Air Quality Modeling Technical Support Document for the 2015 Ozone NAAQS Preliminary Interstate Transport Assessment

Office of Air Quality Planning and Standards
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1. Introduction

In this technical support document (TSD) we describe the air quality modeling performed to support the 2015 ozone National Ambient Air Quality Standards (NAAQS)[1] preliminary interstate transport assessment Notice of Data Availability (NODA). For this assessment, air quality modeling is used to project ozone concentrations at individual monitoring sites to 2023[2] and to estimate state-by-state contributions to those 2023 concentrations. The projected 2023 ozone concentrations are used to identify ozone monitoring sites that are projected to be nonattainment or have maintenance problems for the 2015 ozone NAAQS in 2023. Ozone contribution information is then used to quantify projected interstate contributions from emissions in each upwind state to ozone concentrations at projected 2023 nonattainment and maintenance sites in other states (i.e., in downwind states).

The remaining sections of this TSD are as follows. Section 2 describes the air quality modeling platform and the evaluation of model predictions using measured concentrations. Section 3 defines the procedures for projecting ozone design value concentrations to 2023 and the approach for identifying monitoring sites projected to have nonattainment and/or maintenance problems in 2023. Section 4 describes (1) the source contribution (i.e., source apportionment) modeling and (2) the procedures for quantifying contributions to individual monitoring sites including nonattainment and/or maintenance sites. For questions about the information in this TSD please contact Norm Possiel at possiel.norm@epa.gov or (919) 541-5692. An electronic copy of the 2009 – 2013 base period and projected 2023 ozone design values and 2023 ozone contributions can be obtained from docket for this NODA. An electronic copy of the ozone design values and contributions can also be obtained at www.epa.gov/airtransport.

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[1] The EPA revised the levels of the primary and secondary 8-hour ozone standards to 0.070 parts per million (ppm). 80 FR 65292 (October 26, 20015).

[2] The rationale for using 2023 as the future analytic year for this transport assessment is described in the NODA.

2. Air Quality Modeling Platform

The EPA used a 2011-based air quality modeling platform which includes emissions, meteorology and other inputs for 2011 as the base year for the modeling described in this NODA. The 2011 base year emissions were projected to a future year base case scenario, 2023. The 2011 modeling platform and projected 2023 emissions were used to drive the 2011 base year and 2023 base case air quality model simulations. The 2011 base year emissions and methods for projecting these emissions to 2023 are in large part similar to the data and methods used by EPA in the final Cross-State Air Pollution Rule (CSAPR) Update. The 2011 and 2023 emissions used for the 2015 NAAQS transport assessment are described in the documents, "Preparation of Emissions Inventories for the Version 6.3, 2011 Emissions Modeling Platform"; "Updates to Emissions Inventories for the Version 6.3 2011 Emissions Modeling Platform, Emission Inventories for the Year 2023"; and "EPA Base Case v.5.16 for 2023 Ozone Transport NODA Using IPM Incremental Documentation"; all of which are available in the docket for this notice. The meteorological data and initial and boundary concentrations used for the 2015 NAAQS transport assessment, as described below, are the same as those used for the Final CSAPR Update air quality modeling.

2.1 Air Quality Model Configuration

The photochemical model simulations performed for this ozone transport assessment used the Comprehensive Air Quality Model with Extensions (CAMx version 6.32) which is a version of CAMx v6.30 (Ramboll Environ, 2016) with updated Carbon Bond chemistry (CB6r4).[3] CAMx is a three-dimensional grid-based Eulerian air quality model designed to simulate the formation and fate of oxidant precursors, primary and secondary particulate matter concentrations, and deposition over regional and urban spatial scales (e.g., the contiguous U.S.). Consideration of the different processes (e.g., transport and deposition) that affect primary (directly emitted) and secondary (formed by atmospheric processes) pollutants at the regional scale in different locations is fundamental to understanding and assessing the effects of emissions on air quality concentrations.

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[3] The updates to the Carbon Bond chemical mechanism in CB6r4 are described in a Technical Memorandum "EMAQ4-07_Task7_TechMemo_1Aug16.pdf" which can be found in the docket for this NODA. CAMx v6.32 is a pre-release version of CAMx v6.40.

Figure 2-1 shows the geographic extent of the modeling domain that was used for air quality modeling in this analysis. The domain covers the 48 contiguous states along with the southern portions of Canada and the northern portions of Mexico. This modeling domain contains 25 vertical layers with a top at about 17,550 meters, or 50 millibars (mb), and horizontal grid resolution of 12 km x 12 km. The model simulations produce hourly air quality concentrations for each 12 km grid cell across the modeling domain.

CAMx requires a variety of input files that contain information pertaining to the modeling domain and simulation period. These include gridded, hourly emissions estimates and meteorological data, and boundary concentrations. Separate emissions inventories were prepared for the 2011 base year and the 2023 base case. All other inputs (i.e. meteorological fields, initial concentrations, and boundary concentrations) were specified for the 2011 base year model application and remained unchanged for the future-year model simulations.[4]

Figure 2-1. Map of the CAMx modeling domain used for transport modeling.

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[4] The CAMx annual simulations for 2011 and 2023 were each performed using two time segments (January 1 through April 30, 2011 with a 10-day ramp-up period at the end of December 2010 and May 1 through December 31, 2011 with a 10-day ramp-up period at the end of April 2011). The CAMx 2023 contribution modeling was performed for the period May 1 through September 30, 2011 with a 10-day ramp-up period at the end of April 2011.

2.2 Meteorological Data for 2011

The 2011 meteorological data for the air quality modeling of 2011 and 2023 were derived from running Version 3.4 of the Weather Research Forecasting Model (WRF) (Skamarock, et al., 2008). The meteorological outputs from WRF include hourly-varying horizontal wind components (i.e., speed and direction), temperature, moisture, vertical diffusion rates, and rainfall rates for each vertical layer in each grid cell. Selected physics options used in the WRF simulation include Pleim-Xiu land surface model (Xiu and Pleim, 2001; Pleim and Xiu, 2003), Asymmetric Convective Model version 2 planetary boundary layer scheme (Pleim 2007a,b), Kain-Fritsch cumulus parameterization (Kain, 2004) utilizing the moisture-advection trigger (Ma and Tan, 2009), Morrison double moment microphysics (Morrison, et al., 2005; Morrison and Gettelman, 2008), and RRTMG longwave and shortwave radiation schemes (Iacono, et.al., 2008).

The WRF model simulation was initialized using the 12km North American Model (12NAM) analysis product provided by the National Climatic Data Center (NCDC). Where 12NAM data were unavailable, the 40km Eta Data Assimilation System (EDAS) analysis (ds609.2) from the National Center for Atmospheric Research (NCAR) was used. Analysis nudging for temperature, wind, and moisture was applied above the boundary layer only. The model simulations were conducted in 5.5 day blocks with soil moisture and temperature carried from one block to the next via the “ipxwrf” program (Gilliam and Pleim, 2010). Landuse and land cover data were based on the 2006 National Land Cover Database (NLCD2006) data.[5] Sea surface temperatures at 1 km resolution were obtained from the Group for High Resolution Sea Surface Temperatures (GHRSST) (Stammer, et al., 2003). As shown in Table 2-1, the WRF simulations were performed with 35 vertical layers up to 50 mb, with the thinnest layers being nearest the surface to better resolve the planetary boundary layer (PBL). The WRF 35-layer structure was collapsed to 25 layers for the CAMx air quality model simulations, as shown in Table 2-2.

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[5] The 2006 NLCD data are available at http://www.mrlc.gov/nlcd06_data.php

Table 2-1. WRF and CAMx layers and their approximate height above ground level.

CAMx Layers	WRF Layers	Sigma P	Pressure (mb)	Approximate Height (m AGL)
25	35	0.00	50.00	17,556
	34	0.05	97.50	14,780
24	33	0.10	145.00	12,822
	32	0.15	192.50	11,282
23	31	0.20	240.00	10,002
	30	0.25	287.50	8,901
22	29	0.30	335.00	7,932
	28	0.35	382.50	7,064
21	27	0.40	430.00	6,275
	26	0.45	477.50	5,553
20	25	0.50	525.00	4,885
	24	0.55	572.50	4,264
19	23	0.60	620.00	3,683
18	22	0.65	667.50	3,136
17	21	0.70	715.00	2,619
16	20	0.74	753.00	2,226
15	19	0.77	781.50	1,941
14	18	0.80	810.00	1,665
13	17	0.82	829.00	1,485
12	16	0.84	848.00	1,308
11	15	0.86	867.00	1,134
10	14	0.88	886.00	964
9	13	0.90	905.00	797
	12	0.91	914.50	714
8	11	0.92	924.00	632
	10	0.93	933.50	551
7	9	0.94	943.00	470
	8	0.95	952.50	390
6	7	0.96	962.00	311
5	6	0.97	971.50	232
4	5	0.98	981.00	154
	4	0.99	985.75	115
3	3	0.99	990.50	77
2	2	1.00	995.25	38
1	1	1.00	997.63	19

Details of the annual 2011 meteorological model simulation and evaluation are provided in a separate technical support document (US EPA, 2014a) which can be obtained at http://www.epa.gov/ttn/scram/reports/MET_TSD_2011_final_11-26-14.pdf

The meteorological data generated by the WRF simulations were processed using wrfcamx v4.3 (Ramboll Environ, 2014) meteorological data processing program to create model-ready meteorological inputs to CAMx.[6] In running wrfcamx, vertical eddy diffusivities (Kv) were calculated using the Yonsei University (YSU) (Hong and Dudhia, 2006) mixing scheme. We used a minimum Kv of 0.1 m^2/sec except for urban grid cells where the minimum Kv was reset to 1.0 m^2/sec within the lowest 200 m of the surface in order to enhance mixing associated with the nighttime "urban heat island" effect. In addition, we invoked the subgrid convection and subgrid stratoform cloud options in our wrfcamx run for 2011.

2.3 Initial and Boundary Concentrations

The lateral boundary and initial species concentrations are provided by a three-dimensional global atmospheric chemistry model, GEOS-Chem (Yantosca, 2004) standard version 8-03-02 with 8-02-01 chemistry. The global GEOS-Chem model simulates atmospheric chemical and physical processes driven by assimilated meteorological observations from the NASA's Goddard Earth Observing System (GEOS-5; additional information available at: http://gmao.gsfc.nasa.gov/GEOS/ and http://wiki.seas.harvard.edu/geos-chem/index.php/GEOS-5). This model was run for 2011 with a grid resolution of 2.0 degrees x 2.5 degrees (latitude-longitude). The predictions were used to provide one-way dynamic boundary concentrations at one-hour intervals and an initial concentration field for the CAMx simulations. The 2011 boundary concentrations from GEOS-Chem were used for the 2011 and 2023 model simulations.[7] The procedures for translating GEOS-Chem predictions to initial and boundary concentrations are described elsewhere (Henderson, 2014). More information about the GEOS-

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[6] The meteorological data used for the preliminary 2015 ozone transport assessment modeling are the same as the meteorological data EPA used for the final CSAPR Update air quality modeling.

[7] The initial and boundary concentration data used for the preliminary 2015 ozone transport assessment modeling are the same as the initial and boundary condition data EPA used for the final CSAPR Update air quality modeling.

Chem model and other applications using this tool is available at: http://www-as.harvard.edu/chemistry/trop/geos.

2.4 Emissions Inventories

CAMx requires detailed emissions inventories containing temporally allocated (i.e., hourly) emissions for each grid-cell in the modeling domain for a large number of chemical species that act as primary pollutants and precursors to secondary pollutants. Annual emission inventories for 2011 and 2023 were preprocessed into CAMx-ready inputs using the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system (Houyoux et al., 2000).[8] Information on the emissions inventories used as input to the CAMx model simulations can be found in the emissions inventory technical support documents identified above.

2.5 Air Quality Model Evaluation

An operational model performance evaluation for ozone was conducted to examine the ability of the CAMx v6.32 modeling system to simulate 2011 measured concentrations. This evaluation focused on graphical analyses and statistical metrics of model predictions versus observations. Details on the evaluation methodology, the calculation of performance statistics, and results are provided in Appendix A. Overall, the ozone model performance statistics for the CAMx v6.32 2011 simulation are similar to those from the CAMx v6.20 2011 simulation performed by EPA for the final CSAPR Update. The 2011 CAMx model performance statistics are within or close to the ranges found in other recent peer-reviewed applications (e.g., Simon et al, 2012). As described in Appendix A, the predictions from the 2011 modeling platform correspond closely to observed concentrations in terms of the magnitude, temporal fluctuations, and geographic differences for 8-hour daily maximum ozone. Thus, the model performance results demonstrate the scientific credibility of our 2011 modeling platform. These results provide confidence in the ability of the modeling platform to provide a reasonable projection of expected future year ozone concentrations and contributions.

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[8] The SMOKE output emissions case name for the 2011 base year is "2011el_cb6v2_v6_11g" and the emissions case name for the 2023 base case is "2023el_cb6v2_v6_11g".

3. Identification of Future Nonattainment and Maintenance Receptors

3.1 Definition of Nonattainment and Maintenance Receptors

The ozone predictions from the 2011 and 2023 CAMx model simulations were used to project 2009-2013 average and maximum ozone design values[9] to 2023 following the approach described in the EPA's draft guidance for attainment demonstration modeling (US EPA, 2014b).[10] Using the approach in the final CSAPR Update, we evaluated the 2023 projected average and maximum design values in conjunction with the most recent measured ozone design values (i.e., 2013-2015) to identify sites that may warrant further consideration as potential nonattainment or maintenance sites in 2023. If the approach in the CSAPR Update is applied to evaluate the projected design values, those sites with 2023 average design values that exceed the NAAQS (i.e., 2023 average design values of 71 ppb or greater)[11] and that are currently measuring nonattainment would be considered to be nonattainment receptors in 2023. Similarly, with the CSAPR Update approach, monitoring sites with a projected 2023 maximum design value that exceeds the NAAQS would be projected to be maintenance receptors in 2023. In the CSAPR Update approach, maintenance-only receptors include both those monitoring sites where the projected 2023 average design value is below the NAAQS, but the maximum design value is above the NAAQS, and monitoring sites with projected 2023 average design values that exceed the NAAQS, but for which current design values based on measured data do not exceed the NAAQS.

The procedures for calculating projected 2023 average and maximum design values are described below. The monitoring sites that we project to be nonattainment and maintenance-only receptors for the ozone NAAQS in the 2023 base case are used for assessing the contribution of emissions in upwind states to downwind nonattainment and maintenance of the 2015 ozone NAAQS as part of this transport assessment.

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[9] The ozone design value for a monitoring site is the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration.

[10] EPA's ozone attainment demonstration modeling guidance is referred to as "the modeling guidance" in the remainder of this document.

[11] In determining compliance with the NAAQS, ozone design values are truncated to integer values. For example, a design value of 70.9 parts per billion (ppb) is truncated to 70 ppb which is attainment. In this manner, design values at or above 71.0 ppb are considered to be violations of the NAAQS.

3.2 Approach for Projecting 2023 Ozone Design Values

The ozone predictions from the 2011 and 2023 CAMx model simulations were used to project ambient (i.e., measured) ozone design values (DVs) to 2023 following the approach described in the modeling guidance as summarized here. The modeling guidance recommends using 5-year weighted average ambient design values[12] centered on the base modeling year as the starting point for projecting average design values to the future. Because 2011 is the base emissions year, we used the average ambient 8-hour ozone design values for the period 2009 through 2013 (i.e., the average of design values for 2009-2011, 2010-2012 and 2011-2013) to calculate the 5-year weighted average design values. The 5-year weighted average ambient design value at each site was projected to 2023 using the Model Attainment Test Software program (Abt Associates, 2014**)**. This program calculates the 5-year weighted average design value based on observed data and projects future year values using the relative response predicted by the model. Equation (3-1) describes the recommended model attainment test in its simplest form, as applied for monitoring site *i*:

$$(\mathrm{DVF})_\mathrm{i} = (RRF)_i * (DVB)_i \qquad \text{Equation 3-1}$$

$\mathrm{DVF_i}$ is the estimated design value for the future year at monitoring site *i*; $\mathrm{RRF_i}$ is the relative response factor for monitoring site *i*; and $\mathrm{DVB_i}$ is the base period design value monitored at site *i*. The relative response factor for each monitoring site $(RRF)_i$ is the fractional change in 8-hour daily maximum ozone between the base and future year. The RRF is based on the average ozone on model-predicted "high" ozone days in grid cells in the vicinity of the monitoring site. The modeling guidance recommends calculating RRFs based on the highest 10 modeled ozone days in the base year simulation at each monitoring site. Specifically, the RRF was calculated based on the 10 highest days in the 2011 base year modeling in the vicinity of each monitor location.

As recommended by the modeling guidance, we considered model response in grid cells immediately surrounding the monitoring site along with the grid cell in which the monitor is located. The RRF was based on a 3 x 3 array of 12 km grid cells centered on the location of the grid cell containing the monitor. On each day, the grid cell with the highest 2011 base year ozone value in the 3 x 3 array surrounding the location of the monitoring site was used to identify the top 10 modeled ozone concentration days within the 3 x 3 array of grid cells. These top 10 days

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[12] The air quality design value for a site is the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration.

were used to calculate the base year top 10-day average concentration for each site. The 2023 ozone concentrations from these same days and grid cells were used to calculate the future year 10-day average. Thus, the base year and future year components of the RRF calculation were paired in space and time. In cases for which the base year model simulation did not have 10 days with ozone values greater than or equal to 60 ppb at a site, we used all days with ozone >= 60 ppb, as long as there were at least 5 days that meet that criteria. At monitor locations with less than 5 days with modeled 2011 base year ozone >= 60 ppb, no RRF or DVF was calculated for the site and the monitor in question was not included in this analysis.

The approach for calculating 2023 maximum design values is similar to the approach for calculating 2023 average design values. To calculate the 2023 maximum design value we start with the highest (i.e., maximum) ambient design value from the 2011-centered 5-year period (i.e., the maximum of design values from 2009-2011, 2010-2012, and 2011-2013). The base period maximum design value at each site was projected to 2023 using the site-specific RRFs, as determined using the procedures for calculating RRFs described above.

The base period 2009-2013 ambient and projected 2023 average and maximum design values and 2013-2015 and preliminary 2014-2016 measured design values at the projected 2023 nonattainment receptor sites and maintenance-only receptor sites are provided in Tables 1 and 2, respectively.[13] The 2009-2013 base period and 2023 base case average and maximum design values for individual monitoring sites in the U.S. are provided in the docket for this NODA.[14]

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[13] The preliminary 2014-2016 design values are based on ozone data from the Air Quality System (AQS) and AirNow as of December 20, 2016. These data have not been certified by state agencies. Note that for some sites the preliminary 2014-2016 design values are higher than the corresponding data for 2013-2015.

[14] There are 7 sites in 3 counties in the West that were excluded from this listing because the ambient design values at these sites were dominated by wintertime ozone episodes and not summer season conditions that are the focus of this transport assessment. High winter ozone concentrations that have been observed in certain parts of the Western U.S. are believed to result from the combination of strong wintertime inversions, large NOx and VOC emissions from nearby oil and gas operations, increased UV intensity due to reflection off of snow surfaces and potentially still uncharacterized sources of free radicals. The 7 sites excluded from this analysis are in Rio Blanco County, CO (site ID 081030006), Fremont County, WY (site ID 560130099), and Sublette County, WY (site IDs 560350097, 560350099, 560350100, 560350101, and 560351002). Information on the analysis to identify these sites as influenced by wintertime ozone episodes can be found in Appendix 3A of the Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone (EPA, 2014d) (http://www.epa.gov/ttn/ecas/ria.html)

Table 3-1a. 2009-2013 and 2023 average and maximum design values and 2013-2015 and preliminary 2014-2016 design values at projected nonattainment receptor sites in the East[15] (units are ppb).

Site ID	County	St	2009-2013 Average DV	2009-2013 Maximum DV	2023 Average DV	2023 Maximum DV	2013-2015 DV	2014-2016 DV
240251001	Harford	MD	90.0	93	71.3	73.7	71	73
360850067	Richmond	NY	81.3	83	71.2	72.7	74	76
361030002	Suffolk	NY	83.3	85	71.3	72.7	72	72
480391004	Brazoria	TX	88.0	89	74.4	75.3	80	75
482010024	Harris	TX	80.3	83	71.1	73.5	79	79
482011034	Harris	TX	81.0	82	71.6	72.5	74	73
484392003	Tarrant	TX	87.3	90	73.9	76.2	76	73
484393009	Tarrant	TX	86.0	86	72.0	72.0	78	75
551170006	Sheboygan	WI	84.3	87	71.0	73.3	77	79

Table 3-1b. 2009-2013 and 2023 average and maximum design values and 2013-2015 and preliminary 2014-2016 design values at projected nonattainment receptor sites in the West (units are ppb).

Site ID	County	St	2009-2013 Average DV	2009-2013 Maximum DV	2023 Average DV	2023 Maximum DV	2013-2015 DV	2014-2016 DV
60190007	Fresno	CA	94.7	95	78.9	79.1	86	86
60190011	Fresno	CA	93.0	96	77.8	80.3	85	88
60190242	Fresno	CA	91.7	95	79.2	82.0	86	86
60194001	Fresno	CA	90.7	92	73.0	74.0	89	91
60195001	Fresno	CA	97.0	99	79.1	80.8	88	94
60250005	Imperial	CA	74.7	76	72.8	74.1	77	76
60251003	Imperial	CA	81.0	82	78.5	79.5	78	76
60290007	Kern	CA	91.7	96	76.9	80.5	81	87
60290008	Kern	CA	86.3	88	71.2	72.6	78	81
60290014	Kern	CA	87.7	89	72.7	73.8	84	84
60290232	Kern	CA	87.3	89	72.7	74.1	78	77
60311004	Kings	CA	87.0	90	71.0	73.5	80	84
60370002	Los Angeles	CA	80.0	82	73.9	75.7	82	86
60370016	Los Angeles	CA	94.0	97	86.8	89.6	92	95

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[15] In this notice the East includes all states from Texas northward to North Dakota and eastward to the East Coast. All states in the contiguous U.S. from New Mexico northward to Montana and westward to the West Coast are considered, for this notice, to be in the West.

Site ID	County	St	2009-2013 Average DV	2009-2013 Maximum DV	2023 Average DV	2023 Maximum DV	2013-2015 DV	2014-2016 DV
60371201	Los Angeles	CA	90.0	90	80.3	80.3	84	85
60371701	Los Angeles	CA	84.0	85	78.3	79.2	89	90
60376012	Los Angeles	CA	97.3	99	86.5	88.0	94	96
60379033	Los Angeles	CA	90.0	91	76.7	77.5	89	90
60392010	Madera	CA	85.0	86	71.7	72.6	81	83
60650012	Riverside	CA	97.3	99	83.0	84.4	92	93
60651016	Riverside	CA	100.7	101	85.1	85.3	98	97
60652002	Riverside	CA	84.3	85	72.2	72.8	81	81
60655001	Riverside	CA	92.3	93	79.4	80.0	87	87
60656001	Riverside	CA	94.0	98	78.4	81.7	90	91
60658001	Riverside	CA	97.0	98	86.7	87.6	92	95
60658005	Riverside	CA	92.7	94	82.9	84.1	85	91
60659001	Riverside	CA	88.3	91	73.3	75.6	84	86
60670012	Sacramento	CA	93.3	95	74.1	75.4	80	83
60710005	San Bernardino	CA	105.0	107	96.3	98.1	102	108
60710012	San Bernardino	CA	95.0	97	84.4	86.2	88	91
60710306	San Bernardino	CA	83.7	85	75.5	76.7	86	86
60711004	San Bernardino	CA	96.7	98	89.7	91.0	96	100
60712002	San Bernardino	CA	101.0	103	92.9	94.7	97	97
60714001	San Bernardino	CA	94.3	97	86.0	88.5	88	91
60714003	San Bernardino	CA	105.0	107	94.1	95.9	101	101
60719002	San Bernardino	CA	92.3	94	79.8	81.2	86	86
60719004	San Bernardino	CA	98.7	99	88.5	88.7	99	104
60990006	Stanislaus	CA	87.0	88	73.6	74.5	82	83
61070009	Tulare	CA	94.7	96	75.8	76.9	89	89
61072010	Tulare	CA	89.0	90	72.6	73.4	81	82

Table 3-2a. 2009-2013 and 2023 average and maximum design values and 2013-2015 and preliminary 2014-2016 design values at projected maintenance-only receptor sites in the East (units are ppb).

