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Appendix A

Ambient Air Quality Data

DRAFT *2016 PLAN FOR THE 2008 8-HOUR OZONE STANDARD*

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Appendix A: Ambient Air Quality Data

The concentration of ambient ozone at any given location in the San Joaquin Valley air basin (Valley) is a function of meteorology, the natural environment, atmospheric chemistry, and ozone precursor emissions from both biogenic (natural) and anthropogenic (human caused) sources. The San Joaquin Valley Air Pollution Control District (District), the California Air Resources Board (ARB), and other agencies monitor ozone concentrations throughout the Valley. The U.S. Environmental Protection Agency (EPA) serves as the official repository of ambient ozone data.[1]

The District uses the collected data to show air quality improvement throughout the standardized design value and attainment test calculations, using EPA protocols to document basin-wide improvement and attainment of the National Ambient Air Quality Standards (NAAQS). As shown in this appendix, the design value data show steady, long-term air quality improvement.

The District also uses the data to evaluate the impact of changing daily, monthly, and annual ozone concentrations on public health. These trend analyses provide the District with critical information about how to develop control measures and incentive programs that contribute to the greatest public health improvements and greatest progress toward EPA air quality standards.

A.1 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 San Joaquin Valley (Valley) for the years 1990-2014. The calculation of the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is explained in Chapter 4. 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 Valley for the years 1990-2014. A dash (-) means that there is insufficient (or no) data available to determine the value.

Attainment status is determined for each site by analyzing 2012 through 2014 ozone measurements[2]. If any monitoring site within the Valley has a design value that is greater than 0.075 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.

[1] U.S. Environmental Protection Agency; Technology Transfer Network (TTN), Air Quality System (AQS): AQS Web Application (2010). Available at http://www.epa.gov/ttn/airs/airsaqs/aqsweb/

[2] 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.

Table A-3 shows that two of the 25 air monitoring sites in the Valley currently meet the attainment test for 2008 8-hour ozone standard of 75 ppb in Stockton and Tranquillity. Twenty-Three (23) out of 25 sites are nonattainment for the 8-hour average ozone standard for the 2012-2014 time period. This is an improvement from 1999 to 2001 period where all sites were nonattainment. Figure A-1 shows the Valley-wide design values for 1990-2014. Figure A-2 shows 2014 design values plotted on a map. More air quality trend data can be found at <http://www.arb.ca.gov>.

Table A-1 Fourth Highest 8-hour Average Ozone (ppm)

Name	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Stockton-Hazelton	0.083	0.090	0.076	0.076	0.073	0.075	0.073	0.073	0.083	0.075	0.077	0.070	0.070	0.066	0.072	0.064	0.071
Tracy-Airport	-	-	-	-	-	-	-	-	0.093	0.079	0.090	0.080	0.075	0.080	0.085	0.073	0.080
Modesto-14th St	0.097	0.095	0.086	0.091	0.087	0.082	0.080	0.089	0.090	0.076	0.090	0.079	0.073	0.074	0.078	0.075	0.081
Turlock	-	0.103	0.091	0.094	0.102	0.093	0.087	0.079	0.092	0.075	0.106	0.086	0.087	0.088	0.091	0.080	0.081
Merced-Coffee	-	0.107	0.103	0.096	0.105	0.107	0.096	0.083	0.087	0.087	0.105	0.080	0.090	0.082	0.079	0.083	0.082
Madera-City	-	-	-	-	-	-	-	-	-	-	-	-	0.090	0.081	0.087	0.085	0.082
Madera-Pump Yard	-	-	0.088	0.090	0.096	0.093	0.078	0.076	0.081	0.077	0.091	0.085	0.078	0.080	0.078	0.079	0.088
Tranquillity	-	-	-	-	-	-	-	-	-	-	-	-	0.077	0.079	0.077	0.075	0.075
Fresno-Sky Park	-	0.103	0.114	0.113	0.119	0.102	0.091	0.101	0.097	0.088	0.101	0.093	0.097	0.095	0.085	0.085	0.091
Clovis	-	0.108	0.104	0.110	0.104	0.097	0.085	0.093	0.094	0.092	0.108	0.099	0.103	0.096	0.097	0.091	0.097
Fresno-1st St	0.103	0.108	0.104	0.104	0.109	0.106	0.092	0.101	0.101	0.094	0.108	0.100	0.098	0.090	-	-	-
Fresno-Garland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.095	0.084	0.090
Fresno-Drummond	0.103	0.089	0.099	0.097	0.110	0.104	0.091	0.086	0.085	0.079	0.093	0.097	0.087	0.102	0.096	0.086	0.084
Parlier	0.103	0.106	0.108	0.109	0.115	0.111	0.087	0.091	0.099	0.090	0.101	0.082	0.094	0.089	0.094	0.095	0.087
Hanford	-	0.080	0.105	0.093	0.101	0.092	0.088	0.085	0.086	0.080	-	-	0.103	0.086	**0.082**	**0.085**	0.086
Visalia-Church	0.102	0.104	0.099	0.099	0.102	0.096	0.089	0.095	0.092	0.086	0.105	0.091	0.096	0.079	0.088	0.074	0.078
Porterville	-	-	-	-	-	-	-	-	-	-	-	-	0.091	0.092	0.088	0.084	0.073
Lower Kaweah	0.096	0.095	0.090	0.096	0.108	0.100	0.095	0.097	0.097	0.091	0.101	0.080	0.096	0.081	0.087	0.087	**0.085**
Ash Mountain	-	-	0.105	0.104	0.107	0.110	0.099	0.107	0.104	0.099	0.112	0.098	0.094	0.098	0.095	0.090	0.089
Shafter	0.093	0.095	0.092	0.098	0.096	0.096	0.084	0.090	0.093	0.083	0.093	0.080	0.091	0.084	0.085	0.079	0.081
Oildale	0.098	0.101	0.103	0.097	0.102	0.100	0.094	0.096	0.100	0.090	0.104	0.087	0.093	0.087	0.088	0.078	0.078
Bakersfield-Golden	-	0.096	0.099	0.095	0.101	0.098	0.085	0.088	0.091	0.080	0.094	-	-	-	-	-	-
Bakersfield-California	-	0.107	0.102	0.099	0.101	0.101	0.091	0.099	0.107	0.085	0.101	0.086	0.093	0.087	0.087	0.084	0.084
Bakersfield-Muni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.099**	0.087	0.087
Edison	0.108	0.123	0.105	0.104	0.109	0.100	0.095	0.097	0.108	0.093	0.107	0.097	0.099	0.092	0.088	0.079	0.085
Arvin-Bear Mtn.	0.118	0.115	0.111	0.109	0.118	0.119	0.112	0.108	0.111	0.102	0.112	0.102	0.100	-	-	-	-
Arvin-Di-Giorgio	-	-	-	-	-	-	-	-	-	-	-	-	0.092	0.091	0.091	0.087	0.088
Maricopa	0.098	0.109	0.093	0.098	0.106	0.095	0.088	0.090	0.090	0.086	0.084	0.086	0.085	0.094	0.082	0.078	0.078

