Technical Memorandum

March 2, 2023 STI-1922078-TM

To: Josh Stebbins, Sierra Club

From: Lynn Alley and Kenneth Craig, Sonoma Technology

Re: Analysis of Air Quality Impacts from Coal-Fired EGUs on Ozone Nonattainment areas in Colorado, Indiana, Kentucky, Missouri, and Texas

Introduction and Summary

Sonoma Technology performed source apportionment modeling using the Comprehensive Air Quality Model with Extensions (CAMx) with Ozone Source Apportionment Technology (OSAT) to support the Sierra Club in evaluating ozone impacts from coal-fired power plants and other emission sources on downwind receptors in nonattainment areas. The source apportionment modeling was conducted for the 2016 ozone season (April to October) for a domain covering the continental United States at 12-km spatial resolution, and results were compiled into a database with an online dashboard application that can be used for data mining and analysis.

The source apportionment modeling simulations relied on the U.S. Environmental Protection Agency (EPA) 2016v2 (2016fj_16j) modeling platform, which draws on emissions data from the EPA National Emissions Inventory and data developed by the National Emissions Inventory Collaborative.[1] This EPA modeling platform tends to underpredict maximum daily average 8-hr (MDA8) ozone concentrations for days when the MDA8 ozone is greater than or equal to 60 ppb. Modeling results for the monitoring sites included in this report generally follow this trend. Overall, EPA found that "the ozone model performance results for the CAMx 2016fj (2016v2) simulation are within or close to the ranges found in other recent peer-reviewed applications" and that "the model performance results demonstrate the scientific credibility" of the 2016v2 modeling platform" (U.S. Environmental Protection Agency, 2022b).

Biases in the modeled ozone concentrations can contribute to uncertainty in the source apportionment contribution results. To help mitigate this uncertainty, the source apportionment modeling results are used in a "relative" sense rather than an "absolute" sense where possible. For

[1] The National Emissions Inventory Collaborative is a partnership between state emissions inventory staff, multi-jurisdictional organizations, federal land managers, EPA, and others to develop a North American air pollution emissions modeling platform for use in air quality planning.

this report, relative source contributions were calculated based on a daily 8-hr average basis by multiplying the absolute modeled source contribution by ratio of the monitored concentration and the total modeled ozone value. This approach has been used in past ozone source apportionment modeling analyses (e.g., Craig et al., 2020) and is similar to methods used by EPA to calculate ozone source contributions from a photochemical grid model (U.S. Environmental Protection Agency, 2022b). Anchoring the modeled apportionment results to ambient monitoring data can help mitigate uncertainty associated with imperfect model performance (Foley et al., 2015; Jones et al., 2005). The EGU ozone source apportionment results in this report should be considered indicative of the types of ozone impacts that can be expected from these facilities. Additional details on the models, data, and methods used can be found in **Appendix A**.

The results from this source apportionment modeling were used to analyze impacts of emissions from several facilities with coal-fired electric generating units (EGUs) in Colorado, Indiana, Kentucky, Missouri, and Texas on air quality monitoring station (AQS) locations and in environmental justice (EJ) zip codes in state nonattainment areas. The collective impact of all coal-fired EGUs for selected facilities, and the individual impact of specific facilities/units that either under-utilize [2] or lack selective catalytic reduction (SCR) controls, were analyzed. Modeled contributions are shown on days when the monitored MDA8 ozone concentration exceeded the 2015 ozone standard (70 ppb) in moderate nonattainment areas and exceeded the 2008 ozone standard (75 ppb) in severe nonattainment areas.

In summary, the modeling results showed that on numerous days in 2016, emissions from selected coal-fired EGUs in each state (CO, IN, KY, MO, and TX) had combined impacts of greater than 1% of the NAAQS (i.e., impacts of 0.75 or 0.70 ppb) at AQS monitoring locations and EJ zip code receptors within ozone nonattainment areas. On many of these days, these significant EGU impacts coincided with days when monitored MDA8 ozone concentrations exceeded the ozone NAAQS. Some selected individual facilities with coal-fired EGUs also had impacts in nonattainment areas greater than 1% of the NAAQS on high ozone days. These facilities include Clifty Creek in IN, Mill Creek in KY, Labadie in MO, WA Parish in TX, and Limestone in TX.

2015 Moderate Ozone Nonattainment Areas

For each state of interest—Colorado, Kentucky, Indiana, Missouri, and Texas—collective modeled contributions from selected coal-fired EGUs within the state and modeled contributions from select individual facilities and units that under-utilize or lack SCR controls were evaluated. Impacts were analyzed on days when the observed MDA8 ozone concentration exceeded the 2015 ozone NAAQS of 70 ppb at AQS monitors located within a moderate nonattainment area in each state of interest. Modeled impacts were also evaluated at EJ zip codes in nonattainment areas on monitor exceedance days.

[2] A unit with a SCR that is not achieving the SCR's lowest demonstrated NO_x emissions capabilities. This is defined as a unit that is not operating within 25% of its lowest demonstrated 30 day NO_x emission rate.

Relative source contributions at monitoring locations are presented, with contributions that equal or exceed 1% of the NAAQS (0.70 ppb) highlighted in red and contributions that equal or exceed 0.5% of the NAAQS (0.35 ppb) highlighted in yellow. Relative source contributions from the model are calculated on an 8-hr average basis by multiplying the absolute modeled source contribution by the ratio of the monitored concentration and the total modeled ozone concentration. The resulting value gives a relative modeled contribution during a monitor exceedance day.

Modeled contributions at EJ zip codes in nonattainment areas are presented as absolute modeled concentrations since there are no ozone monitors at the EJ zip code locations. In **Appendix B**, tabular data for each state show monitoring MDA8 values compared with total modeled values on days when monitors exceeded the NAAQS.

Colorado

Impacts from all selected coal-fired EGUs in Colorado (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within Denver Metro/North Front Range, CO, 2015 moderate ozone nonattainment areas on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS.

Monitoring days in 2016 that exceeded 70 ppb in Colorado nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-1** in **Appendix B**. Modeled contributions from the selected coal-fired facilities in Colorado on those days are shown in **Table 1**.

Table 1. Modeled impacts from selected coal-fired EGUs[1] in Colorado (with or without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	Welby	WELCH	80216	80223
6/16	0.14	0.08	0.23	0.04	0.23	0.24	0.24	0.22	0.13	0.21	0.09
6/17		0.36				0.41			0.36	0.28	0.25
6/18							0.94			0.62	0.48
6/19						0.55				0.57	0.50
6/26						0.47	0.45			0.45	0.49
6/27	1.31	1.40	1.24	1.31	1.24	1.40	1.27		1.40	1.17	1.17
6/28						0.82	0.84			0.70	0.68
7/7		0.21				0.36	0.31		0.27	0.39	0.30
7/12						0.14	0.14			0.20	0.21
7/14	0.28	0.29		0.27		0.30			0.27	0.23	0.22
7/16		0.43		0.48		0.52	0.44		0.46	0.55	0.53
7/17		0.82								0.74	0.67
7/19		0.18								0.24	0.21
7/22		0.29		0.34						0.43	0.28
7/25		0.99				1.10	1.07		1.01	0.90	0.90
7/27		0.94	1.03	0.89	1.03	1.03	0.96		0.93	0.83	0.80
7/28		1.09								0.94	0.96
7/29		1.08				1.09			0.98	0.71	0.67

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	Welby	WELCH	80216	80223
7/30	1.01	1.00				0.93			1.06	0.75	0.76
8/2						0.73	0.77			0.60	0.55
8/3	1.77	1.65				1.50	1.44		1.45	1.21	1.23
8/7						1.01				0.76	0.82
8/12		0.58				0.53			0.51	0.55	0.51
8/16							0.82			0.80	0.77

[1] Selected coal-fired EGUs in Colorado include: Cherokee, Comanche, Craig (Yampa), Rawhide, and Ray D Nixon

Indiana

Impacts from all selected coal-fired EGUs in Indiana (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Indiana portion of the Louisville, KY-IN, and Chicago, IL-IN-WI, 2015 moderate ozone nonattainment areas on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS.

Monitoring days in 2016 that exceeded 70 ppb in Indiana nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-2** in **Appendix B**. Modeled contributions from the selected coal-fired facilities in Indiana on those days are shown in **Table 2**.

Table 2. Modeled impacts from selected coal-fired EGUs[1] in Indiana (with/without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas, on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are red, and values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are yellow.

Date	Charlestown State Park	Gary-IITRI	HAMMOND CAAP	New Albany	Ogden Dunes-Water Treatment Plant	VALPARAISO
4/17		0.64			0.66	
4/18	0.43					1.19
4/19	0.84					
4/20	0.19			0.15		
5/24						0.37
6/9	0.88			0.81		
6/10	0.28	<0.01		0.27	<0.01	<0.01
6/11	1.71			1.79		
6/13				0.20		
6/19						1.73
6/25				1.58		
7/21	0.09					
7/27			0.06			
8/3		0.73	0.67		0.78	
8/10			0.65			

[1] Selected coal-fired EGUs in Indiana include: Cayuga, Clifty Creek, F.B. Culley, Michigan City, Petersburg, and Warrick

Kentucky

Impacts from all selected coal-fired EGUs in Kentucky (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Kentucky portion of the Louisville, KY-IN, and Cincinnati, OH-KY, 2015 moderate ozone nonattainment areas on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS. Impacts were also assessed for the Mill Creek Power Facility for all units combined, including Units 1 and 2 (without SCR controls) and Units 3 and 4 (with SCR controls).

Monitoring days in 2016 that exceeded 70 ppb in Kentucky nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-3** in **Appendix B**. Modeled contributions from the selected coal-fired facilities in Kentucky on those days are shown in **Table 3**. **Figure 1** shows the Mill Creek facility location and AQS ozone monitoring stations located in 2015 ozone moderate nonattainment areas. **Table 4** presents modeled contributions from the Mill Creek facility for all units combined, units without SCR, and units with SCR.

