SJVUAPCD

Appendix A

Ambient Air Quality Data

PROPOSED *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 1990-2015. The calculation of the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is explained further in Chapter 2. 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 1990-2015. A dash (-) means that there is insufficient (or no) data available to determine the value.

Attainment status is determined for each site by analyzing 2013 through 2015 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 https://www.epa.gov/aqs

[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 2013-2015 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 1990-2015. Figure A-2 shows 2015 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-hr Average Ozone (ppm)

Name	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Stockton-Hazelton	0.083	0.090	0.076	0.076	0.074	0.075	0.073	0.073	0.083	0.075	0.077	0.070	0.070	0.066	0.072	0.064	0.071	0.069
Tracy-Airport	-	-	-	-	-	-	-	-	0.093	0.079	0.090	0.080	0.075	0.080	0.085	0.073	0.080	0.077
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	0.083
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	0.085
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	0.083
Madera-City	-	-	-	-	-	-	-	-	-	-	-	-	0.090	0.081	0.087	0.085	0.082	0.083
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	0.080
Tranquillity	-	-	-	-	-	-	-	-	-	-	-	-	0.077	0.079	0.077	0.075	0.075	0.077
Fresno-Sky Park	0.094	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	0.084
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	0.093
Fresno-1st/Garland	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	0.095	0.084	0.090	0.087
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	0.088
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	0.093
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	0.085
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	0.087
Porterville	-	-	-	-	-	-	-	-	-	-	-	-	0.091	0.092	0.088	0.084	0.073	0.086
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	0.077	0.081	0.087	0.087	**0.085**	0.083
Ash Mountain	-	-	0.105	0.104	0.107	0.110	0.099	0.107	0.104	0.099	0.112	0.098	0.094	0.096	0.095	0.090	0.089	0.088
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	0.082
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	0.082
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	0.088
Bakersfield-Muni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.099**	0.087	0.087	0.097
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	0.090
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	0.087
Maricopa	0.098	0.109	0.095	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	0.083

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-yr Average of the Annual Fourth-Highest Daily Maximum 8-hr Average Ozone Concentrations (ppm)

Name	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
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	0.068
Tracy-Airport	-	-	-	-	-	-	-	-	-	-	0.087	0.083	0.081	0.078	0.080	0.079	0.079	0.076
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	0.079
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	0.082
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	0.082
Madera-City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.086	0.084	0.084	0.083
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	0.082
Tranquillity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.077	0.077	0.075	0.075
Fresno- Sky Park	0.102	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	0.086
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	0.093
Fresno- 1st/Garland	-	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	0.094	0.089	0.089	0.087
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	0.086
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	0.091
Hanford	-	-	0.102	0.098	0.099	0.095	0.093	0.088	0.086	0.083	-	-	-	-	0.090	0.084	0.084	0.085
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	0.079
Porterville	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.090	0.088	0.081	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	0.086	0.079	0.081	0.085	0.086	0.085
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	0.093	0.091	0.089
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	0.080
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	0.079
Bakersfield- Golden	-	-	0.100	0.096	0.098	0.098	0.094	0.090	0.088	0.086	0.088	-	-	-	-	-	-	-
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	0.085
Bakersfield-Muni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.091	0.090
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	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	-	-	-	-	-
Arvin-Di-Giorgio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.091	0.089	0.088	0.087
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	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	2013-2015 8-hour Ozone Design Values (ppm)	Meets Attainment Test
San Joaquin	Stockton	0.068	yes
San Joaquin	Tracy	0.076	no
Stanislaus	Modesto	0.079	no
Stanislaus	Turlock	0.082	no
Merced	Merced	0.082	no
Madera	Madera-Pump Yard	0.082	no
Madera	Madera-City	0.083	no
Fresno	Tranquillity	0.075	yes
Fresno	Fresno-Sky Park	0.086	no
Fresno	Clovis	0.093	no
Fresno	Fresno-Garland	0.087	no
Fresno	Fresno - Drummond	0.086	no
Fresno	Parlier	0.091	no
Kings	Hanford	0.085	no
Tulare	Ash Mountain	0.089	no
Tulare	Lower Kaweah	0.085	no
Tulare	Visalia	0.079	no
Tulare	Porterville	0.081	no
Kern	Shafter	0.080	no
Kern	Oildale	0.079	no
Kern	Bakersfield - California	0.085	no
Kern	Bakersfield - Muni	0.090	no
Kern	Edison	0.084	no
Kern	Arvin-Di-Giorgio	0.087	no
Kern	Maricopa	0.079	no
Valley	**All Sites**	**0.093**	**no**

[3] 2013-2015 are the design value years.