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

Bold indicates that there were completeness issues with the data.

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

Name	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Stockton	0.083	0.084	0.082	0.079	0.075	0.075	0.074	0.073	0.076	0.077	0.078	0.074	0.072	0.068	0.069	0.067	0.069
Tracy-Airport	-	-	-	-	-	-	-	-	-	-	0.087	0.083	0.081	0.078	0.080	0.079	0.079
Modesto-14th St	0.094	0.092	0.090	0.088	0.088	0.086	0.083	0.083	0.086	0.085	0.085	0.081	0.080	0.075	0.075	0.075	0.078
Turlock	-	0.095	0.096	0.091	0.095	0.096	0.094	0.086	0.086	0.082	0.091	0.089	0.093	0.087	0.088	0.086	0.084
Merced-Coffee	-	0.100	0.106	0.101	0.101	0.102	0.102	0.095	0.088	0.085	0.093	0.090	0.091	0.084	0.083	0.081	0.081
Madera-City	-	-	-	-	-	-	-	-	-	-	-	-	0.090	0.085	0.086	0.084	0.084
Madera-Pump Yard	-	-	0.089	0.088	0.091	0.093	0.089	0.082	0.078	0.078	0.083	0.084	0.084	0.081	0.078	0.079	0.081
Tranquillity	-	-	-	-	-	-	-	-	-	-	-	-	-	0.078	0.077	0.077	0.075
Fresno- Sky Park	-	0.104	0.111	0.108	0.115	0.111	0.104	0.098	0.096	0.095	0.095	0.094	0.097	0.095	0.092	0.088	0.087
Clovis	-	0.104	0.109	0.106	0.106	0.103	0.095	0.091	0.090	0.093	0.098	0.099	0.103	0.099	0.098	0.094	0.095
Fresno- 1st St	-	0.108	0.108	0.104	0.105	0.106	0.102	0.099	0.098	0.098	0.101	0.100	0.102	0.096	-	-	-
Fresno-Garland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.095	0.089	0.089
Fresno- Drummond	0.102	0.093	0.104	0.099	0.102	0.103	0.101	0.093	0.087	0.083	0.085	0.089	0.092	0.095	0.095	0.094	0.088
Parlier	0.110	0.099	0.107	0.107	0.110	0.111	0.104	0.096	0.092	0.093	0.096	0.091	0.092	0.088	0.092	0.092	0.092
Hanford	-	-	0.102	0.098	0.099	0.095	0.093	0.088	0.086	0.083	-	-	0.103	0.094	0.090	0.084	0.084
Visalia-Church	0.106	0.107	0.102	0.099	0.100	0.099	0.095	0.093	0.092	0.091	0.094	0.094	0.097	0.088	0.087	0.080	0.080
Porterville	-	-	-	-	-	-	-	-	-	-	-	-	0.091	0.091	0.090	0.088	0.081
Lower Kaweah	0.094	0.102	0.093	0.094	0.098	0.101	0.101	0.097	0.096	0.095	0.096	0.090	0.092	0.085	0.088	0.085	0.086
Ash Mountain	-	-	-	0.104	0.105	0.107	0.105	0.105	0.103	0.103	0.105	0.103	0.101	0.096	0.095	0.094	0.091
Shafter	-	0.097	0.095	0.094	0.095	0.096	0.092	0.090	0.089	0.088	0.089	0.085	0.088	0.085	0.086	0.082	0.081
Oildale	0.103	0.099	0.101	0.097	0.100	0.099	0.098	0.096	0.096	0.095	0.098	0.093	0.094	0.089	0.089	0.084	0.081
Bakersfield- Golden	-	-	0.100	0.096	0.098	0.098	0.094	0.090	0.088	0.086	0.088	0.087	0.094	-	-	-	-
Bakersfield- California	-	-	0.101	0.100	0.100	0.100	0.097	0.097	0.099	0.097	0.097	0.090	0.093	0.088	0.089	0.086	0.085
Bakersfield-Muni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.099	0.093	0.091
Edison	0.112	0.119	0.111	0.104	0.106	0.104	0.101	0.097	0.100	0.099	0.102	0.099	0.101	0.096	0.093	0.086	0.084
Arvin-Bear Mtn.	-	0.112	0.111	0.109	0.112	0.115	0.116	0.113	0.110	0.107	0.108	0.105	0.104	0.101	0.100	-	-
Arvin-Di-Giorgio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.091	0.089	0.088
Maricopa	0.105	0.101	0.102	0.094	0.099	0.099	0.096	0.091	0.089	0.088	0.086	0.085	0.085	0.088	0.087	0.084	0.079