Table 3. Modeled Impacts from selected coal-fired EGUs[1] in Kentucky (with/without SCR) at AQS monitors in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Bates	BUCKNER	CANNONS LANE	NORTHERN KENTUCKY UNIVERSITY (NKU)	SHEPHERDSVILLE	Watson Lane
5/24		1.34	1.44	2.22		
6/3						0.74
6/10	2.54		4.10			
6/11	2.35	1.47	2.02	2.37		
6/13			0.42	0.22		2.25
6/25			2.45			
6/30	0.89		1.73			
7/19			0.89			
7/21			4.50			
7/23			4.29			
8/3			0.82			
9/14	0.56				0.88	0.68
9/23		0.86	0.52			
9/24	1.27		1.18			
9/25			1.50			

[1] Selected coal-fired EGUs in Kentucky include: E.W. Brown, Ghent, H.L Spurlock, J. Sherman Cooper, Mill Creek, Shawnee, and Trimble County

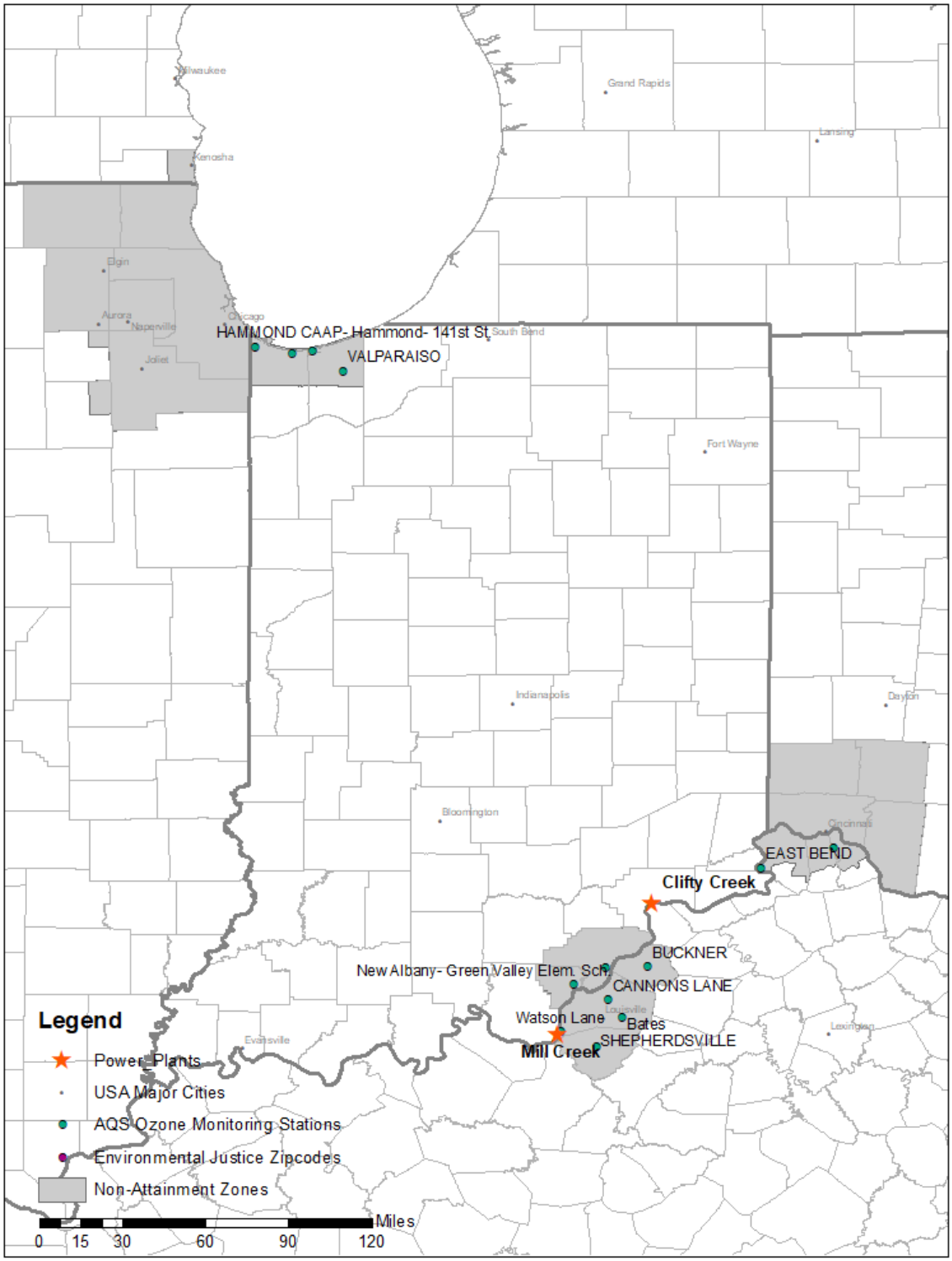

Figure 1. Kentucky Mill Creek facility location with AQS ozone monitoring locations that exceeded the NAAQS in 2015 ozone moderate nonattainment areas.

Table 4. Modeled impacts from Mill Creek, KY, facility at AQS monitors in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr modeled ozone contributions are relative values (ppb) at AQS monitors. Values from all units combined that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Contribution from Mill Creek sum of all units combined, (from Units 1 and 2 without SCR), [from Units 3 and 4 with SCR]

Date	Bates	BUCKNER	CANNONS LANE	NORTHERN KENTUCKY UNIVERSITY (NKU)	SHEPHERDSVILLE	Watson Lane
5/24		0.89 (0.82) [0.07]	1.04 (0.95) [0.08]	0.30 (0.28) [0.02]		
6/3						0.65 (0.55) [0.09]
6/10	2.04 (1.52) [0.52]		3.50 (2.59) [0.91]			
6/11	1.61 (1.08) [0.53]	0.61 (0.41) [0.20]	1.04 (0.70) [0.34]	0.09 (0.06) [0.03]		
6/13			0.11 (0.09) [0.02]			1.87 (1.46) [0.40]
6/25			1.42 (1.09) [0.32]			
6/30	0.55 (0.44) [0.11]		1.30 (1.03) [0.27]			
7/19			0.10 (0.07) [0.03]			
7/21			4.18 (3.41) [0.77]			
7/23			3.92 (2.87) [1.06]			
8/3			0.26 (0.21) [0.05]			
9/14	0.05 (0.04) [0.01]				0.49 (0.38) [0.11]	0.43 (0.33) [0.10]
9/23		0.63 (0.58) [0.05]	0.39 (0.35) [0.04]			
9/24	0.24 (0.21) [0.02]		0.23 (0.20) [0.02]			
9/25			0.72 (0.30) [0.42]			

Missouri

Impacts from all selected coal-fired EGUs in Missouri (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Missouri portion of the St. Louis, MO-IL, moderate ozone nonattainment area on days where the monitored MDA8 ozone concentrations in the nonattainment area exceeded the 70 ppb NAAQS. Impacts were also assessed for the Labadie Power Facility for all units combined, which include Units 1, 2, 3, and 4 (without SCR controls).

Monitoring days in 2016 that exceeded 70 ppb in Missouri nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-4** in **Appendix B**. Modeled contributions from the selected coal-fired facilities in Missouri on those days are shown in **Table 5**. **Figure 2** shows the Labadie facility location, AQS ozone monitoring stations and EJ zip codes located in 2015 ozone moderate nonattainment areas. **Table 6** presents modeled contributions from the Labadie facility.

Table 5. Modeled impacts from selected coal-fired[1] EGUs in Missouri (with/without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton	Zip 63031, 63042, 63044	Zip 63033	Zips 63103, 63104, 63106, 63107, 63108	Zips 63109, 63111, 63116, 63118, 63139	Zips 63112, 63113, 63115, 63120, 63133, 63147	Zips 63135, 63136, 63137, 63138	Zip 63801	Zip 63869
5/23					0.50		0.70	0.34	0.74	0.30	0.30	0.30	0.37	2.50	2.65
6/8				0.76				0.38	0.83	0.16	0.08	0.16	0.42	0.92	1.11
6/9							1.91	1.35	1.99	0.79	0.72	0.79	1.00	4.10	4.42
6/10			1.40				2.47	1.48	2.36	0.91	0.63	0.91	1.18	4.52	5.09
6/13							1.91	0.72	0.98	0.23	0.18	0.23	0.49	1.74	2.74
6/16				1.12				0.60	2.51	1.04	1.55	1.04	1.26	1.03	0.96
6/18	0.03			0.31	1.67	0.08	1.01	0.51	0.50	0.07	0.03	0.07	0.25	0.21	0.11
6/27						2.11		1.06	1.70	0.66	0.40	0.66	0.85	0.51	0.72
7/20				0.53				0.33	0.41	0.16	0.12	0.16	0.21	6.50	6.55
7/23				1.87				1.46	2.46	0.98	1.11	0.98	1.23	2.90	5.94
8/4					3.62		2.11	2.38	3.32	1.43	1.42	1.43	1.66	5.56	7.03
8/9	0.08	0.08		0.36			0.27	0.07	0.14	0.05	0.04	0.05	0.07	1.14	2.11
8/10					2.41		1.89	0.56	0.74	0.18	0.16	0.18	0.37	5.86	3.77
9/21					0.23			0.06	0.10	0.03	0.04	0.03	0.05	0.29	0.23
9/22					3.58		1.98	2.21	3.23	1.35	1.43	1.35	1.62	3.51	2.88
9/23		1.38			3.09		2.43	2.12	3.68	2.12	0.86	1.19	1.19	1.19	1.19
9/24					0.52		0.64	0.32	0.71	0.32	0.56	0.42	0.42	0.42	0.42