Site ID	County	St	2009-2013 Average DV	2009-2013 Maximum DV	2023 Average DV	2023 Maximum DV	2013-2015 DV	2014-2016 DV
90013007	Fairfield	CT	84.3	89	69.4	73.2	83	81
90019003	Fairfield	CT	83.7	87	70.5	73.3	84	85
90099002	New Haven	CT	85.7	89	69.8	72.5	78	76
260050003	Allegan	MI	82.7	86	68.8	71.5	75	74
261630019	Wayne	MI	78.7	81	69.6	71.7	70	72
360810124	Queens	NY	78.0	80	69.9	71.7	69	69
481210034	Denton	TX	84.3	87	70.8	73.0	83	80
482010026	Harris	TX	77.3	80	68.6	71.0	68	68
482011039	Harris	TX	82.0	84	73.0	74.8	69	67
482011050	Harris	TX	78.3	80	69.5	71.0	71	70

Table3- 2b. 2009-2013 and 2023 average and maximum design values and 2013-2015 and preliminary 2014-2016 design values at projected maintenance-only receptor sites in the West (units are ppb).

Site ID	County	St	2009-2013 Average DV	2009-2013 Maximum DV	2023 Average DV	2023 Maximum DV	2013-2015 DV	2014-2016 DV
60295002	Kern	CA	84.3	91	70.4	76.0	85	88
60296001	Kern	CA	84.3	86	70.6	72.0	79	81
60372005	Los Angeles	CA	78.0	82	70.6	74.3	74	83
61070006	Tulare	CA	81.7	85	69.1	71.8	84	84
61112002	Ventura	CA	81.0	83	70.7	72.4	77	77
80350004	Douglas	CO	80.7	83	69.6	71.6	79	77
80590006	Jefferson	CO	80.3	83	70.5	72.9	79	77
80590011	Jefferson	CO	78.7	82	69.7	72.7	80	80

4. Ozone Contribution Modeling

4.1 Methodology

The EPA performed nationwide, state-level ozone source apportionment modeling using the CAMx Ozone Source Apportionment Technology/Anthropogenic Precursor Culpability Analysis (OSAT/APCA) technique[16] to provide information regarding the expected contribution of 2023 base case NO_X and VOC emissions from all anthropogenic sources in each state to projected 2023 ozone concentrations at each air quality monitoring site. In the source apportionment model run, we tracked the ozone formed from each of the following contribution categories (i.e., "tags"):

- States – anthropogenic NO_X and VOC emissions from each of the contiguous 48 states and the District of Columbia tracked individually (emissions from all anthropogenic sectors in a given state were combined);
- Biogenics – biogenic NO_X and VOC emissions domain-wide (i.e., not by state);
- Boundary Concentrations – concentrations transported into the modeling domain from the lateral boundaries;
- Tribes – the emissions from those tribal lands for which we have point source inventory data in the 2011 NEI (we did not model the contributions from individual tribes);
- Canada and Mexico – anthropogenic emissions from sources in the portions of Canada and Mexico included in the modeling domain (contributions from Canada and Mexico were not modeled separately);
- Fires – combined emissions from wild and prescribed fires domain-wide (i.e., not by state); and
- Offshore – combined emissions from offshore marine vessels and offshore drilling platforms (i.e., not by state).

As noted above, the contribution modeling provided contributions to ozone from anthropogenic NO_X and VOC emissions in each state, individually. The contributions to ozone from chemical reactions between biogenic NO_X and VOC emissions were modeled and assigned to the "biogenic" category. The contributions from wild fire and prescribed fire NO_X and VOC

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[16] As part of this technique, ozone formed from reactions between biogenic VOC and NO_X with anthropogenic NO_X and VOC are assigned to the anthropogenic emissions.

emissions were modeled and assigned to the “fires” category. The contributions from the “biogenic”, “offshore”, and “fires” categories are not assigned to individual states nor are they included in the state contributions.

CAMx OSAT/APCA model run was performed for the period May 1 through September 30 using the projected 2023 base case emissions and 2011 meteorology for this time period. The hourly contributions[17] from each tag were processed to calculate an 8-hour average contribution metric. The contributions to ozone at an individual monitoring site are calculated using model predictions for the grid cell containing the monitoring site. The process for calculating the contribution metric uses the contribution modeling outputs in a “relative sense” to apportion the projected 2023 average design value at each monitoring location into contributions from each individual tag. This process is similar in concept to the relative approach described above for using model predictions to calculate 2023 ozone design values. The approach used to calculate the contribution metric is described by the following steps:

Step 1. Modeled hourly ozone concentrations are used to calculate the 8-hour daily maximum ozone (MDA8) concentration in each grid cell on each day.

Step 2. The gridded hourly ozone contributions from each tag are subtracted from the corresponding gridded hourly total ozone concentrations to create a “pseudo” hourly ozone value for each tag for each hour in each grid cell.

Step 3. The hourly “pseudo” concentrations from Step 2 are used to calculate 8-hour average “pseudo” concentrations for each tag for the time period that corresponds to the MDA8 concentration from Step 1. Step 3 results in spatial fields of 8-hour average “pseudo” concentrations for each grid cell for each tag on each day.

Step 4. The 8-hour average “pseudo” concentrations for each tag and the MDA8 concentrations are extracted for those grid cells containing ozone monitoring sites. We used the data for all days with 2023 MDA8 concentrations >=71 ppb (i.e., projected 2023 exceedance days) in the downstream calculations. If there were fewer than five 2023 exceedance days at a particular

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[17] Contributions from anthropogenic emissions under “NO_X-limited” and “VOC-limited” chemical regimes were combined to obtain the net contribution from NO_X and VOC anthropogenic emissions in each state.

monitoring site then the data from the top five 2023 MDA8 concentration days are extracted and used in the calculations.[18]

Step 5. For each monitoring site and each tag, the 8-hour "pseudo" concentrations are then averaged across the days selected in Step 4 to create a multi-day average "pseudo" concentration for tag at each site. Similarly, the MDA8 concentrations were average across the days selected in Step 4.

Step 6. The multi-day average "pseudo" concentration and the corresponding multi-day average MDA8 concentration are used to create a Relative Contribution Factor (RCF) for each tag at each monitoring site.

Step 7. The RCF for each tag is multiplied by the 2023 average ozone design value to create the ozone contribution metrics for each tag at each site. Note that the sum of the contributions from each tag equals the 2023 average design value for that site.

Step 8. The contributions calculated from Step 7 are truncated to two digits to the right of the decimal (e.g., a calculated contribution of 0.78963… is truncated to 0.78 ppb). As a result of truncation, the tabulated contributions may not always sum to the 2023 average design value.

The average contribution metric calculated in this manner is intended to provide a reasonable representation of the contribution from individual states to the projected 2023 design value, based on modeled transport patterns and other meteorological conditions generally associated with modeled high ozone concentrations in the vicinity of the monitoring site. This average contribution metric is beneficial since the magnitude of the contributions is directly related to the magnitude of the design value at each site.

4.2 Contribution Modeling Results

The contributions from each tag to individual nonattainment and maintenance-only sites are provided in Appendix B. The largest contributions from each state to 2023 downwind nonattainment sites and to downwind maintenance-only sites are provided in Tables 4-1 and 4-2, respectively. The 2023 contributions from each tag to individual monitoring sites are provided in a file in the docket.[19]

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[18] If there were fewer than 5 days with a modeled 2023 MDA8 concentration ≥ 60 ppb for the location of a particular monitoring site, then contributions were not calculated at that monitor.

[19] The file containing the contributions is named: "2015 O3 NAAQS Transport Assessment_Design Values & Contributions."

Table 4-1. Largest Contribution from Each State to Downwind 8-Hour Ozone Nonattainment Receptors (units are ppb).

Upwind States	Largest Contribution to a Downwind Nonattainment Receptor	Upwind States	Largest Contribution to a Downwind Nonattainment Receptor
Alabama	0.37	Montana	0.09
Arizona	0.74	Nebraska	0.37
Arkansas	1.16	Nevada	0.62
California	0.19	New Hampshire	0.01
Colorado	0.32	New Jersey	11.73
Connecticut	0.43	New Mexico	0.18
Delaware	0.55	New York	0.19
District of Columbia	0.70	North Carolina	0.43
Florida	0.49	North Dakota	0.15
Georgia	0.38	Ohio	2.38
Idaho	0.07	Oklahoma	2.39
Illinois	14.92	Oregon	0.61
Indiana	7.14	Pennsylvania	9.11
Iowa	0.43	Rhode Island	0.00
Kansas	1.01	South Carolina	0.16
Kentucky	2.15	South Dakota	0.08
Louisiana	2.87	Tennessee	0.52
Maine	0.01	Texas	1.92
Maryland	1.73	Utah	0.24
Massachusetts	0.05	Vermont	0.00
Michigan	1.77	Virginia	5.04
Minnesota	0.43	Washington	0.15
Mississippi	0.56	West Virginia	2.59
Missouri	1.20	Wisconsin	0.47
-	-	Wyoming	0.31

Table 4-2. Largest Contribution from Each State to Downwind 8-Hour Ozone Maintenance Receptors (units are ppb).

Upwind States	Largest Contribution to a Downwind Maintenance Receptor	Upwind States	Largest Contribution to a Downwind Maintenance Receptor
Alabama	0.48	Montana	0.11
Arizona	0.52	Nebraska	0.41
Arkansas	2.20	Nevada	0.43
California	2.03	New Hampshire	0.02
Colorado	0.25	New Jersey	8.65
Connecticut	0.36	New Mexico	0.41
Delaware	0.38	New York	15.36
District of Columbia	0.08	North Carolina	0.43
Florida	0.22	North Dakota	0.13
Georgia	0.31	Ohio	3.82
Idaho	0.16	Oklahoma	1.30
Illinois	21.69	Oregon	0.17
Indiana	6.45	Pennsylvania	6.39
Iowa	0.60	Rhode Island	0.02
Kansas	0.64	South Carolina	0.15
Kentucky	1.07	South Dakota	0.06
Louisiana	3.37	Tennessee	0.69
Maine	0.00	Texas	2.49
Maryland	2.20	Utah	1.32
Massachusetts	0.11	Vermont	0.01
Michigan	1.76	Virginia	2.03
Minnesota	0.34	Washington	0.11
Mississippi	0.65	West Virginia	0.92
Missouri	2.98	Wisconsin	1.94
-	-	Wyoming	0.92

4.3 Upwind/Downwind Linkages

In CSAPR and the CSAPR Update, the EPA used a contribution screening threshold of 1 percent of the NAAQS to identify upwind states that may significantly contribute to downwind nonattainment and/or maintenance problems and which warrant further analysis to determine if emissions reductions might be required from each state to address the downwind air quality problem. The EPA determined that 1 percent was an appropriate threshold to use in the analysis for those rulemakings because there were important, even if relatively small, contributions to identified nonattainment and maintenance receptors from multiple upwind states mainly in the eastern U.S. The agency has historically found that the 1 percent threshold is appropriate for identifying interstate transport linkages for states collectively contributing to downwind ozone nonattainment or maintenance problems because that threshold captures a high percentage of the total pollution transport affecting downwind receptors.

Based on the approach used in CSAPR and the CSAPR Update, upwind states that contribute ozone in amounts at or above the 1 percent of the NAAQS threshold to a particular downwind nonattainment or maintenance receptor would be considered to be “linked” to that receptor in step 2 of the CSAPR framework for purposes of further analysis in step 3 to determine whether and what emissions from the upwind state contribute significantly to downwind nonattainment and interfere with maintenance of the NAAQS at the downwind receptors. For the 2015 ozone NAAQS the value of a 1 percent threshold would be 0.70 ppb.

The EPA notes that, when applying the CSAPR framework, an upwind state’s linkage to a downwind receptor alone does not determine whether the state significantly contributes to nonattainment or interferes with maintenance of a NAAQS to a downwind state. While the 1 percent screening threshold has been traditionally applied to evaluate upwind state linkages in eastern states where such collective contribution was identified, the EPA noted in the CSAPR Update that, as to western states, there may be geographically specific factors to consider in determining whether the 1 percent screening threshold is appropriate. For certain receptors, where the collective contribution of emissions from one or more upwind states may not be a considerable portion of the ozone concentration at the downwind receptor, the EPA and states have considered, and could continue to consider other factors to evaluate those states’ planning obligation pursuant to the Good Neighbor provision.[20] However, where the collective contribution of emissions from one or more upwind states is responsible for a considerable portion of the downwind air quality problem, the CSAPR framework treats a contribution from an individual state at or above 1 percent of the NAAQS as significant, and this reasoning applies regardless of where the receptor is geographically located.

The linkages between upwind states and downwind nonattainment receptors and maintenance-only receptors are provided by receptor site in Table 4-3. The linkages between individual upwind states and counties containing downwind nonattainment and maintenance receptors are provided by upwind state in Table 4-4.

Table 4-3. Upwind states that are "linked" to each downwind nonattainment and maintenance-only receptors.

Site ID	State	County	# Linked States	Linked Upwind States										
60250005	CA	Imperial	1	AZ										
60251003	CA	Imperial	1	AZ										
80350004	CO	Douglas	3	CA	UT	WY								
80590006	CO	Jefferson	3	CA	UT	WY								
80590011	CO	Jefferson	4	CA	TX	UT	WY							
90013007	CT	Fairfield	10	IL	IN	KY	MD	NJ	NY	OH	PA	VA	WV	
90019003	CT	Fairfield	9	IN	KY	MD	NJ	NY	OH	PA	VA	WV		
90099002	CT	New Haven	8	IN	MD	NJ	NY	OH	PA	VA	WV			
240251001	MD	Harford	10	DC	IL	IN	KY	MO	OH	PA	TX	VA	WV	
260050003	MI	Allegan	8	AR	IL	IN	LA	MO	OK	TX	WI			
261630019	MI	Wayne	5	IL	IN	KY	OH	WI						
360810124	NY	Queens	8	IL	IN	MD	MI	NJ	OH	PA	VA			
360850067	NY	Richmond	11	IL	IN	KY	MD	MI	NJ	OH	PA	TX	VA	WV
361030002	NY	Suffolk	10	IL	IN	MD	MI	NJ	OH	PA	TX	VA	WV	
480391004	TX	Brazoria	5	AR	IL	LA	MO	OK						
481210034	TX	Denton	3	AR	LA	OK								
482010024	TX	Harris	1	LA										
482010026	TX	Harris	5	AR	IL	LA	MO	OK						
482011034	TX	Harris	3	LA	MO	OK								

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[20] *See, e.g.*, 81 FR 31513 (May 19, 2016) (approving Arizona Good Neighbor SIP addressing 2008 ozone NAAQS based on determination that upwind states would not collectively contribute to a considerable portion of the downwind air quality problem).

Site ID	State	County	# Linked States	Linked Upwind States										
482011039	TX	Harris	5	AR	IL	LA	MO	OK						
482011050	TX	Harris	4	AR	IL	LA	MO							
484392003	TX	Tarrant	4	AR	KS	LA	OK							
484393009	TX	Tarrant	3	AR	LA	OK								
551170006	WI	Sheboygan	10	IL	IN	KS	KY	LA	MI	MO	OH	OK	TX	

Table 4-4. Linkages between individual upwind states and counties with downwind nonattainment and maintenance-only receptors.

AZ	Imperial Co., CA					
AR	Allegan Co., MI	Denton & Tarrant Co. TX	Brazoria & Harris Co., TX			
CA	Douglas & Jefferson Co., CO					
DC	Harford Co., MD					
IL	Fairfield Co., CT	Queens, Richmond, & Suffolk Co., NY	Harford Co., MD	Allegan & Wayne Co., MI	Brazoria & Harris Co., TX	Sheboygan Co., WI
IN	Fairfield & New Haven Co., CT	Queens, Richmond, & Suffolk Co., NY	Harford Co., MD	Allegan & Wayne Co., MI	Sheboygan Co., WI	
KS	Tarrant Co., TX	Sheboygan Co., WI				
KY	Fairfield Co., CT	Richmond Co., NY	Harford Co., MD	Wayne Co., MI		
LA	Allegan Co., MI	Sheboygan Co., WI	Denton & Tarrant Co., TX	Brazoria & Harris Co., TX		
MD	Fairfield & New Haven Co., CT	Queens, Richmond, & Suffolk Co., NY				
MI	Queens, Richmond, &Suffolk Co., NY	Sheboygan Co., WI				
MO	Harford Co., MD	Allegan Co., MI	Sheboygan Co., WI	Brazoria & Harris Co., TX		
NJ	Fairfield & New Haven Co., CT	Queens, Richmond, & Suffolk Co., NY				
NY	Fairfield & New Haven Co., CT					
OH	Fairfield & New Haven Co., CT	Queens, Richmond, & Suffolk Co., NY	Harford Co., MD	Wayne Co., MI	Sheboygan Co., WI	
OK	Allegan Co., MI	Sheboygan Co., WI	Denton & Tarrant Co., TX	Brazoria & Harris Co., TX		
PA	Fairfield & New Haven Co., CT	Queens, Richmond, & Suffolk Co., NY	Harford Co., MD			
TX	Jefferson Co., CO	Richmond & Suffolk Co., NY	Harford Co., MD	Allegan Co., MI	Sheboygan Co., WI	
UT	Douglas & Jefferson Co., CO					
VA	Fairfield & New Haven Co., CT	Harford Co., MD	Queens, Richmond, & Suffolk Co., NY			
WV	Fairfield & New Haven Co., CT	Harford Co., MD	Richmond & Suffolk Co., NY			
WI	Allegan & Wayne Co., MI					
WY	Douglas & Jefferson Co., CO					

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Appendix A

2011 Model Performance Evaluation

An operational model evaluation was conducted for the 2011 base year CAMx v6.32 simulation performed for the 12 km U.S. modeling domain. The purpose of this evaluation is to examine the ability of the 2011 air quality modeling platform to represent the magnitude and spatial and temporal variability of measured (i.e., observed) ozone concentrations within the modeling domain. The evaluation presented here is based on model simulations using the 2011 emissions platform (i.e., scenario name 2011el_cb6r4_v6_11g). The model evaluation for ozone focuses on comparisons of model predicted 8-hour daily maximum concentrations to the corresponding observed data at monitoring sites in the EPA Air Quality System (AQS) and the Clean Air Status and Trends Network (CASTNet). The locations of the ozone monitoring sites in these two networks are shown in Figures A-1a and A-1b.

Included in the evaluation are statistical measures of model performance based upon model-predicted versus observed concentrations that were paired in space and time. Model performance statistics were calculated for several spatial scales and temporal periods. Statistics were calculated for individual monitoring sites, and in aggregate for monitoring sites within each state and within each of nine climate regions of the 12 km U.S. modeling domain. The regions include the Northeast, Ohio Valley, Upper Midwest, Southeast, South, Southwest, Northern Rockies, Northwest and West[1,2], which are defined based upon the states contained within the National Oceanic and Atmospheric Administration (NOAA) climate regions (Figure A-2)[3] as defined in Karl and Koss (1984).

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[1] The nine climate regions are defined by States where: Northeast includes CT, DE, ME, MA, MD, NH, NJ, NY, PA, RI, and VT; Ohio Valley includes IL, IN, KY, MO, OH, TN, and WV; Upper Midwest includes IA, MI, MN, and WI; Southeast includes AL, FL, GA, NC, SC, and VA; South includes AR, KS, LA, MS, OK, and TX; Southwest includes AZ, CO, NM, and UT; Northern Rockies includes MT, NE, ND, SD, WY; Northwest includes ID, OR, and WA; and West includes CA and NV.

[2] Note most monitoring sites in the West region are located in California (see Figures 2A-2a and 2A-2b), therefore statistics for the West will be mostly representative of California ozone air quality.

[3] NOAA, National Centers for Environmental Information scientists have identified nine climatically consistent regions within the contiguous U.S., http://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php.

For maximum daily average 8-hour (MDA8) ozone, model performance statistics were created for the period May through September.[4] The aggregate statistics by state and by climate region are presented in this appendix. Model performance statistics for MDA8 ozone at individual monitoring sites based on days with observed values $\geq$ 60 ppb can be found in the docket in the file named "2015 O3 NAAQS Preliminary Transport Assessment_2011 Ozone Model Performance Statistics by Site".

In addition to the above performance statistics, we prepared several graphical presentations of model performance for MDA8 ozone. These graphical presentations include:
(1) maps that show the mean bias and error as well as normalized mean bias and error calculated for MDA8 $\geq$ 60 ppb for May through September at individual AQS and CASTNet monitoring sites;
(2) bar and whisker plots that show the distribution of the predicted and observed MDA8 ozone concentrations by month (May through September) and by region and by network; and
(3) time series plots (May through September) of observed and predicted MDA8 ozone concentrations for the 2023 nonattainment and maintenance-only sites for which upwind states contribute at or above the 1 percent of the NAAQS screening threshold (see Table A-3).

The Atmospheric Model Evaluation Tool (AMET) was used to calculate the model performance statistics used in this document (Gilliam et al., 2005). For this evaluation we have selected the mean bias, mean error, normalized mean bias, and normalized mean error to characterize model performance, statistics which are consistent with the recommendations in Simon et al. (2012) and the draft photochemical modeling guidance (U.S. EPA, 2014a).

Mean bias (MB) is the average of the difference (predicted – observed) divided by the total number of replicates (n). Mean bias is given in units of ppb and is defined as:

MB = $\frac{1}{n}\sum_{1}^{n}(P-O)$, where P = predicted and O = observed concentrations

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[4] In calculating the ozone season statistics we limited the data to those observed and predicted pairs with observations that are $\geq$ 60 ppb in order to focus on concentrations at the upper portion of the distribution of values.

Mean error (ME) calculates the absolute value of the difference (predicted - observed) divided by the total number of replicates (n). Mean error is given in units of ppb and is defined as:

$$\mathrm{ME} = \frac{1}{n}\sum_{1}^{n}|P - O|$$

Normalized mean bias (NMB) is the average the difference (predicted - observed) over the sum of observed values. NMB is a useful model performance indicator because it avoids over inflating the observed range of values, especially at low concentrations. Normalized mean bias is given in percentage units and is defined as:

$$\mathrm{NMB} = \frac{\sum_{1}^{n}(P-O)}{\sum_{1}^{n}(O)} * 100$$

Normalized mean error (NME) is the absolute value of the difference (predicted - observed) over the sum of observed values. Normalized mean error is given in percentage units and is defined as:

$$\mathrm{NME} = \frac{\sum_{1}^{n}|P-O|}{\sum_{1}^{n}(O)} * 100$$

As described in more detail below, the model performance statistics indicate that the 8-hour daily maximum ozone concentrations predicted by the 2011 CAMx modeling platform closely reflect the corresponding 8-hour observed ozone concentrations in each region of the 12 km U.S. modeling domain. The acceptability of model performance was judged by considering the 2011 CAMx performance results in light of the range of performance found in recent regional ozone model applications (NRC, 2002; Phillips et al., 2007; Simon et al., 2012; U.S. EPA, 2005; U.S. EPA, 2009; U.S. EPA, 2010).[5] These other modeling studies represent a wide range of modeling analyses that cover various models, model configurations, domains, years and/or episodes, chemical mechanisms, and aerosol modules. Overall, the ozone model performance results for the 2011 CAMx simulations are within the range found in other recent peer-reviewed and regulatory applications. The model performance results, as described in this document, demonstrate that the predictions from the 2011 modeling platform correspond closely to observed concentrations in terms of the magnitude, temporal fluctuations, and geographic differences for 8-hour daily maximum ozone.