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

Table A-3 Current[3] 8-hour Ozone Design Values and Attainment Status for the San Joaquin Valley Air Basin

County	Site	2012-2014 8-hour Ozone Design Values (ppm)	Meets Attainment Test
San Joaquin	Stockton	0.069	yes
San Joaquin	Tracy	0.079	no
Stanislaus	Modesto	0.078	no
Stanislaus	Turlock	0.084	no
Merced	Merced	0.081	no
Madera	Madera-Pump Yard	0.081	no
Madera	Madera-City	0.084	no
Fresno	Tranquillity	0.075	yes
Fresno	Fresno-Sky Park	0.087	no
Fresno	Clovis	0.095	no
Fresno	Fresno-Garland	0.089	no
Fresno	Fresno - Drummond	0.088	no
Fresno	Parlier	0.092	no
Kings	Hanford	0.084	no
Tulare	Ash Mountain	0.091	no
Tulare	Lower Kaweah	0.086	no
Tulare	Visalia	0.080	no
Tulare	Porterville	0.081	no
Kern	Shafter	0.081	no
Kern	Oildale	0.081	no
Kern	Bakersfield - California	0.085	no
Kern	Bakersfield - Munii	0.091	no
Kern	Edison	0.084	no
Kern	Arvin-Di-Giorgio	0.088	no
Kern	Maricopa	0.079	no
Valley	**All Sites**	**0.95**	**no**

[3] 2012-2014 are the design value years.

Figure A-1 Valley Maximum 8-hour Ozone Design Value Trend

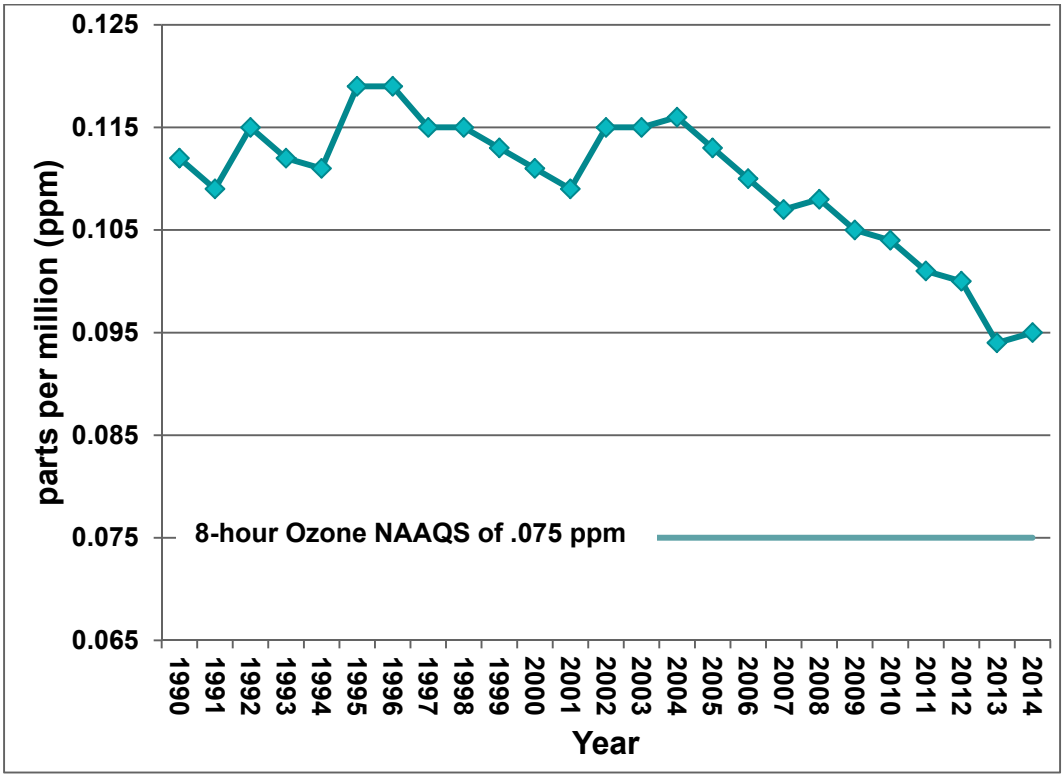
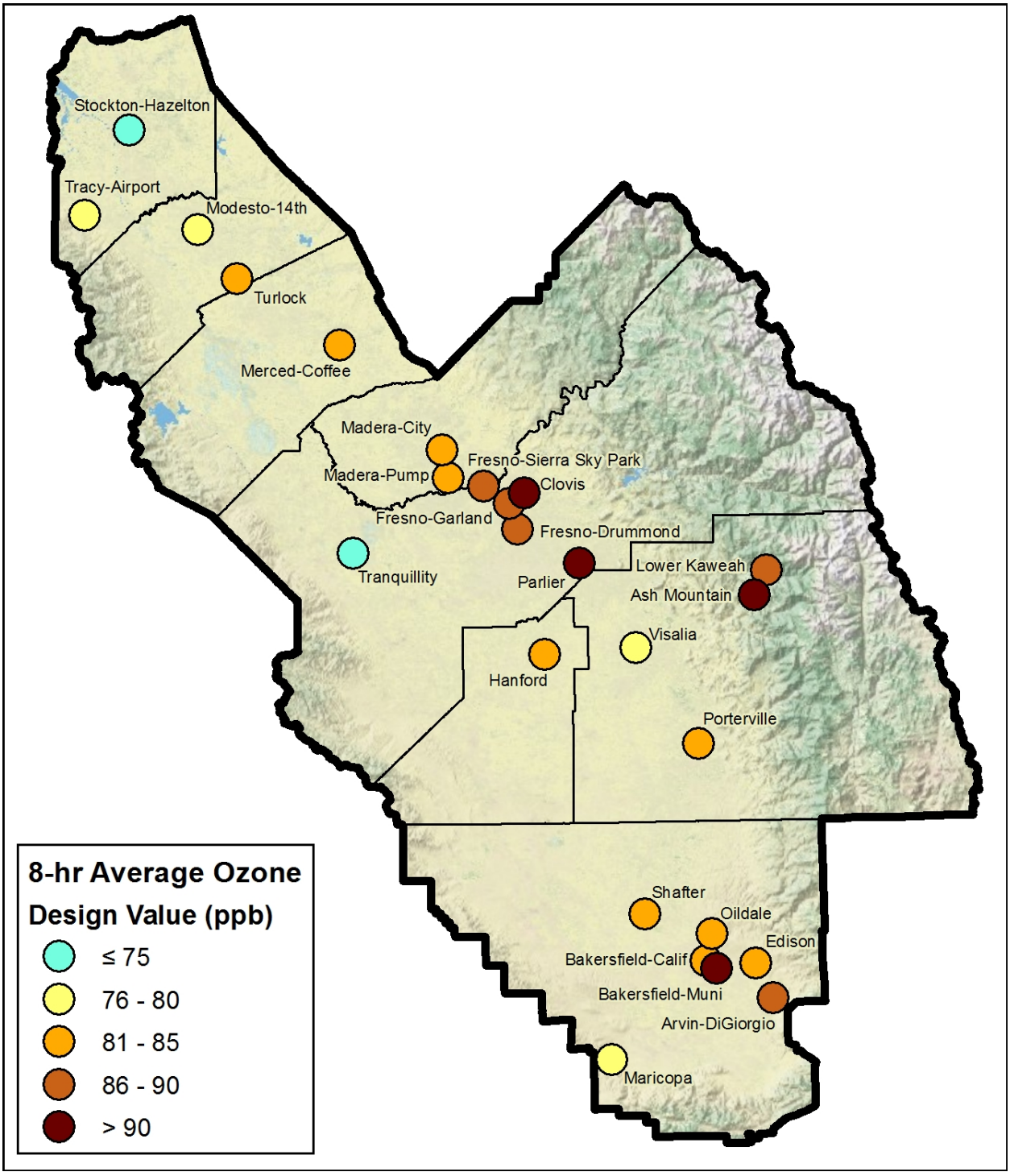


