ozone NAAQS

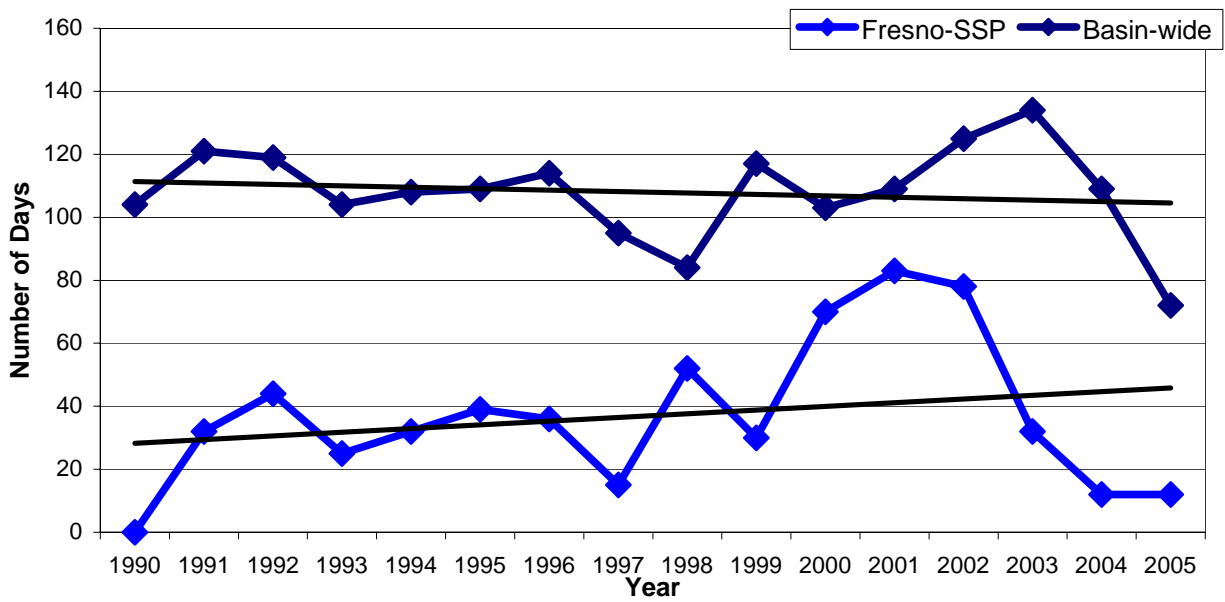
The regulatory 8-hour ozone attainment status for the SJVAB is based upon the design value being less than or equal to 0.08 ppm. Previous figures (A-3, A-4, and A-5) demonstrate examples of trends using the 3-year average of the annual fourth-highest daily maximum 8-hour average concentration vs. year for a particular site. Another way to examine the ozone air quality data is to determine the number of days where the 8-hour ozone concentration is greater than 0.08 ppm. (Note that the number of days greater than 0.08 ppm is not used in determining the attainment status of the SJVAB. It is solely used in determining the number of days of exposure to levels above the level of the NAAQS for 8-hour ozone.)

Figure 1-5 (in Chapter 1) shows the number of days over the 8-hour numerical value by site for 2003, 2004, and 2005; it shows that all sites of the Valley are experiencing fewer days over the level of the standard than a couple of years ago. Figures A-6, A-7, and A-8 show the number of days over the level of the 8-hour ozone standard for the Visalia, Fresno – Sierra Sky Park, and Fresno – Drummond air monitoring sites, respectively. On each of these figures, the number of days over of ozone standard for the entire basin is included to emphasize that the number of days at individual sites is generally much lower than the total number of days for the entire basin. Table A-3 summarizes the number of days above the 8-hour ozone standard for each air-monitoring site in the SJVAB and basin-wide from 1990-2005. On a site-by-site basis, a majority of the SJVAB residents are not being exposed to as many days over the level of the 8-hour standard as the Basin-wide total shows.