The 8-hour ozone model performance bias and error statistics by network for the period May-September for each region and each state are provided in Tables A-1 and A-2, respectively. The statistics shown were calculated using data pairs on days with observed 8-hour ozone of ≥ 60 ppb. The distributions of observed and predicted 8-hour ozone by month in the period May through September for each region are shown in Figures A-3 through A-11. Spatial plots of the mean bias and error as well as the normalized mean bias and error for individual monitors are shown in Figures A-12 through A-15. Time series plots of observed and predicted MDA 8-hour ozone during the period May through September at the projected 2023 nonattainment and

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[5] National Research Council (NRC), 2002. Estimating the Public Health Benefits of Proposed Air Pollution Regulations, Washington, DC: National Academies Press.

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maintenance-only sites listed in Table A-3 are provided in Figure A-16, (a) through (x). Overall, model performance for MDA8 ozone concentrations for the 2011 CAMx v6.32 simulation is similar to what was found in the model performance evaluation conducted for the 2011 CAMx v6.20 simulation performed for the final CSAPR Update.

As indicated by the statistics in Table A-1, bias and error for 8-hour daily maximum ozone are relatively low in each region. Generally, mean bias for 8-hour ozone ≥ 60 ppb during the period May through September is within ± 5 ppb[6] at AQS and CASTNet sites in four of the eastern climate regions (i.e., Northeast, Ohio Valley, Upper Midwest, and Southeast). The mean error is 10 ppb or less in all regions, except the West. Normalized mean bias is within ± 5 percent for AQS sites in the Northeast, Ohio Valley, Southeast, with somewhat larger values in the Upper Midwest and South where the normalized mean bias is also relatively low at -5.9 percent and -7.6 percent, respectively. The mean bias and normalized mean bias statistics indicate a tendency for the model to under predict MDA8 ozone concentrations in the western regions for AQS and CASTNet sites. The normalized mean error is less than 15 percent for both networks in all regions, except for the CASTNet sites in the Northern Rockies and West regions. Looking at model performance for individual states (Table A-2) indicates that mean bias is within ± 5 ppb for a majority of the states and within ± 10 ppb for all but two states. The mean error is less than 10 ppb for nearly all states. The normalized mean bias is within ± 10 percent in except for California, Idaho, Nevada, North Dakota, South Dakota, and Wyoming where the normalized mean bias ranges from - 10.3 percent (Nevada) to - 23.7 percent (North Dakota) . The normalized mean error is within 15 percent for all but three states (Idaho, North Dakota, and South Dakota) and the District of Columbia.

The monthly distributions of 8-hour daily maximum model predicted ozone generally corresponds well with that of the observed concentrations, as indicated by the graphics in Figures A-3 through A-11. The distribution of predicted concentrations tends to be close to that of the observed data at the 25th percentile, median and 75th percentile values for each region, although there is a persistent overestimation bias in the Northeast, Ohio Valley, and Southeast regions,

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[6] Note that "within ± 5 ppb" includes values that are greater than or equal to -5 ppb and less than or equal to 5 ppb.

and a tendency for under-prediction in some months for the western regions (i.e., Southwest, Northern Rockies, Northwest,[7] and West), particularly at CASTNet sites in the West region.

Figures A-12 through A-15 show the spatial variability in bias and error at monitor locations. Mean bias, as seen from Figure A-12, is within ± 5 ppb at many sites across the East with over-prediction of 5 to 10 ppb or more at some of the sites from the Southeast into the Northeast. Elsewhere in the U.S., mean bias is generally in the range of -5 to -10 ppb. The most notable exception is in portions of California where the mean bias is in the range of -10 to -15 ppb at a number of interior sites. Figure A-13 indicates that the normalized mean bias for days with observed 8-hour daily maximum ozone ≥ 60 ppb is within ± 10 percent at the vast majority of monitoring sites across the modeling domain. There are regional differences in model performance, where the model tends to over-predict at some sites from the Southeast into the Northeast and generally under predict, mainly within the range of - 10 to - 20 percent, at sites in the Southwest, Northern Rockies, and West. Model performance in the Ohio Valley and Upper Midwest states shows that most sites are within ± 10 percent with only a relatively few sites outside of this range.

Model error, as seen from Figure A-14, is generally 10 ppb or less at most of the sites across the modeling domain. Figure A-15 indicates that the normalized mean error for days with observed 8-hour daily maximum ozone ≥ 60 ppb is within 15 percent at the vast majority of monitoring sites across the modeling domain. Somewhat greater error (i.e., 15 to 20 percent) is evident at sites in several areas of the domain, most notably within portions of interior California.

In addition to the above analysis of overall model performance, we also examine how well the modeling platform replicates day to day fluctuations in observed 8-hour daily maximum concentrations using data for the sites identified in Table A-3. For this site-specific analysis we present the time series of observed and predicted 8-hour daily maximum concentrations by site over the period May through September. The results, as shown in Figures A-16 (a) through (x), indicate that the modeling platform generally replicates the day-to-day variability in ozone

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[7] Note that the over-prediction at CASTNet sites in the Northwest seen in Figure A-10 may not be representative of performance in rural areas of this region because there are so few observed and predicted data values in this region.

during this time period at these sites. That is, days with high modeled concentrations are generally also days with high measured concentrations and, conversely, days with low modeled concentrations are also days with low measured concentrations in most cases.[8] For example, model predictions at several sites not only accurately capture the day-to-day variability in the observations, but also appear to have relatively low bias on individual days: Queens County, NY; Richmond County, NY; and Suffolk County, NY. The sites in Fairfield County, CT, New Haven County, CT, Harford County, MD, and Allegan County, MI each track closely with the observations, but there is a tendency to over predict on several of the observed high ozone days. Other sites generally track well and capture day-to-day variability but underestimate ozone on some of the days with measured high ozone concentrations: Imperial County, CA; Douglas County, CO; Jefferson County, CO; Wayne County, MI; Brazoria County, TX; Denton County, TX; Harris County, TX; Tarrant County, TX; and Sheboygan County, WI. Note that at the site in Brazoria County, TX and at the Harris County, TX sites, the model tends to over predict ozone on days with low observed concentrations. In particular, there is an extended period from mid-July to mid-August with very low observed ozone concentrations, mainly in the range of 30 to 40 ppb. The model also predicts generally low ozone concentrations at these sites during this period, but the modeled values were in the range of 40 to 60 ppb which is not quite as low as the observed values. Looking across all 24 sites indicates that the modeling platform is able to capture both the site-to-site differences in the short-term (i.e., day-to-day) variability and the general magnitude of the observed ozone concentrations.

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[8] At site 060250005 in Imperial County, CA, the model predicted MDA8 concentrations were generally within the range of the corresponding observed values from May through early July. The monitor may have been offline during much of July since there are no measured data in AQS during this time period. When data became available again in late July, the measurements were notably lower than the predictions and also lower than the observations during May and June. The reasons for the difference in observed concentrations and model performance before versus after the break in the data record are not clear.

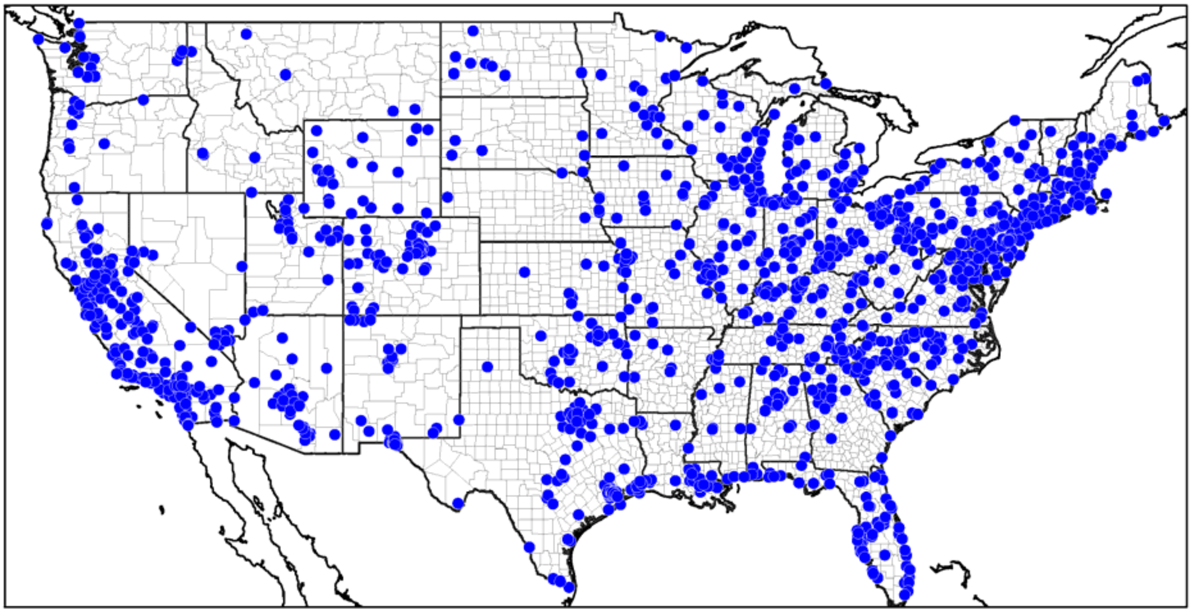

Figure A-1a. AQS ozone monitoring sites.

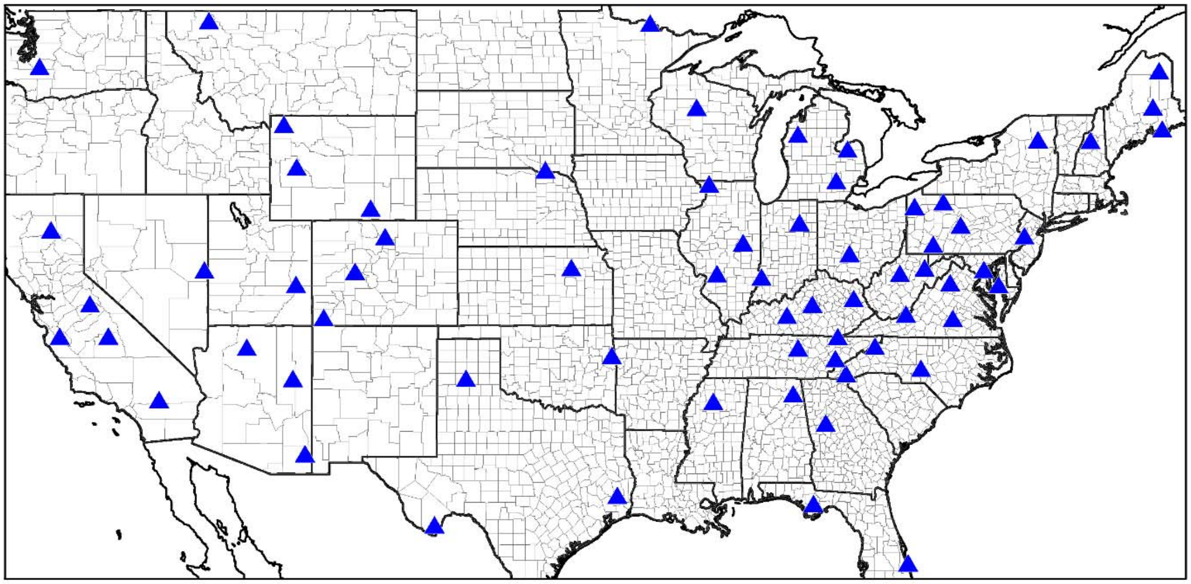

Figure A-1b. CASTNet ozone monitoring sites.

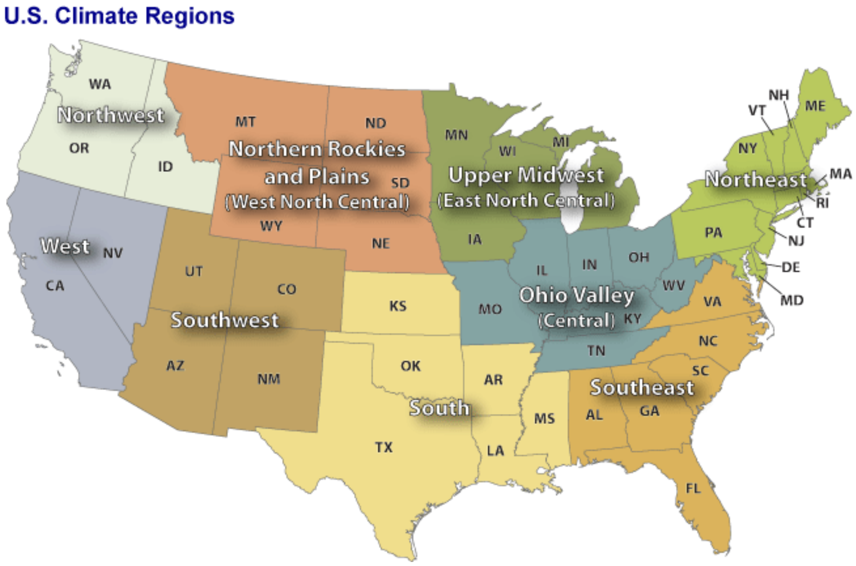

Figure A-2. NOAA climate regions (source: http://www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php#references)

Table A-1. Performance statistics for MDA8 ozone ≥ 60 ppb for May through September by climate region, for AQS and CASTNet networks.

Network	Climate Region	No. of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
AQS	Northeast	4085	1.2	7.3	1.8	10.7
	Ohio Valley	6325	-0.6	7.5	-0.9	11.1
	Upper Midwest	1162	-4.0	7.6	-5.9	11.1
	Southeast	4840	2.3	6.8	3.4	10.2
	South	5694	-5.3	8.4	-7.6	12.2
	Southwest	6033	-6.2	8.5	-9.4	12.9
	Northern Rockies	380	-7.2	8.4	-11.4	13.4
	Northwest	79	-5.6	9	-8.7	14.0
	West	8655	-8.6	10.3	-12.2	14.5
CASTNet	Northeast	264	1.2	5.9	1.9	8.8
	Ohio Valley	433	-3.0	6.5	-4.5	9.7
	Upper Midwest	38	-4.6	6.0	-6.8	9.0
	Southeast	201	0.1	5.2	0.2	8.1
	South	215	-8.2	8.8	-12.3	13.2
	Southwest	382	-8.8	9.6	-13.4	14.6
	Northern Rockies	110	-9.7	10.0	-15.3	15.7
	Northwest	-	-	-	-	-
	West	425	-13.6	13.9	-18.7	19.1

Table A-2. Performance statistics for MDA8 ozone ≥ 60 ppb for May through September by state based on data at AQS network sites.

State	No. of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
AL	739	2.9	6.9	4.4	10.4
AZ	2334	-5.8	9.1	-8.8	13.7
AR	252	-4.2	8.7	-6.1	12.9
CA	7533	-8.9	10.6	-12.4	14.8
CO	2067	-6.6	8.4	-9.9	12.6
CT	245	1.5	9.7	2.1	13.6
DE	232	1.3	6.5	1.9	9.5
DC	87	1.8	11.4	2.6	16.4
FL	581	1.2	7.4	1.8	11.1
GA	829	3.0	7.5	4.4	11.2
ID	51	-10.0	10.3	-15.7	16.3
IL	782	-3.3	8.6	-4.8	12.8
IN	1142	-0.5	6.8	-0.8	10.1
IA	126	-3.4	6.7	-5.3	10.4
KS	352	-5.1	7.8	-7.6	11.7
KY	845	0.4	7.5	0.6	11.3
LA	711	0.2	7.4	0.3	10.8
ME	101	-4.1	7.2	-6.2	10.9
MD	766	2.5	7.9	3.6	11.2
MA	197	1.5	7.3	2.2	10.8
MI	638	-4.0	7.9	-5.9	11.4
MN	35	0.5	6.9	0.7	10.4
MS	260	0.6	8.1	0.9	12.3
MO	719	-1.9	7.8	-2.7	11.4
MT*	-	-	-	-	-
NE	41	-2.6	5.5	-4.1	8.7
NV	1122	-6.8	8.1	-10.3	12.2
NH	98	-6.0	8.7	-9.1	13.3
NJ	439	1.4	7.2	2.0	10.3
NM	961	-5.9	7.9	-9.1	12.1
NY	504	-0.7	7.2	-1.1	10.5
NC	1496	2.4	6.2	3.5	9.3
ND	10	-14.8	14.8	-23.7	23.7
OH	1624	-0.4	7.7	-0.6	11.3
OK	1475	-6.7	8.4	-9.7	12.3
OR	21	2.6	6.3	4.0	9.7
PA	1336	2.1	6.5	3.1	9.6
RI	75	-0.6	7.8	-0.8	11.5

State	No. of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
SC	545	1.7	6.1	2.6	9.3
SD	21	-11.9	12.1	-18.9	19.2
TN	993	0.5	7.2	0.8	10.8
TX	2644	-6.6	8.8	-9.5	12.6
UT	671	-6.4	7.7	-9.9	11.9
VT	5	-6.4	8.5	-9.6	12.6
VA	650	2.0	7.4	2.9	11.1
WA	7	2.2	7.0	3.4	10.9
WV	220	2.2	6.1	3.3	9.3
WI	363	-4.7	7.5	-6.8	10.9
WY	308	-7.3	8.4	-11.5	13.3

*No statistics were calculated for Montana because there were no days with observed MDA8 ozone ≥ 60 ppb in the ambient data set used for these calculations.

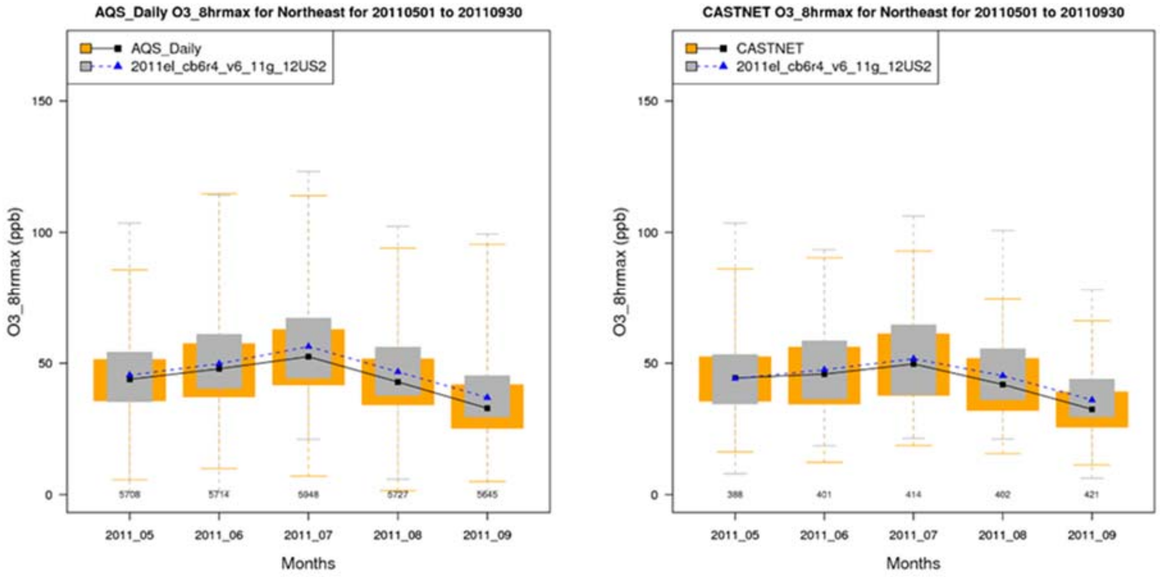

Figure A-3. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the Northeast region, AQS Network (left) and CASTNet (right). [symbol = median; top/bottom of box = 75th/25th percentiles; top/bottom line = max/min values]

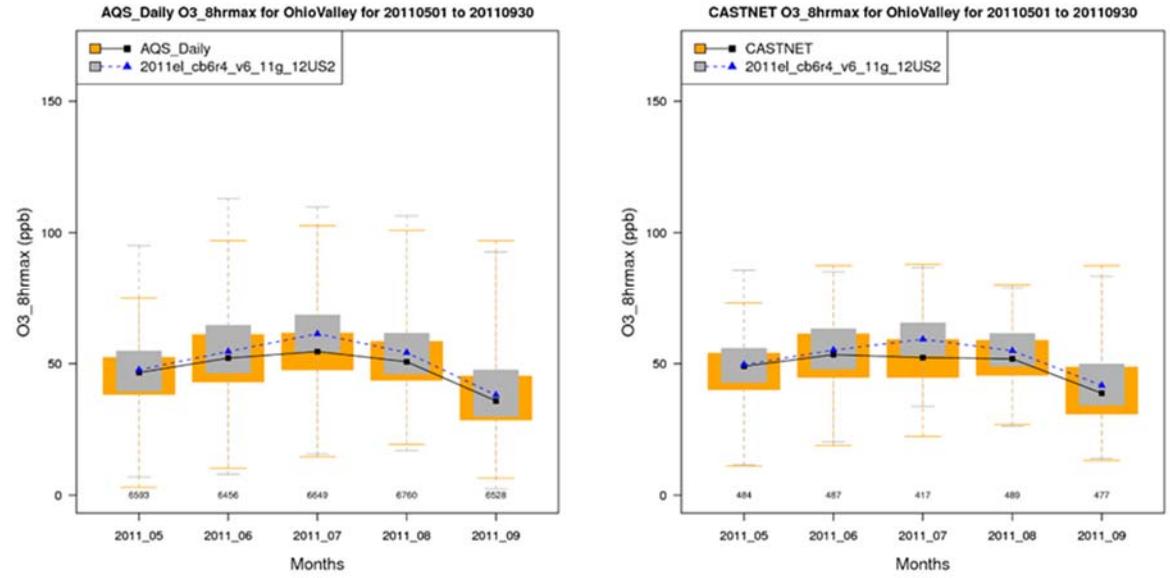

Figure A-4. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the Ohio Valley region, AQS Network (left) and CASTNet (right).

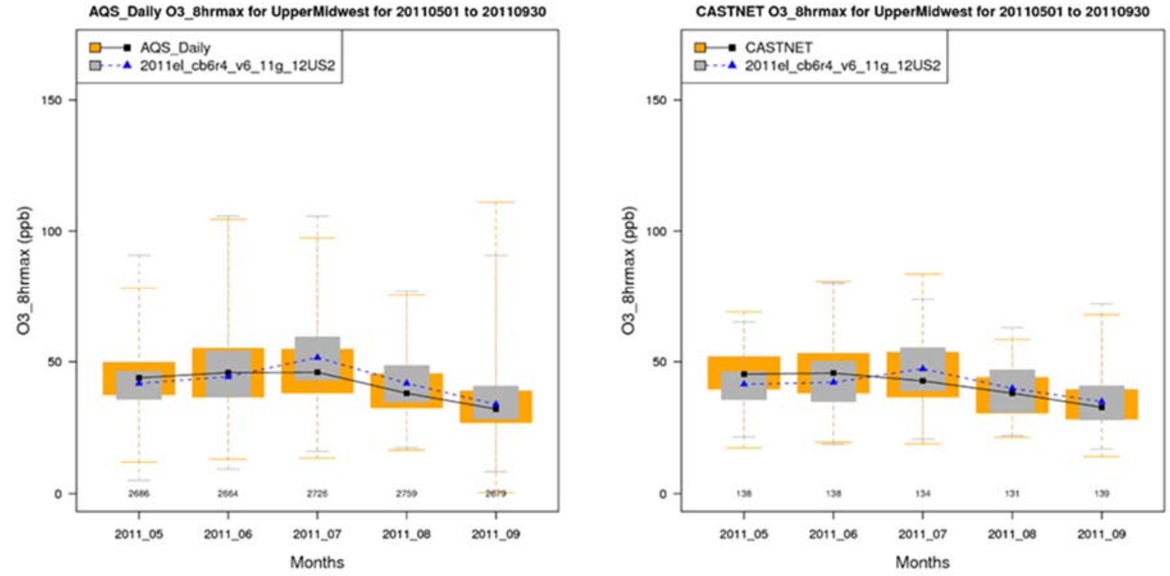

Figure A-5. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the Upper Midwest region, AQS Network (left) and CASTNet (right).