Figure A-2 8-Hour Ozone Design Value (2014)



A.3 TREND AND SPATIAL VARIATIONS

A.3.1 Local Trends

Figures A-3 through A-5 revel the decreasing design value trends at Stockton, Clovis, and Edison. While ozone design values have generally been trending downward, there have been periods of upward trending as well. Design values increased Valley-wide in 2008 due to the summer wildfire impacts. In addition to causing elevated PM2.5 concentrations, wildfires also generate and transport ozone (NOx and VOC) precursors. Since the design value calculation is a three-year average, the 2007-2009 and 2008-2010 design values for some sites were higher due wildfire smoke. Other instances of upward design value trends occurred for some air monitoring stations such as Hanford and Bakersfield-Municipal Airport which were either non-operational for extended periods of time due to construction or repairs. Such periods caused data completeness issues which skewed the design value calculations higher. Although upward trends have occurred from time to time, design values have still remained lower than they were in 1996.

In order to identify factors that will help determine a successful strategy for attainment of the 8-hour ozone standard, the District and ARB continue to evaluate air quality data and trends. In addition, comparisons of trend analyses, modeling results, and other analyses will be conducted as support analysis for the regulatory decision-making process.

Figure A-3 Stockton 8-hour Ozone Design Value Trend, 1990-2014

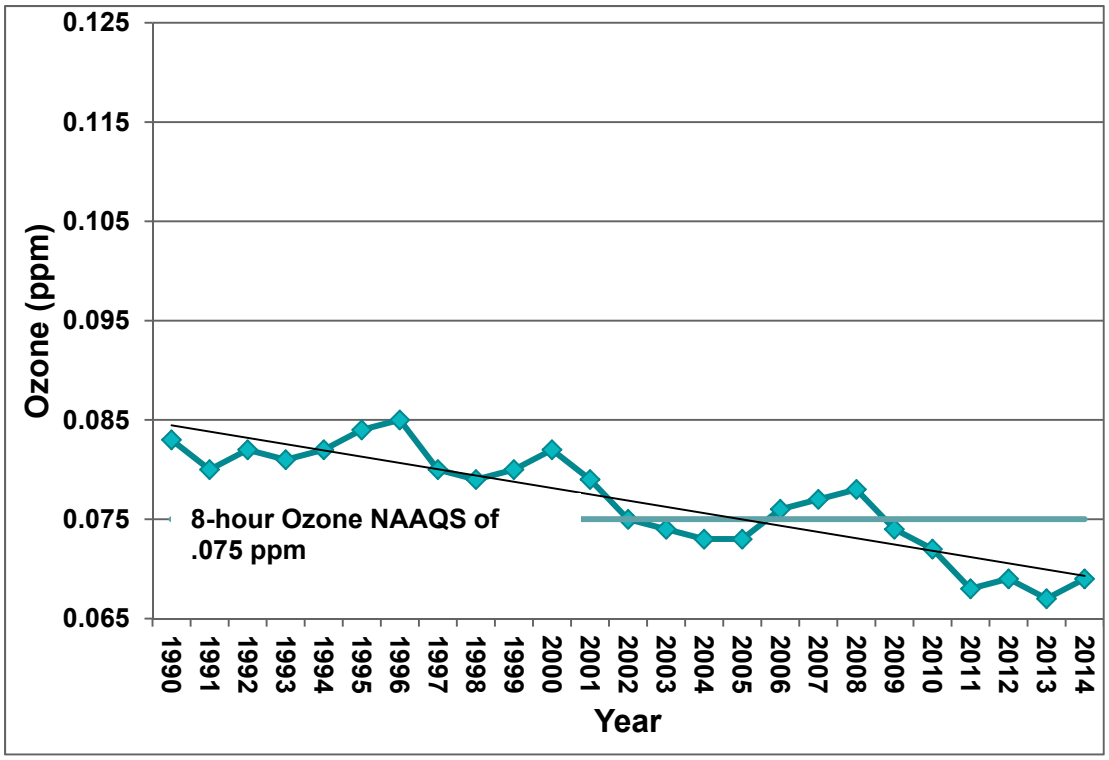


Figure A-4 Clovis 8-hour Ozone Design Value Trend, 1992-2014

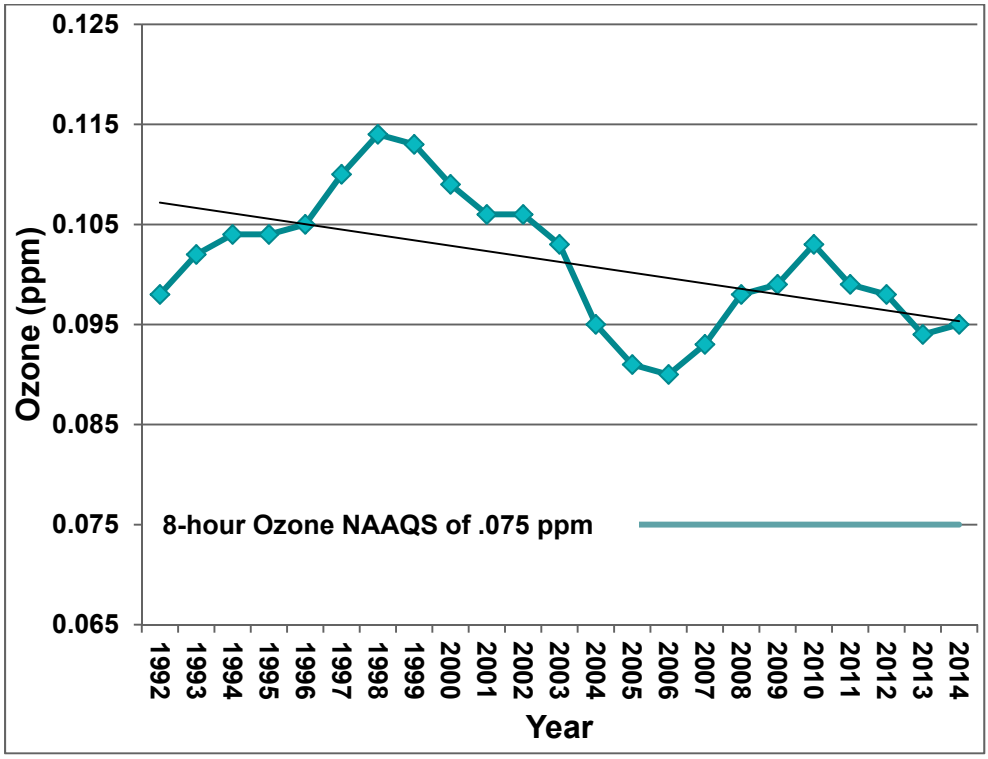
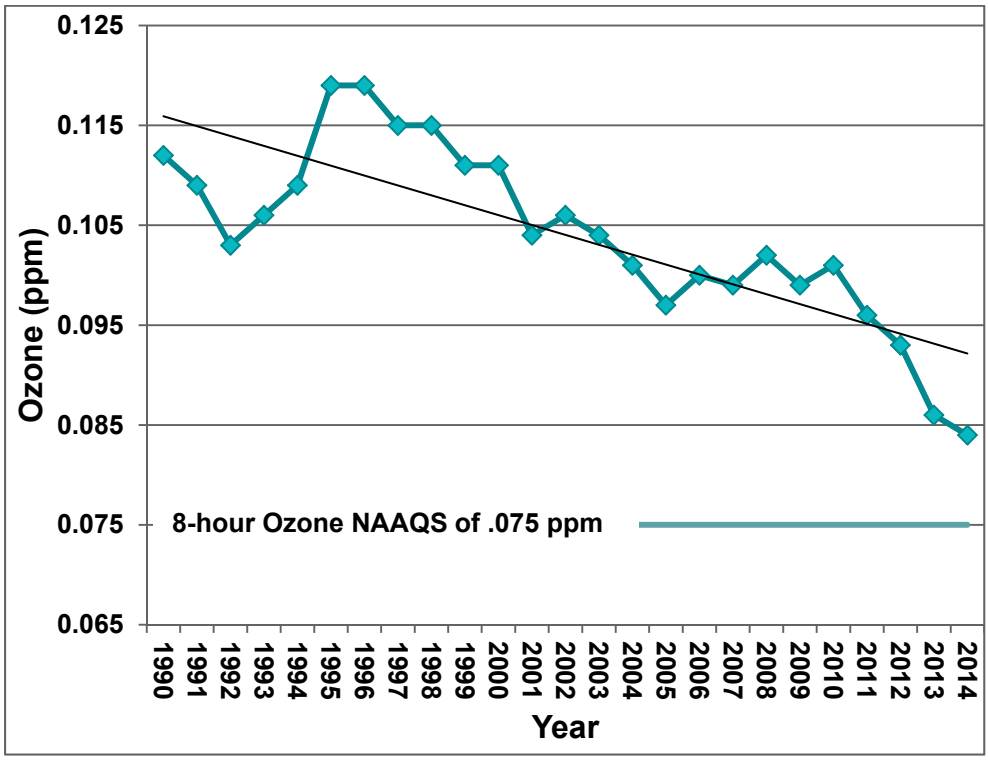


Figure A-5 Edison 8-hour Ozone Design Value Trend, 1990-2014



A.3.2 Number of Days Above the 8-hour Ozone NAAQS

The regulatory 8-hour ozone attainment status for the Valley is based upon the design value being less than or equal to 0.075 ppm. Previous figures (A-1, A-3 through 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 and entire basin. 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 0.075 ppm. (Note that the number of days greater than 0.075 ppm is not used in determining the attainment status of the Valley. It is solely used in determining the number of days of exposure to levels above the level of the NAAQS for 8-hour ozone.)