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

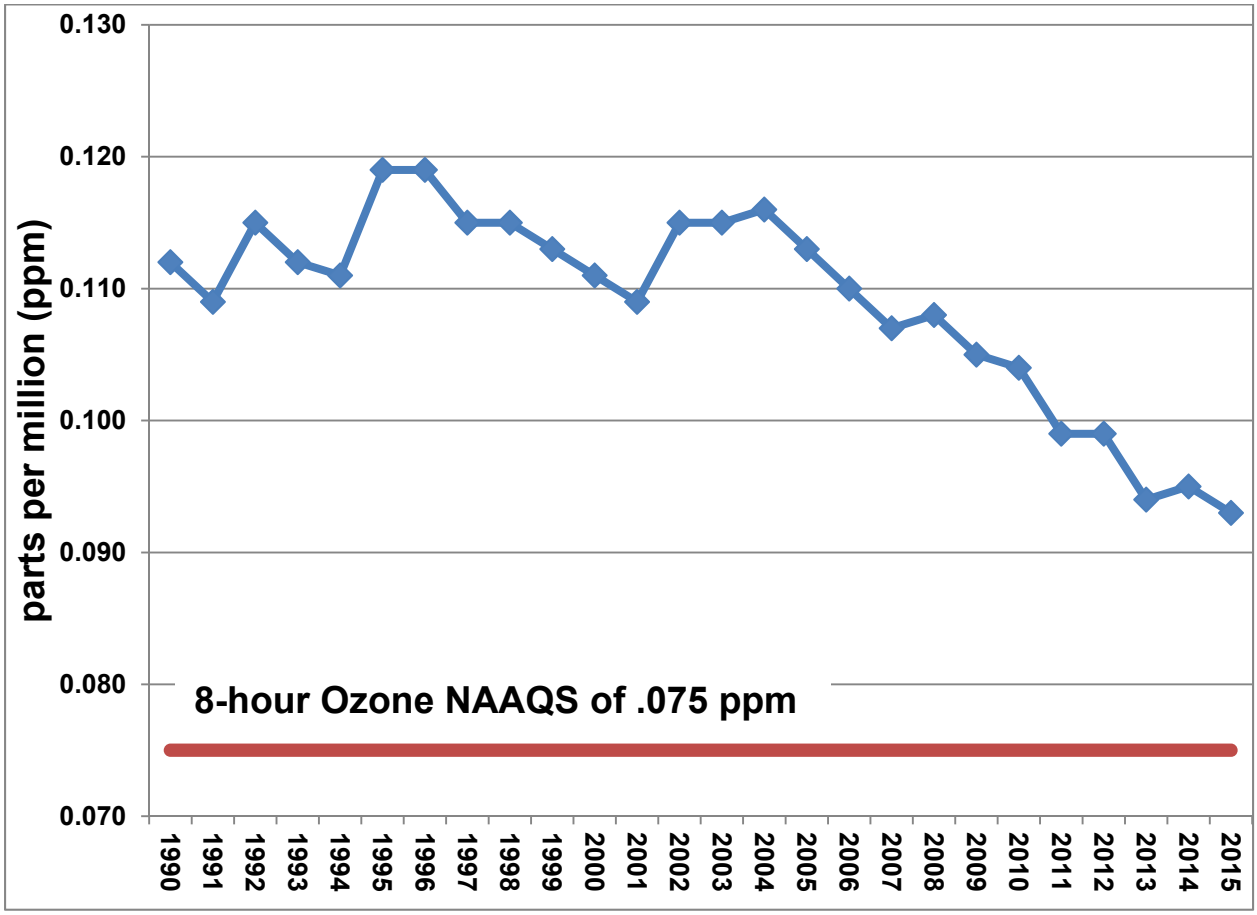
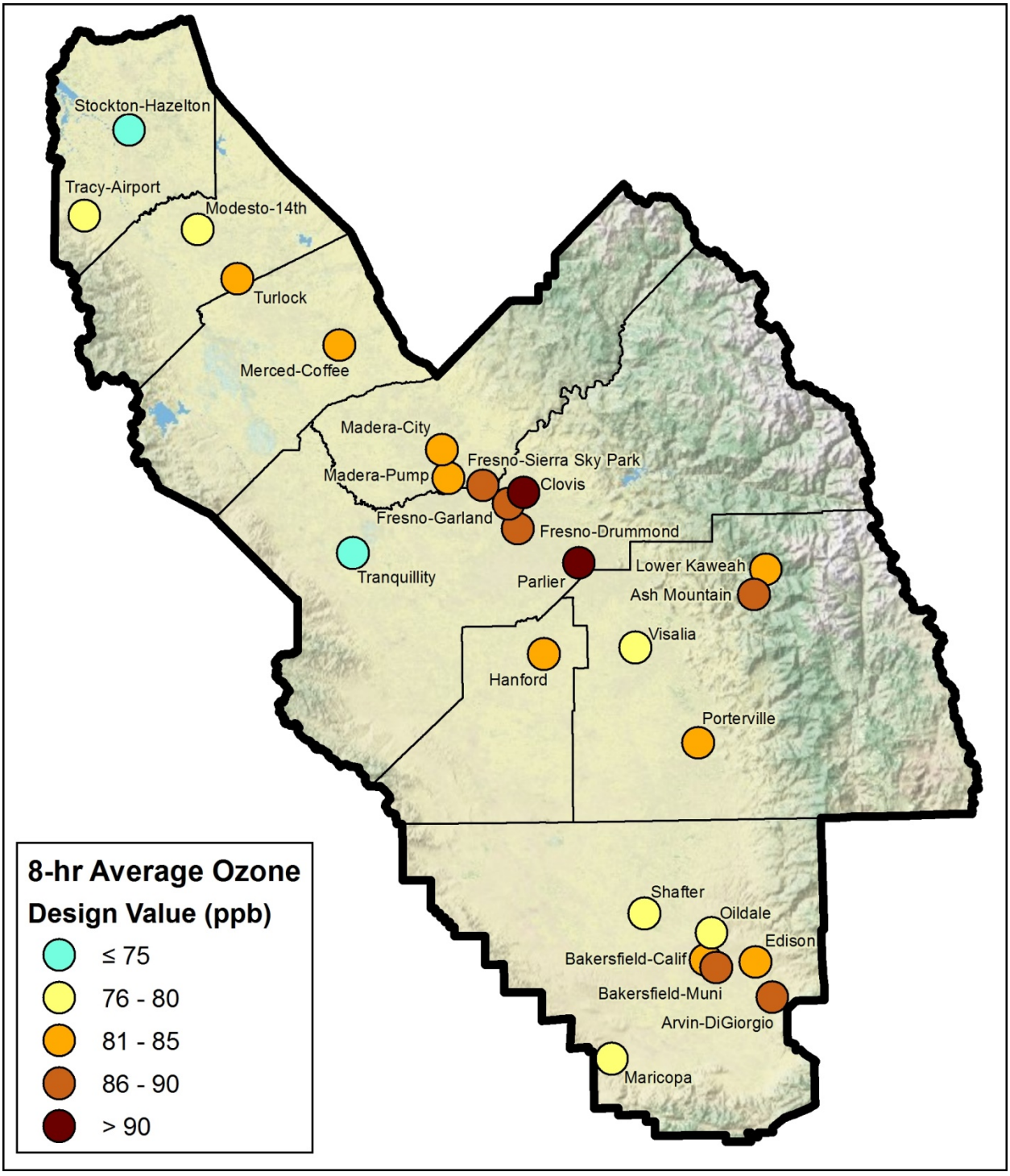