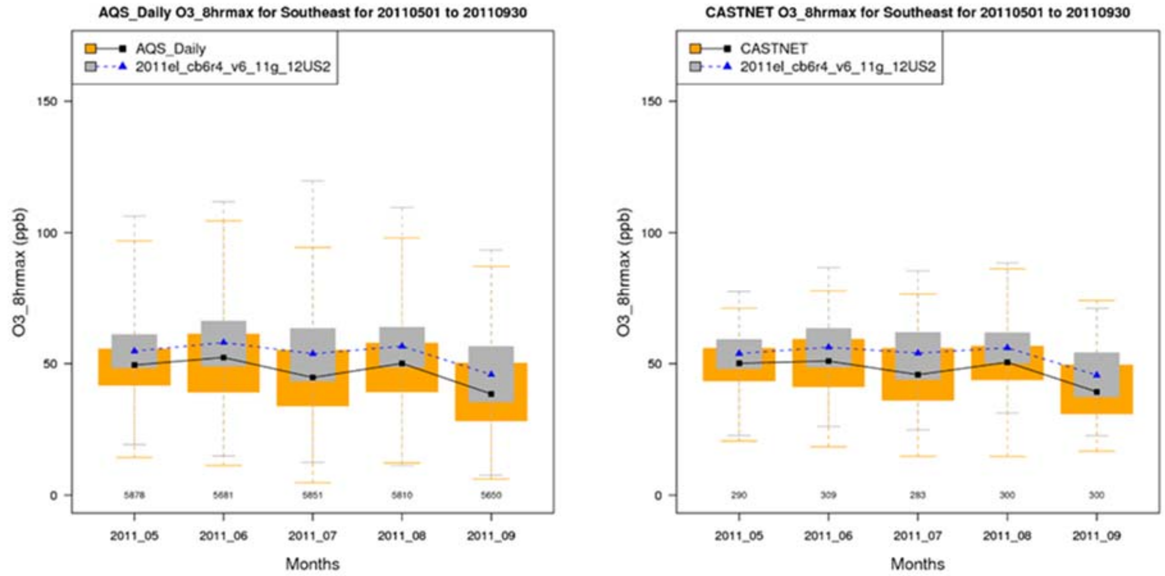

Figure A-6. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the Southeast region, AQS Network (left) and CASTNet (right).

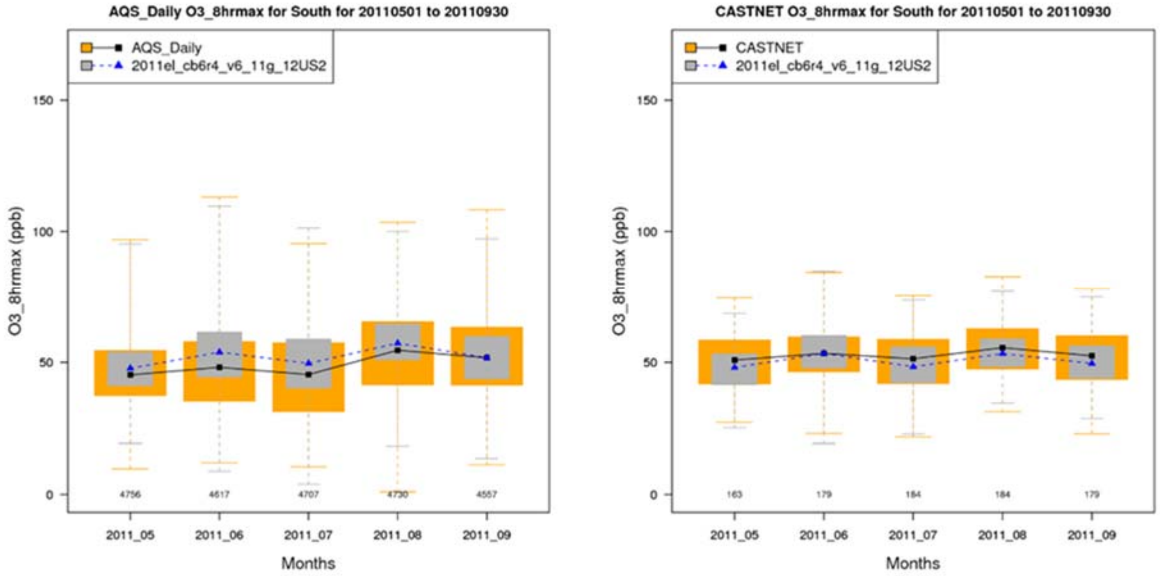

Figure A-7. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the South region, AQS Network (left) and CASTNet (right).

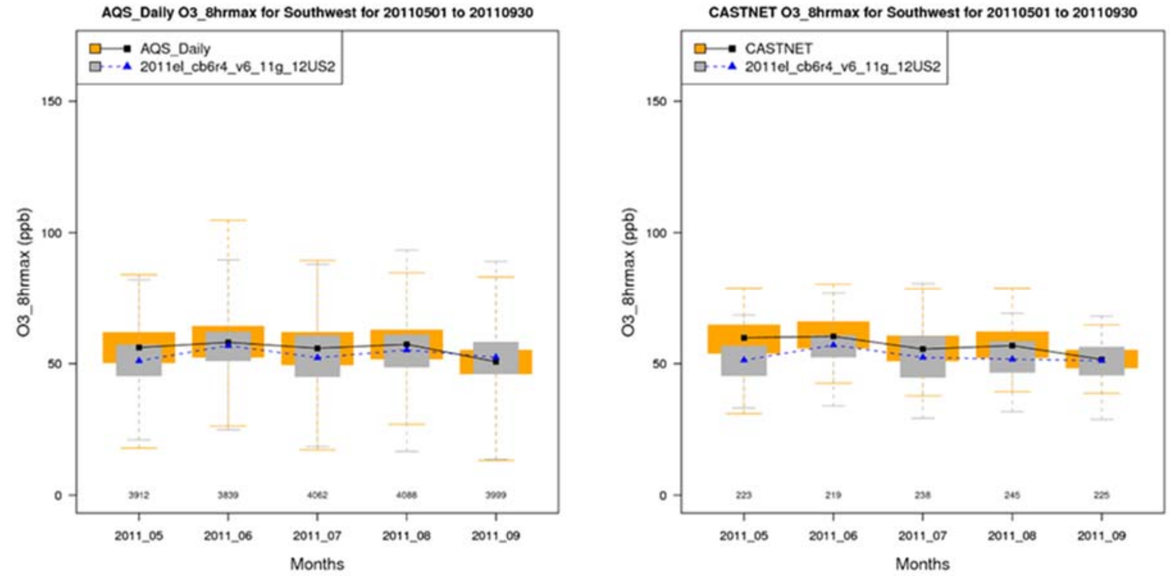

Figure A-8. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the Southwest region, AQS Network (left) and CASTNet (right).

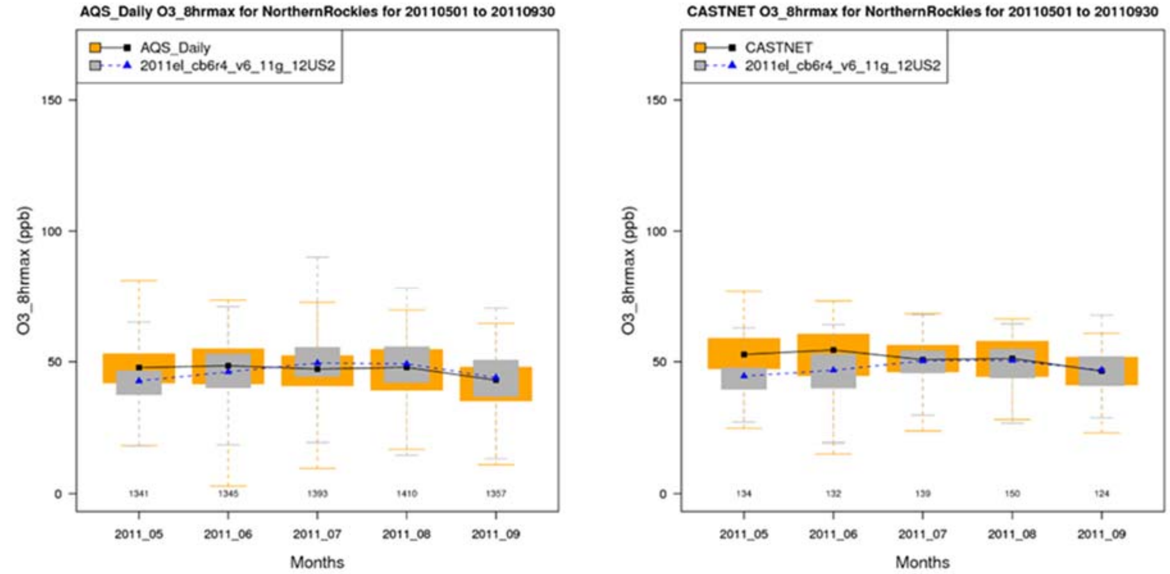

Figure A-9. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the Northern Rockies region, AQS Network (left) and CASTNet (right).

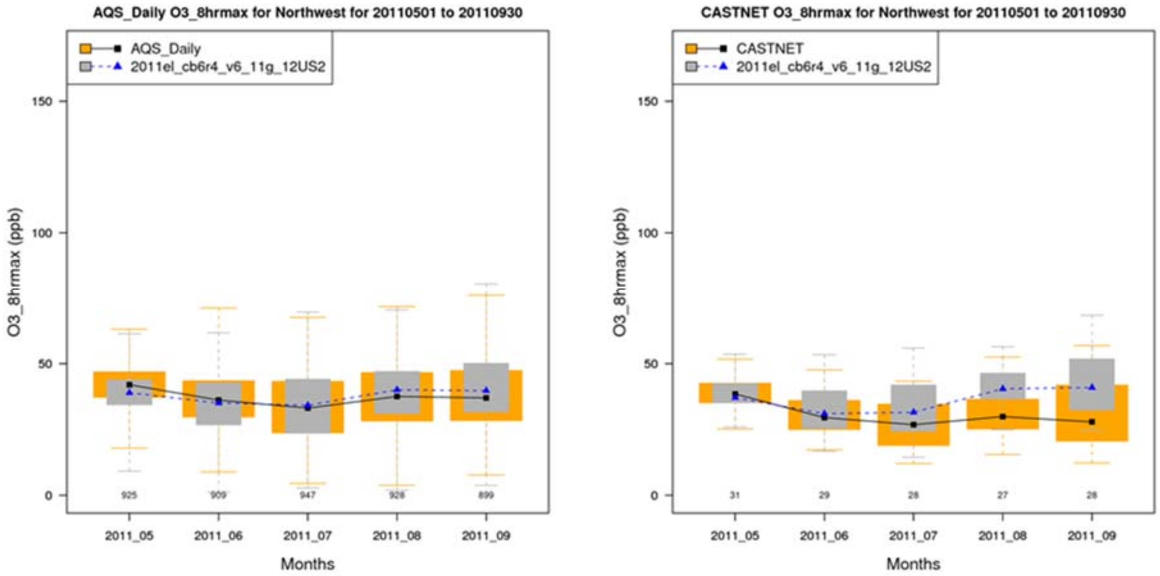

Figure A-10. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the Northwest region, AQS Network (left) and CASTNet (right).

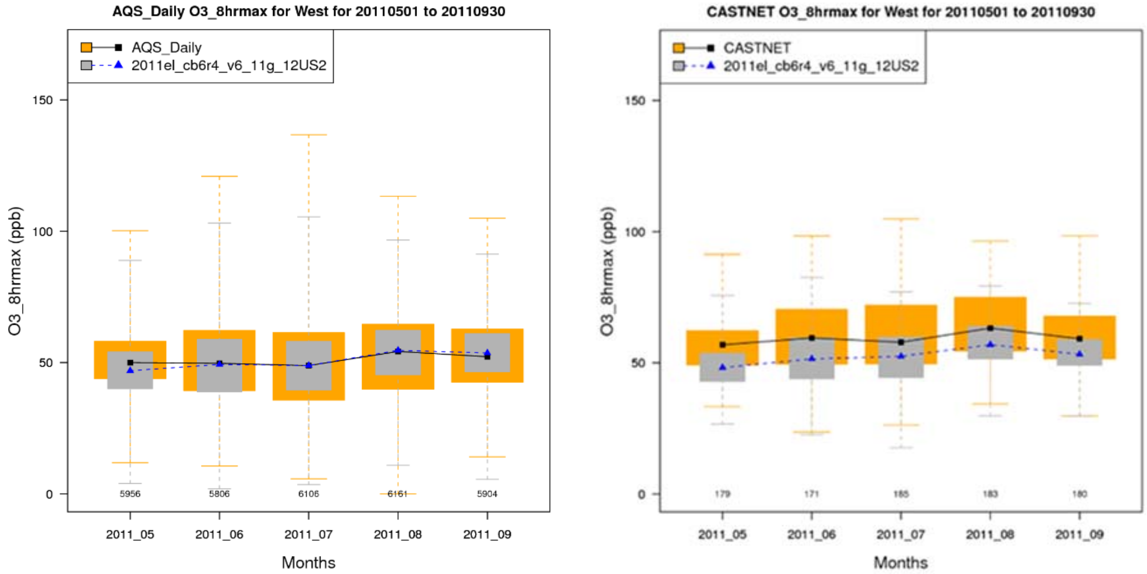

Figure A-11. Distribution of observed and predicted MDA8 ozone by month for the period May through September for the West region, AQS Network (left) and CASTNet (right).

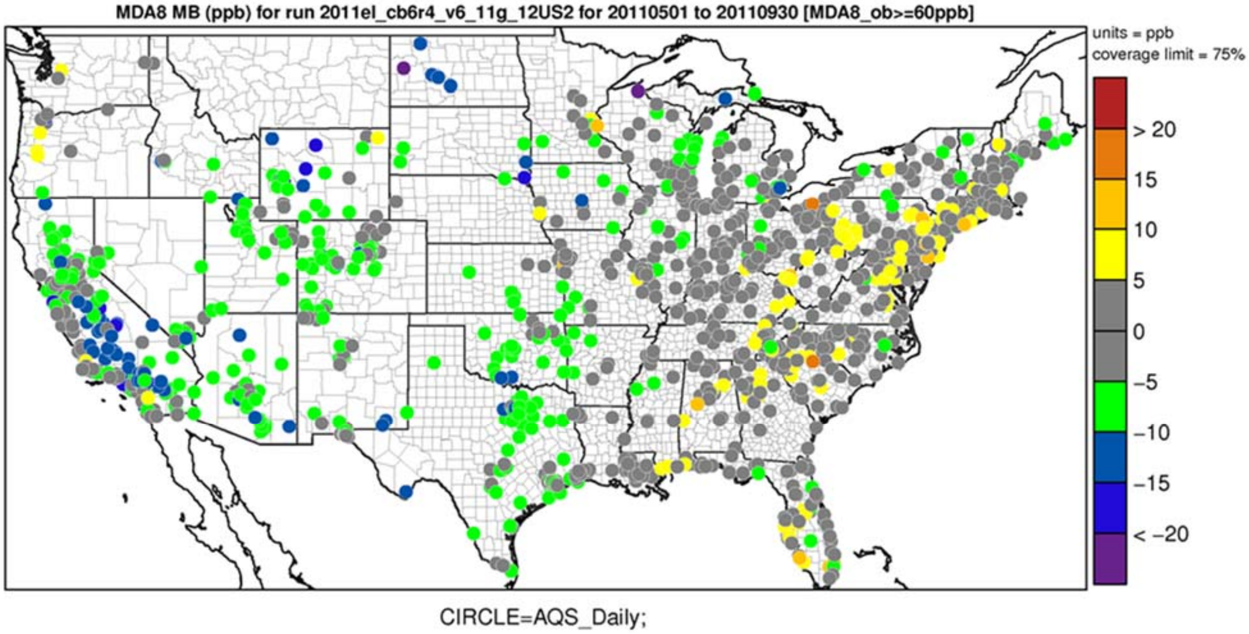

Figure A-12. Mean Bias (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2011 at AQS and CASTNet monitoring sites.

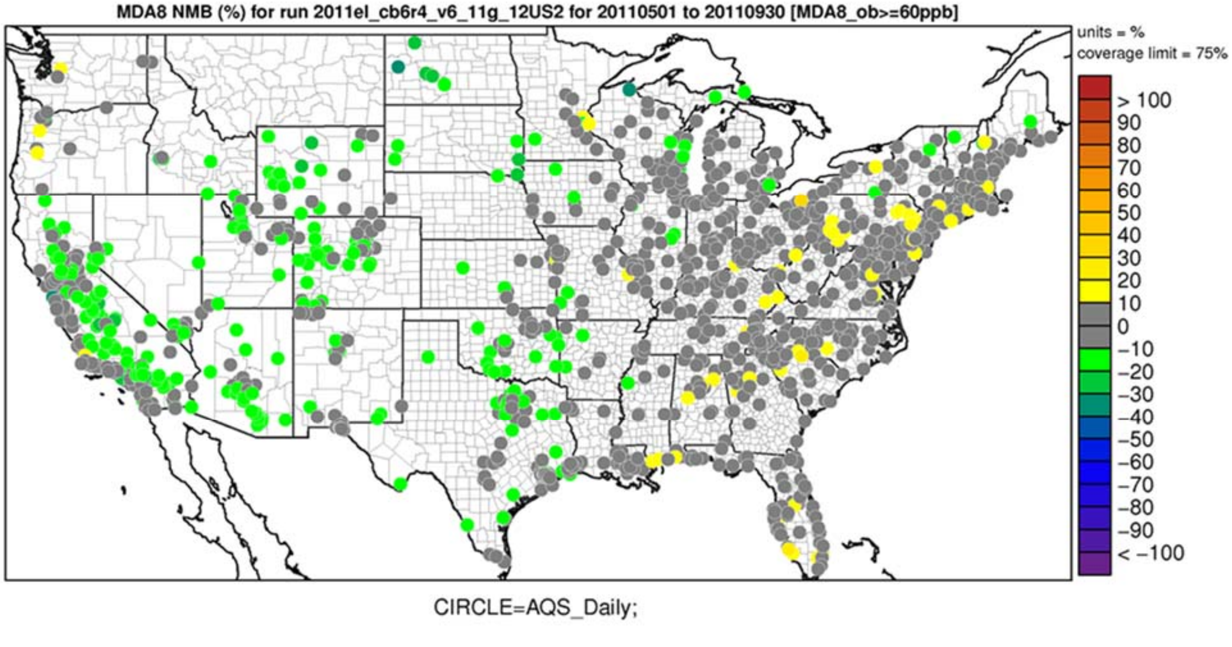

Figure A-13. Normalized Mean Bias (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2011 at AQS and CASTNet monitoring sites.

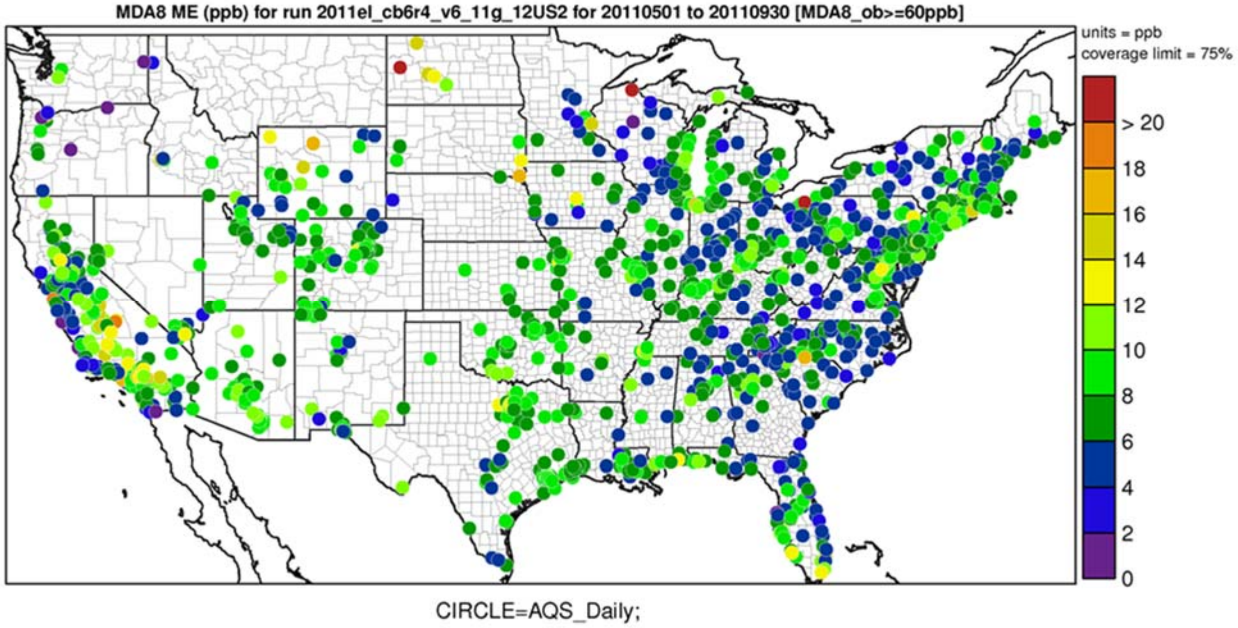

Figure A-14. Mean Error (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2011 at AQS and CASTNet monitoring sites.

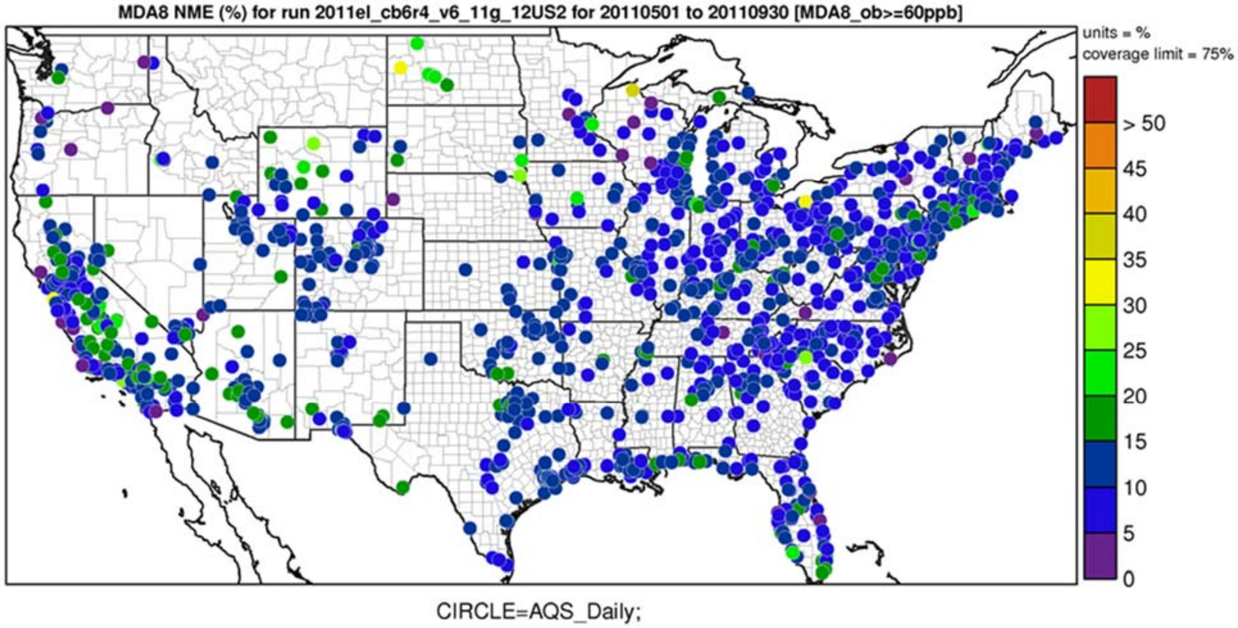

Figure A-15. Normalized Mean Error (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2011 at AQS and CASTNet monitoring sites.