Figures A-6, A-7, and A-8 show the number of days over the level of the 8-hour ozone standard for the Modesto-14th, Fresno – Drummond, and Shafter air monitoring sites, respectively. On each of these figures, the number of days over the 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-4 summarizes the number of days above the 8-hour ozone standard for each air monitoring site in the Valley and basin-wide from 1990-2014. On a site-by-site basis, a majority of the Valley residents are not being exposed to as many days over the level of the 8-hour standard as the basin-wide total shows. In fact, the average number of days a resident experienced ozone levels above the 1997 and 2008 8-hour ozone standards have been reduced by 91% and 73%, respectively, since 2002.

Figure A-6 Number of Days Over the 8-hour Ozone Standard: Modesto-14th

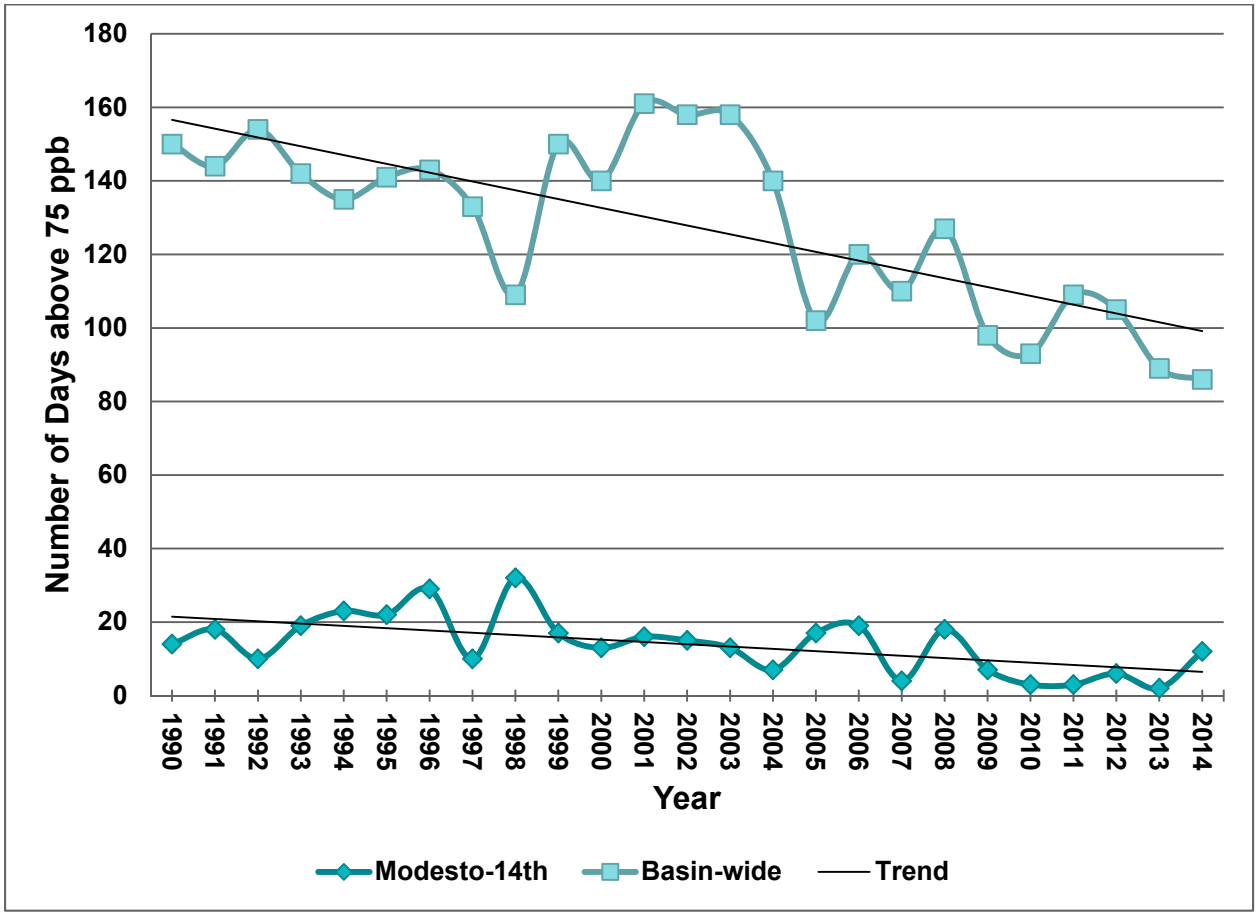


Figure A-7 Number of Days Over the 8-hour Ozone Standard: Fresno – Drummond

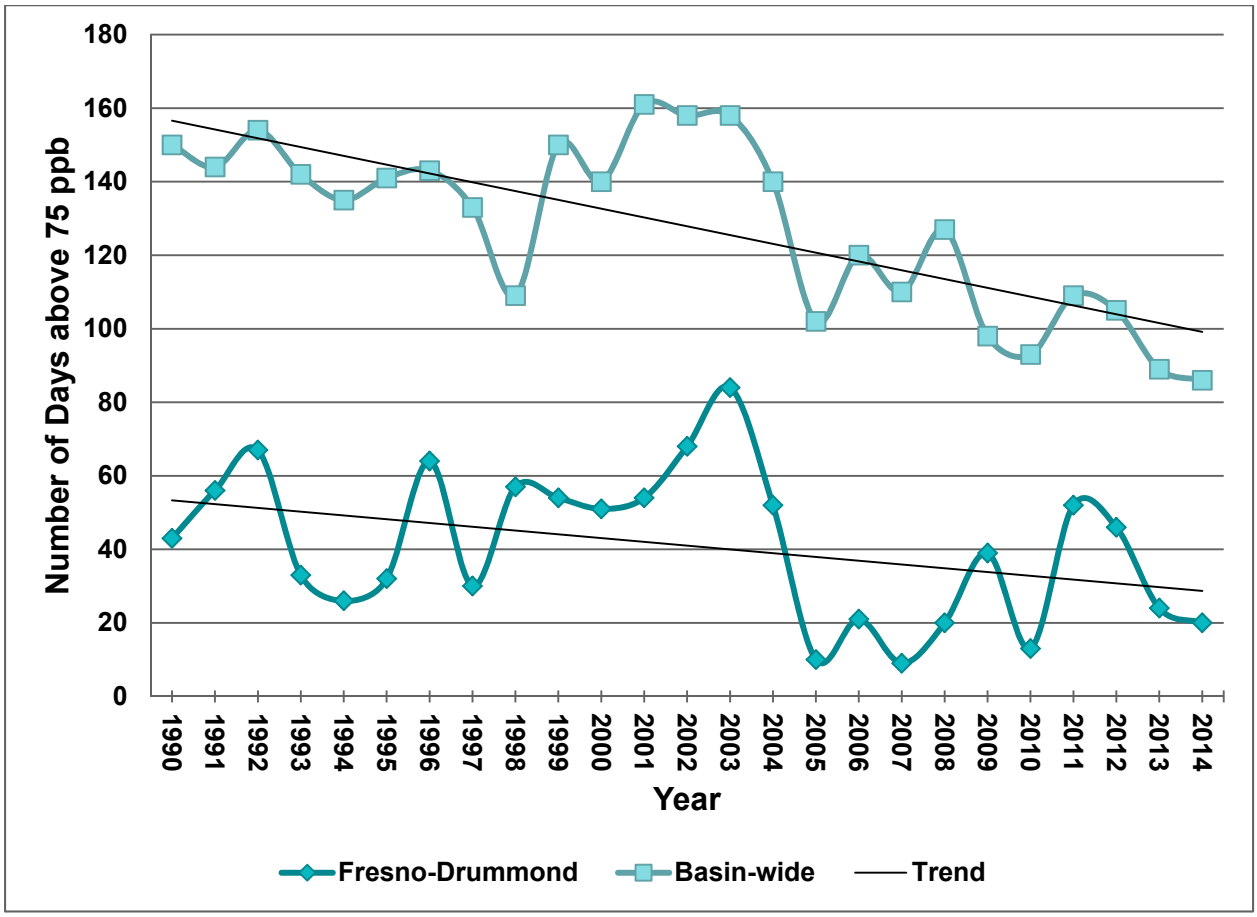


Figure A-8 Number of Days Over the 8-hour Ozone Standard: Shafter

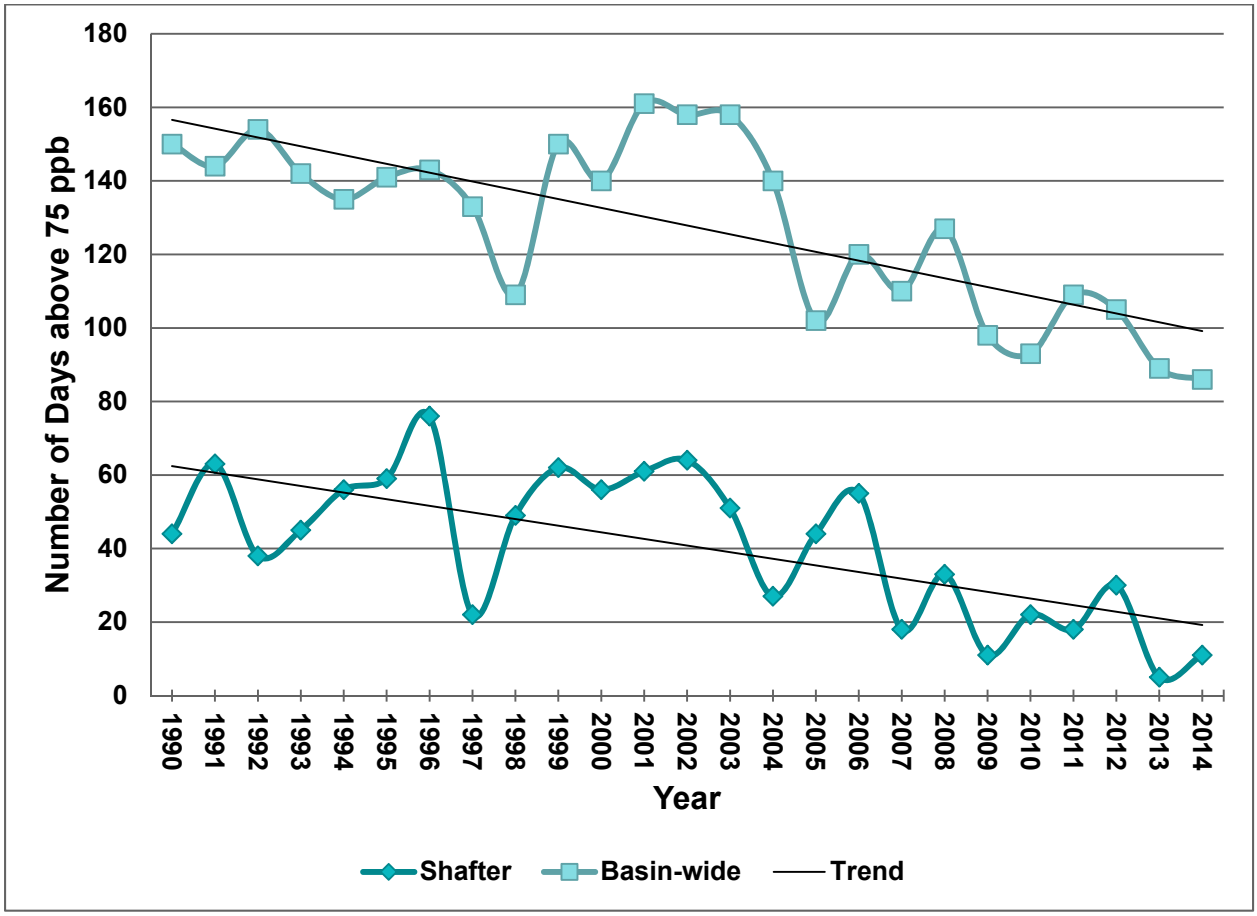


Table A-4 Number of Days Above the 8-Hour Ozone Standard of 0.075 ppm

SITE	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Stockton-Hzltn	8	11	4	6	3	2	2	1	13	3	4	2	2	0	2	0	1
Tracy	--	--	--	--	--	--	--	--	22	6	16	8	3	8	16	2	8
Modesto-14th	14	22	13	16	15	13	7	17	19	4	18	7	3	3	6	2	12
Turlock	--	33	29	13	40	40	12	5	24	3	29	18	10	17	35	14	12
Merced-Coffee	--	73	66	61	89	92	47	20	30	18	33	15	14	19	9	15	22
Madera-City	--	--	--	--	--	--	--	--	--	--	--	--	22	30	60	44	26
Madera-Pump	--	--	30	37	40	42	7	5	15	5	24	13	8	8	7	6	20
Fresno-SSP	--	64	109	130	131	67	30	37	54	18	39	34	35	45	19	25	32
Fresno-Drummond	43	32	51	54	68	84	52	10	21	9	20	39	13	52	46	24	20