[1] Selected coal-fired EGUs in Missouri include: Hawthorn, John Twitty, Labadie, New Madrid, Sikeston, Sioux, and Thomas Hill

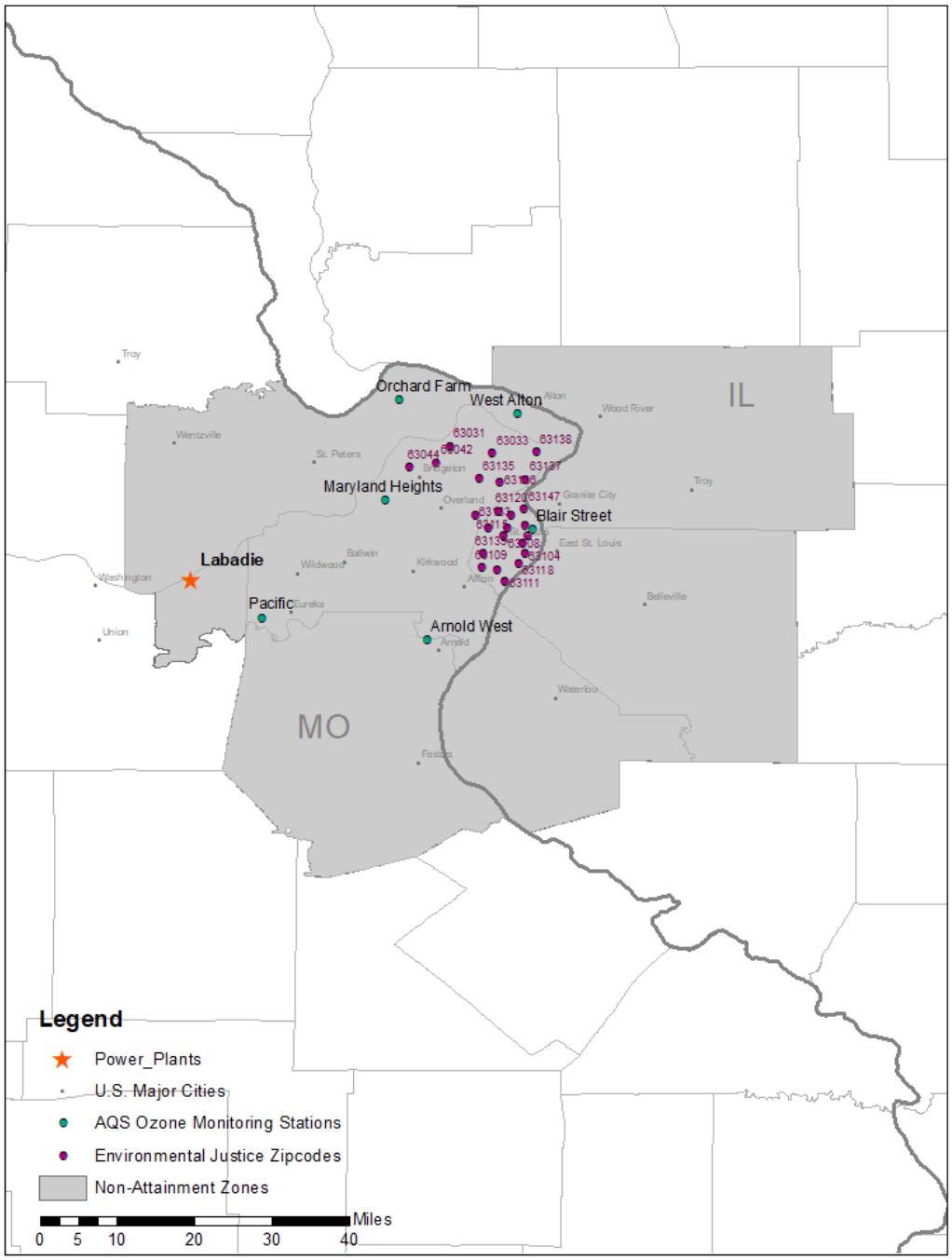

Figure 2. Missouri Labadie facility location with AQS ozone monitoring stations that exceeded the NAAQS and EJ zip codes located in 2015 ozone moderate nonattainment areas.

Table 6. Modeled impacts from **Labadie, MO**, facility (Units 1, 2, 3, 4 without SCR) at AQS monitors and EJ zip codes in moderate ozone nonattainment areas on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr modeled ozone contributions are relative values (ppb) at AQS Monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton	Zip 63031, 63042, 63044	Zip 63033	Zip 63103, 63104, 63106, 63107, 63108	Zip 63109, 63111, 63116, 63118, 63139	Zip 63112, 63113, 63115, 63120, 63133, 63147	Zip 63135, 63136, 63137, 63138	Zip 63801	Zip 63869
5/23					0.22		0.21	0.12	0.26	0.08	0.06	0.08	0.13	0.02	0.02
6/8				0.57				0.01	0.01	0.01	0.01	0.01	<0.01	0.16	0.24
6/9							0.74	0.92	0.93	0.26	0.13	0.26	0.46	0.09	0.08
6/10			0.06				1.10	1.30	1.86	0.72	0.42	0.72	0.93	0.04	0.04
6/13							0.24	0.49	0.34	0.10	0.06	0.10	0.17	0.01	<0.01
6/16				0.48				0.04	0.06	0.17	0.81	0.17	0.03	<0.01	<0.01
6/18	<0.01			<0.01	<0.01	0.04	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01
6/27						1.06		<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.13	0.16
7/20				0.48				0.27	0.20	0.08	0.03	0.08	0.10	0.06	0.09
7/23				1.35				0.67	0.89	0.44	0.52	0.44	0.45	0.03	0.02
8/4					1.87		0.43	1.19	1.05	0.65	0.65	0.65	0.53	0.06	0.05
8/9	0.04	0.04		0.31			0.03	0.05	0.05	0.02	0.02	0.02	0.02	0.01	0.01
8/10					0.34		0.06	0.08	0.10	0.04	0.03	0.04	0.05	<0.01	<0.01
9/21					0.12			0.02	0.03	0.01	0.01	0.01	0.02	<0.01	<0.01
9/22					1.50		0.28	0.56	0.35	0.09	0.04	0.09	0.18	<0.01	<0.01

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton	Zip 63031, 63042, 63044	Zip 63033	Zip 63103, 63104, 63106, 63107, 63108	Zip 63109, 63111, 63116, 63118, 63139	Zip 63112, 63113, 63115, 63120, 63133, 63147	Zip 63135, 63136, 63137, 63138	Zip 63801	Zip 63869
9/23		0.91			2.51		1.40	1.64	2.58	0.79	0.46	0.79	1.29	<0.01	<0.01
9/24					0.24		0.02	0.03	0.02	0.01	<0.01	0.01	0.01	<0.01	<0.01

Texas

Impacts from all selected coal-fired EGUs in Texas (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within 2015 moderate ozone nonattainment areas (Dallas-Fort Worth, Houston-Galveston-Brazoria, and San Antonio) on days where monitoring concentrations exceeded the 70 ppb NAAQS. Impacts were also assessed for several individual facilities with coal-fired units that lacked or under-utilized SCR controls.

Monitoring days in 2016 that exceeded 70 ppb in Texas nonattainment areas were compared with total modeled values from all sources and are presented for the ozone nonattainment areas in **Appendix B** for Dallas-Fort Worth (**Table B-5)**, Houston-Galveston-Brazoria (**Table B-6**), and San Antonio (**Table B-7**). Modeled contributions from the coal-fired facilities in Texas on those days in each nonattainment area are shown in **Tables 7 through 9. Table 10** shows individual Texas facilities that have modeled contributions ≥ 0.5% of the NAAQS (0.35 ppb) on monitored 2016 NAAQS exceedance day/s. **Figure 3** shows locations of facilities listed in **Table 10**, AQS ozone monitoring stations, and EJ zip codes located in 2015 ozone moderate nonattainment areas. **Tables 11 through 19** present modeled contributions from the individual facilities in nonattainment areas where the facility had modeled contributions ≥ 0.5% of the NAAQS (0.35 ppb).

Table 7. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01											0.01	0.01
6/7	0.04	0.08	0.03	0.04		0.01	0.02		0.01	0.01	0.01		0.03	0.03
6/8					2.02							1.83	1.56	1.59
6/9					0.88							0.65	0.79	0.92
6/10					0.74								0.86	0.76
6/20			1.22		1.20				1.08				0.89	0.90
6/29										0.33			0.33	0.36
6/30					0.63			0.39	0.40			0.61	0.28	0.29
7/1					0.87			0.72	0.62			1.00	0.64	0.71
7/26							1.60			1.41			0.96	1.00
8/5								0.37				0.44	0.28	0.32
8/31		0.38											0.27	0.33
9/11			0.36										0.27	0.38
9/20									2.25				2.00	2.48
9/21					0.67				0.55				0.38	0.32
9/22					0.79							0.74	0.73	0.59
10/1								0.03				0.01	0.07	0.08
10/3		0.88			0.46								0.28	0.23

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Twin Oaks, Tolk, WA Parish, and Welsh

Table 8. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/3			0.31										0.48	0.47	0.44
4/5	0.44												0.33	0.26	0.72
4/7		0.54											0.36	0.27	0.84
4/14		0.37											0.79	0.87	0.70
4/15				0.27				0.26					0.78	0.55	0.35
4/23		0.06	0.09	0.29				0.54		0.13		0.35	1.58	1.56	1.20
4/27	0.39		0.61										0.28	0.22	1.50
5/4		0.66											0.37	0.37	0.26
5/6				0.94			0.60	1.04		0.67			2.04	1.77	1.47
5/7	0.25	<0.01	0.22										0.50	0.51	0.67
5/13				0.65				0.68					1.42	1.31	0.86
6/8		0.04			0.21			0.30					2.79	1.51	0.85
7/21			0.28							0.27		0.74	1.17	1.68	0.94
7/22			0.32										1.42	1.20	1.32
8/3			0.23										0.87	0.68	0.67
8/4	0.28												0.82	0.68	0.65
9/21					0.07								0.96	0.50	0.21
9/28						0.41					0.92		1.03	0.65	0.69
9/29									0.64				0.47	0.38	0.31
10/2					0.02						0.01		0.73	0.41	0.15
10/3								0.07					0.67	0.37	0.23
10/10								0.07					1.43	1.09	0.52
10/26			0.09										0.85	0.71	0.43