Table A-3. Monitoring sites included in the ozone time series analysis.[9]

Site	County	State
90013007	Fairfield	CT
90019003	Fairfield	CT
90099002	New Haven	CT
360810124	Queens	NY
360850067	Richmond	NY
361030002	Suffolk	NY
240251001	Harford	MD
261630019	Wayne	MI
260050003	Allegan	MI
551170006	Sheboygan	WI

Site	County	State
480391004	Brazoria	TX
481210034	Denton	TX
482010024	Harris	TX
482010026	Harris	TX
482011034	Harris	TX
482011039	Harris	TX
482011050	Harris	TX
484392003	Tarrant	TX
484393009	Tarrant	TX
60250005	Imperial	CA
60251003	Imperial	CA
80350004	Douglas	CO
80590006	Jefferson	CO
80590011	Jefferson	CO

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[9] Note that the monitoring site identification number for site 90099002 in Fairfield County, CT was previously 90093002. The latter site identification number for this site is used in Figure A-16c and in the model performance statistics file "2015 O3 NAAQS Preliminary Transport Assessment_2011 Ozone Model Performance Statistics by Site", which can be found in the docket for this notice.

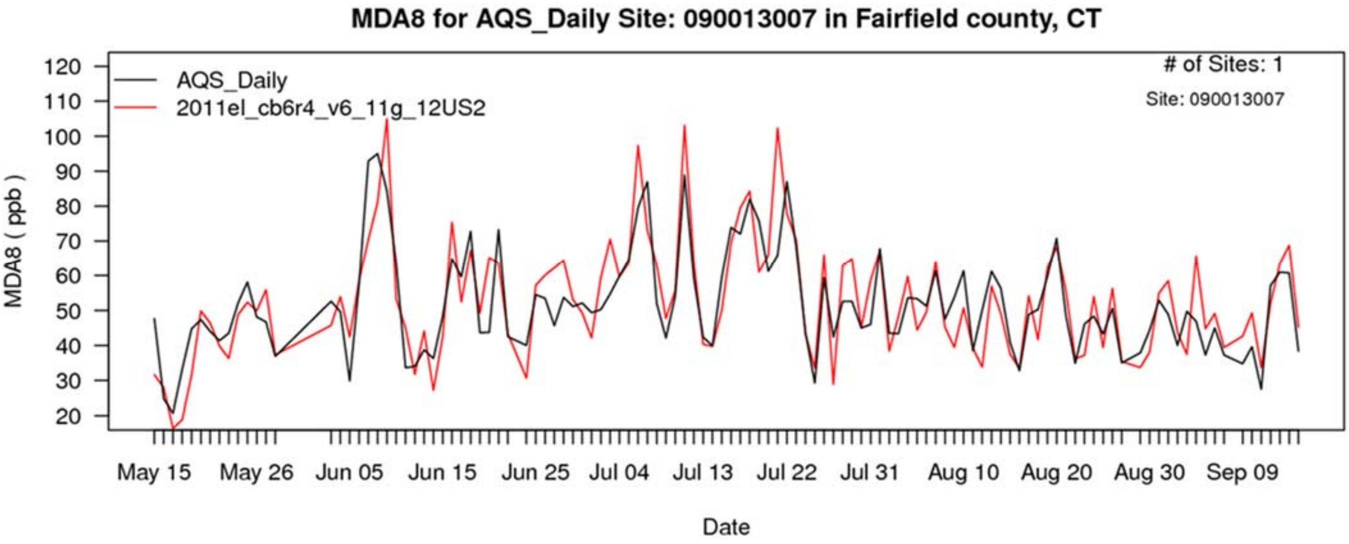

Figure A-16a. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 090013007 in Fairfield Co., Connecticut.

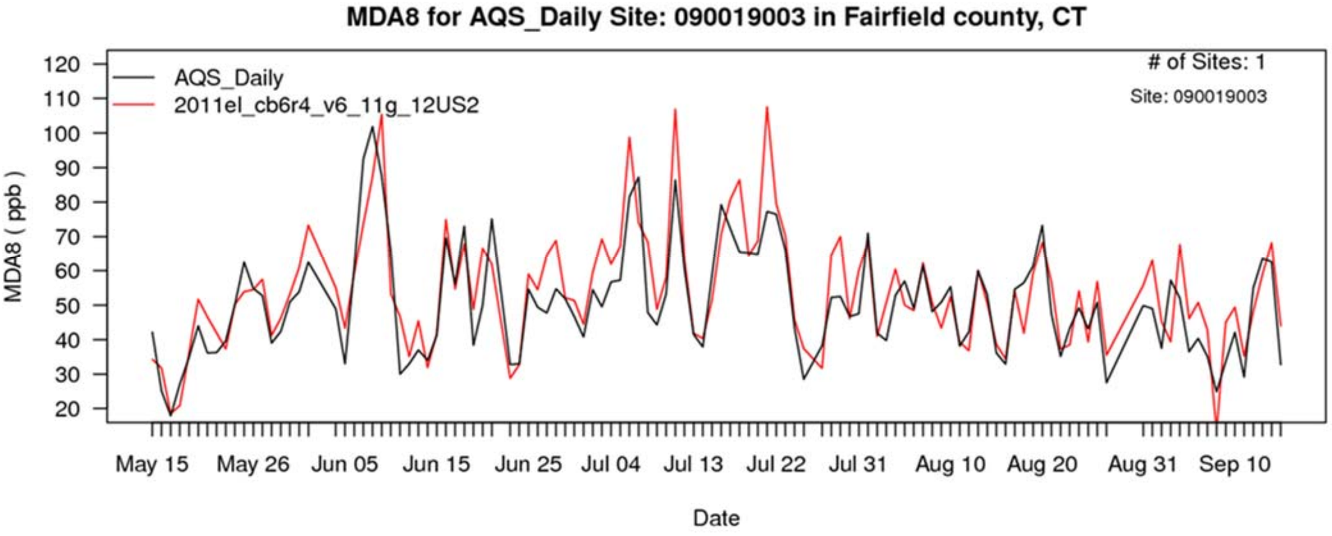

Figure A-16b. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 090019003 in Fairfield Co., Connecticut.

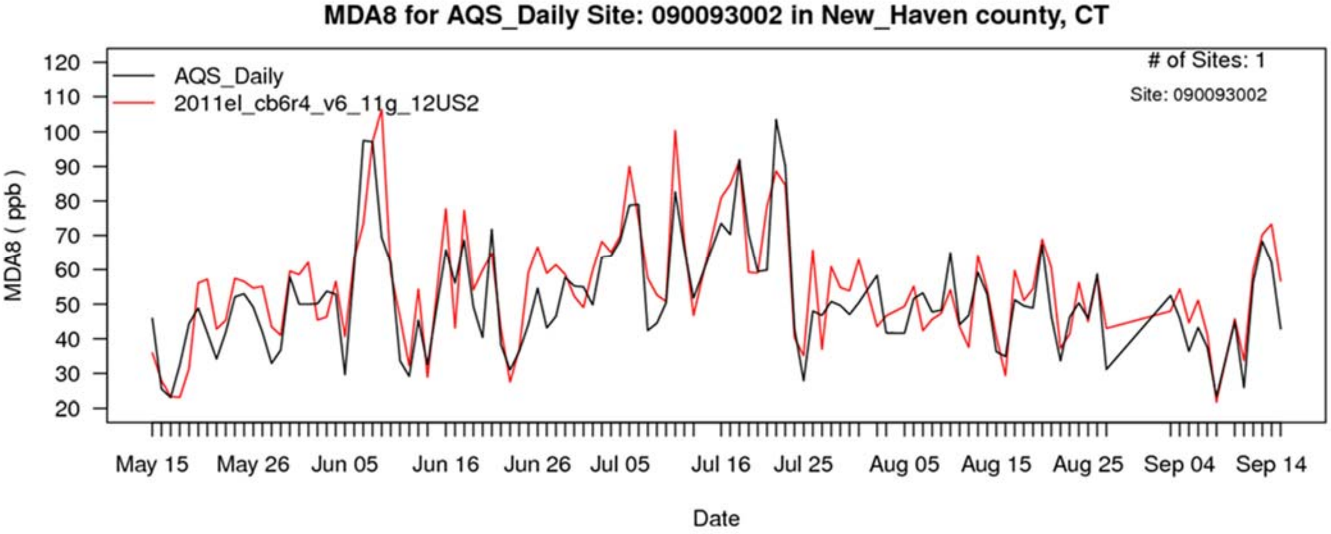

Figure A-16c. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 090099002 in New Haven Co., Connecticut.

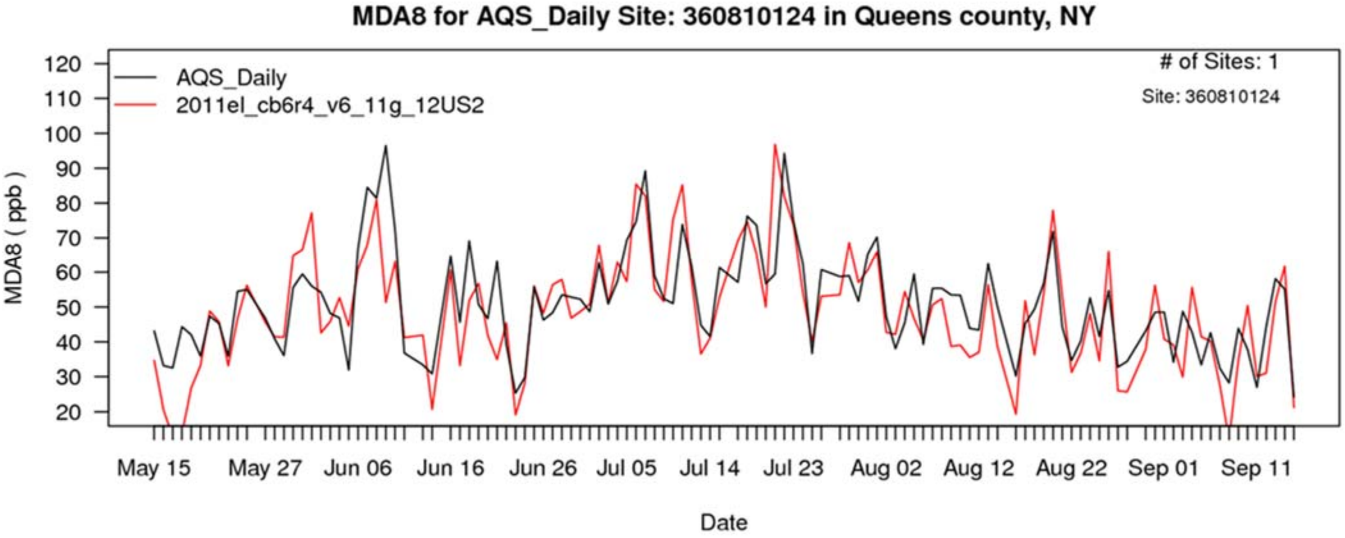

Figure A-16d. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 36810124 in Queens Co., New York.

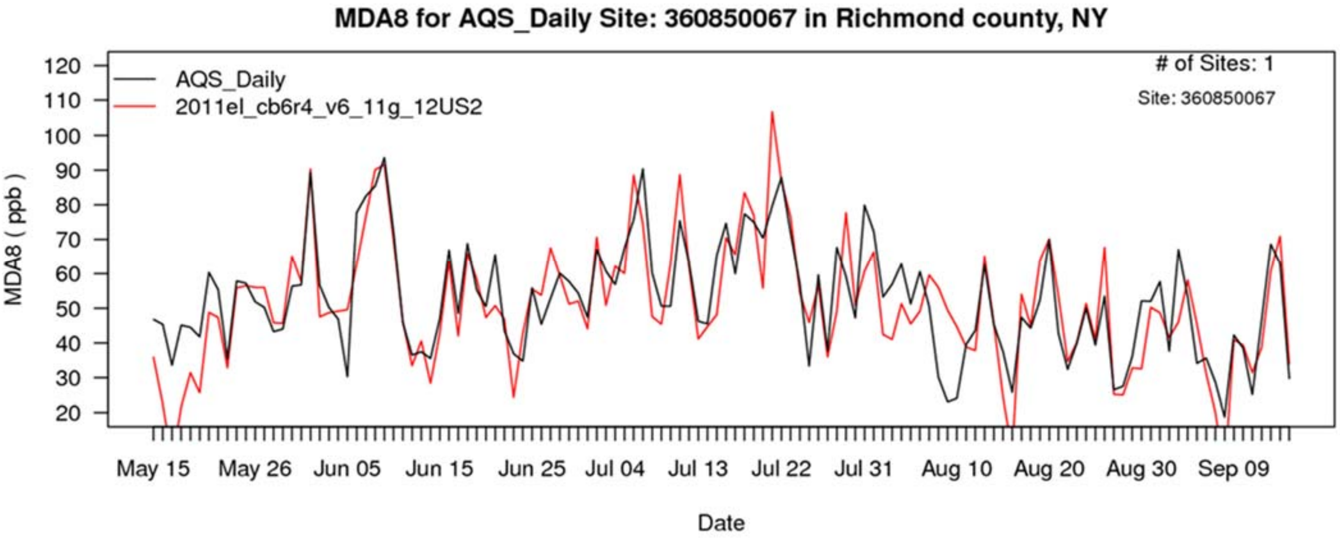

Figure A-16e. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 360850067 in Richmond Co., New York.

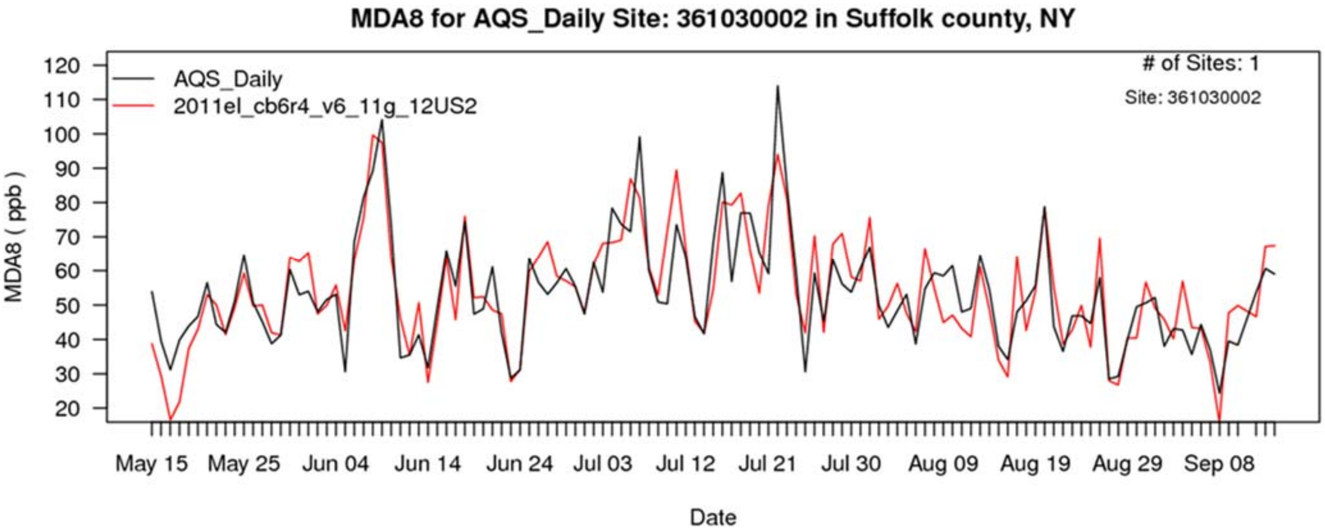

Figure A-16f. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 361030002 in Suffolk Co., New York.

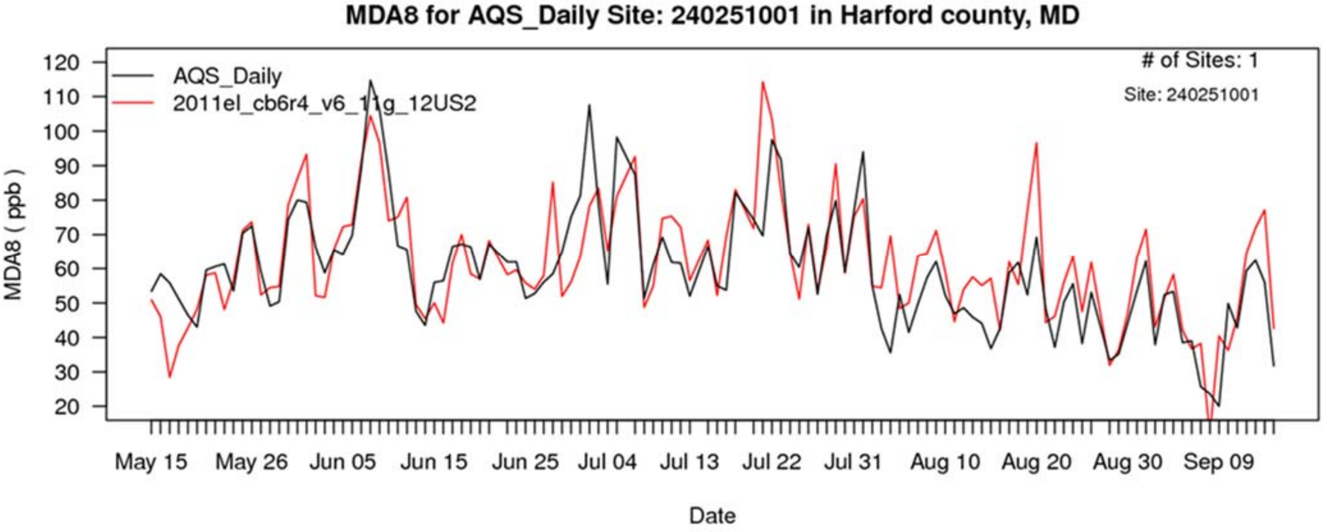

Figure A-16g. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 240251001 in Harford Co., Maryland.

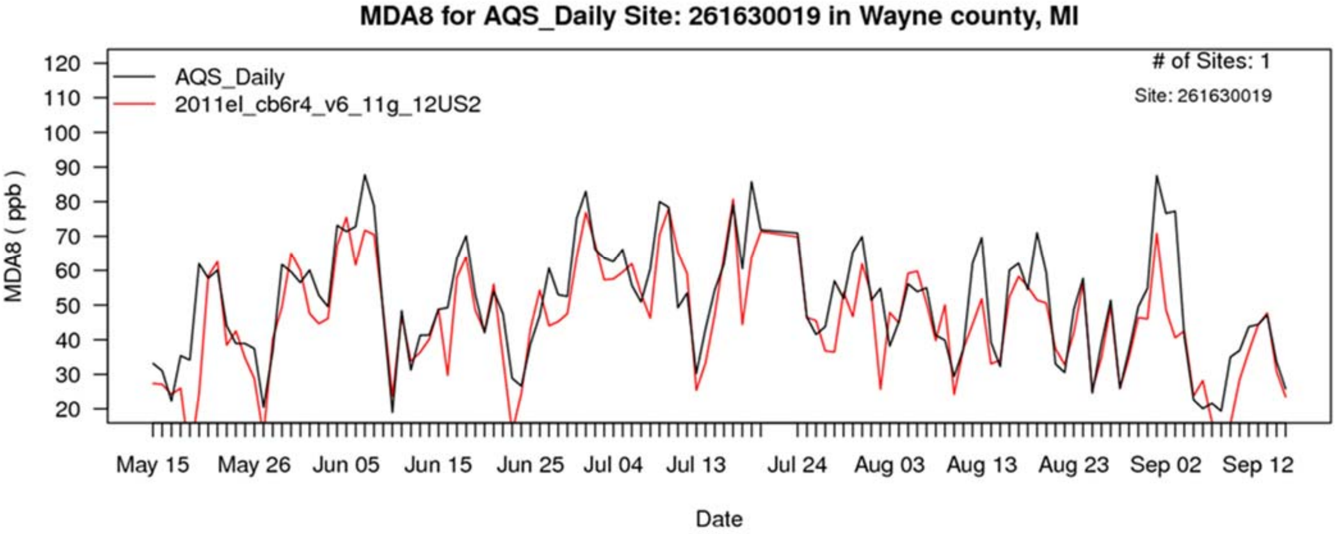

Figure A-16h. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 261630019 in Wayne Co., Michigan.

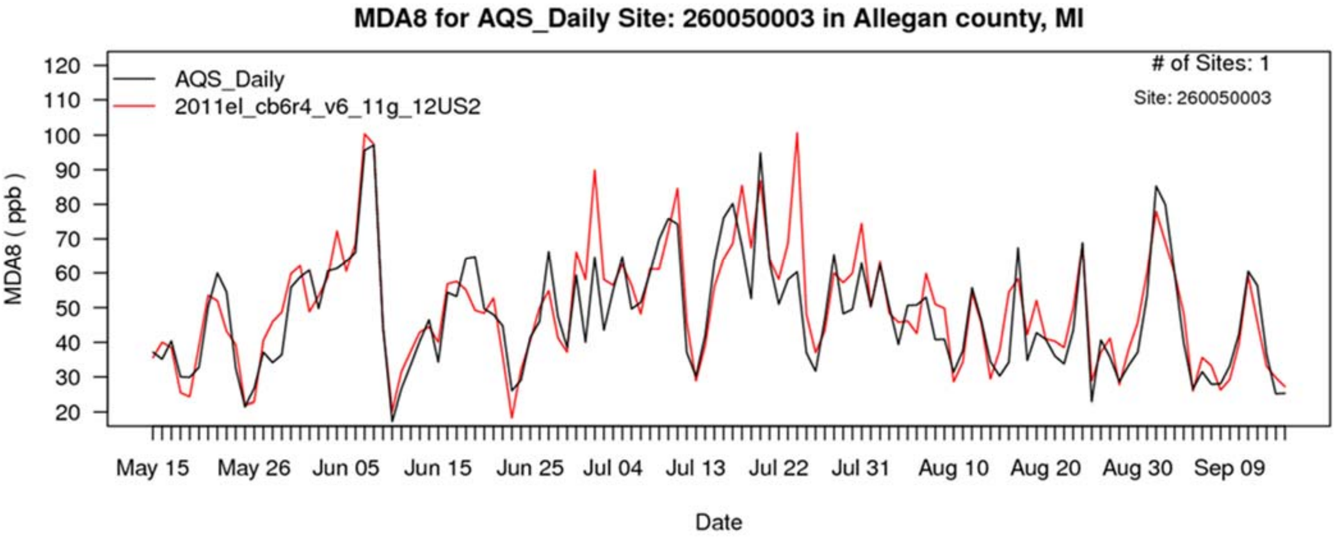

Figure A-16i. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 26005003 in Allegan Co., Michigan.