Clovis	--	68	71	92	62	61	30	38	51	30	44	48	39	49	57	38	56
Fresno-Garland	55	79	67	66	66	82	48	55	69	37	62	24	26	33	47	17	29
Parlier	66	45	93	122	130	136	41	46	61	30	51	26	30	43	62	50	36
Tranquillity	--	--	--	--	--	--	--	--	--	--	--	--	7	7	6	3	3
Hanford	--	11	91	43	62	45	25	24	37	8	38	21	41	28	8	25	14
Visalia-Church	53	64	70	53	59	65	40	46	51	31	60	48	34	17	37	2	10
Porterville	--	--	--	--	--	--	--	--	--	--	--	--	43	47	44	23	0
Ash Mountain	--	--	58	117	117	112	94	78	86	83	74	72	66	84	82	56	51
Lower Kaweah	63	50	33	65	107	75	49	56	62	70	73	18	9	31	41	38	32
Shafter	44	59	56	61	64	51	27	44	55	18	33	11	22	18	30	5	11
Oildale	59	69	71	74	72	84	77	61	70	41	49	37	30	29	46	5	7
BFL-Cali	--	88	77	83	75	86	46	71	79	25	40	34	28	25	56	22	20
Bakersfield-Muni	--	50	67	62	62	64	38	27	38	14	21	--	--	--	61	23	32
Edison	102	112	92	90	98	81	66	55	68	44	79	60	47	47	42	8	24
Arvin-DiGiorgio	124	113	105	118	125	144	133	90	99	89	102	44	28	36	53	34	36
Maricopa	74	98	39	86	97	72	53	43	45	23	20	31	12	49	24	10	8
Average	63	67	69	79	84	83	55	50	59	37	51	37	30	37	44	23	24
Basin-wide	150	141	140	161	158	158	140	102	120	110	127	98	93	109	105	89	86

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

A.4 DIFFERENCE BETWEEN URBAN AND RURAL OZONE RESPONSE

The difference between how ozone levels change in urban areas versus rural areas is most evident during the nighttime hours when ozone formation ceases. At night, fresh NOx emissions in urban areas interact with and remove or scavenge existing ozone. This process causes a rapid change which results in very low nighttime ozone concentrations.