Figure A-6 Number of Days Over the Level of the 8-hour Ozone Standard: Visalia



**Figure A-7 Number of Days Over the Level of the 8-hour Ozone Standard:
Fresno – Sierra Sky Park**



**Figure A-8 Number of Days Over the Level of the 8-hour Ozone Standard:
Fresno – Drummond**

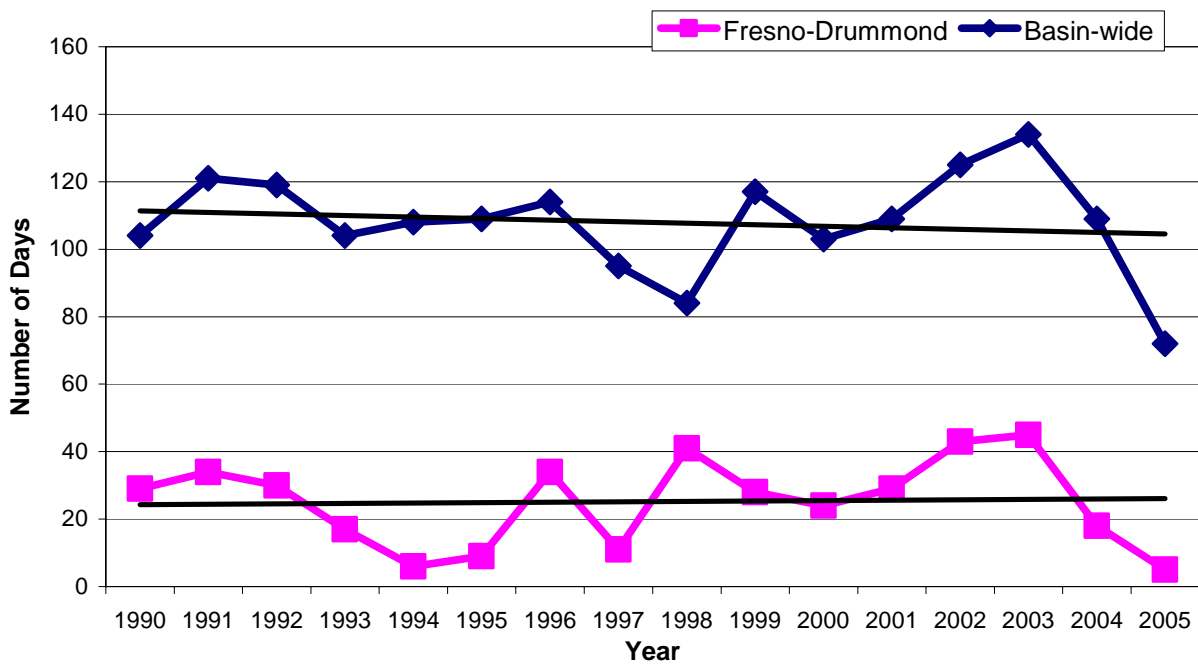


Table A-4 Number of Days Above the 8-Hour Ozone Standard of 0.08 ppm

Site	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Stockton	3	3	2	1	4	4	2	0	4	4	0	1	0	1	0	1
Modesto	7	5	2	7	9	14	15	2	13	7	4	7	6	1	0	6
Turlock	-	-	11	11	10	18	19	8	29	9	10	7	25	18	4	0
Merced	-	-	40	19	26	36	44	1	35	40	37	29	56	54	15	3
Madera	-	-	-	-	-	-	-	-	12	10	9	13	18	14	0	0
Clovis	8	18	61	29	33	44	60	69	62	49	44	56	38	30	4	15
Fresno-Drummond	29	34	30	17	6	9	34	11	41	28	24	29	43	45	18	5
Fresno-First	31	72	42	54	51	53	49	23	44	45	41	40	41	47	18	27
Fresno-SSP	-	32	44	25	32	39	36	15	52	30	70	83	78	32	12	12
Parlier	39	50	44	44	8	25	59	48	54	68	66	74	83	92	8	14
Ash Mtn.	-	-	-	-	-	-	-	-	-	52	40	61	80	72	52	54
Lower Kaweah	27	34	50	48	58	18	50	26	27	39	8	27	73	42	24	32
Visalia	33	23	14	50	51	40	44	17	45	33	29	25	26	31	12	13
Hanford	-	-	-	-	12	1	81	26	31	25	51	18	27	15	9	4
Arvin	82	103	87	77	77	80	106	46	64	85	73	81	87	116	103	54
Bakersfield-California	-	-	-	-	33	57	67	23	38	47	40	47	35	48	13	33
Bakersfield-Golden	-	-	-	-	-	25	47	11	33	26	30	27	29	40	5	6
Edison	66	76	17	87	89	88	78	30	61	55	58	54	51	50	28	26
Maricopa	30	45	36	29	23	67	78	36	66	14	15	46	53	29	9	15
Oildale	29	48	30	24	28	37	52	5	44	28	36	35	37	49	28	27
Shafter	16	31	12	24	24	26	49	4	27	25	25	30	25	15	3	15
Basin-Wide	104	121	119	104	108	109	114	95	84	117	103	109	125	134	109	72