Figure A - 2 8-Hour Ozone Design Value (2015)



A.2 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 precursors (e.g. NOx and VOC). 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, 1990-2015

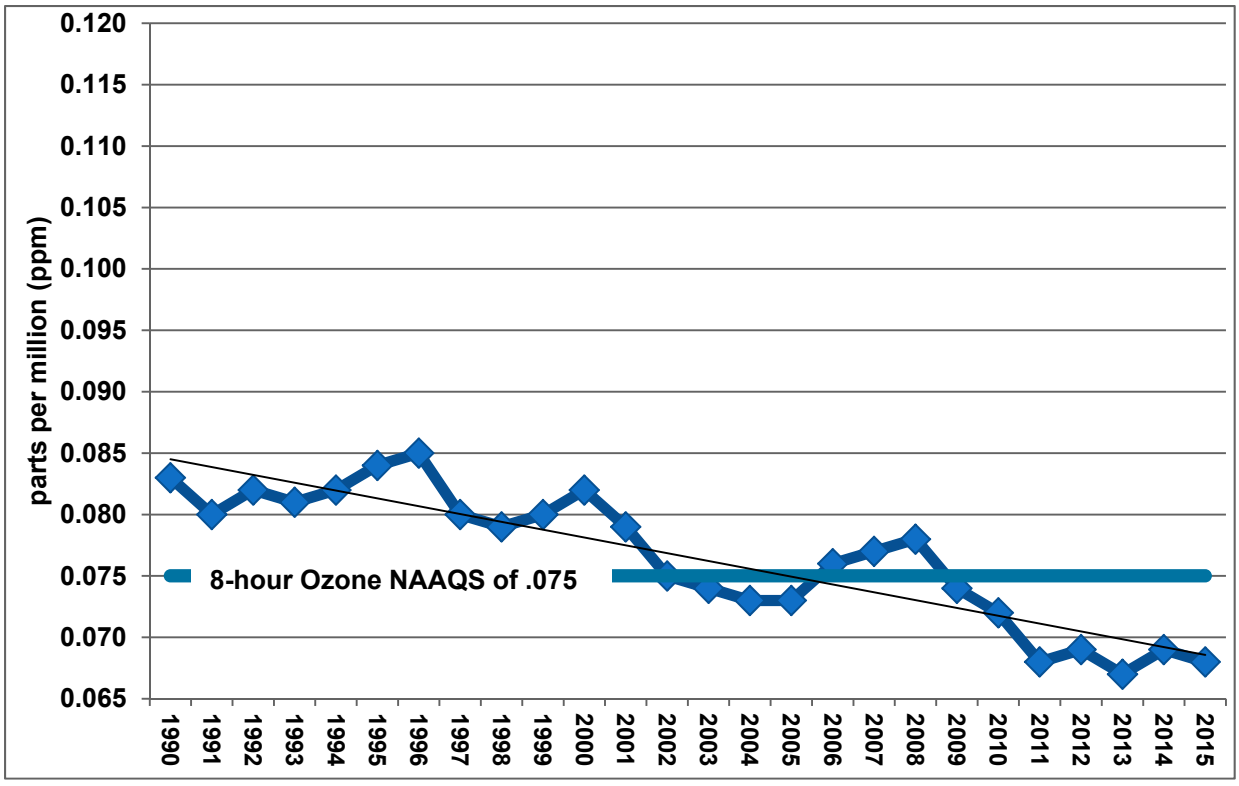


Figure A - 4 Clovis 8-hour Ozone Design Value Trend, 1992-2015

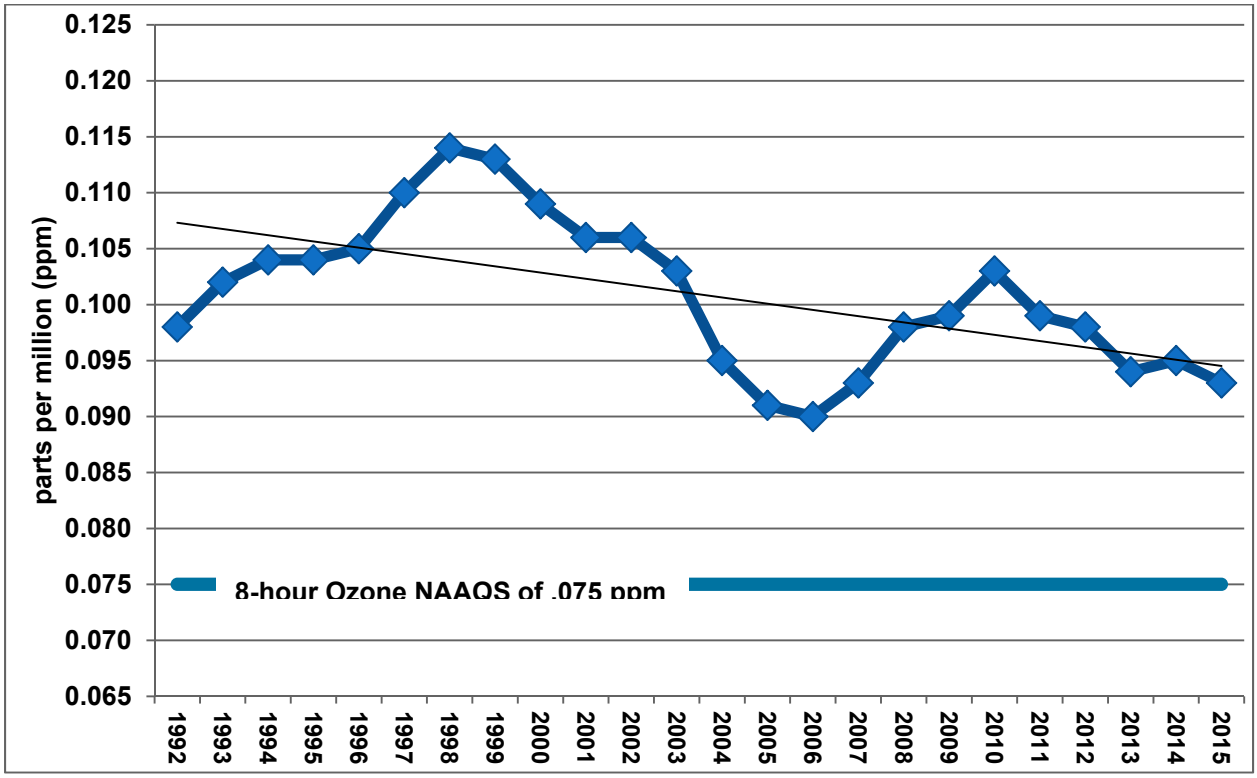
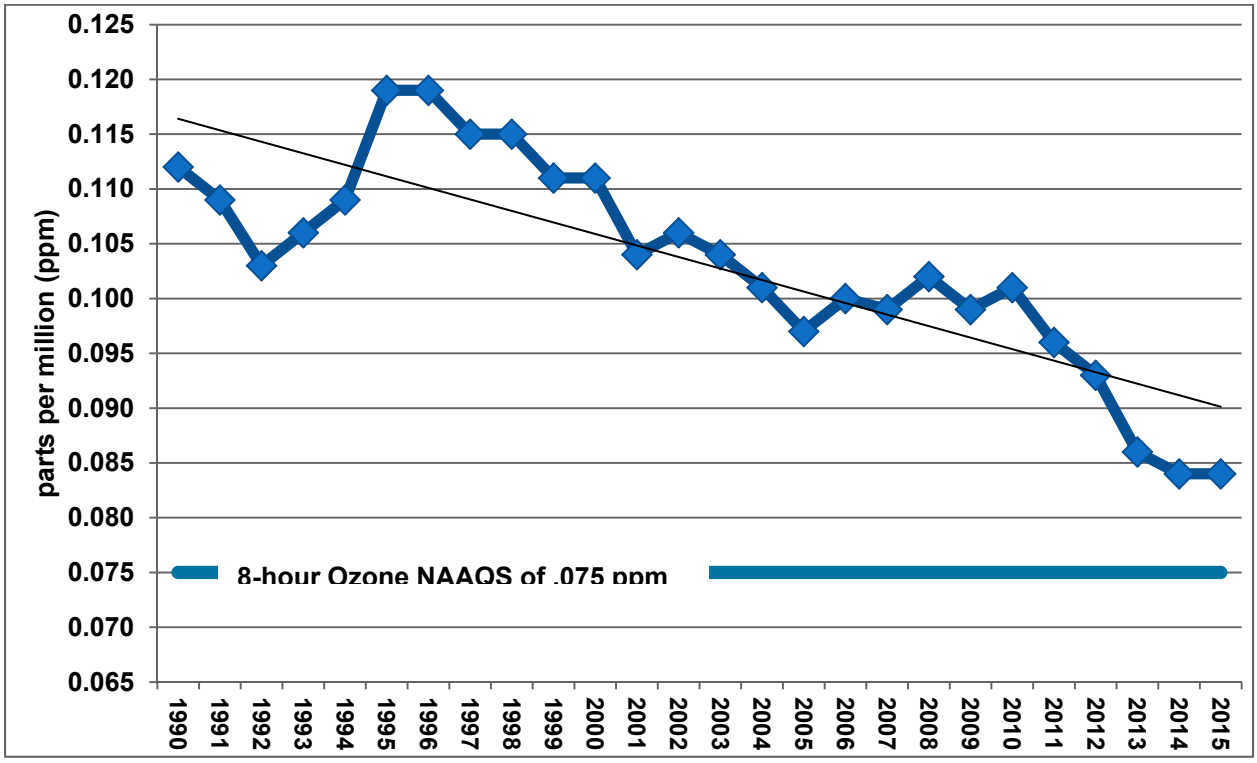