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, WA Parish, and Welsh

Table 9. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the San Antonio ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest	Zip 78101	Zip 78112	Zip 78221	Zip 78223	Zip 78263	Zip 78264
5/5			0.16	0.33	0.56	0.38	0.37	0.33	0.62
5/6			1.64	1.43	1.03	1.53	1.58	1.43	1.09
9/28	0.46			0.28	0.20	0.09	0.14	0.28	0.13
10/2		1.56	1.50	2.13	2.32	2.43	2.44	2.13	2.49
10/11		1.06	1.04	1.30	1.28	1.09	1.21	1.30	1.24

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, TWA Parish, and Welsh

Table 10. Individual Texas facilities and units that have modeled contributions ≥ 0.5% of the NAAQS (0.35 ppb) on monitored 2016 NAAQS exceedance days

Facility	Modeled Units
WA Parish, TX	5, 6, 7, and 8 combined ('with SCR')
Fayette Power Project, TX	1, 2, and 3 combined ('No SCR')
JK Spruce, TX	1 ('No SCR') 2 ('With SCR') (contributions shown combined)
Limestone, TX	1, and 2 combined ('No SCR')
Martin Lake, TX	1, 2, and 3 combined ('No SCR')
Welsh, TX	1 and 3 combined ('No SCR')

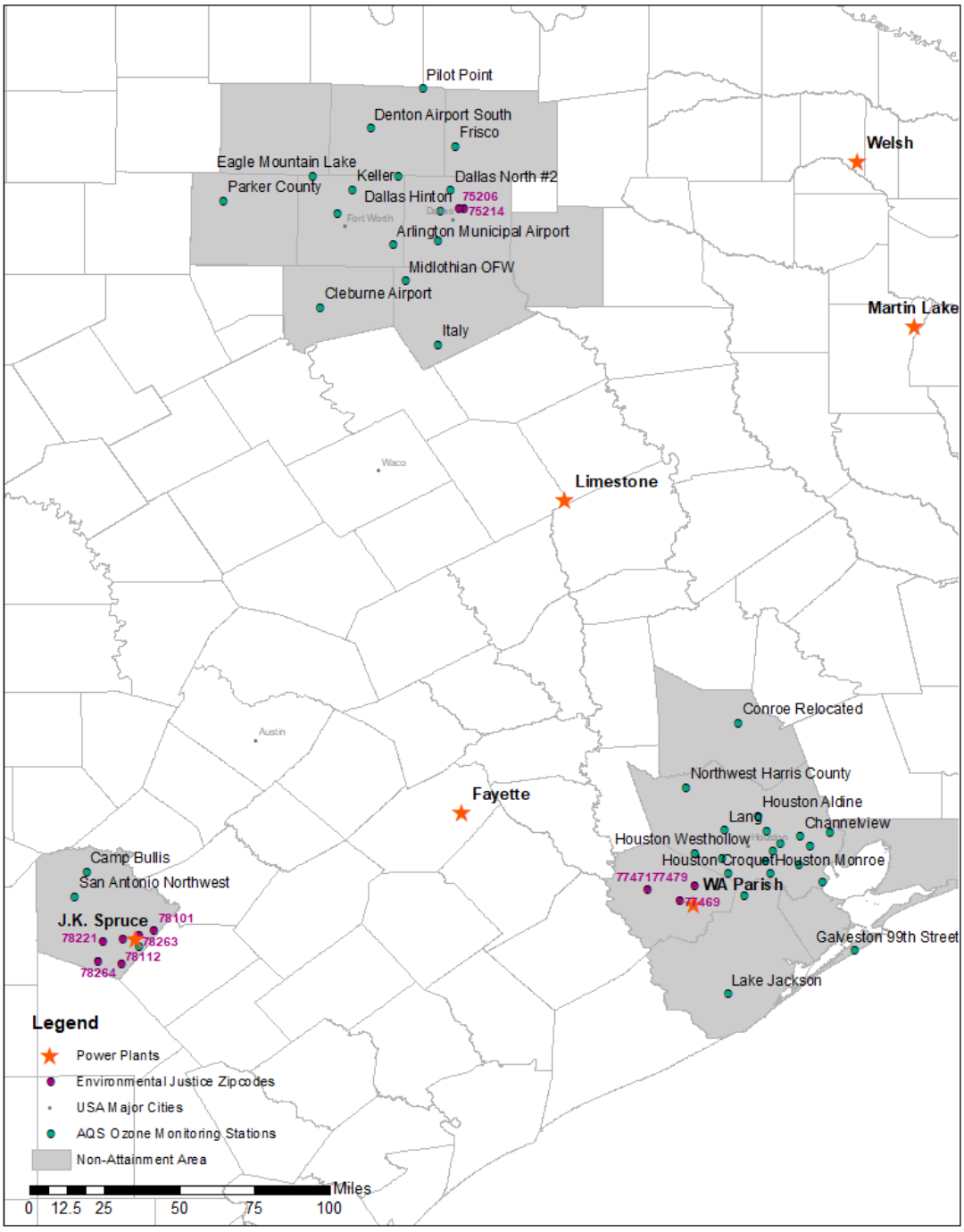

Figure 3. Facility locations with AQS ozone monitoring stations that exceeded that NAAQS and EJ zip codes located in 2015 ozone moderate nonattainment areas.

Table 11. Modeled impacts from WA Parish facility (Units 5, 6, 7, 8 combined, with SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/3			0.03										0.13	0.09	0.14
4/5	0.14												0.18	0.12	0.56
4/7		0.06											0.15	0.05	0.66
4/14		0.01											0.03	0.01	0.02
4/15				0.07				0.07					0.61	0.36	0.20
4/23		<0.01	0.01	0.20				0.46		0.05		0.27	1.49	1.48	1.12
4/27	0.29		0.58										0.27	0.20	1.48
5/4		0.11											0.02	<0.01	0.01
5/6				0.12			<0.01	0.32		0.02			1.33	1.11	0.78
5/7	0.06	<0.01	0.02										0.26	0.25	0.48
5/13				0.26				0.32					1.30	1.15	0.65
6/8		0.01			0.10			0.13					2.70	1.35	0.75
7/21			0.28							0.27		0.71	1.17	1.68	0.94
7/22			0.31										1.42	1.19	1.32
8/3			0.21										0.86	0.68	0.67
8/4	0.21												0.80	0.65	0.62
9/21					0.01								0.91	0.44	0.15

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
9/28						0.08					0.54		0.58	0.08	0.26
9/29									0.18				0.12	<0.01	0.01
10/2					0.01						<0.01		0.73	0.40	0.14
10/3								0.05					0.65	0.36	0.22
10/10								0.06					1.43	1.09	0.52
10/26			0.01										0.81	0.66	0.38

Table 12. Modeled impacts from **Fayette** facility (Units 1, 2, 3 combined, without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01											<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					<0.01							<0.01	<0.01	<0.01

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/9					0.26							0.19	0.18	0.19
6/10					0.12								0.10	0.10
6/20			0.54		0.51				0.48				0.40	0.40
6/29										0.02			0.02	0.02
6/30					0.01			0.01	0.01			0.01	0.01	0.01
7/1					0.23			0.13	0.18			0.14	0.16	0.16
7/26							0.15			0.13			0.08	0.08
8/5								0.09				0.13	0.04	0.05
8/31		<0.01											<0.01	<0.01
9/11			<0.01										<0.01	<0.01
9/20									0.77				0.76	0.82
9/21					0.01				0.01				0.01	0.01
9/22					0.01							<0.01	0.01	<0.01
10/1								<0.01				<0.01	<0.01	<0.01
10/3		0.09			0.01								<0.01	<0.01

Table 13. Modeled impacts from **JK Spruce** facility (Unit 1, no SCR + Unit 2, with SCR combined) at AQS monitors and EJ zip codes in the San Antonio ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest	Zip 78101	Zip 78112	Zip 78221	Zip 78223	Zip 78263	Zip 78264
5/5			0.16	0.33	0.55	0.38	0.36	0.33	0.60
5/6			0.81	0.65	0.13	0.71	0.79	0.65	0.15
9/28	0.42			0.25	0.16	0.05	0.11	0.25	0.09
10/2		0.58	0.61	1.28	1.46	1.61	1.62	1.28	1.62
10/11		0.23	0.11	0.76	0.54	0.31	0.56	0.76	0.29

Table 14. Modeled impacts from **Limestone** facility (Units 1, 2 combined, no SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01											<0.01	<0.01

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/7	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.86							0.63	0.48	0.39
6/9					0.02							0.07	0.28	0.40
6/10					0.47								0.64	0.54
6/20			0.06		0.21				0.11				0.04	0.04
6/29										0.03			0.02	0.02
6/30					0.39			0.05	0.22			0.12	0.07	0.04
7/1					0.37			0.35	0.20			0.62	0.14	0.20
7/26							0.71			0.51			0.33	0.30
8/5								0.02				0.02	0.05	0.07
8/31		<0.01											<0.01	<0.01
9/11			<0.01										<0.01	<0.01
9/20									0.65				0.56	0.73
9/21					0.23				0.22				0.13	0.07
9/22					0.55							0.36	0.52	0.34
10/1								<0.01				<0.01	0.02	0.02
10/3		0.50			0.33								0.20	0.12