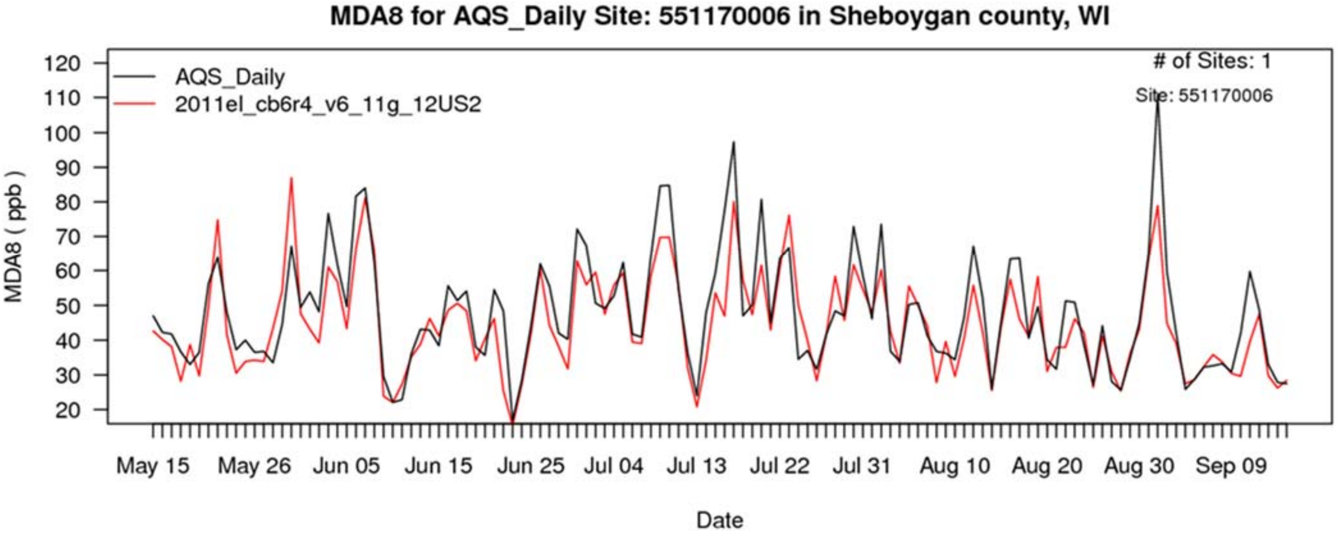

Figure A-16j. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 551170006 in Sheboygan Co., Wisconsin.

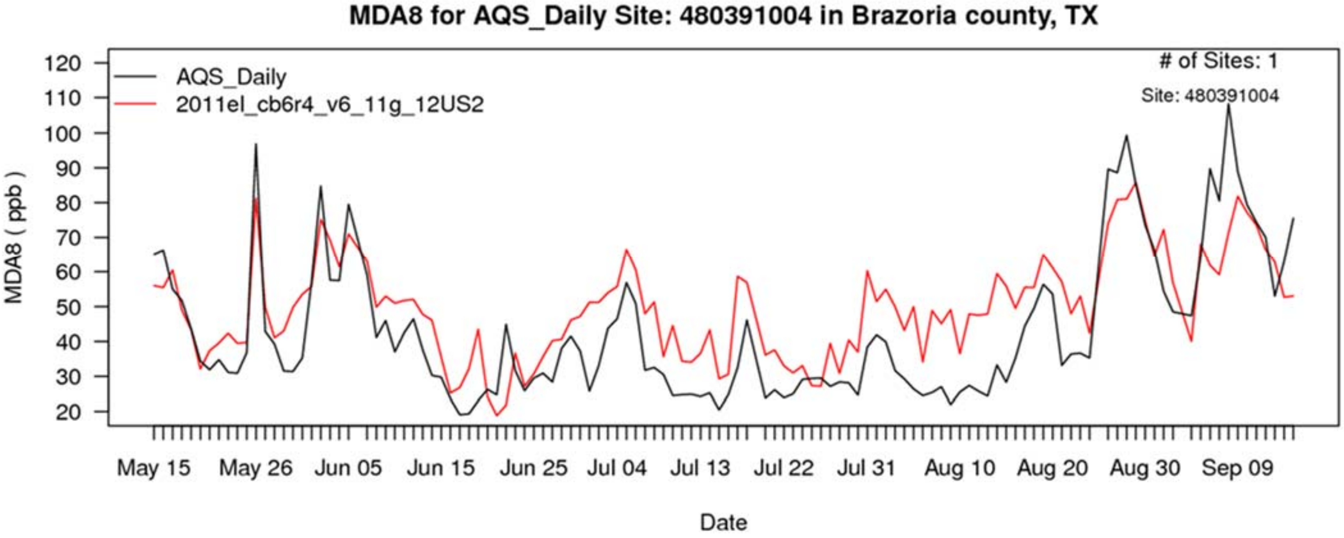

Figure A-16k. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 480391004 in Brazoria Co., Texas.

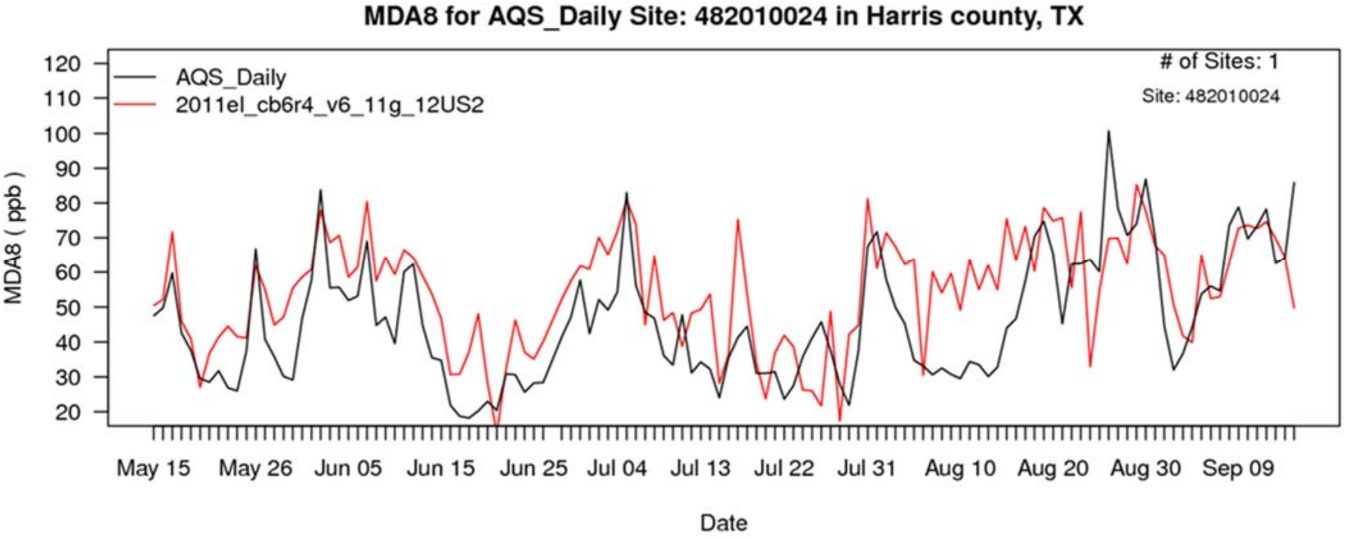

Figure A-16l. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 482010024 in Harris Co., Texas.

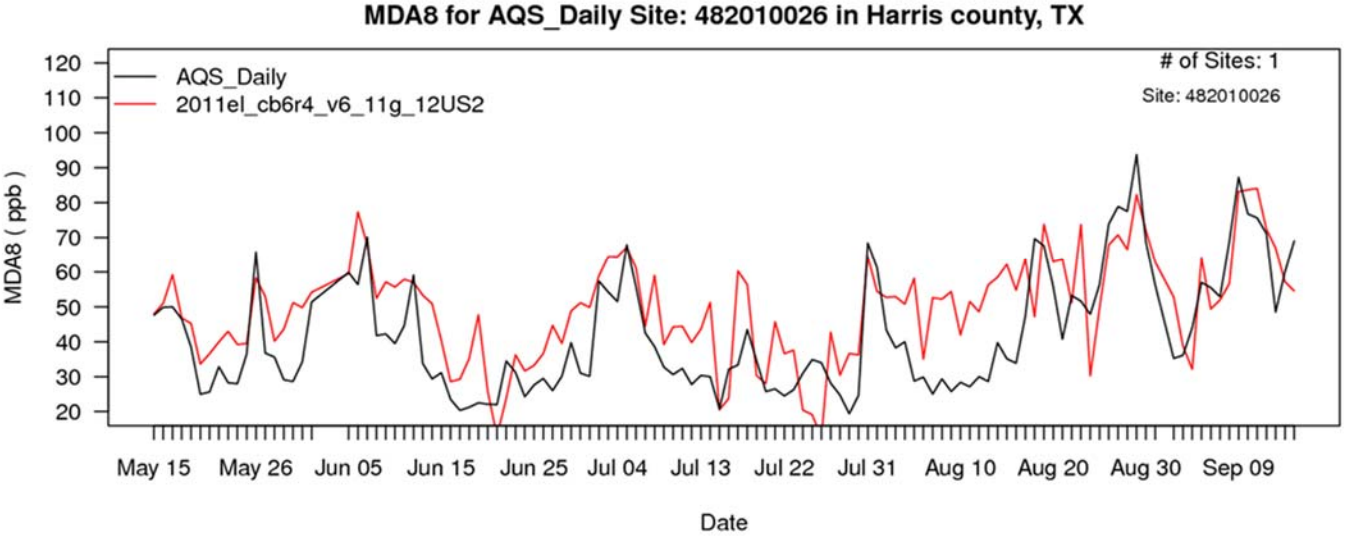

Figure A-16m. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 482010026 in Harris Co., Texas.

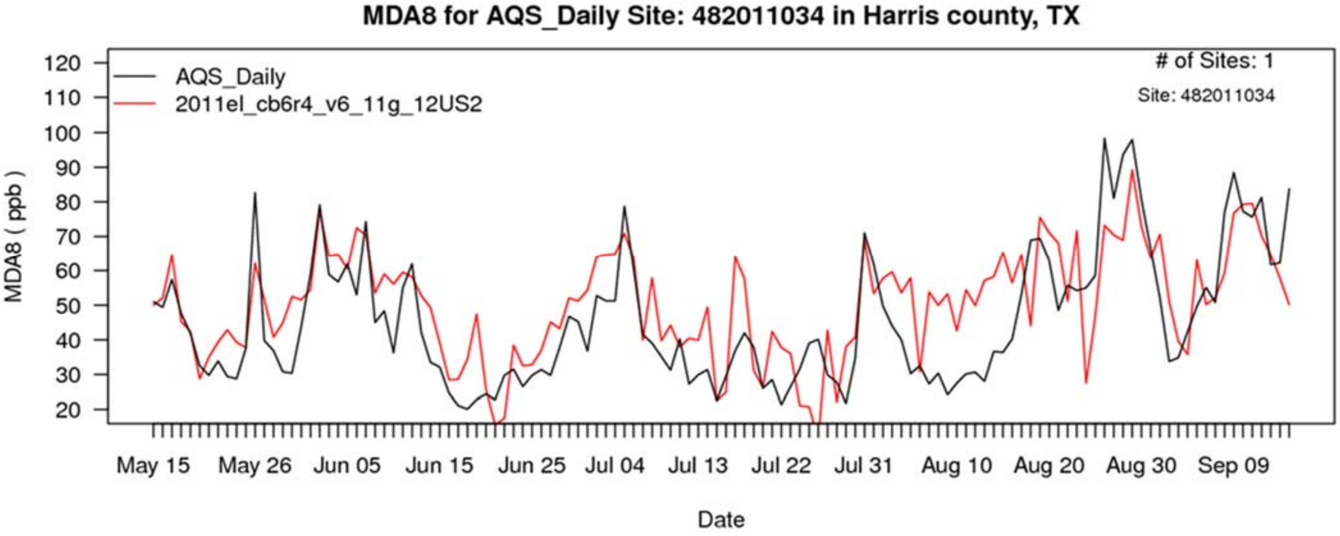

Figure A-16n. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 482011034 in Harris Co., Texas.

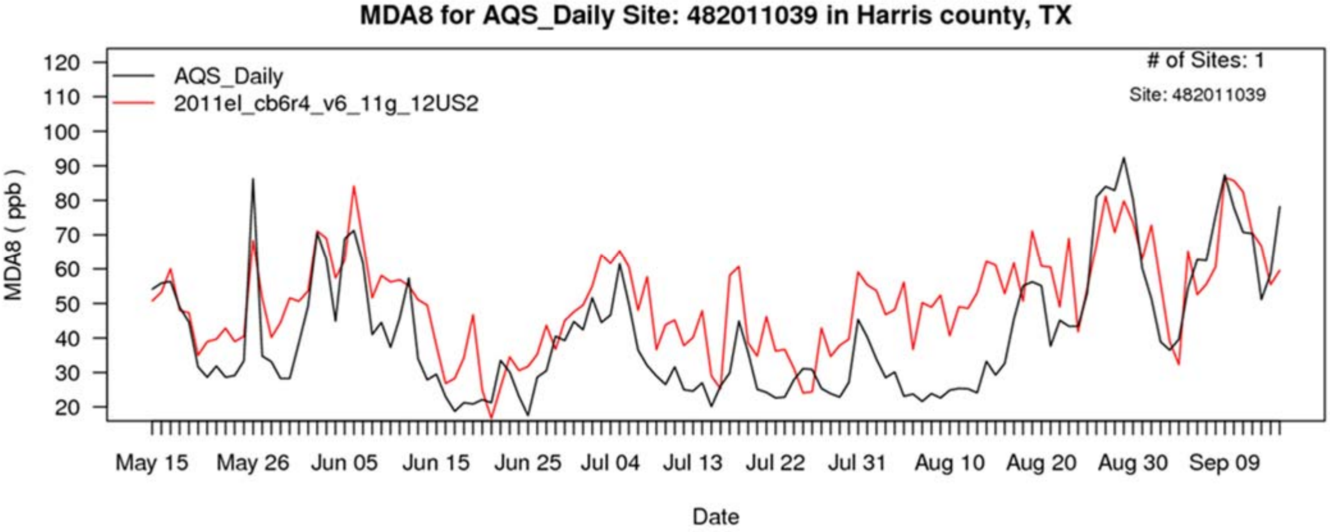

Figure A-16o. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 482011039 in Harris Co., Texas.

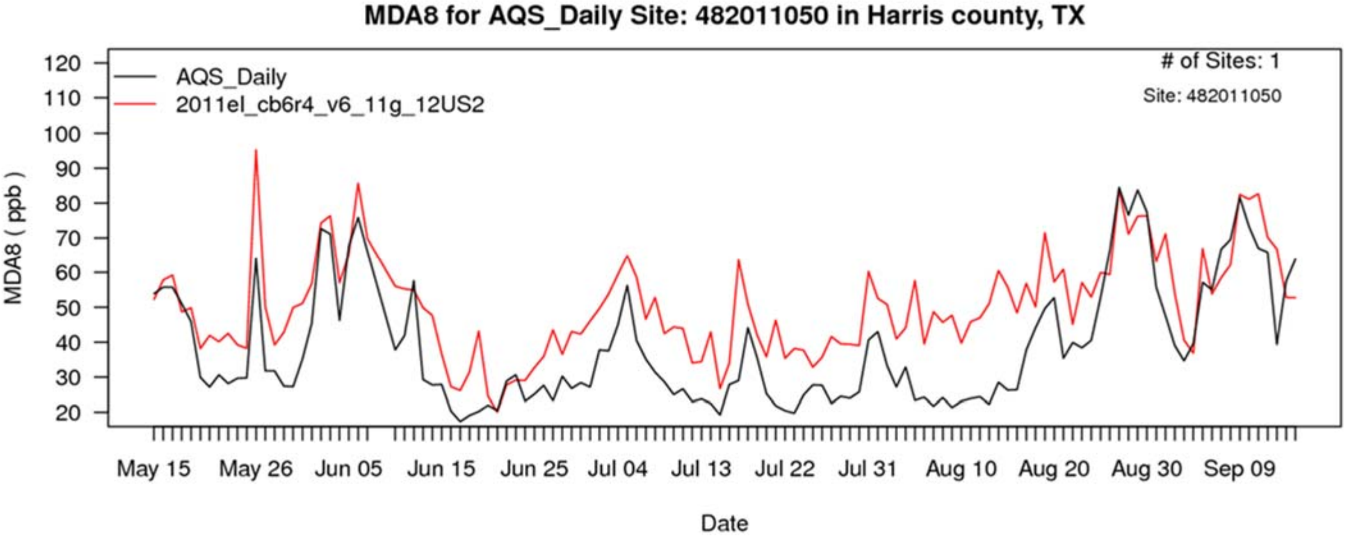

Figure A-16p. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 482011050 in Harris Co., Texas.

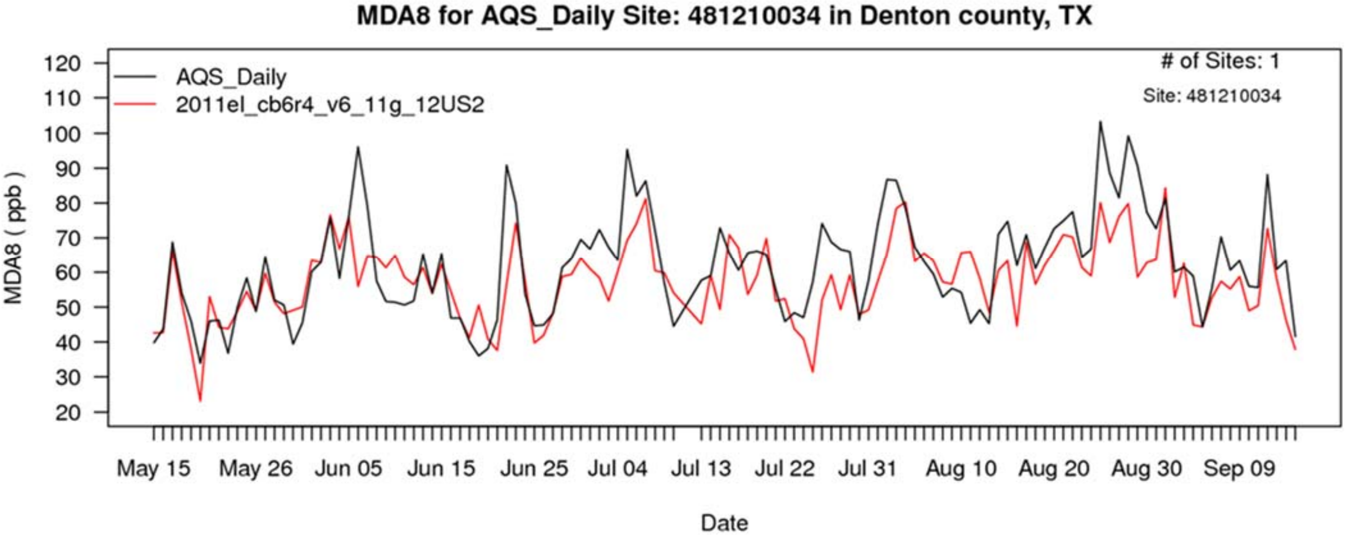

Figure A-16q. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 481210034 in Denton Co., Texas.

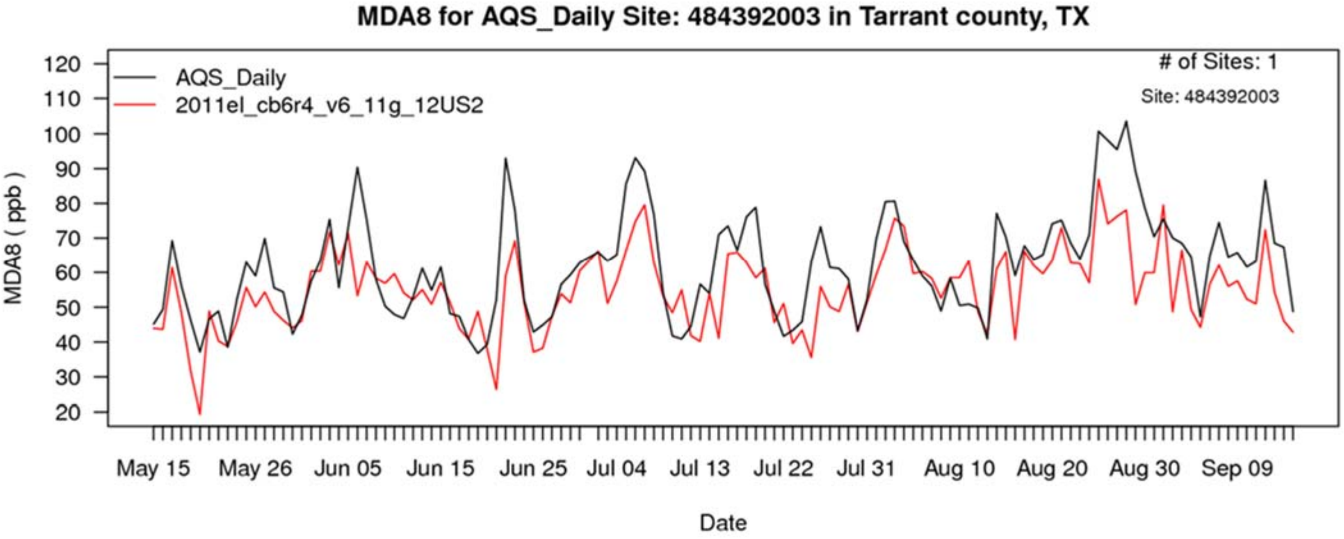

Figure A-16r. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 484392003 in Tarrant Co., Texas.

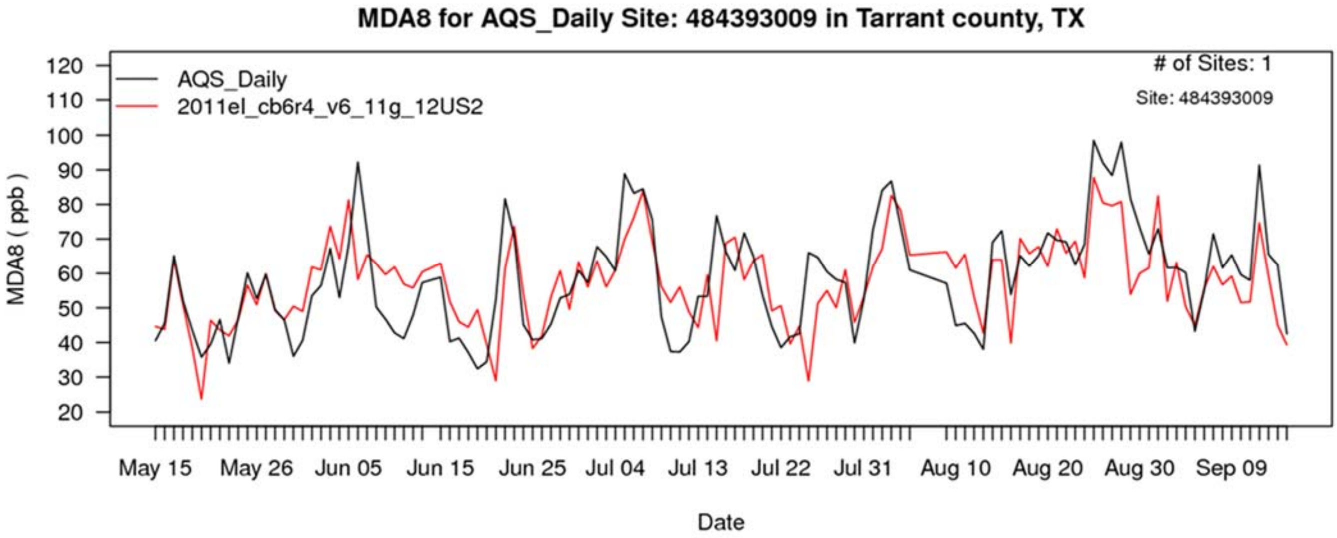

Figure A-16s. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 484393009 in Tarrant Co., Texas.