Figure A - 5 Edison 8-hour Ozone Design Value Trend, 1990-2015



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 regulatory air monitoring site in the Valley from 1990-2015. The basin-wide count represents the number of days that at least one site had at minimum one 8-hr average above the ozone NAAQS of 0.075ppm. 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

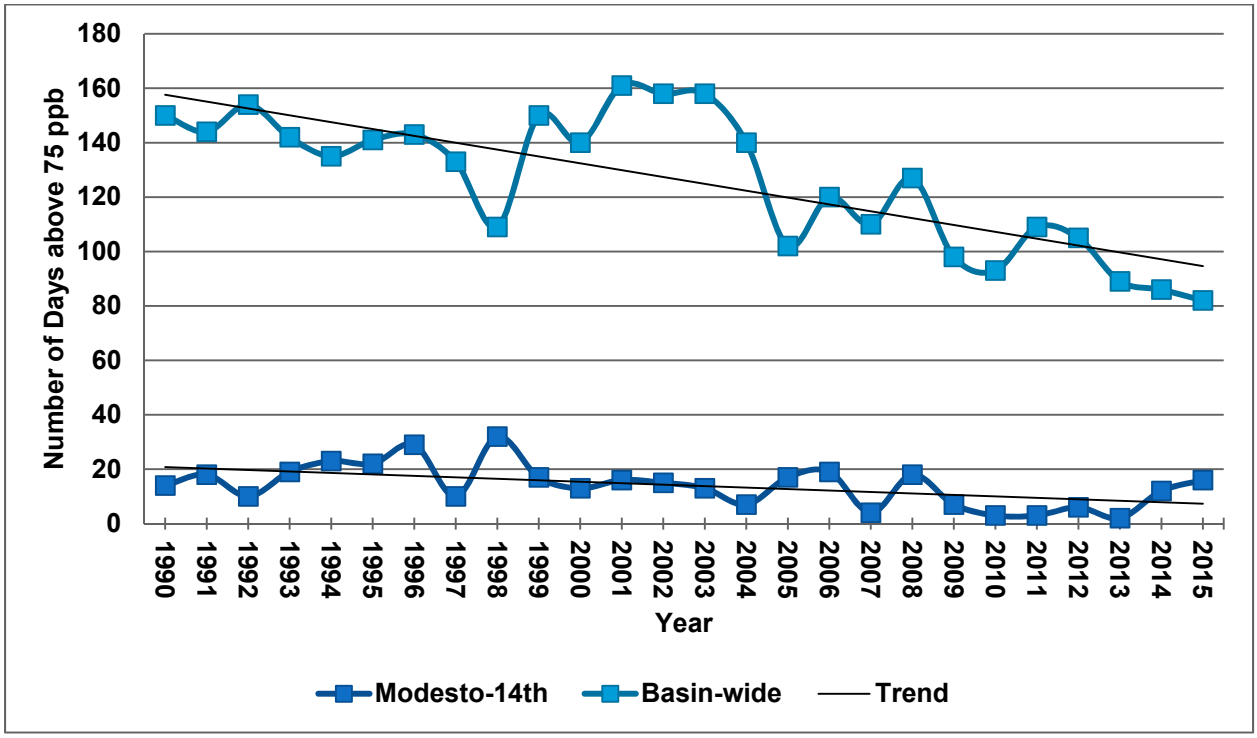


Figure A - 7 Number of Days Over the 8-hour Ozone Standard: Fresno – Drummond

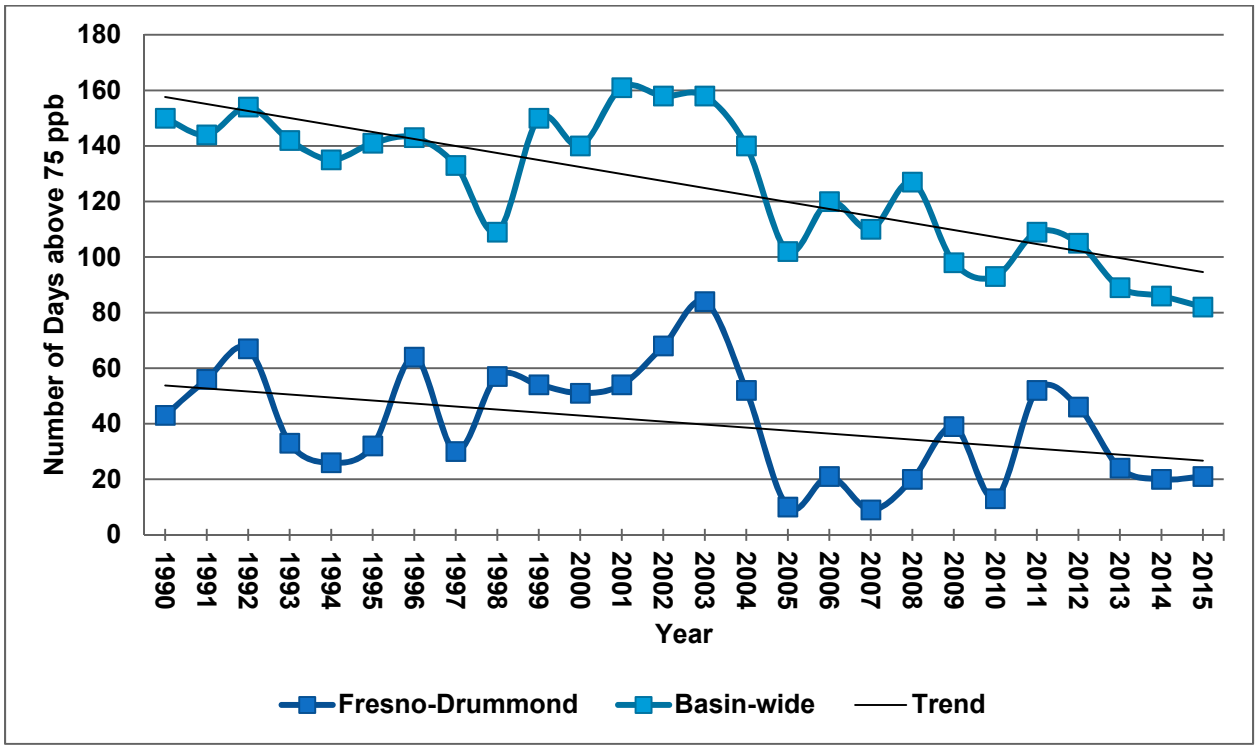


Figure A - 8 Number of Days Over the 8-hour Ozone Standard: Shafter

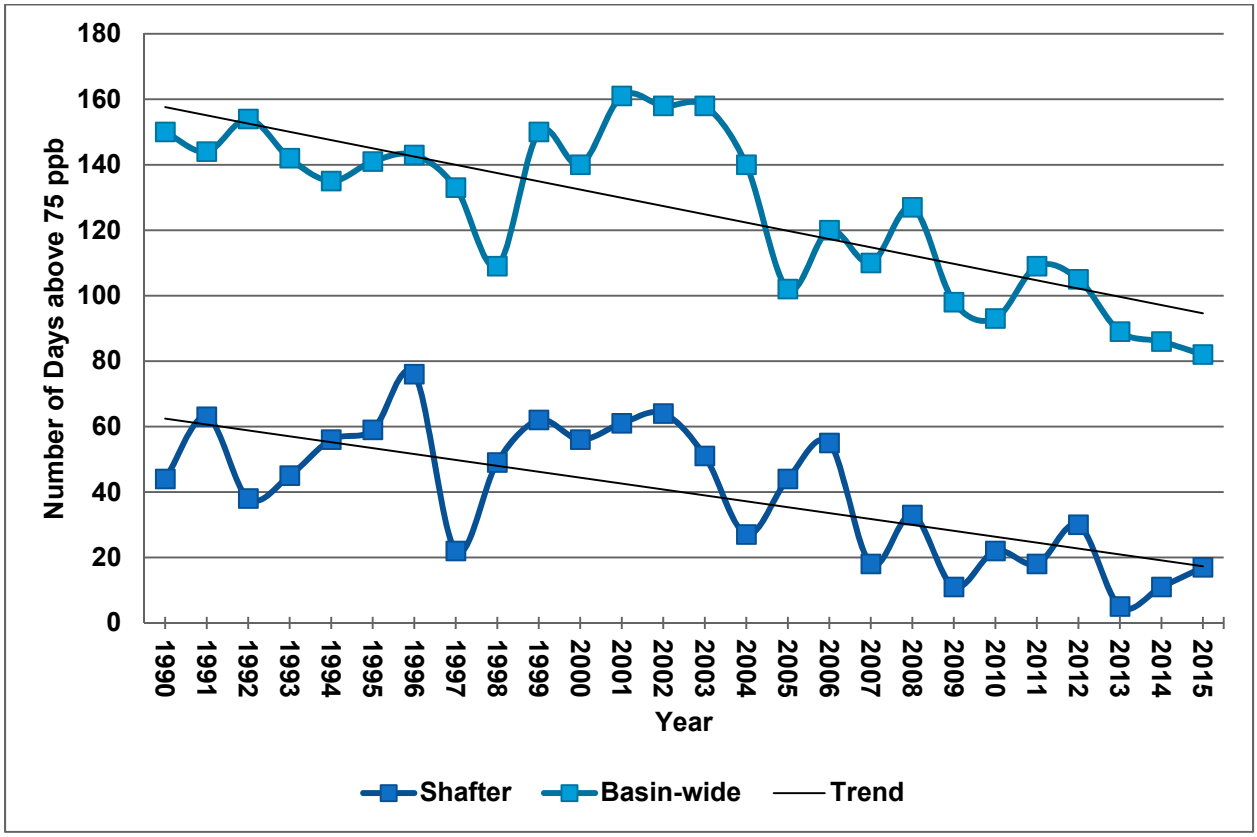


Table A-4 Number of Days Above the 8-Hour Ozone Standard of 0.075 ppm

REGULATORY SITE	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Stockton-Hzltn	8	11	4	6	3	2	2	1	13	3	4	2	2	0	2	0	1	1
Tracy	--	--	--	--	--	--	--	--	22	6	16	8	3	8	16	2	8	5