Table 15. Modeled impacts from **Limestone** facility (Units 1, 2 combined, no SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.70 ppb). Values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/3			0.19										0.18	0.19	0.17
4/5	0.04												0.04	0.04	0.04
4/7		0.44											0.14	0.09	0.13
4/14		0.23											0.57	0.65	0.51
4/15				0.12				0.10					0.10	0.11	0.09
4/23		0.01	<0.01	0.01				0.01		<0.01		0.01	0.02	0.02	0.01
4/27	<0.01		<0.01										<0.01	<0.01	<0.01
5/4		0.04											0.08	0.09	0.09
5/6				<0.01			<0.01	<0.01		<0.01			<0.01	0.01	<0.01
5/7	0.01	<0.01	0.01										0.03	0.04	0.02
5/13				0.13				0.12					0.05	0.06	0.07
6/8		<0.01			<0.01			<0.01					<0.01	<0.01	<0.01
7/21			<0.01							<0.01		<0.01	<0.01	<0.01	<0.01
7/22			<0.01										<0.01	<0.01	<0.01
8/3			<0.01										<0.01	<0.01	<0.01

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
8/4	0.01												0.01	0.01	0.01
9/21					0.01								0.01	0.01	0.01
9/28						0.03					0.08		0.17	0.28	0.16
9/29									0.27				0.15	0.11	0.11
10/2					<0.01						<0.01		<0.01	<0.01	<0.01
10/3								<0.01					<0.01	<0.01	<0.01
10/10								<0.01					<0.01	<0.01	<0.01
10/26			0.01										0.01	0.01	0.01

Table 16. Modeled impacts from **Limestone** facility (Units 1, 2 combined, no SCR) at AQS monitors and EJ zip codes in the San Antonio ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.70 ppb). Values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest	Zip 78101	Zip 78112	Zip 78221	Zip 78223	Zip 78263	Zip 78264
5/5			0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
5/6			<0.01	0.35	0.35	0.34	0.35	0.35	0.35
9/28	<0.01			0.01	0.01	0.01	0.01	0.01	0.01

10/2		0.01	<0.01	0.07	0.08	0.10	0.08	0.07	0.09
10/11		<0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 17. Modeled impacts from Martin Lake facility (Units 1, 2, 3 combined, no SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01											<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.54							0.60	0.71	0.85
6/9					0.11							0.08	0.06	0.06
6/10					<0.01								<0.01	<0.01
6/20			0.04		0.07				0.06				0.04	0.04
6/29										0.09			0.08	0.10
6/30					0.20			0.30	0.15			0.42	0.17	0.22
7/1					0.05			0.06	0.04			0.07	0.05	0.05

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
7/26							0.35			0.42			0.41	0.49
8/5								0.03				0.03	0.03	0.04
8/31		0.02											<0.01	<0.01
9/11			<0.01										<0.01	<0.01
9/20									0.11				0.24	0.49
9/21					0.36				0.27				0.21	0.22
9/22					0.18							0.36	0.16	0.23
10/1								<0.01				<0.01	<0.01	0.01
10/3		0.02			0.08								0.06	0.10

Table 18. Modeled impacts from Welsh facility (Units 1, 3 combined, no SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.70 ppb). Values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01											0.01	0.01
6/7	0.03	0.06	0.03	0.04		0.01	0.02		0.01	0.01	0.01		0.03	0.03
6/8					0.38							0.42	0.35	0.34
6/9					0.02							0.02	0.01	0.01
6/10					<0.01								<0.01	<0.01
6/20			0.01		0.04				0.02				0.01	0.01
6/29										0.13			0.17	0.20
6/30					0.02			0.01	0.02			0.02	0.01	0.01
7/1					0.01			0.01	0.01			0.01	0.01	0.01
7/26							0.01			0.02			0.01	0.02
8/5								0.01				0.01	0.01	0.01
8/31		0.30											0.26	0.31
9/11			0.26										0.26	0.37

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
9/20									0.01				0.02	0.04
9/21					0.02				0.02				0.01	0.01
9/22					<0.01							<0.01	<0.01	<0.01
10/1								0.02				0.01	0.04	0.05
10/3		<0.01			<0.01								<0.01	<0.01

Table 19. Modeled impacts from Welsh facility (Units 1, 3 combined, no SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2015 ozone NAAQS of 70 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.70 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.35 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/3			0.01										<0.01	<0.01	<0.01
4/5	<0.01												0.01	0.01	0.01
4/7		<0.01											<0.01	<0.01	<0.01

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County	Zip 77469	Zip 77471	77479
4/14		0.02											0.03	0.03	0.02
4/15				0.01				0.01					0.01	0.01	0.01
4/23		0.03	0.06	0.07				0.06		0.06		0.05	0.04	0.04	0.05
4/27	<0.01		<0.01										<0.01	<0.01	<0.01
5/4		0.32											0.01	0.01	0.01
5/6				0.58			0.43	0.54		0.48			0.49	0.45	0.48
5/7	0.08	<0.01	0.08										0.07	0.07	0.06
5/13				0.08				0.07					0.02	0.03	0.05
6/8		0.01			0.02			0.03					0.02	0.03	0.02
7/21			<0.01							<0.01		<0.01	<0.01	<0.01	<0.01
7/22			<0.01										<0.01	<0.01	<0.01
8/3			<0.01										<0.01	<0.01	<0.01
8/4	0.01												<0.01	<0.01	<0.01
9/21					0.01								0.01	0.01	0.01
9/28						0.01					0.01		0.01	0.01	0.01
9/29									<0.01				<0.01	<0.01	<0.01
10/2					<0.01						<0.01		<0.01	<0.01	<0.01
10/3								<0.01					<0.01	<0.01	<0.01
10/10								<0.01					<0.01	<0.01	<0.01
10/26			0.01										<0.01	<0.01	<0.01

2008 Severe Ozone Nonattainment Areas

For Colorado and Texas, collective modeled contributions from selected coal-fired EGUs within the state, as well as modeled contributions from select individual facility and units that under-utilize or lack SCR controls, were evaluated. Impacts were analyzed on days when the observed MDA8 ozone concentration exceeded the 2015 ozone NAAQS of 75 ppb at AQS monitors located within a severe nonattainment area in each state of interest. Modeled impacts were also estimated at EJ zip codes in nonattainment areas on monitor exceedance days.

Relative source contributions at monitoring locations are also presented, with contributions that equal or exceed 1% of the NAAQS (0.75 ppb) highlighted in red and contributions that equal or exceed 0.5% of the NAAQS (≈0.37 ppb) highlighted in yellow. Relative source contributions from the model are calculated on an 8-hr average basis by multiplying the absolute modeled source contribution by the ratio of the monitored concentration and the total modeled ozone concentration. The resulting value gives a relative modeled contribution during a monitor exceedance day.

Modeled contributions at EJ zip codes in nonattainment areas are presented as absolute modeled concentrations since there are no ozone monitors at the EJ zip code locations. In **Appendix B**, tabular data for each state show monitoring MDA8 values compared with total modeled values on days when monitors exceeded the NAAQS.

Colorado

Impacts from selected coal-fired EGUs in Colorado (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within the Denver-Boulder-Greely-Ft. Collins-Loveland 2008 severe ozone nonattainment area on days where the monitored MDA8 ozone concentrations exceeded the 75 ppb NAAQS.

Monitoring days in 2016 that exceeded 75 ppb in Colorado nonattainment areas were compared with total modeled values from all sources and are presented in **Table B-8** in **Appendix B**. Modeled contributions from the coal-fired facilities in Colorado on those days are shown in **Table 20**.

Table 20. Modeled impacts from selected coal-fired EGUs[1] in Colorado (with/without SCR) at AQS monitors and EJ zip codes in severe ozone nonattainment areas on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Aspen Park	Chatfield State Park	HIGHLAND RESERVOIR	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	WELCH	Zip 80216	Zip 80223
6/16	0.14			0.24	0.24		0.21	0.09
6/18					0.94		0.62	0.48
6/19				0.55			0.57	0.50
6/27		1.39		1.39	1.27	1.39	1.17	1.17
6/28					0.84		0.70	0.68
7/7				0.36			0.39	0.30
7/14		0.29		0.30			0.23	0.22
7/16		0.43		0.52			0.55	0.53
7/25				1.10	1.07	1.01	0.90	0.90
7/27		0.94	0.88	1.03	0.96	0.93	0.83	0.80
7/29				1.08			0.71	0.67
7/30		1.00					0.75	0.76
8/3		1.65		1.50			1.21	1.23

[1] Selected coal-fired EGUs in Colorado include: Cherokee, Comanche, Craig (Yampa), Rawhide, and Ray D Nixon

Texas

Impacts from all selected coal-fired EGUs in Texas (with/without SCR controls) were evaluated at AQS monitors and at EJ zip codes located within 2008 severe ozone nonattainment areas (Dallas-Fort Worth and Houston-Galveston-Brazoria) on days where monitoring concentrations exceeded the 75 ppb NAAQS. Impacts were also assessed for several facilities that had units that lacked or under-utilized SCR controls.

Monitoring days in 2016 that exceeded 75 ppb in Texas nonattainment areas were compared with total modeled values from all sources and are presented in Appendix B for the Dallas-Fort Worth (Table B-9) and Houston-Galveston-Brazoria (Table B-10) nonattainment areas. Modeled contributions from all selected coal-fired facilities in Texas on those days in each nonattainment area are shown in Tables 21 and 22. Table 23 shows individual Texas facilities that have modeled contributions ≥ 0.5% of the NAAQS (0.37 ppb) on monitored 2008 NAAQS exceedance day/s. Figure 3 shows locations of facilities listed in Table 23, AQS ozone monitoring stations, and EJ zip codes located in 2015 ozone moderate nonattainment areas. Tables 24 through 29 present modeled contributions from the individual facilities in nonattainment areas where the facility had modeled contributions ≥ 0.5% of the NAAQS (0.37 ppb).