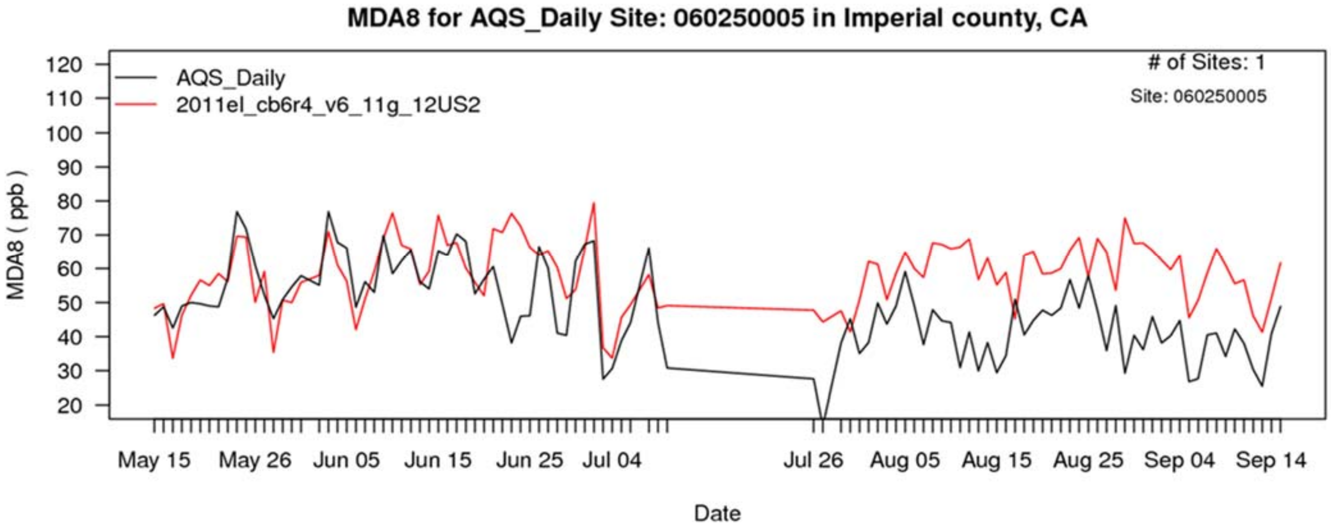

Figure A-16t. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 060250005 in Imperial Co., California.

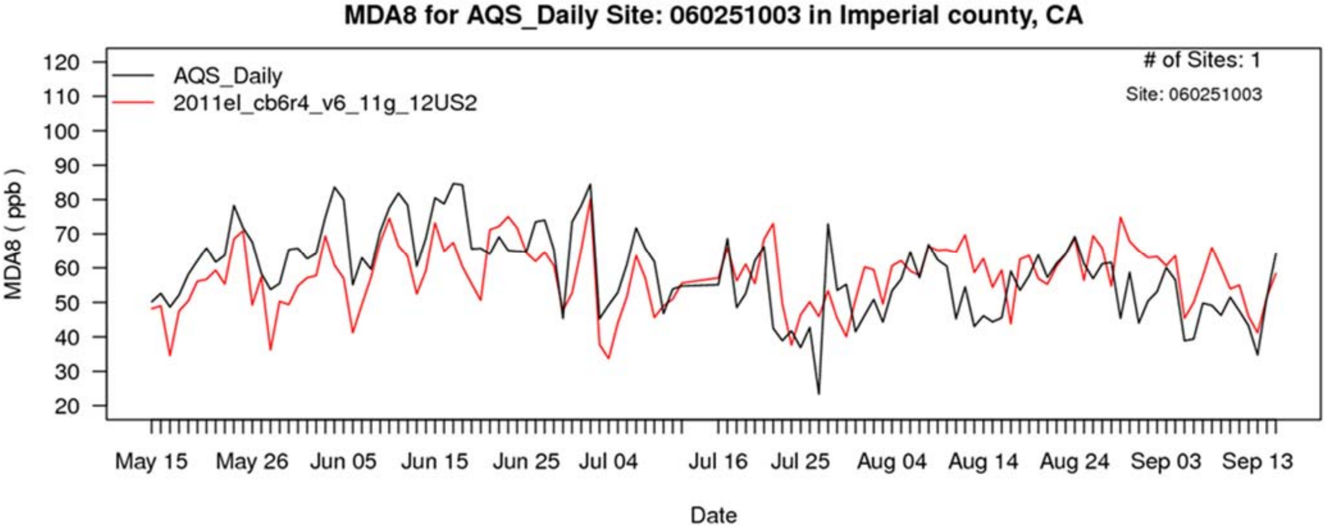

Figure A-16u. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 060251003 in Imperial Co., California.

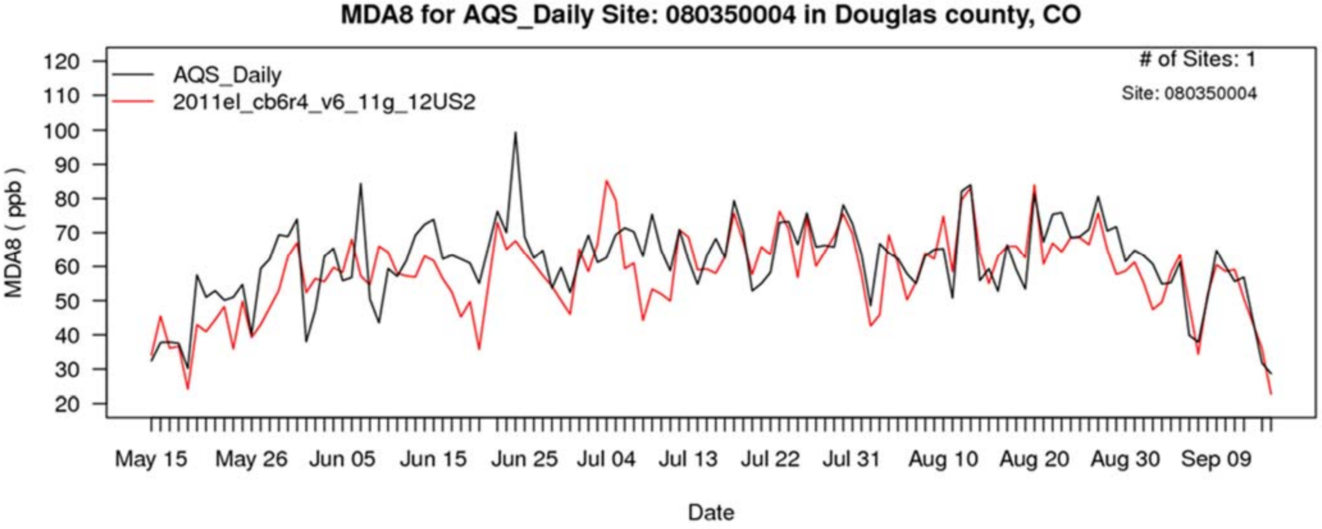

Figure A-16v. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 080350004 in Douglas Co., Colorado.

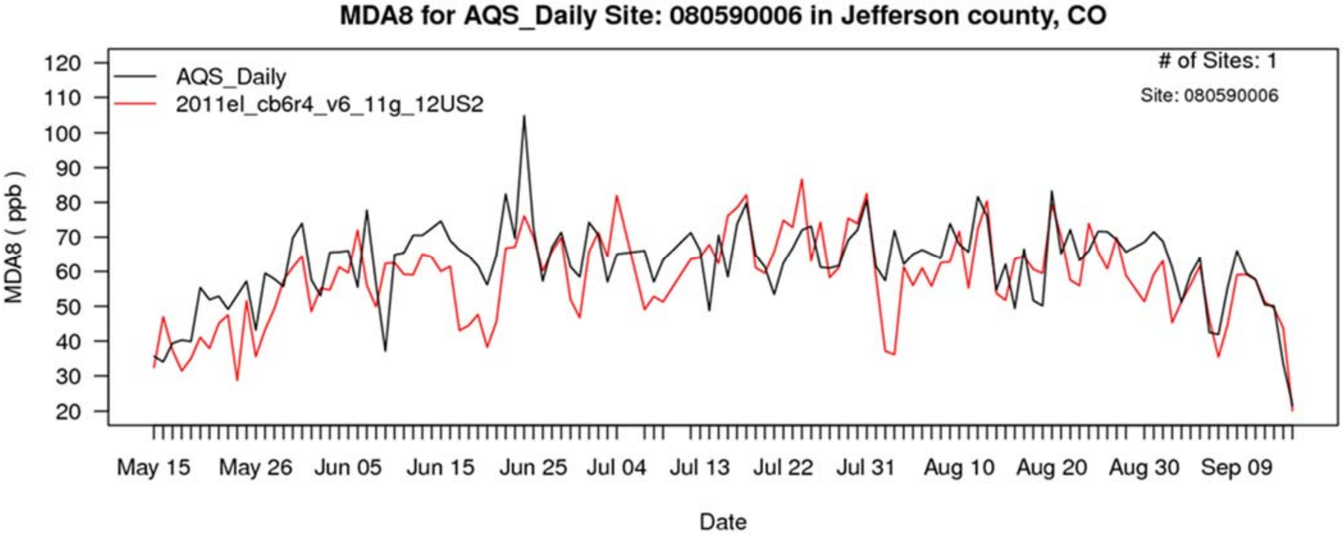

Figure A-16w. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 080590006 in Jefferson Co., Colorado.

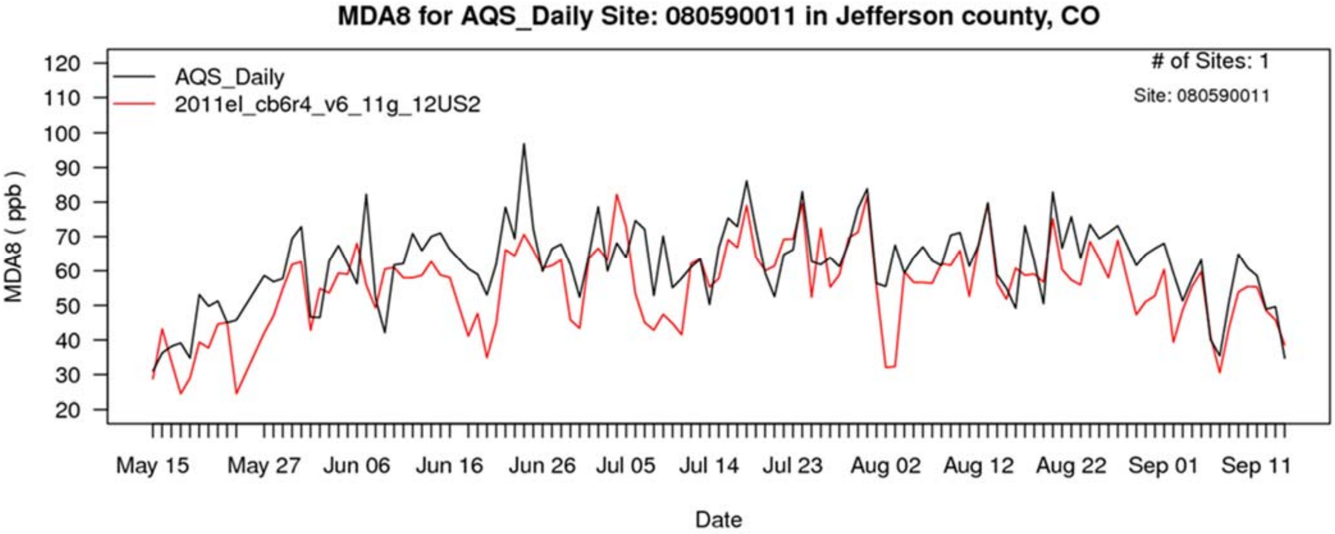

Figure A-16x. Time series of observed (black) and predicted (red) MDA8 ozone for May through September 2011 at site 080590011 in Jefferson Co., Colorado.

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Appendix B

Contributions to 2023 8-Hour Ozone Design Values at Projected 2023 Nonattainment and Maintenance-Only Sites

This appendix contains tables with the projected ozone contributions from 2023 anthropogenic NOx and VOC emissions in each state to the projected 2023 nonattainment receptor and maintenance-only receptors. In addition to the state contributions, we have included the contributions from each of the other categories tracked in the contribution modeling including point source emissions on Tribal lands, anthropogenic emissions in Canada and Mexico, emissions from Offshore sources, Fires, Biogenics, as well as contributions from Initial and Boundary concentrations.

For each monitoring site we provide the site ID, state name, and county name in the first three columns of the table. This information is followed by columns containing the projected 2023 average and maximum design values. Next we provide the contributions from each state and the District of Columbia, individually. Lastly, we provide the contributions from the Tribal, Canada and Mexico, Offshore, Fires, Initial and Boundary concentrations, and Biogenics categories. The units of the 2023 design values and contributions are “ppb”. Note that the contributions presented in these tables may not sum exactly to the 2023 average design value due to truncation of the contributions to two places to the right of the decimal.

Contributions to 2023 Nonattainment and Maintenance-Only Sites in the East (Part 1)

Monitor ID	State	County	2023 Average DV	2023 Maximum DV	AL	AZ	AR	CA	CO	CT	DE	DC	FL	GA	ID	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS	MO	MT
90013007	Connecticut	Fairfield	69.4	73.2	0.14	0.03	0.18	0.02	0.07	4.78	0.36	0.08	0.03	0.18	0.01	0.79	1.08	0.15	0.14	1.04	0.07	0.00	2.20	0.04	0.61	0.15	0.07	0.44	0.02
90019003	Connecticut	Fairfield	70.5	73.3	0.13	0.03	0.15	0.02	0.06	3.69	0.38	0.08	0.03	0.15	0.00	0.68	0.93	0.12	0.12	0.89	0.06	0.00	2.12	0.05	0.51	0.13	0.06	0.37	0.02
90099002	Connecticut	New Haven	69.8	72.5	0.09	0.05	0.10	0.05	0.10	6.44	0.36	0.05	0.04	0.10	0.01	0.65	0.80	0.11	0.15	0.65	0.09	0.00	1.57	0.11	0.54	0.10	0.04	0.35	0.02
240251001	Maryland	Harford	71.3	73.7	0.37	0.09	0.22	0.08	0.13	0.00	0.04	0.70	0.15	0.38	0.02	1.00	1.69	0.23	0.30	2.15	0.24	0.00	23.35	0.00	0.50	0.10	0.09	0.71	0.03
260050003	Michigan	Allegan	68.8	71.5	0.41	0.07	2.20	0.06	0.11	0.00	0.00	0.00	0.15	0.23	0.00	21.69	6.45	0.60	0.64	0.39	0.79	0.00	0.01	0.00	2.77	0.04	0.44	2.98	0.00
261630019	Michigan	Wayne	69.6	71.7	0.11	0.03	0.24	0.13	0.13	0.00	0.00	0.00	0.04	0.10	0.05	1.61	2.31	0.23	0.34	1.07	0.20	0.00	0.04	0.00	21.58	0.34	0.10	0.46	0.11
360810124	New York	Queens	69.9	71.7	0.05	0.06	0.12	0.08	0.12	0.36	0.36	0.05	0.04	0.09	0.04	1.00	0.88	0.32	0.26	0.38	0.13	0.00	1.56	0.00	1.76	0.22	0.04	0.48	0.07
360850067	New York	Richmond	71.2	72.7	0.32	0.09	0.14	0.09	0.13	0.40	0.55	0.05	0.12	0.36	0.02	0.98	1.22	0.20	0.20	1.31	0.17	0.00	1.73	0.05	0.85	0.11	0.09	0.47	0.02
361030002	New York	Suffolk	71.3	72.7	0.16	0.07	0.14	0.08	0.12	0.43	0.22	0.04	0.05	0.15	0.03	0.72	0.85	0.21	0.25	0.68	0.15	0.01	1.15	0.02	1.06	0.18	0.07	0.45	0.06
480391004	Texas	Brazoria	74.4	75.3	0.36	0.06	1.16	0.19	0.21	0.00	0.00	0.00	0.14	0.19	0.07	1.27	0.32	0.43	0.47	0.13	2.87	0.00	0.01	0.00	0.21	0.43	0.56	1.18	0.09
481210034	Texas	Denton	70.8	73.0	0.48	0.07	0.94	0.15	0.25	0.00	0.00	0.00	0.22	0.31	0.06	0.44	0.31	0.11	0.41	0.20	2.56	0.00	0.00	0.00	0.14	0.08	0.33	0.36	0.07
482010024	Texas	Harris	71.1	73.5	0.19	0.02	0.31	0.11	0.11	0.00	0.00	0.00	0.49	0.14	0.05	0.29	0.05	0.16	0.15	0.06	2.04	0.00	0.00	0.00	0.02	0.05	0.26	0.48	0.06
482010026	Texas	Harris	68.6	71.0	0.02	0.02	1.43	0.08	0.20	0.00	0.00	0.00	0.01	0.01	0.05	1.11	0.16	0.42	0.50	0.03	3.29	0.00	0.00	0.00	0.37	0.33	0.37	1.31	0.09
482011034	Texas	Harris	71.6	72.5	0.09	0.02	0.64	0.10	0.13	0.00	0.00	0.00	0.35	0.11	0.05	0.66	0.10	0.41	0.49	0.05	2.06	0.00	0.00	0.00	0.18	0.40	0.23	0.89	0.08
482011039	Texas	Harris	73.0	74.8	0.27	0.03	1.35	0.09	0.12	0.00	0.00	0.00	0.13	0.15	0.04	1.24	0.20	0.38	0.41	0.07	3.37	0.00	0.01	0.00	0.44	0.30	0.65	1.29	0.07
482011050	Texas	Harris	69.5	71.0	0.26	0.02	0.96	0.06	0.10	0.00	0.00	0.00	0.16	0.14	0.01	0.96	0.18	0.23	0.21	0.05	2.72	0.00	0.00	0.00	0.45	0.28	0.52	0.77	0.02
484392003	Texas	Tarrant	73.9	76.2	0.10	0.09	0.92	0.13	0.32	0.00	0.00	0.00	0.06	0.05	0.07	0.47	0.23	0.28	1.01	0.11	1.74	0.00	0.02	0.00	0.15	0.24	0.13	0.48	0.09
484393009	Texas	Tarrant	72.0	72.0	0.32	0.08	0.83	0.15	0.24	0.00	0.00	0.00	0.49	0.21	0.06	0.43	0.25	0.07	0.30	0.13	2.12	0.00	0.02	0.00	0.05	0.06	0.17	0.31	0.06
551170006	Wisconsin	Sheboygan	71.0	73.3	0.22	0.07	0.39	0.13	0.10	0.00	0.00	0.00	0.11	0.11	0.04	14.92	7.14	0.43	0.70	0.71	1.03	0.00	0.02	0.00	1.77	0.30	0.45	1.20	0.05

Contributions to 2023 Nonattainment and Maintenance-Only Sites in the East (Part 2)

Monitor ID	State	County	2023 Average DV	2023 Maximum DV	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
90013007	Connecticut	Fairfield	69.4	73.2	0.06	0.00	0.00	7.12	0.05	14.43	0.43	0.06	1.28	0.19	0.00	5.69	0.01	0.15	0.02	0.35	0.38	0.02	0.00	2.03	0.01	0.92	0.23	0.05
90019003	Connecticut	Fairfield	70.5	73.3	0.05	0.00	0.01	8.61	0.05	15.36	0.36	0.05	1.08	0.16	0.00	5.92	0.01	0.12	0.02	0.30	0.32	0.02	0.00	1.89	0.01	0.83	0.19	0.04
90099002	Connecticut	New Haven	69.8	72.5	0.07	0.01	0.02	5.75	0.05	14.60	0.40	0.04	1.64	0.27	0.01	6.39	0.02	0.07	0.02	0.22	0.52	0.06	0.01	1.19	0.01	0.90	0.16	0.10
240251001	Maryland	Harford	71.3	73.7	0.13	0.01	0.00	0.09	0.11	0.19	0.43	0.05	2.38	0.45	0.02	2.70	0.00	0.13	0.04	0.52	0.91	0.07	0.00	5.04	0.03	2.59	0.17	0.13
260050003	Michigan	Allegan	68.8	71.5	0.06	0.01	0.00	0.00	0.12	0.00	0.06	0.01	0.08	1.30	0.00	0.02	0.00	0.06	0.01	0.69	2.49	0.04	0.00	0.03	0.00	0.04	1.94	0.04
261630019	Michigan	Wayne	69.6	71.7	0.13	0.03	0.00	0.02	0.04	0.07	0.31	0.13	3.82	0.34	0.08	0.21	0.00	0.08	0.04	0.40	0.69	0.08	0.00	0.33	0.11	0.33	0.95	0.18
360810124	New York	Queens	69.9	71.7	0.14	0.02	0.00	8.65	0.06	13.50	0.28	0.13	2.09	0.42	0.03	6.17	0.00	0.09	0.06	0.06	0.67	0.09	0.00	1.60	0.05	0.65	0.50	0.17
360850067	New York	Richmond	71.2	72.7	0.09	0.02	0.00	11.73	0.11	7.83	0.28	0.04	2.25	0.35	0.01	9.11	0.00	0.12	0.02	0.48	0.77	0.08	0.00	1.21	0.01	1.33	0.31	0.11
361030002	New York	Suffolk	71.3	72.7	0.13	0.02	0.01	9.17	0.07	16.80	0.28	0.15	1.69	0.42	0.02	6.07	0.00	0.07	0.05	0.28	0.71	0.09	0.00	1.14	0.04	0.86	0.25	0.14
480391004	Texas	Brazoria	74.4	75.3	0.23	0.06	0.00	0.00	0.07	0.00	0.06	0.05	0.05	0.74	0.05	0.02	0.00	0.07	0.06	0.32	30.09	0.13	0.00	0.04	0.05	0.02	0.47	0.21
481210034	Texas	Denton	70.8	73.0	0.14	0.05	0.00	0.00	0.09	0.01	0.07	0.02	0.13	1.19	0.04	0.03	0.00	0.08	0.03	0.20	26.34	0.17	0.00	0.04	0.04	0.04	0.11	0.24
482010024	Texas	Harris	71.1	73.5	0.08	0.03	0.00	0.00	0.03	0.00	0.15	0.03	0.05	0.11	0.03	0.02	0.00	0.16	0.02	0.12	25.81	0.09	0.00	0.07	0.03	0.05	0.02	0.14
482010026	Texas	Harris	68.6	71.0	0.25	0.03	0.00	0.00	0.04	0.01	0.00	0.05	0.02	1.02	0.02	0.00	0.00	0.00	0.05	0.13	25.43	0.08	0.00	0.00	0.03	0.00	0.39	0.21
482011034	Texas	Harris	71.6	72.5	0.23	0.03	0.00	0.00	0.02	0.00	0.13	0.05	0.05	0.89	0.03	0.02	0.00	0.14	0.05	0.11	26.65	0.09	0.00	0.06	0.03	0.04	0.29	0.18
482011039	Texas	Harris	73.0	74.8	0.19	0.03	0.00	0.00	0.03	0.01	0.05	0.04	0.04	0.79	0.02	0.02	0.00	0.05	0.04	0.31	27.68	0.07	0.00	0.03	0.03	0.02	0.40	0.16
482011050	Texas	Harris	69.5	71.0	0.13	0.01	0.00	0.00	0.04	0.02	0.04	0.03	0.04	0.56	0.00	0.02	0.00	0.04	0.03	0.21	31.38	0.03	0.00	0.02	0.01	0.01	0.40	0.07
484392003	Texas	Tarrant	73.9	76.2	0.37	0.04	0.00	0.00	0.18	0.02	0.04	0.05	0.08	2.39	0.04	0.09	0.00	0.03	0.08	0.09	29.43	0.17	0.00	0.05	0.04	0.05	0.21	0.31
484393009	Texas	Tarrant	72.0	72.0	0.11	0.05	0.00	0.00	0.10	0.01	0.12	0.01	0.07	0.83	0.03	0.06	0.00	0.10	0.02	0.12	32.61	0.17	0.00	0.07	0.02	0.05	0.08	0.21
551170006	Wisconsin	Sheboygan	71.0	73.3	0.04	0.02	0.00	0.00	0.13	0.02	0.05	0.08	0.72	1.26	0.06	0.22	0.00	0.04	0.02	0.46	1.92	0.07	0.00	0.09	0.05	0.30	9.47	0.12