A dash (-) indicates that there is insufficient data available to determine the value.

A.3.3 Difference Between Urban and Rural Ozone Response

Previous strategies have been directed at the one-hour ozone standard. Peak values of the one-hour ozone standard are associated with large urban areas and nearby downwind areas adjacent to the large urban areas. The one-hour ozone strategy was implemented to reduce maximum hourly values in the large urban and down-wind areas and was expected to similarly reduce peak one-hour ozone in the smaller urban and rural areas. The one-hour ozone strategy assumes a proportional effect for benefit of urban reductions on rural ozone levels, but this may not be an accurate assumption for the eight-hour ozone.

Eight-hour ozone is much different in pattern and frequency of occurrences than one-hour ozone due to technical factors that affect how ozone levels change over a period of several hours in urban and rural areas. Changes in ozone levels occur more rapidly in urban areas than in rural areas. The difference in response to emissions changes creates a difficult challenge for determining an optimum approach for achieving attainment of the eight-hour standard.

During the night, in urban areas, fresh emissions of ozone precursors interact with and remove existing ozone (referred to as scavenging). This process causes a rapid change in the ozone concentrations and results in very low nighttime ozone concentrations. When focusing on the peak hour of ozone, this removal process is not a dominant technical issue; however, lowering the eight-hour concentration requires more attention on this issue.