Table 21. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area, on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01										0.01	0.01
6/7	0.04	0.08	0.03	0.04		0.02		0.01	0.01	0.01		0.03	0.03
6/8					2.02						1.83	1.56	1.59
6/20								1.08				0.89	0.90
6/30					0.63		0.39	0.40			0.61	0.28	0.29
7/1					0.87		0.72					0.64	0.71

8/31		0.38										0.27	0.33
9/21					0.67							0.38	0.32

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, WA Parish, and Welsh

Table 22. Modeled impacts from all selected coal-fired EGUs[1] in Texas (with/without SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area, on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, , while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/15				0.27	0.26			0.78	0.55	0.35
4/23		0.06		0.29	0.54	0.13	0.35	1.58	1.56	1.20
5/4		0.66						0.37	0.37	0.26
5/6				0.94	1.04	0.67		2.04	1.77	1.47
5/7	0.25							0.50	0.51	0.67
5/13				0.65				1.42	1.31	0.86
6/8					0.30			2.79	1.51	0.85
7/21							0.74	1.17	1.68	0.94
7/22			0.32					1.42	1.20	1.32
8/3			0.23					0.87	0.68	0.67
10/3					0.07			0.67	0.37	0.23
10/10					0.07			1.43	1.09	0.52

[1] Selected coal-fired EGUs in Texas include: Coleto Creek, Fayette, JK Spruce, Limestone, Martin Lake, San Miguel, Tolk, Twin Oaks, WA Parish, and Welsh

Table 23. Individual Texas facilities and units that have modeled contributions ≥ 0.5% of the NAAQS (0.37 ppb) on monitored 2008 NAAQS exceedance days

Facility	Modeled Units
WA Parish, TX	5, 6, 7, and 8 combined ('with SCR')
Fayette Power Project, TX	1, 2, and 3 combined ('No SCR')
Limestone, TX	1, and 2 combined ('No SCR')
Martin Lake, TX	1, 2, and 3 combined ('No SCR')
Welsh, TX	1 and 3 combined ('No SCR')

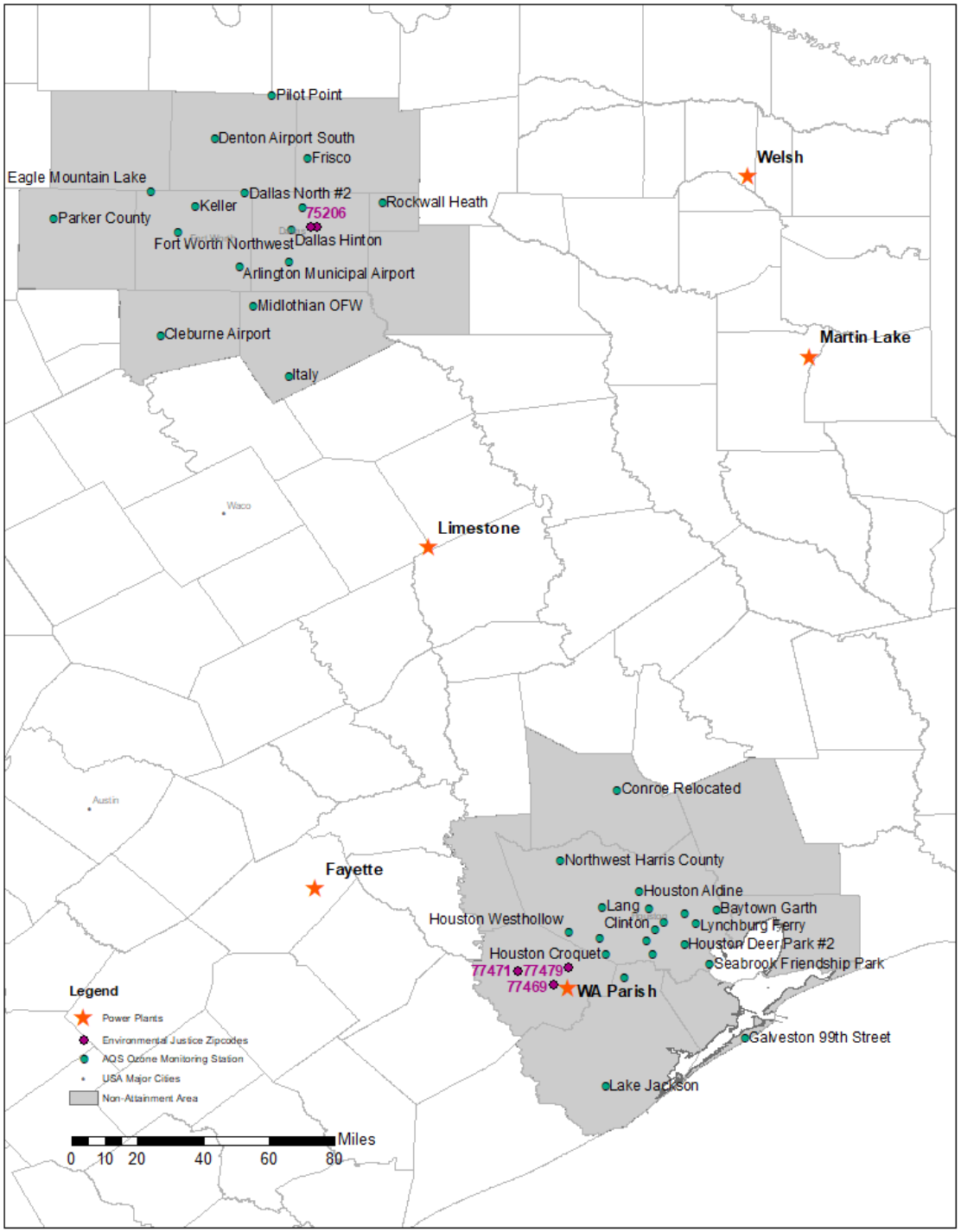

Figure 4. Facility locations with AQS ozone monitoring stations that exceeded the NAAQS and EJ zip codes located in 2008 ozone severe nonattainment areas.

Table 24. Modeled impacts from WA Parish facility (Units 5, 6, 7, 8 combined, with SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/15				0.07	0.07			0.61	0.36	0.20
4/23		<0.01		0.20	0.46	0.05	0.27	1.49	1.48	1.12
5/4		0.11						0.02	<0.01	0.01
5/6				0.12	0.32	0.02		1.33	1.11	0.78
5/7	0.06							0.26	0.25	0.48
5/13				0.26				1.30	1.15	0.65
6/8					0.13			2.70	1.35	0.75
7/21							0.71	1.17	1.68	0.94
7/22			0.31					1.42	1.19	1.32
8/3			0.21					0.86	0.68	0.67
10/3					0.05			0.65	0.36	0.22
10/10					0.06			1.43	1.09	0.52

Table 25. Modeled impacts from **Fayette** facility (Units 1, 2, 3 combined, without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.75 ppb). Values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01										<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					<0.01						<0.01	<0.01	<0.01
6/20								0.48				0.40	0.40
6/30					0.01		0.01	0.01			0.01	0.01	0.01
7/1					0.23		0.13					0.16	0.16
8/31		<0.01										<0.01	<0.01
9/21					0.01							0.01	0.01

Table 26. Modeled impacts from **Limestone** facility (Units 1 and 2 without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01										<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.86						0.63	0.48	0.39
6/20								0.11				0.04	0.04
6/30					0.39		0.05	0.22			0.12	0.07	0.04
7/1					0.37		0.35					0.14	0.20
8/31		<0.01										<0.01	<0.01
9/21					0.23							0.13	0.07

Table 27. Modeled impacts from Martin Lake facility (Units 1, 2, and 3 combined without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. . Values that equal or exceed 1% of the NAAQS (0.75 ppb) are highlighted in red, while values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		<0.01										<0.01	<0.01
6/7	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01	<0.01	<0.01		<0.01	<0.01
6/8					0.54						0.60	0.71	0.85
6/20								0.06				0.04	0.04
6/30					0.20		0.30	0.15			0.42	0.17	0.22
7/1					0.05		0.06					0.05	0.05
8/31		0.02										<0.01	<0.01
9/21					0.36							0.21	0.22

Table 28. Modeled impacts from **Welsh** facility (Units 1 and 3 without SCR) at AQS monitors and EJ zip codes in the Dallas-Fort Worth ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.75 ppb). Values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point	Zip 75206	Zip 75214
6/6		0.01										0.01	0.01
6/7	0.03	0.06	0.03	0.04		0.02		0.01	0.01	0.01		0.03	0.03
6/8					0.38						0.42	0.35	0.34
6/20								0.02				0.01	0.01
6/30					0.02		0.01	0.02			0.02	0.01	0.01
7/1					0.01		0.01					0.01	0.01
8/31		0.30										0.26	0.31
9/21					0.02							0.01	0.01

Table 29. Modeled impacts from **Welsh** facility (Units 1 and 3 without SCR) at AQS monitors and EJ zip codes in the Houston-Galveston-Brazoria ozone nonattainment area on days in 2016 that exceeded the 2008 ozone NAAQS of 75 ppb. 8-hr maximum modeled ozone contributions are relative values (ppb) at AQS monitors and absolute values (ppb) at EJ zip codes. Values do not equal or exceed 1% of the NAAQS (0.75 ppb). Values that equal or exceed 0.5% of the NAAQS (0.37 ppb) are highlighted in yellow.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County	Zip 77469	Zip 77471	Zip 77479
4/15				0.01	0.01			0.01	0.01	0.01
4/23		0.03		0.07	0.06	0.06	0.05	0.04	0.04	0.05
5/4		0.32						0.01	0.01	0.01
5/6				0.58	0.54	0.48		0.49	0.45	0.48
5/7	0.08							0.07	0.07	0.06
5/13				0.08				0.02	0.03	0.05
6/8					0.03			0.02	0.03	0.02
7/21							<0.01	<0.01	<0.01	<0.01
7/22			<0.01					<0.01	<0.01	<0.01
8/3			<0.01					<0.01	<0.01	<0.01
10/3					<0.01			<0.01	<0.01	<0.01
10/10					<0.01			<0.01	<0.01	<0.01

Appendix A. Modeling Methods

Photochemical Grid Model and Source Apportionment

To quantify the ozone impacts due to precursor emissions from individual EGUs and other emission source groups, Sonoma Technology performed CAMx OSAT source apportionment model simulations for the 2016 ozone season (April to October). The modeling domain covers all lower 48 U.S. states, plus adjacent portions of Canada and Mexico, using a horizontal grid resolution of 12 km x 12 km. The domain and configurations used were based on those developed by EPA in recent ozone transport assessments using CAMx OSAT (U.S. Environmental Protection Agency, 2022a), and included the use of the carbon-bond 6 gas phase chemistry mechanism and the two-mode course/fine (CF) aerosol chemistry mechanism.