Contributions to 2023 Nonattainment and Maintenance-Only Sites in the East (Part 3)

Monitor ID	State	County	2023 Average DV	2023 Maximum DV	Tribal	Canada & Mexico	Offshore	Fires	Initial & Boundary	Biogenics
90013007	Connecticut	Fairfield	69.4	73.2	0.00	1.50	1.45	0.34	15.41	4.26
90019003	Connecticut	Fairfield	70.5	73.3	0.00	1.58	1.19	0.30	17.03	3.94
90099002	Connecticut	New Haven	69.8	72.5	0.01	1.40	2.32	0.27	16.21	4.22
240251001	Maryland	Harford	71.3	73.7	0.02	0.77	0.37	0.48	15.14	5.51
260050003	Michigan	Allegan	68.8	71.5	0.01	0.43	0.38	0.94	11.18	8.59
261630019	Michigan	Wayne	69.6	71.7	0.01	3.84	0.12	0.42	22.01	5.37
360810124	New York	Queens	69.9	71.7	0.02	1.90	0.96	0.23	17.53	5.12
360850067	New York	Richmond	71.2	72.7	0.02	1.82	1.00	0.35	16.83	4.96
361030002	New York	Suffolk	71.3	72.7	0.02	1.78	1.24	0.33	17.17	4.70
480391004	Texas	Brazoria	74.4	75.3	0.02	0.54	0.78	2.39	21.08	6.23
481210034	Texas	Denton	70.8	73.0	0.02	0.50	1.07	1.13	25.35	5.94
482010024	Texas	Harris	71.1	73.5	0.01	0.19	4.13	0.70	31.41	2.37
482010026	Texas	Harris	68.6	71.0	0.01	0.29	1.59	2.75	21.62	4.55
482011034	Texas	Harris	71.6	72.5	0.01	0.20	3.53	1.73	26.03	3.78
482011039	Texas	Harris	73.0	74.8	0.00	0.41	2.13	3.08	21.63	4.91
482011050	Texas	Harris	69.5	71.0	0.00	0.43	3.13	1.99	18.05	4.47
484392003	Texas	Tarrant	73.9	76.2	0.02	2.05	0.70	1.73	22.11	6.59
484393009	Texas	Tarrant	72.0	72.0	0.02	0.53	1.54	1.46	21.56	5.44
551170006	Wisconsin	Sheboygan	71.0	73.3	0.01	0.64	0.73	0.57	16.79	7.00

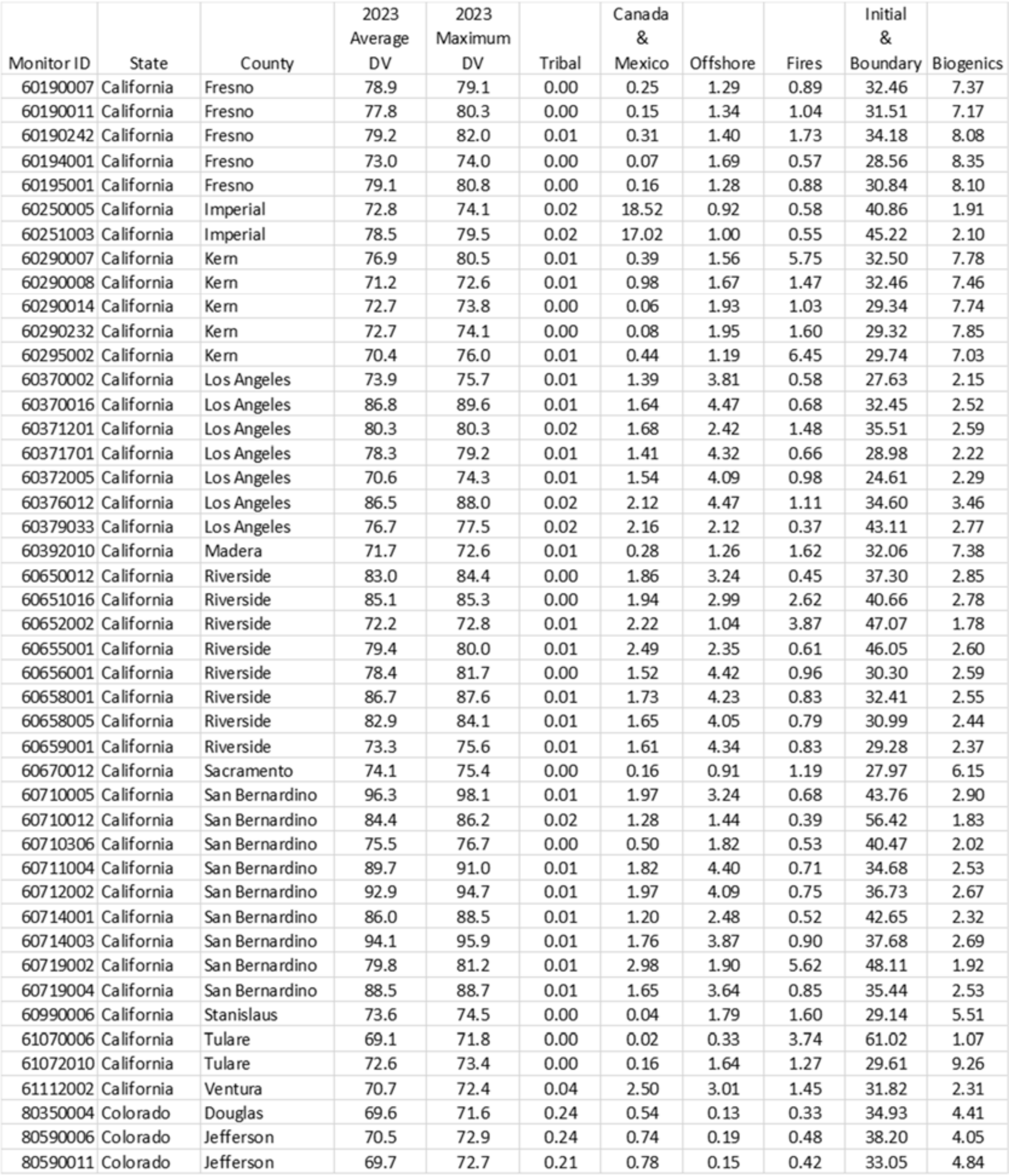
Contributions to 2023 Nonattainment and Maintenance-Only Sites in the West (Part 1)

Monitor ID	State	County	2023 Average DV	2023 Maximum DV	AL	AZ	AR	CA	CO	CT	DE	DC	FL	GA	ID	IL	IN	IA	KS	KY	LA	ME	MD	MA	MI	MN	MS	MO	MT
60190007	California	Fresno	78.9	79.1	0.00	0.21	0.00	34.97	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60190011	California	Fresno	77.8	80.3	0.00	0.04	0.00	35.11	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60190242	California	Fresno	79.2	82.0	0.00	0.17	0.00	31.80	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60194001	California	Fresno	73.0	74.0	0.00	0.03	0.00	32.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60195001	California	Fresno	79.1	80.8	0.00	0.07	0.00	36.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60250005	California	Imperial	72.8	74.1	0.00	0.70	0.00	8.56	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60251003	California	Imperial	78.5	79.5	0.00	0.74	0.00	11.07	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60290007	California	Kern	76.9	80.5	0.00	0.11	0.00	27.74	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60290008	California	Kern	71.2	72.6	0.00	0.24	0.00	26.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60290014	California	Kern	72.7	73.8	0.00	0.02	0.00	31.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60290232	California	Kern	72.7	74.1	0.00	0.03	0.00	31.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60295002	California	Kern	70.4	76.0	0.00	0.13	0.00	24.60	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60370002	California	Los Angeles	73.9	75.7	0.00	0.19	0.00	37.44	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60370016	California	Los Angeles	86.8	89.6	0.00	0.22	0.00	43.97	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60371201	California	Los Angeles	80.3	80.3	0.00	0.36	0.00	35.27	0.06	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60371701	California	Los Angeles	78.3	79.2	0.00	0.18	0.00	39.81	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60372005	California	Los Angeles	70.6	74.3	0.00	0.24	0.00	35.96	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60376012	California	Los Angeles	86.5	88.0	0.00	0.38	0.00	39.24	0.07	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60379033	California	Los Angeles	76.7	77.5	0.00	0.52	0.00	24.87	0.06	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60392010	California	Madera	71.7	72.6	0.00	0.15	0.00	27.49	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60650012	California	Riverside	83.0	84.4	0.00	0.18	0.00	36.38	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60651016	California	Riverside	85.1	85.3	0.00	0.20	0.00	33.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60652002	California	Riverside	72.2	72.8	0.00	0.35	0.00	14.96	0.05	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60655001	California	Riverside	79.4	80.0	0.01	0.29	0.01	23.52	0.09	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
60656001	California	Riverside	78.4	81.7	0.00	0.12	0.00	37.95	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60658001	California	Riverside	86.7	87.6	0.00	0.24	0.00	43.87	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60658005	California	Riverside	82.9	84.1	0.00	0.23	0.00	41.94	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60659001	California	Riverside	73.3	75.6	0.00	0.25	0.00	34.01	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60670012	California	Sacramento	74.1	75.4	0.00	0.01	0.00	36.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60710005	California	San Bernardino	96.3	98.1	0.00	0.31	0.00	42.38	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60710012	California	San Bernardino	84.4	86.2	0.00	0.62	0.00	21.69	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60710306	California	San Bernardino	75.5	76.7	0.00	0.09	0.00	29.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60711004	California	San Bernardino	89.7	91.0	0.00	0.23	0.00	44.43	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60712002	California	San Bernardino	92.9	94.7	0.00	0.27	0.00	45.48	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60714001	California	San Bernardino	86.0	88.5	0.00	0.27	0.00	35.79	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60714003	California	San Bernardino	94.1	95.9	0.00	0.23	0.00	46.14	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60719002	California	San Bernardino	79.8	81.2	0.00	0.22	0.00	18.25	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60719004	California	San Bernardino	88.5	88.7	0.00	0.21	0.00	43.39	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60990006	California	Stanislaus	73.6	74.5	0.00	0.02	0.00	34.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61070006	California	Tulare	69.1	71.8	0.00	0.00	0.00	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61072010	California	Tulare	72.6	73.4	0.00	0.05	0.00	29.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
61112002	California	Ventura	70.7	72.4	0.00	0.52	0.00	28.06	0.10	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80350004	Colorado	Douglas	69.6	71.6	0.00	0.31	0.01	1.34	22.81	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.38	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
80590006	Colorado	Jefferson	70.5	72.9	0.01	0.32	0.00	2.03	20.07	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.06	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.06
80590011	Colorado	Jefferson	69.7	72.7	0.01	0.32	0.03	1.48	23.18	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.37	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02

Contributions to 2023 Nonattainment and Maintenance-Only Sites in the West (Part 2)

Monitor ID	State	County	2023 Average DV	2023 Maximum DV	NE	NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VT	VA	WA	WV	WI	WY
60190007	California	Fresno	78.9	79.1	0.00	0.62	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.02	0.20	0.00	0.00	0.08	0.00	0.00	0.02
60190011	California	Fresno	77.8	80.3	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.02	0.20	0.00	0.00	0.08	0.00	0.00	0.02
60190242	California	Fresno	79.2	82.0	0.00	0.62	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.02	0.23	0.00	0.00	0.08	0.00	0.00	0.02
60194001	California	Fresno	73.0	74.0	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
60195001	California	Fresno	79.1	80.8	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
60250005	California	Imperial	72.8	74.1	0.00	0.11	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.10	0.06	0.00	0.00	0.02	0.00	0.00	0.03
60251003	California	Imperial	78.5	79.5	0.00	0.14	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.11	0.07	0.00	0.00	0.02	0.00	0.00	0.03
60290007	California	Kern	76.9	80.5	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.02	0.15	0.00	0.00	0.03	0.00	0.00	0.04
60290008	California	Kern	71.2	72.6	0.00	0.38	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.00	0.00	0.02	0.00	0.00	0.01
60290014	California	Kern	72.7	73.8	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
60290232	California	Kern	72.7	74.1	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
60295002	California	Kern	70.4	76.0	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.01	0.13	0.00	0.00	0.02	0.00	0.00	0.03
60370002	California	Los Angeles	73.9	75.7	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.01	0.19	0.00	0.00	0.00	0.00	0.00	0.10	0.04	0.00	0.00	0.07	0.00	0.00	0.01
60370016	California	Los Angeles	86.8	89.6	0.00	0.08	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.23	0.00	0.00	0.00	0.00	0.00	0.12	0.05	0.00	0.00	0.09	0.00	0.00	0.01
60371201	California	Los Angeles	80.3	80.3	0.00	0.18	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.02	0.08	0.00	0.00	0.00	0.00	0.00	0.17	0.12	0.00	0.00	0.06	0.00	0.00	0.02
60371701	California	Los Angeles	78.3	79.2	0.00	0.07	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.01	0.21	0.00	0.00	0.00	0.00	0.00	0.09	0.05	0.00	0.00	0.08	0.00	0.00	0.01
60372005	California	Los Angeles	70.6	74.3	0.00	0.09	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.02	0.16	0.00	0.00	0.00	0.00	0.00	0.18	0.06	0.00	0.00	0.05	0.00	0.00	0.02
60376012	California	Los Angeles	86.5	88.0	0.00	0.17	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.02	0.19	0.00	0.00	0.00	0.00	0.00	0.20	0.09	0.00	0.00	0.06	0.00	0.00	0.03
60379033	California	Los Angeles	76.7	77.5	0.00	0.22	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.01	0.07	0.00	0.00	0.00	0.00	0.00	0.10	0.06	0.00	0.00	0.01	0.00	0.00	0.02
60392010	California	Madera	71.7	72.6	0.00	0.58	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.02	0.24	0.00	0.00	0.07	0.00	0.00	0.02
60650012	California	Riverside	83.0	84.4	0.00	0.14	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.02	0.16	0.00	0.00	0.00	0.00	0.00	0.11	0.02	0.00	0.00	0.06	0.00	0.00	0.01
60651016	California	Riverside	85.1	85.3	0.00	0.22	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.03	0.13	0.00	0.00	0.00	0.00	0.00	0.17	0.03	0.00	0.00	0.05	0.00	0.00	0.01
60652002	California	Riverside	72.2	72.8	0.00	0.25	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.03	0.05	0.00	0.00	0.00	0.00	0.00	0.18	0.05	0.00	0.00	0.01	0.00	0.00	0.02
60655001	California	Riverside	79.4	80.0	0.00	0.21	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.09	0.10	0.00	0.00	0.00	0.00	0.00	0.46	0.07	0.00	0.00	0.03	0.00	0.00	0.04
60656001	California	Riverside	78.4	81.7	0.00	0.12	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.05	0.00	0.00	0.01
60658001	California	Riverside	86.7	87.6	0.00	0.10	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.21	0.00	0.00	0.00	0.00	0.00	0.11	0.06	0.00	0.00	0.08	0.00	0.00	0.01
60658005	California	Riverside	82.9	84.1	0.00	0.10	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.20	0.00	0.00	0.00	0.00	0.00	0.11	0.06	0.00	0.00	0.07	0.00	0.00	0.01
60659001	California	Riverside	73.3	75.6	0.00	0.12	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.00	0.00	0.03	0.00	0.00	0.02
60670012	California	Sacramento	74.1	75.4	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.15	0.00	0.00	0.00
60710005	California	San Bernardino	96.3	98.1	0.00	0.18	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.02	0.18	0.00	0.00	0.00	0.00	0.00	0.19	0.08	0.00	0.00	0.06	0.00	0.00	0.02
60710012	California	San Bernardino	84.4	86.2	0.00	0.11	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.11	0.06	0.00	0.00	0.02	0.00	0.00	0.03
60710306	California	San Bernardino	75.5	76.7	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.15	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.04	0.00	0.00	0.00
60711004	California	San Bernardino	89.7	91.0	0.00	0.10	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.24	0.00	0.00	0.00	0.00	0.00	0.13	0.06	0.00	0.00	0.09	0.00	0.00	0.01
60712002	California	San Bernardino	92.9	94.7	0.00	0.12	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.01	0.22	0.00	0.00	0.00	0.00	0.00	0.14	0.07	0.00	0.00	0.08	0.00	0.00	0.02
60714001	California	San Bernardino	86.0	88.5	0.00	0.14	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.02	0.16	0.00	0.00	0.00	0.00	0.00	0.13	0.03	0.00	0.00	0.04	0.00	0.00	0.01
60714003	California	San Bernardino	94.1	95.9	0.00	0.13	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.19	0.00	0.00	0.00	0.00	0.00	0.13	0.05	0.00	0.00	0.06	0.00	0.00	0.01
60719002	California	San Bernardino	79.8	81.2	0.00	0.06	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.04	0.10	0.00	0.00	0.00	0.00	0.00	0.20	0.03	0.00	0.00	0.04	0.00	0.00	0.02
60719004	California	San Bernardino	88.5	88.7	0.00	0.12	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.01	0.17	0.00	0.00	0.00	0.00	0.00	0.12	0.05	0.00	0.00	0.06	0.00	0.00	0.01
60990006	California	Stanislaus	73.6	74.5	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
61070006	California	Tulare	69.1	71.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
61072010	California	Tulare	72.6	73.4	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.11	0.00	0.00	0.00
61112002	California	Ventura	70.7	72.4	0.00	0.13	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.17	0.15	0.00	0.00	0.04	0.00	0.00	0.04
80350004	Colorado	Douglas	69.6	71.6	0.41	0.38	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.15	0.11	0.00	0.00	0.00	0.03	0.00	0.33	1.32	0.00	0.00	0.02	0.00	0.00	0.92
80590006	Colorado	Jefferson	70.5	72.9	0.22	0.43	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.04	0.14	0.00	0.00	0.00	0.01	0.00	0.50	1.05	0.00	0.00	0.06	0.00	0.00	0.85
80590011	Colorado	Jefferson	69.7	72.7	0.39	0.37	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.20	0.10	0.00	0.00	0.00	0.03	0.00	1.03	1.10	0.00	0.00	0.02	0.00	0.00	0.80

Contributions to 2023 Nonattainment and Maintenance-Only Sites in the West (Part 3)



Monitor ID	State	County	2023 Average DV	2023 Maximum DV	Tribal	Canada & Mexico	Offshore	Fires	Initial & Boundary	Biogenics
60190007	California	Fresno	78.9	79.1	0.00	0.25	1.29	0.89	32.46	7.37
60190011	California	Fresno	77.8	80.3	0.00	0.15	1.34	1.04	31.51	7.17
60190242	California	Fresno	79.2	82.0	0.01	0.31	1.40	1.73	34.18	8.08
60194001	California	Fresno	73.0	74.0	0.00	0.07	1.69	0.57	28.56	8.35
60195001	California	Fresno	79.1	80.8	0.00	0.16	1.28	0.88	30.84	8.10
60250005	California	Imperial	72.8	74.1	0.02	18.52	0.92	0.58	40.86	1.91
60251003	California	Imperial	78.5	79.5	0.02	17.02	1.00	0.55	45.22	2.10
60290007	California	Kern	76.9	80.5	0.01	0.39	1.56	5.75	32.50	7.78
60290008	California	Kern	71.2	72.6	0.01	0.98	1.67	1.47	32.46	7.46
60290014	California	Kern	72.7	73.8	0.00	0.06	1.93	1.03	29.34	7.74
60290232	California	Kern	72.7	74.1	0.00	0.08	1.95	1.60	29.32	7.85
60295002	California	Kern	70.4	76.0	0.01	0.44	1.19	6.45	29.74	7.03
60370002	California	Los Angeles	73.9	75.7	0.01	1.39	3.81	0.58	27.63	2.15
60370016	California	Los Angeles	86.8	89.6	0.01	1.64	4.47	0.68	32.45	2.52
60371201	California	Los Angeles	80.3	80.3	0.02	1.68	2.42	1.48	35.51	2.59
60371701	California	Los Angeles	78.3	79.2	0.01	1.41	4.32	0.66	28.98	2.22
60372005	California	Los Angeles	70.6	74.3	0.01	1.54	4.09	0.98	24.61	2.29
60376012	California	Los Angeles	86.5	88.0	0.02	2.12	4.47	1.11	34.60	3.46
60379033	California	Los Angeles	76.7	77.5	0.02	2.16	2.12	0.37	43.11	2.77
60392010	California	Madera	71.7	72.6	0.01	0.28	1.26	1.62	32.06	7.38
60650012	California	Riverside	83.0	84.4	0.00	1.86	3.24	0.45	37.30	2.85
60651016	California	Riverside	85.1	85.3	0.00	1.94	2.99	2.62	40.66	2.78
60652002	California	Riverside	72.2	72.8	0.01	2.22	1.04	3.87	47.07	1.78
60655001	California	Riverside	79.4	80.0	0.01	2.49	2.35	0.61	46.05	2.60
60656001	California	Riverside	78.4	81.7	0.00	1.52	4.42	0.96	30.30	2.59
60658001	California	Riverside	86.7	87.6	0.01	1.73	4.23	0.83	32.41	2.55
60658005	California	Riverside	82.9	84.1	0.01	1.65	4.05	0.79	30.99	2.44
60659001	California	Riverside	73.3	75.6	0.01	1.61	4.34	0.83	29.28	2.37
60670012	California	Sacramento	74.1	75.4	0.00	0.16	0.91	1.19	27.97	6.15
60710005	California	San Bernardino	96.3	98.1	0.01	1.97	3.24	0.68	43.76	2.90
60710012	California	San Bernardino	84.4	86.2	0.02	1.28	1.44	0.39	56.42	1.83
60710306	California	San Bernardino	75.5	76.7	0.00	0.50	1.82	0.53	40.47	2.02
60711004	California	San Bernardino	89.7	91.0	0.01	1.82	4.40	0.71	34.68	2.53
60712002	California	San Bernardino	92.9	94.7	0.01	1.97	4.09	0.75	36.73	2.67
60714001	California	San Bernardino	86.0	88.5	0.01	1.20	2.48	0.52	42.65	2.32
60714003	California	San Bernardino	94.1	95.9	0.01	1.76	3.87	0.90	37.68	2.69
60719002	California	San Bernardino	79.8	81.2	0.01	2.98	1.90	5.62	48.11	1.92
60719004	California	San Bernardino	88.5	88.7	0.01	1.65	3.64	0.85	35.44	2.53
60990006	California	Stanislaus	73.6	74.5	0.00	0.04	1.79	1.60	29.14	5.51
61070006	California	Tulare	69.1	71.8	0.00	0.02	0.33	3.74	61.02	1.07
61072010	California	Tulare	72.6	73.4	0.00	0.16	1.64	1.27	29.61	9.26
61112002	California	Ventura	70.7	72.4	0.04	2.50	3.01	1.45	31.82	2.31
80350004	Colorado	Douglas	69.6	71.6	0.24	0.54	0.13	0.33	34.93	4.41
80590006	Colorado	Jefferson	70.5	72.9	0.24	0.74	0.19	0.48	38.20	4.05
80590011	Colorado	Jefferson	69.7	72.7	0.21	0.78	0.15	0.42	33.05	4.84