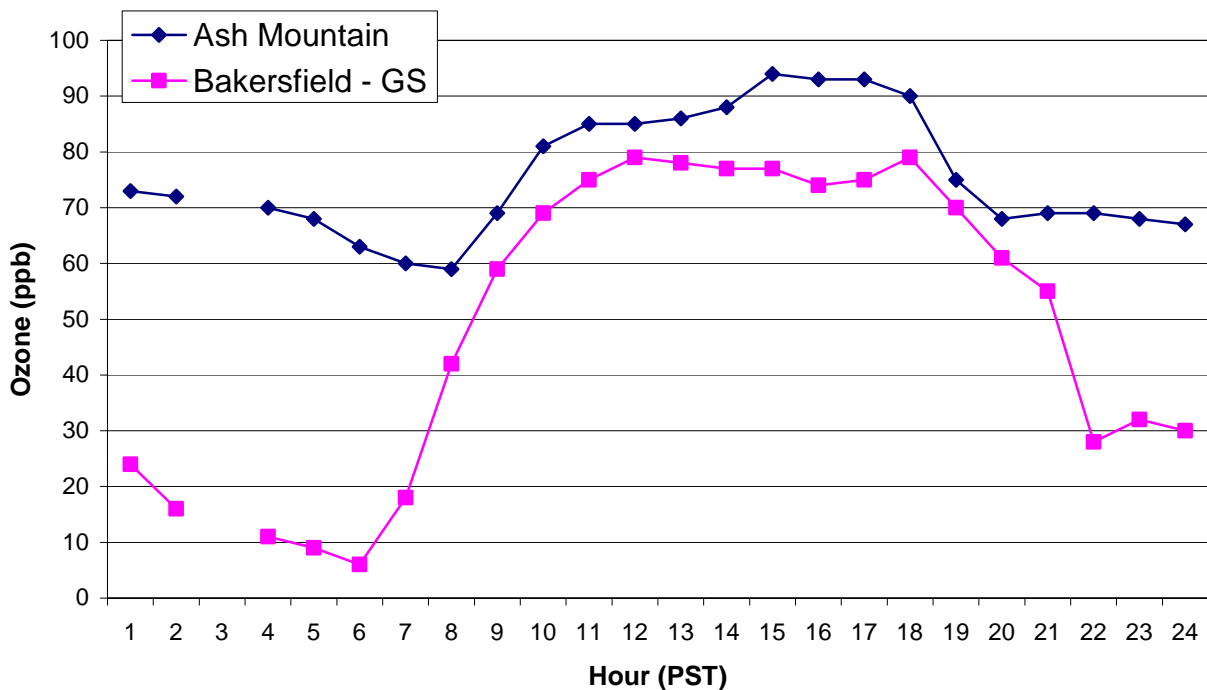
Rural areas with fewer sources emitting precursor emissions do not experience the same ozone removal process as the urban areas. When ozone is transported directly to a rural area, or is created there by transported precursors, there are not enough fresh (scavenging) emissions to remove the ozone quickly. In the rural areas, ozone may remain at high levels during extended periods during the entire 24-hour day.

Figure A-9 provides an example of how urban and rural ozone levels vary due to the differences in local emissions during a day. Hourly averaged ozone at Ash Mountain and Bakersfield (Golden State Highway) monitoring stations on July 2, 2005 shows how urban levels change rapidly and rural ozone levels are less responsive. The urban mechanism described above is demonstrated in the plot of ozone data at Bakersfield, where there are significant hourly emissions of NO_x and volatile organic compounds (VOC). After sunrise, there is a dramatic rise in ozone because sunlight is now available to drive the creation of ozone from the available NO_x and VOC. After the sun sets, chemical reactions and deposition result in a drop in ozone concentrations, which typically continues its downward trend until dawn.

The Ash Mountain monitoring station, which is located at the southern entrance of Sequoia National Park at 1500-foot elevation, demonstrates the hourly ozone response in a rural area. On summer days, ozone and precursors can be transported to Ash Mountain from other locations. At this location, there are significantly lower hourly

emissions of NOx as compared to urban areas such as Bakersfield or Fresno. The amount of available NOx at Ash Mountain to scavenge the ozone is much lower. Because the ozone scavenging at Ash Mountain is much less than the ozone scavenging in urban areas, Ash Mountain can experience elevated ozone concentrations for a 24-hour period during ozone episodes. Since the ozone concentration is already fairly high at dawn, only a relatively small amount of additional ozone can cause levels in the atmosphere to exceed federal standards. All areas with a small population and low NOx emissions that are located in regions subject to ozone transport can experience a similar ozone pattern. This pattern can occur at Arvin and the foothills of the Sierra Nevada and Tehachapi mountain ranges. This phenomenon is an important issue to be examined as part of the plan to reach attainment of the 8-hour ozone standard.

Figure A-9 Ozone Concentrations (ppb) at Ash Mountain and Bakersfield - Golden on July 2, 2005



Trend analysis of air quality monitoring data has not indicated what changes in the current strategy designed to address the one-hour standard would be effective in enhancing ozone reduction efforts for the eight-hour standard. District staff and ARB continue to evaluate air quality data and trends to identify factors that will aid in the determination of a successful strategy for attainment of the eight-hour ozone standard. Trend evaluation will be compared to results of modeling and other corroborative analysis to provide support for the regulatory decision-making process.