The Comprehensive Air Quality Model with Extensions (CAMx version 7.10) (Ramboll US Corporation, 2020) is a publicly available, peer-reviewed, state-of-the-science three-dimensional grid-based (Eulerian) photochemical air quality model designed to simulate the emission, transport, diffusion, chemical transformation, and removal of gaseous and particle pollutants in the atmosphere over spatial scales ranging from continental to urban. CAMx was designed to approach air quality wholistically by including capabilities for modeling multiple air quality issues, including tropospheric ozone, fine particles, visibility degradation, acid deposition, air toxics, and mercury. The ability of photochemical grid models, such as CAMx, to treat a large number of sources and their chemical interactions makes them well suited for assessing the impacts of natural and anthropogenic emissions sources on air quality. CAMx is widely used to support regulatory air quality assessments and air quality management policy decisions in the United States. In recent years, the EPA has used CAMx to support the NAAQS designation process (U.S. Environmental Protection Agency, 2015) and evaluate interstate pollutant transport (U.S. Environmental Protection Agency 2015a, 2021a, 2022a).

CAMx also includes OSAT, which can be used to estimate the contributions of individual sources, groups of sources, or source regions to ozone concentrations at a given receptor location (Yarwood et al., 1996). Source apportionment modeling is useful for understanding model performance, designing emission control strategies, and performing culpability assessments to identify emission sources that contribute significantly to pollution. The key precursor species for ozone production are volatile organic compounds (VOC) and oxides of nitrogen (NO_x). OSAT uses reactive tracers to track the fate of these precursor emissions and the ozone formation resulting from them within a CAMx simulation. The ozone and precursors are tracked and apportioned by OSAT without perturbing the host model chemistry; therefore, the OSAT results are fully consistent with the host model results for total concentrations. OSAT can efficiently estimate source contributions from multiple emission sources within a single model simulation. Importantly, while source apportionment modeling can be used to estimate source contributions to ozone concentrations for a given set of emission inputs,

sensitivity modeling approaches such as brute-force modeling[3] or the direct decoupled method (DDM)[4] are needed to quantify the effect of a given emission control scenario (e.g., 90% NO_x reduction at power plants) on ozone concentrations.

2016 EPA Model Platform

The CAMx OSAT simulations were based on EPA's 2016 air quality modeling platform. A modeling platform consists of a structured system of connected data and models that provide a consistent and transparent basis for assessing the air quality impact of anticipated changes in emissions. EPA develops and evaluates a new modeling platform each time the National Emissions Inventory (NEI) is updated (every three years). EPA has recently used the 2016 modeling platform to support the proposed Federal Implementation Plan ("Transport Rule") to help states fully resolve their obligations under the "Good Neighbor" provision of the Clean Air Act for the 2015 ozone NAAQS (U.S. Environmental Protection Agency, 2022a).

The CAMx OSAT simulations relied on EPA's 2016v2 (2016fj_16j) modeling platform. This platform draws on emissions data from the 2017 NEI (released spring of 2020) and data developed by the National Emissions Inventory Collaborative.[5] The NEI is compiled by EPA on a triennial basis, primarily from data submitted by state, local, and tribal air agencies. The 2017 NEI includes emissions from five source sectors: point sources, nonpoint (or area) sources, onroad mobile sources, nonroad mobile sources, and fire events. These NEI source sectors are divided into 20 sectors for the modeling platform. For the 2016v2 modeling platform, EPA updated the 2017 NEI data to represent year 2016 through the incorporation of 2016-specific state and local data along with adjustment methods appropriate for each emission sector.

For air quality modeling purposes, the 2016 NEI data was augmented by EPA to include biogenic emissions and data from Canadian and Mexican emissions inventories. In addition, the annualized point source data for EGUs in the NEI were replaced with hourly 2016 continuous emissions monitoring (CEMS) data from EPA's Clean Air Markets Division for SO_2 and NO_x. Annual emissions for pollutants were converted to an hourly basis using CEMS input data (U.S. Environmental Protection Agency, 2022c). The EGUs in the modeling platform are matched to units found in the National Electric Energy Data System (NEEDS) v6.20 database.[6] Onroad and nonroad mobile source emissions were developed using the version 3 of the Motor Vehicle Emissions Simulator (MOVES3) using activity data provided by state and local agencies.

[3] The brute-force modeling method involves running the model both with and without emission controls applied to the source(s) of interest. The difference in pollutant concentrations between the two simulations yields the impact of the emission control scenario.
[4] DDM provides sensitivity coefficients that relate emissions changes to model outcomes. These sensitivity coefficients can be used to evaluate how pollutant concentrations would respond to a range of changes in emissions from a source or group of sources.
[5] The National Emissions Inventory Collaborative is a partnership between state emissions inventory staff, multi-jurisdictional organizations, federal land managers, EPA, and others to develop a North American air pollution emissions modeling platform for use in air quality planning.
[6] https://www.epa.gov/airmarkets/national-electric-energy-data-system-needs-v6 dated 5/28/2021

Source Apportionment Tagging

Sonoma Technology worked with the Sierra Club to identify sources and source groups to be tagged for ozone attribution analysis. In total, approximately 500 emission source tags were identified and modeled across multiple simulations. The tagged sources fell into one of the following categories:

- **EGU point sources (~250 tags)**: Coal and natural gas power plants, and in some cases individual units within a facility. Units may be tagged individually, by control equipment, by retirement date, and/or grouped by region.
- **Non-EGU point sources (~150 tags)**: Industrial point sources, tagged individually and/or grouped by state.
- **Transportation**: Onroad mobile sources separated by light- and heavy-duty vehicle emissions, grouped by region.
- **Building Combustion**: Commercial, institutional, and residential fossil fuel building combustion from the NEI nonpoint sector, grouped by state or ozone nonattainment area. This excludes residential wood combustion.

Meteorology

Meteorological inputs for the CAMx-OSAT simulations were developed by EPA for the 2016 modeling platform using version 3.8 of the Weather Research and Forecasting (WRF) numerical weather prediction model (Skamarock et al., 2008).The meteorological outputs from WRF include hourly varying winds, temperature, moisture, vertical diffusion rates, clouds, and rainfall rates. Selected physics options used in the WRF simulations include the Pleim-Xiu land surface model, Asymmetric Convective Model version 2 planetary boundary layer scheme, Kain-Fritsch cumulus parameterization, Morrison double moment microphysics, and RRTMG longwave and shortwave radiation schemes. Additional details about this WRF simulation and its performance evaluation can be found in U.S. Environmental Protection Agency (2021b).

Initial and Boundary Conditions

Initial and lateral boundary conditions for the 2016v2 modeling platform were developed from three-dimensional global atmospheric chemistry simulations with the Hemispheric version of the Community Multi-scale Air Quality Model (H-CMAQ) version 3.1.1 (Mathur et al., 2017). EPA used an H-CMAQ simulation for 2016 develop boundary conditions for a CAMx simulation at a horizontal grid resolution of 36 km x 36 km. The outputs from this simulation were used to provide initial and boundary conditions for the 12 km model simulation. OSAT tracks ozone transported through the boundaries, as well as ozone formation resulting from precursor emissions transported through the boundaries.

Post-Processing

The raw result from a CAMx OSAT simulation is hourly ozone contributions from each source tag at each grid cell in the modeling domain for the 2016 ozone season. These hourly contributions were extracted and post-processed for several hundred receptor sites, including ozone monitoring sites as well as locations identified by Sierra Club as environmental justice receptors within ozone nonattainment areas. At each receptor and for each day, the 8-hr average ozone contribution was calculated for each source tag using the averaging period corresponding to the period of highest modeled 8-hr average concentration at the receptor location. Although this analysis approach may not capture the largest ozone contributions modeled during the day, it does reflect contributions during time periods when modeled ozone concentrations are highest. This analysis approach also ensures that ozone contributions from all source tags[7] sum to total modeled 8-hr ozone concentration each day. The post-processed OSAT results along with relevant metadata were compiled into a web-based shinyapps.io dashboard application to facilitate future data mining and analysis.

OSAT outputs can also be used in a "relative sense" (rather than a "absolute sense") to apportion an ozone observation (e.g., a design value) into contributions from individual tags. One advantage to such an approach is that the contribution can be tied to an observed ozone concentration, rather than tied strictly to a modeled ozone concentration that may be biased. Ozone contributions were calculated using OSAT results in a "relative sense". Relative contribution fractions for each tag on a daily basis were calculated by multiplying the absolute modeled source contribution by the ratio of the monitored concentration and the total modeled ozone value.