Modesto-14th	14	22	13	16	15	13	7	17	19	4	18	7	3	3	6	2	12	16
Turlock	--	33	29	13	40	40	12	5	24	3	29	18	10	17	35	14	12	17
Merced-Coffee	--	73	66	61	89	92	47	20	30	18	33	15	14	19	9	15	22	14
Madera-City	--	--	--	--	--	--	--	--	--	--	--	--	11	15	30	22	13	11
Madera-Pump	--	--	30	37	40	42	7	5	15	5	24	13	8	8	7	6	20	10
Fresno-SSP	--	64	109	130	131	67	30	37	54	18	39	34	35	45	19	25	32	19
Fresno-Drummond	43	32	51	54	68	84	52	10	21	9	20	39	13	52	46	24	20	21
Clovis	--	68	71	92	62	61	30	38	51	30	44	48	39	49	57	38	56	28
Fresno-1st/Garland	55	79	67	66	66	82	48	55	69	37	62	51	26	33	47	17	29	24
Parlier	66	45	93	122	130	136	41	46	61	30	51	26	30	43	62	50	36	46
Tranquillity	--	--	--	--	--	--	--	--	--	--	--	--	7	7	6	3	3	5
Hanford	--	11	91	43	62	45	25	24	37	8	--	--	41	28	8	25	14	22
Visalia-Church	53	64	70	53	59	65	40	46	51	31	60	48	34	17	37	2	10	22
Porterville	--	--	--	--	--	--	--	--	--	--	--	--	43	47	44	23	0	25