Rural areas, on the other hand, have fewer sources of fresh NOx emissions and do not experience the same ozone removal process that occurs in urban areas. Since ozone is either transported directly to rural areas, or it is created, in part, by precursors that have been transported to those areas, there are not enough fresh scavenging emissions to remove the ozone quickly. Thus ozone in rural areas may remain elevated for longer durations during a 24-hour period.

Figure A-9 shows how urban and rural ozone levels vary due to the differences in local emissions during a day. The diurnal increase and decrease in ozone levels at the Bakersfield – Municipal Airport air monitoring station are quite distinct, whereas, the diurnal response of the ozone levels at Ash Mountain is more subtle. The urban mechanism described above is evident in the ozone data at Bakersfield, where there are higher emissions of NOx and volatile organic compounds (VOC) available. After sunrise, there is a dramatic rise in ozone because sunlight is now available to drive the creation of ozone from the available NOx 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 entrance of Sequoia National Park at 1,500-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. At Ash Mountain, the amount of NOx available to scavenge the ozone is much lower. Because much less ozone scavenging occurs at Ash Mountain compared to the amount of scavenging that occurs in urban areas, Ash Mountain can experience elevated ozone concentrations throughout a 24-hour period. Since the ozone concentration is already fairly high at dawn, only a relatively small amount of additional ozone can cause levels at Ash Mountain to exceed federal standards. All areas with small populations and low NOx emissions that are located in regions subject to ozone transport can experience a similar ozone pattern. This pattern can occur at 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 Municipal Airport on August 24, 2014