Model Performance Evaluation

EPA evaluated its 2016 modeling platform using statistical assessments of modeled ozone predictions versus observations paired in time and space. Overall, EPA found that "the ozone model performance results for the CAMx 2016fj (2016v2) simulation are within or close to the ranges found in other recent peer-reviewed applications (e.g., Simon et al., 2012 and Emery et al., 2017)" and that "the model performance results demonstrate the scientific credibility" of the 2016v2 modeling platform." Additional details on the ozone model performance evaluation for EPA's 2016v2 platform can be found in the Technical Support Document (TSD) for the modeling platform (U.S. Environmental Protection Agency, 2022b).

[7] Including a leftover residual contribution from all untagged sources calculated by CAMx.

Appendix B. Monitoring Value and Modeling Value Tables on NAAQS Exceedance Days

The following tables present monitoring maximum daily average 8-hr (MDA8) values compared with total modeled MDA8 values on days when monitors exceeded the NAAQS.

Table B-1. Colorado monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS -	ROCKY FLATS-N	Welby	WELCH
6/16	81 (66)	75 (64)	74 (69)	72 (63)	73 (69)	86 (73)	82 (72)	72 (69)	74 (70)
6/17		74 (69)				72 (66)			71 (68)
6/18							79 (69)		
6/19						76 (78)			
6/26						75 (71)	71 (68)		
6/27	75 (67)	76 (65)	71 (67)	71 (62)	71 (67)	83 (73)	78 (70)		82 (73)
6/28						74 (66)	76 (68)		
7/7		71 (67)				80 (64)	72 (64)		74 (65)
7/12						73 (62)	73 (61)		
7/14	72 (70)	81 (66)		73 (62)		79 (59)			75 (64)
7/16		78 (69)		73 (71)		79 (73)	71 (70)		73 (73)
7/17		71 (63)							
7/19		75 (54)							
7/22		72 (44)		71 (43)					
7/25		71 (67)				83 (67)	89 (66)		76 (70)
7/27		86 (70)	73 (59)	76 (68)	73 (59)	88 (64)	81 (61)		82 (67)
7/28		75 (65)							
7/29		75 (60)				77 (57)			73 (60)
7/30	73 (57)	76 (59)				73 (57)			73 (58)
8/2						72 (55)	74 (53)		
8/3	74 (74)	80 (73)				76 (69)	74 (65)		75 (74)
8/7						73 (57)			

Date	Aspen Park	Chatfield State Park	DENVER - CAMP	HIGHLAND RESERVOIR	La Casa	NATIONAL RENEWABLE ENERGY LABS -	ROCKY FLATS-N	Welby	WELCH
8/12		73 (73)				72 (73)			72 (76)
8/16							75 (67)		

Table B-2. Indiana monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Charlestown State Park	Gary-IITRI	HAMMOND CAAP	New Albany-Green Valley Elem. Sch.	Ogden Dunes-Water Treatment Plant	VALPARAISO
4/17		73 (56)			71 (57)	
4/18	73 (63)					71 (66)
4/19	72 (63)					
4/20	71 (60)			73 (61)		
5/24						72 (57)
6/9	77 (70)			71 (67)		
6/11	72 (69)	78 (61)		73 (69)	78 (62)	77 (58)
6/10	83 (69)			80 (64)		
6/13				71 (69)		
6/19						72 (55)
6/25				83 (77)		
7/21	72 (85)					
7/27			78 (66)			
8/3		71 (72)	76 (69)		72 (69)	
8/10			75 (64)			

Table B-3. Kentucky monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Bates	BUCKNER	CANNONS LANE	NORTHERN KENTUCKY UNIVERSITY (NKU)	SHEPHERDS-VILLE	Watson Lane
5/24		74 (63)	71 (59)	71 (65)		
6/3						72 (65)
6/10	71 (69)		80 (74)			
6/11	81 (72)	72 (71)	80 (71)	71 (70)		
6/13			76 (66)	75 (65)		73 (74)
6/25			72 (88)			
6/30	73 (65)		86 (74)			
7/19			71 (69)			
7/21			74 (80)			
7/23			71 (65)			
8/3			71 (66)			
9/14	74 (63)				77 (70)	77 (70)
9/23		73 (57)	72 (66)			
9/24	73 (67)		73 (64)			
9/25			73 (59)			

Table B-4. Missouri monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Arnold West	Blair Street	Farrar	Maryland Heights	Orchard Farm	Pacific	West Alton
5/23					75 (65)		75 (63)
6/8				78 (62)			
6/9							74 (71)
6/10			76 (62)				72 (70)
6/13							86 (67)
6/16				71 (62)			
6/18	73 (63)			77 (67)	76 (60)	77 (67)	74 (60)
6/27						73 (77)	
7/20				72 (55)			
7/23				73 (76)			
8/4					81 (78)		75 (76)
8/9	71 (51)	79 (48)		81 (43)			74 (57)
8/10					72 (70)		71 (59)
9/21					78 (62)		
9/22					71 (66)		78 (69)
9/23		74 (64)			78 (66)		78 (76)
9/24					72 (66)		71 (64)

Table B-5. Dallas-Fort Worth nonattainment area, Texas monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Eagle Mountain Lake	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point
6/6		80 (60)										
6/7	95 (81)	85 (67)	82 (78)	81 (79)		72 (63)	95 (79)		83 (67)	85 (69)	88 (58)	
6/8					83 (67)							78 (68)
6/9					75 (62)							75 (66)
6/10					73 (63)							
6/20			71 (52)		72 (63)				77 (68)			
6/29										72 (70)		
6/30					76 (78)			76 (77)	76 (80)			83 (79)
7/1					79 (75)			76 (81)	71 (79)			75 (73)
7/26							73 (51)			72 (55)		
8/5								73 (58)				71 (55)
8/31		78 (68)										
9/11			73 (55)									
9/20									72 (51)			
9/21					81 (78)				75 (75)			
9/22					72 (73)							73 (74)
10/1								74 (62)				75 (58)
10/3		72 (55)			71 (60)							

Table B-6. Houston-Galveston-Brazoria ozone nonattainment area, Texas monitoring days in 20[illegible] exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Croquet	Houston Deer Park #2	Houston East	Houston Westhollow	Lake Jackson	Lang	Manvel Croix Park	Northwest Harris County
4/3			73 (52)									
4/5	75 (61)											
4/7		74 (53)										
4/14		71 (35)										
4/15				83 (54)				79 (56)				
4/23		84 (62)	74 (67)	78 (68)				79 (73)		80 (71)		78 (71)
4/27	75 (61)		75 (58)									
5/4		82 (58)										
5/6				84 (65)			71 (59)	84 (73)		78 (67)		
5/7	80 (68)	71 (51)	71 (58)									
5/13				78 (59)				73 (72)				
6/8		75 (67)			72 (76)			78 (75)				
7/21			72 (61)							74 (65)		79 (66)
7/22			83 (47)									
8/3			89 (58)									
8/4	71 (59)											
9/21					74 (64)							
9/28						72 (65)					75 (64)	
9/29									73 (69)			
10/2					73 (59)						73 (57)	
10/3								84 (70)				
10/10								80 (71)				
10/26			74 (56)									

Table B-7. San Antonio ozone nonattainment area, Texas monitoring days in 2016 exceeding the 2015 ozone NAAQS of 70 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Calaveras Lake	Camp Bullis	San Antonio Northwest
5/5			73 (56)
5/6			71 (59)
9/28	71 (59)		
10/2		74 (64)	76 (71)
10/11		81 (71)	72 (69)

Table B-8. Colorado monitoring days in 2016 exceeding the 2008 ozone NAAQS of 75 ppb at AQS monitors in severe ozone nonattainment areas. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Aspen Park	Chatfield State Park	HIGHLAND RESERVOIR	NATIONAL RENEWABLE ENERGY LABS - NREL	ROCKY FLATS-N	WELCH
6/16	81 (66)			86 (73)	82 (72)	
6/18					79 (69)	
6/19				76 (78)		
6/26						
6/27		76 (65)		83 (73)	78 (70)	82 (73)
6/28					76 (68)	
7/7				80 (64)		
7/14		81 (66)		79 (59)		
7/16		78 (69)		79 (73)		
7/25				83 (67)	89 (66)	76 (70)
7/27		86 (70)	76 (68)	88 (64)	81 (61)	82 (67)
7/29				77 (57)		
7/30		76 (59)				
8/3		80 (73)		76 (69)		

Table B-9. Dallas-Fort Worth nonattainment area, Texas monitoring days in 2016 exceeding the 2008 ozone NAAQS of 75 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Arlington Municipal Airport	Cleburne Airport	Dallas Hinton	Dallas Redbird Airport Executive	Denton Airport South	Fort Worth Northwest	Frisco	Grapevine Fairway	Keller	Parker County	Pilot Point
6/6		80 (60)									
6/7	95 (81)	85 (67)	82 (78)	81 (79)		95 (79)		83 (67)	85 (69)	88 (58)	
6/8					83 (67)						78 (68)
6/20								77 (68)			
6/30					76 (78)		76 (77)	76 (80)			83 (79)
7/1					79 (75)		76 (81)				
8/31		78 (68)									
9/21					81 (78)						

Table B-10. Houston-Galveston-Brazoria ozone nonattainment area, Texas monitoring days in 2016 exceeding the 2008 ozone NAAQS of 75 ppb at AQS monitors in the nonattainment area. Total modeled values in paratheses.

Daily monitored (modeled) MDA8 ozone concentration in ppb.

Date	Conroe Relocated	Galveston 99th Street	Houston Aldine	Houston Bayland Park	Houston Westhollow	Lang	Northwest Harris County
4/15				83 (54)	79 (56)		
4/23		84 (62)		78 (68)	79 (73)	80 (71)	78 (71)
5/4		82 (58)					
5/6				84 (65)	84 (73)	78 (67)	
5/7	80 (68)						
5/13				78 (59)			
6/8					78 (75)		
7/21							79 (66)
7/22			83 (47)				
8/3			89 (58)				
10/3					84 (70)		
10/10					80 (71)		

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