Ash Mountain	--	--	58	117	117	112	94	78	86	83	74	72	66	84	82	56	51	52
Lower Kaweah	63	50	33	65	107	75	49	56	62	70	73	18	9	31	41	38	32	23
Shafter	44	59	56	61	64	51	27	44	55	18	33	11	22	18	30	5	11	17
Oildale	59	69	71	74	72	84	77	61	70	41	49	37	30	29	46	5	7	17
BFL-California	--	88	77	83	75	86	46	71	79	25	40	34	28	25	56	22	20	28
Bakersfield-Golden	--	50	67	62	62	64	38	27	38	14	21	--	--	--	--	--	--	--
Bakersfield-Muni	--	--	--	--	--	--	--	--	--	--	--	--	--	--	61	23	32	55
Edison	102	112	92	90	98	81	66	55	68	44	79	60	47	47	42	8	24	23
Arvin-Bear Mtn.	124	113	105	118	125	144	133	90	99	89	102	80	66	--	--	--	--	--
Arvin-DiGiorgio	--	--	--	--	--	--	--	--	--	--	--	--	28	36	53	34	36	33
Maricopa	74	98	39	86	97	72	53	43	45	23	20	31	12	49	24	10	8	16
Average	59	60	62	69	75	71	44	39	49	28	42	33	25	30	35	19	20	22
Basin-wide Days Over	150	141	140	162	158	158	140	102	120	110	127	98	93	109	105	89	86	82

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

A.3 DIFFERENCE BETWEEN URBAN AND RURAL OZONE RESPONSE

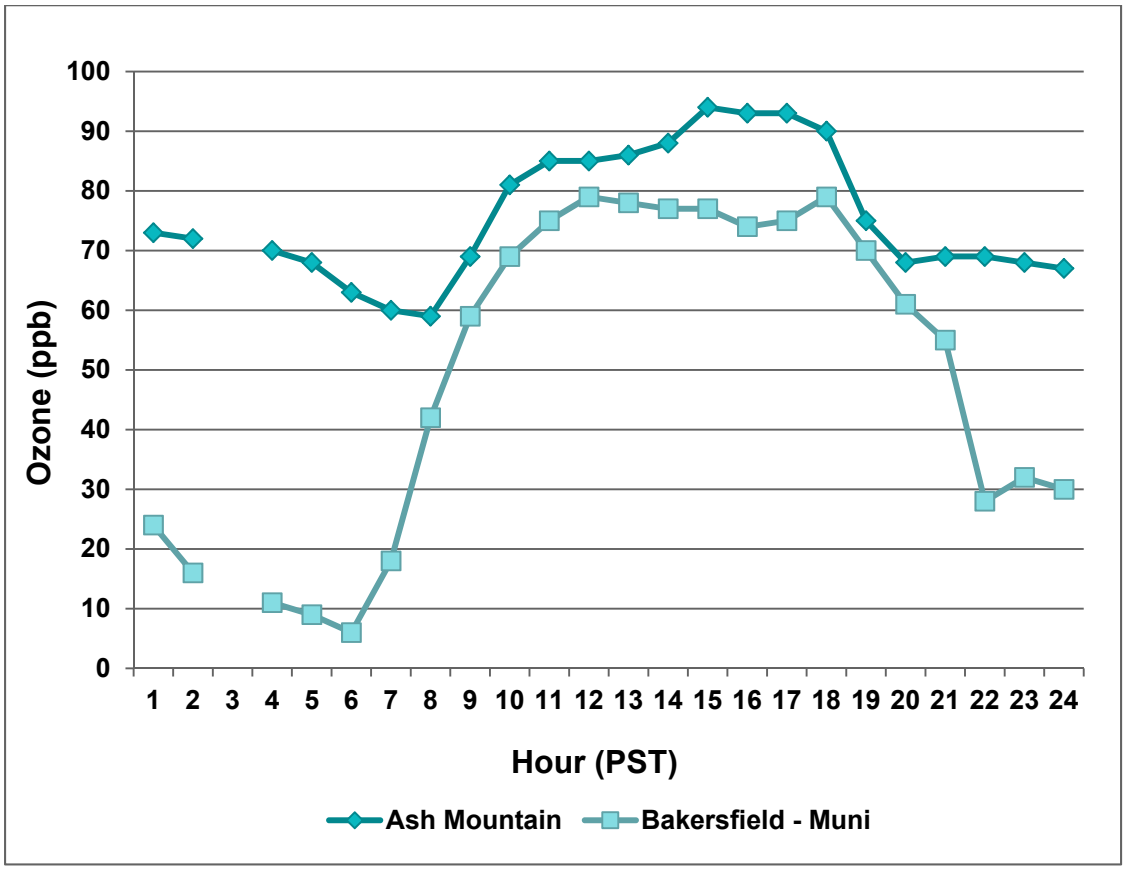
The difference between how ozone levels change in urban areas versus rural areas is most evident during the nighttime hours when ozone formation ceases. At night, fresh NOx emissions in urban areas interact with and remove or scavenge existing ozone. This process causes a rapid change which results in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

Figure A - 9 Ozone Concentrations (ppb) at Ash Mountain and Bakersfield Municipal Airport on August 24, 2014



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